BONAPARTE MC3D MARINE SEISMIC SURVEY

Environment Plan

Prepared for:

Schlumberger Australia Pty Limited
Level 5
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ABBREVIATIONS AND DEFINITIONS

3D	3-dimensional
AASM	Airgun Array Source Model
ABARES	Australian Bureau of Agriculture and Resource Economics and Sciences
AFMA	Australian Fisheries Management Authority
AHO	Australian Hydrographic Office
AIMS	Australian Institute of Marine Science
AIS	Automated Identification System
ALA	Atlas of Living Australia
ALAN	Artificial light at night
ALARP	As Low As Reasonably Practicable
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
Animat	Animal Movement and Exposure Modelling
ANZG	Australian and New Zealand Guidelines
APPEA	Australian Petroleum Production and Exploration Association
ARPA	Automatic Radar Plotting Aids
AS/NZS ISO 31000:2018	Australian & New Zealand International Standard Risk Management – Guidelines 31000:2018
BACI	Before, After, Control, Impact
BCA	Biodiversity Conservation Act 2016
BIA	Biologically Important Areas
BOD	Biochemical Oxygen Demand
Bonn Convention	Convention on the Conservation of Migratory Species of Wild Animals
CA	Controlling Authority
CAES	Catch and Effort System
COLREGS	International Regulations for Preventing Collisions at Sea 1972
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTS	Commonwealth Trawl Sector
DAFF	Department of Agriculture, Fisheries and Forestry
dB	Decibels

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DEPWS	Department of Environment, Parks and Water Security
DFAT	Department of Foreign Affairs and Trade
DITT	Northern Territory Department of Industry, Tourism and Trade
DMIRS	Department of Mines, Industry Regulation and Safety
DNP	Director of National Parks
DoCCEEW	Department of Climate Change, Energy, the Environment and Water
DoE	Department of the Environment
DoEE	Department of the Environment and Energy
DPIR	Department of Primary Industry and Resources
DPIRD	Department of Primary Industries and Regional Development
EEZ	Exclusive Economic Zone
EMBA	Environment that May Be Affected
Environment Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
EP	Environment Plan
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPBC Regulations	Environment Protection and Biodiversity Conservation Regulations 2000
EPO	Environmental Performance Outcomes
EPS	Environmental Performance Standards
ERA	Environmental Risk Assessment
ERM	Environmental Resources Management
ESD	Ecologically Sustainable Development
GHG	Greenhouse Gas
HFO	Heavy-Fuel-Oil
IAGC	International Associated of Geophysical Contractors
IAPP Certificate	International Air Pollution Prevention Certificate
IMO	International Maritime Organisation
IMS	Invasive Marine Species
IOPP Certificate	International Oil Pollution Prevention Certificate
irMA	Intrinsic Ranging by Modulated Acoustics

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ISPP Certificate	International Sewage Pollution Prevention Certificate
ITF	Indonesian Throughflow
IUCN	International Union for Conservation of Nature
JASMINE	JASCO's Animal Simulation Model Including Noise Exposure
JBG	Joseph Bonaparte Gulf
JRCC	Joint Rescue Coordination Centre
KEF	Key Ecological Features
KPMF	Kimberley Prawn Managed Fishery
LAC	Limits of Acceptable Change
London Protocol	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972
MARPOL	International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978
MCS	Maximum Credible Scenario
MFO	Marine Fauna Observer
MGO	Marine Gas Oil
MMF	Mackerel Managed Fishery
MMO	Marine Mammal Observer
MoC	Management of Change
MoU	Memorandum of Understanding
MSDS	Material Safety Data Sheets
MSS	Marine Seismic Survey
National Plan	Australian National Plan to Combat Pollution of the Sea by Oil and other Noxious and Hazardous Substances
NDSMF	Northern Demersal Scalefish Managed Fishery
NEBA	Net Environmental Benefit Analysis
NES	National Environmental Significance
NM	Nautical Mile
NMP	Ningaloo Marine Park
NMR	North Marine Region
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority

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NOPTA	National Offshore Petroleum Titles Administrator
NT	Northern Territories
NPF	Northern Prawn Fishery
NWCS	North-West Cable System
NWMR	North-west Marine Region
OA	Operational Area
ODS	Ozone Depleting Substance
OPEP	Oil Pollution Emergency Plan
OPGGS Act	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation
PAM	Passive Acoustic Monitoring
PAR	Pre-Arrival Report
PK	Peak Sound Pressure level
PK-PK	Peak to Peak Sound Pressure Level
Policy Statement 2.1	EPBC Act Policy Statement 2.1 – Interaction between Offshore Seismic Exploration and Whales
POLREP	Pollution report
PSPPS Act	Protection of the Sea (Prevention of Pollution from Ships) Act 1983
PSZ	Petroleum Safety Zones
PTS	Permanent Threshold Shift
QHSE Policy	Quality, Health, Safety and Environment Policy
RADAR	Radio Detection and Ranging
Ramsar Convention	The Convention on Wetlands of International Importance
RFFWI	Request for further written information
RMS SPL	Root-Mean-Square Sound Pressure Level
RMS	Root Mean Square
SEEMP	Ship Energy Efficiency Management Plan
SEA	Survey Environmental Advisor
SEL	Sound Exposure Level
SEL_{cum}	Cumulative Sound Exposure Level

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SIMA	Spill Impact Mitigation Assessment
SLB	Schlumberger Australia Pty Limited
SOLAS	International Convention of the Safety of Life at Sea
SOP	Standard Operating Procedures
SOPEP	Shipboard Oil Pollution Emergency Plan
SPL	Sound Pressure Level
Seismic Vessel	Seismic Survey Vessel
STCW Convention	International Convention of Standards of Training, Certification and Watch Keeping for Seafarers
TACC	Total Allowable Commercial Catch
TEC	Threatened Ecological Community
The Appeal Decision	Santos NA Barossa Pty Ltd v Tipakalippa [2022] FCAFC 193
The Guidance Document	NOPSEMA Guidance Document N-04750-GL2086 A900179 (Consultation in the course of preparing an environment plan, NOPSEMA 2023)
The Primary Decision	Tipakalippa v National Offshore Petroleum Safety and Environmental Management Authority (No 2) [2022] FCA 1121
TTS	Temporary Threshold Shift
UAM	Underwater Acoustic Modelling
UNCLOS	United Nations Convention on the Law of the Sea 1982
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UXO	Department of Defence's unexploded ordinance register
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council

1 Introduction

1.1 Overview

Schlumberger Australia Pty Limited (**SLB**) is proposing to acquire the Bonaparte Multiclient 3D Marine Seismic Survey. Hereafter, these activities may also be referred to as the **Seismic Survey**. The Seismic Survey may commence as early as November 2022 and will be completed before 30 June 2024. Up to a maximum of 10,000 km^2 may be acquired per calendar year between 2022 and 2024. It is estimated to take approximately between 120 and 190 days to acquire 12,000 km^2 (including contingency time for potential vessel or equipment down time and adverse weather conditions).

This Environment Plan (**EP**) has been prepared to ensure the Seismic Survey is planned and undertaken in accordance with SLB's Quality, Health, Safety and Environment Policy (**QHSE Policy**), which is discussed further in **Section 1.6**, along with the regulatory requirements of the Offshore Petroleum and *Greenhouse Gas Storage Act 2006* (**OPGGS Act**) and the associated *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (the **Environment Regulations**).

1.2 Purpose and Objectives

In accordance with the requirements of the Environment Regulations, the purpose of this EP is to demonstrate that the Seismic Survey will be undertaken in a manner that is consistent with the principles of Ecologically Sustainable Development (**ESD**). This includes assessing the potential risks and impacts to the different receptors within the receiving environment and relevant persons/marine users that utilise the area. This assessment considers the controls measures and operational procedures proposed to be implemented in order to reduce the potential adverse environmental impacts and risks associated with the Seismic Survey to As Low As Reasonably Practicable (**ALARP**) and to **Acceptable Levels**. Environmental performance standards (**EPS**) have also been developed as part of this EP to measure the performance of the controls measures and operational measures that will be implemented during the Seismic Survey.

The objective of the proposed Seismic Survey is to provide an improved subsurface image of the eastern flank of the Vulcan Sub-basin and Londonderry High. The new data will provide an improved understanding of the subsurface, which to-date has been limited due to legacy surveys being unable to resolve shallow carbonate intervals and complex faulting.

Ultimately the new data will provide improved confidence in mapping major geological units aiding in the identification and de-risking of petroleum prospectively across the Seismic Survey area.

1.3 Scope of the Environment Plan

The scope of this EP addresses the proposed petroleum activity, that being a marine seismic survey (**MSS**), and the associated activities described in **Section 3**. Specifically, the scope of this EP covers the seismic acquisition and associated line turns, seismic testing and support activities associated with the Seismic Survey within the defined Operational Area (**OA**) (**Figure 1**).

The EP addresses potential environmental impacts which may occur as a result of planned activities and any potential unplanned events. Transit to and from the OA by vessels associated with the Seismic Survey, as well as port activities associated with these vessels, are not considered within the scope of this EP. Vessels supporting the Seismic Survey outside of the OA are subject to relevant maritime regulations and requirements not managed within this EP.

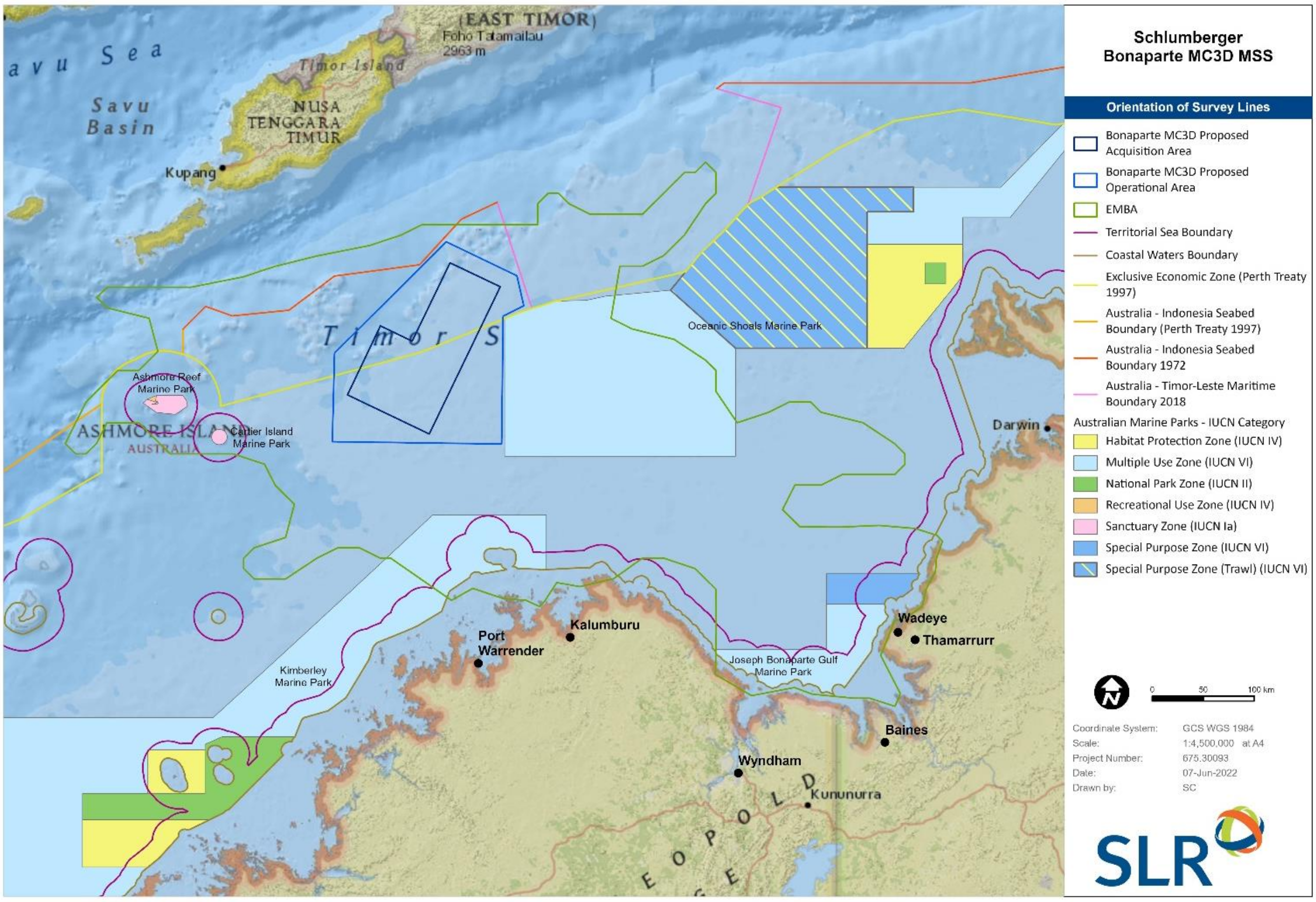


Figure 1 Location of the OA

1.4 Environment Plan Summary

In accordance with the requirements of Regulation 11(4) within the Environment Regulations, an EP summary is provided in **Table 1**.

Table 1 EP Summary

EP summary parameter	Section
Location	**Section 3.2**
Description of the receiving environment	**Section 4**
Description of the activity	**Section 3**
Details of the environmental impacts and risks	**Section 7** (Planned); **Section 8** (Unplanned)
A summary of the control measures for the activity	Throughout **Section 7** (Planned); **Section 8** (Unplanned)

EP summary parameter	Section
A summary of the arrangements for ongoing monitoring of the titleholder's environmental performance	Throughout **Section 7** (Planned); **Section 8** (Unplanned) and **Section 10.6.1**
A summary of the response arrangements in the OPEP	**Section 10.10**
Details of the consultation (already undertaken and proposed)	**Section 5**
Details of the titleholder's nominated liaison	**Section 1.5**

1.5 Titleholder and Nominated Liaison

SLB is the Titleholder for this activity. SLB is the world's leading supplier of technology, integrated project management and information solutions to customers working in the oil and gas industry worldwide. Employing over 100,000 people, representing over 140 nationalities, and working in more than 85 countries, SLB provides the industry's widest range of products and services from exploration through to production. WesternGeco, a business segment of SLB, provides advanced seismic acquisition and data processing services and has extensive experience in conducting MSSs internationally and in Australia. As WesternGeco is a business segment of SLB, it will be referred to as SLB throughout this EP.

In accordance with Regulation 15(1) of the Environment Regulations, details of the titleholder and liaison person are detailed within **Table 2** and **Table 3**, below.

Table 2 Titleholder Details

Environment Regulation Requirements	Description
Name	Schlumberger Australia Pty Limited
Business address	Level 5, 10 Telethon Avenue, Perth, WA 6000
Telephone number	+61 8 6208 3572
Fax number	+61 8 9420 4600
Email address	environment@slb.com
Australian Company Number	002 459 225

Table 3 Liaison Person Details

Environment Regulation Requirements	Description
Name	Kunal Mishra
Business address	Level 5, 10 Telethon Avenue, Perth, WA 6000
Telephone number	+61 8 6208 3572
Fax number	+61 8 9420 4600
Email address	environment@slb.com

As per Regulation 15(3) of the Environment Regulations, the nominated SLB Liaison Person (**Table 3**) or the SLB Project Manager (**Table 122**) will notify the National Offshore Petroleum Safety and Environmental Management Authority (**NOPSEMA**) both verbally and in writing, as soon as practicable, and prior to a change in the titleholder or the liaison person occurring. This protocol will also apply, should the contact details for either the titleholder or liaison person change.

1.6 SLB Environmental Policy

SLB has developed, publicly disseminated and implemented a QHSE Policy which demonstrates the organisation's commitment to protecting the environment during all operations, including the proposed Seismic Survey. Environment Regulation 16(a) requires a statement of the titleholder's corporate environmental policy; as such, SLB's corporate QHSE Policy is provided within **Figure 2**.

Quality, Health, Safety, and Environmental (QHSE) Policy

Schlumberger

The long-term business success of Schlumberger depends on our ability to continually improve the quality of our services and products while protecting people and the environment. Emphasis must be placed on ensuring human health, operational safety, environmental protection, quality enhancement and community goodwill. This commitment is in the best interests of our customers, our employees and contractors, our stockholders and the communities in which we live and work.

Schlumberger requires the active commitment to and accountability for, QHSE from all employees and contractors. Line management has a leadership role in the communication and implementation of, and ensuring compliance with, QHSE policies and standards. We are committed to:

- Protect, and strive for improvement of, the health, safety and security of our people at all times;
- Eliminate Quality non-conformances and HSE accidents;
- Meet specified customer requirements and ensure continuous customer satisfaction;
- Set Quality & HSE performance objectives, measure results, assess and continually improve processes, services and product quality, through the use of an effective management system;
- Plan for, respond to and recover from any emergency, crisis and business disruption;
- Minimize our impact on the environment through pollution prevention, reduction of natural resource consumption and emissions, and the reduction and recycling of waste;
- Apply our technical skills to all HSE aspects in the design and engineering of our services and products;
- Communicate openly with stakeholders and ensure an understanding of our QHSE policies, standards, programs and performance. Reward outstanding QHSE performance;
- Improve our performance on issues relevant to our stakeholders that are of global concern and on which we can have an impact, and share with them our knowledge of successful QHSE programs and initiatives.

This Policy shall be regularly reviewed to ensure ongoing suitability. The commitments listed are in addition to our basic obligation to comply with Schlumberger standards, as well as all applicable laws and regulations where we operate. This is critical to our business success because it allows us to systematically minimize all losses and adds value for all our stakeholders.

Olivier Le Peuch
Chief Executive Officer, Schlumberger Limited

For further information regarding this policy:
CONTACT: Mohamed Kermoud, Vice President HSE
LOCATION: Schlumberger Limited, Houston
EMAIL: Mohamed Kermoud

SLB-QHSE-L001
Released on 5 June 1997
Last update on 9 August 2019

Figure 2 SLBs Corporate QHSE Policy

2 Environmental Management Framework

2.1 Legislation Requirements

Petroleum and greenhouse gas storage activities, including MSSs, in 'offshore areas' – defined as those waters between the outer limit of coastal water (three nautical miles (**NM**)) and the outer limit of the Continental Shelf (at least 200 NM) – are required to be assessed and authorised under the OPGGS Act and the associated Environment Regulations.

The following sections detail the requirements of the Environment Regulations, along with all applicable environmental management requirements that are relevant to the Seismic Survey. **Section 2.1.1.1** provides a summary of the Environmental Regulations, in particular, Regulation 13 and provides a road map to the relevant sections of this EP which describe how each of the requirements have been adhered to.

2.1.1 OPGGS Act

The OPGGS Act provides an effective regulatory framework for petroleum exploration and recovery, and the injection and storage of greenhouse gas substances in Australia's offshore areas. The OPGGS Act confers powers to NOPSEMA to regulate the health and safety, structural integrity and environmental management of petroleum exploration and development activities within Australia's offshore areas.

The OPGGS Act is supported by regulations covering matters such as safety, diving, petroleum resource management and environmental management (see **Section 2.1.1.1**).

In addition to establishing the regulatory regime for environmental management authorisation, the OPGGS Act has other relevant powers, including:

- Requiring that an activity in an offshore area must be undertaken in a manner that does not interfere with navigation, fishing, conservation of the resources of the sea and seabed, any lawfully established activities of another person and the enjoyment of native title rights and interests;
- Requiring operations to be carried out in accordance with good oilfield practices;
- Requiring titleholders, in the event of an escape of petroleum, to eliminate or control the escape, clean up the escaped petroleum and remediate any resulting damage to the environment, and carry out environmental monitoring of the impact of the escape on the environment;
- Providing for NOPSEMA to give written directions to titleholders covering all aspects of petroleum exploration and production;
- Providing for remedial directions by NOPSEMA with regard to the restoration of the environment; and
- Requiring a titleholder to maintain in good condition and repair all structures and equipment that are used in connection with the operations authorised by the permit, lease, licence or authority.

2.1.1.1 Environment Regulations

The Environment Regulations have been developed under the OPGGS Act and provide an objective-based regime for the management of environmental performance for Australian offshore petroleum exploration and production and greenhouse gas storage activities in areas of Commonwealth jurisdiction.

The objectives of the Environment Regulations are to ensure any activity is carried out:

- In a manner consistent with the principles of ESD (outlined further in **Section 2.1.2**);
- In a manner in which the environmental impacts and risks of the activity will be reduced to **ALARP.** To ensure the impacts and risks from the proposed activities are reduced to **ALARP**, a hierarchy of controls have been utilised which follows a tiered system which are defined within **Section 6.3**; and
- In a manner in which the impacts and risks will be of an **Acceptable Level**. The criteria used to determine whether the residual risk of an activity following the implementation of the control measures is at an **Acceptable Level** is provided within **Section 6.4**.

2.1.2 EPBC Act

The Environment Protection and Biodiversity Conservation Act 1999 (**EPBC Act**) is the Australian Government's central piece of environmental legislation which provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places as matters of National Environmental Significance (**NES**). There are nine matters of NES to which the EPBC Act applies (outlined within Sections 12 to 24 of the EPBC Act), which are:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (RAMSAR sites);
- Listed threatened species and ecological communities;
- Listed migratory species;
- Nuclear actions;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park; and
- Protection of water resources from coal seam gas development and large coal mining development.

The NES listed above are discussed in detail within **Section 4**, where relevant to the Seismic Survey.

In relation to the listed threatened species and ecological communities, the EPBC Act has established a list of categories, including: extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependant. **Section 4.5** includes a description of the biological environment comprising the OA and surrounds, which includes some species that are listed as threatened. Where threatened species occur, this has been identified.

The EP must describe matters protected under Part 3 of the EPBC Act and assess any impacts and risks to these. As outlined within **Section 2.1.1.1**, one objective of the Environment Regulations is to ensure that the activity is carried out in a manner consistent with the principles of ESD, the principles of which are set out in Section 3A of the EPBC Act as:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations;
- If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- The principle of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;
- The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making; and
- Improved valuation, pricing and incentive mechanisms should be promoted.

The EPBC Act has been utilised throughout the development of this EP, particularly in relation to the existing environment (**Section 4**) and within the assessment of the impacts and risks from the proposal (**Section 7** and **Section 8**).

2.1.2.1 EPBC Act Policy Statement 2.1 – Interaction between Offshore Seismic Exploration and Whales

Under the EPBC Act, a number of whale species are listed as threatened and/or migratory species (see **Section 4.5.6**) and are subsequently protected under the EPBC Act as matters of NES. In order to manage the interaction between offshore seismic exploration and whales, the EPBC Act Policy Statement 2.1 – Interaction between Offshore Seismic Exploration and Whales (**Policy Statement 2.1**) was developed, with the aim being to:

- Provide practical standards to minimise the risk of acoustic injury to whales in the vicinity of MSS operations;
- Provide a framework that minimises the risk of biological consequences from acoustic disturbance from MSS sources to whales in biologically important habitat areas or during critical behaviours; and
- Provide guidance to both proponents of MSSs and operators conducting MSSs about their legal responsibilities under the EPBC Act.

The following sections provide an outline of the applicable provisions of Policy Statement 2.1.

2.1.2.1.1 Potential Impacts to be Considered

Section 4 of Policy Statement 2.1 discusses the potential impacts to be considered when planning a MSS, which has been utilised in the preparation of this EP. An important aspect to consider when assessing the likelihood of potential impacts on whales is determining whether the MSS will have a 'low likelihood' or a 'moderate to high likelihood' of encountering whales. These are defined within Policy Statement 2.1 as:

- Low likelihood – spatially and temporally outside aggregation areas, migratory pathways and areas considered to provide biologically important habitat; and
- Moderate to high likelihood – spatially and/or temporally proximate to aggregation areas, migratory pathways and/or areas considered to provide biologically important habitat.

In addition to the above, identifying whether a proposed survey will occur within a biologically important habitat of a whale species is necessary because displacement from these areas may have a greater impact than elsewhere. An assessment into the likelihood of encountering whale species has been undertaken and included within **Section 4.5.6**, along with the identification of any areas which are biologically important habitats for those whale species.

2.1.2.1.2 Legislative Responsibilities

There are two obligations that need to be considered under the EPBC Act when developing a MSS: referrals and permits. These are defined as follows:

- Referrals – if an MSS has, or is likely to have, a significant impact on a matter of NES or the 'environment' (including threatened and migratory species) then that action should be referred to the Australian Government Environment Minister under the EPBC Act. The Minister may then determine the referral to be either a 'controlled action' in which the action is subject to the assessment and approval processes under the EPBC Act, or not a controlled action where further approval is not required if the action is undertaken in accordance with the referral, or in a particular way specific in the decision notice.

  As part of the development of this EP, a number of control measures has been utilised in assessing the impact of the Seismic Survey (contained throughout **Section 7** for planned activities, and **Section 8** for unplanned activities). Based on these control measures, overall, it is considered that the Seismic Survey activities will not have a significant impact on a matter of NES or on the 'environment' in general, as outlined within **Sections 7** and **8**.

- Permits – an action that will kill, injure, take or interfere with a whale or dolphin within the Australian Whale Sanctuary (described within **Section 4.4.5**) is an offence under the EPBC Act, unless the proposed action has been referred to the Environment Minister and approved, or a permit has been granted. Generally, an MSS will not interfere with whales if it is undertaken in an area and time where the likelihood of encountering whales is low and appropriate measures are implemented.

  As outlined above, the likelihood of encountering whales during the Seismic Survey is discussed within **Section 4.5.6** and the control measures to be implemented are contained within **Sections 7** and **8**. Based on these sections, it is considered that the Seismic Survey will not kill, injure, take or interfere with a whale or dolphin within the Australian Whale Sanctuary.

2.1.2.1.3 Management Measures for Vessels Conducting Seismic Surveys in Australian Waters

Policy Statement 2.1 provides a discussion on the management measures for vessels and organisations looking to conduct MSSs within Australian waters. These measures are divided into two primary areas, precautionary zones and management procedures which are discussed in the following sections.

2.1.2.1.4 Precautionary Zones

Section 6.1 of Policy Statement 2.1 defines three zones (observation, low-power and shut-down) which are to be used during MSSs, based on the likely sound levels surrounding the seismic sound source. There are two levels of precautionary zones, dependant on the sound exposure level (**SEL**) each seismic emission makes which is to be demonstrated through sound modelling or empirical measurements.

If the received sound exposure level will not likely exceed 160 decibels (**dB**) re 1 $\mu Pa^2 s$ for 95% of seismic shots at 1 km range, the following precautionary zones are recommended under Policy Statement 2.1:

- Observation zone: 3^+ km horizontal radius from the acoustic source;
- Low-power zone: 1 km horizontal radius from the acoustic source; and

- Shut-down zone: 500 m horizontal radius from the acoustic source.

For all other proposed MSSs, Policy Statement 2.1 recommends the following zones:

- Observation zone: 3^+ km horizontal radius from the acoustic source;
- Low-power zone: 2 km horizontal radius from the acoustic source; and
- Shut-down zone: 500 m horizontal radius from the acoustic source.

A graphical representation of the three recommended zones is indicated within **Figure 3**.

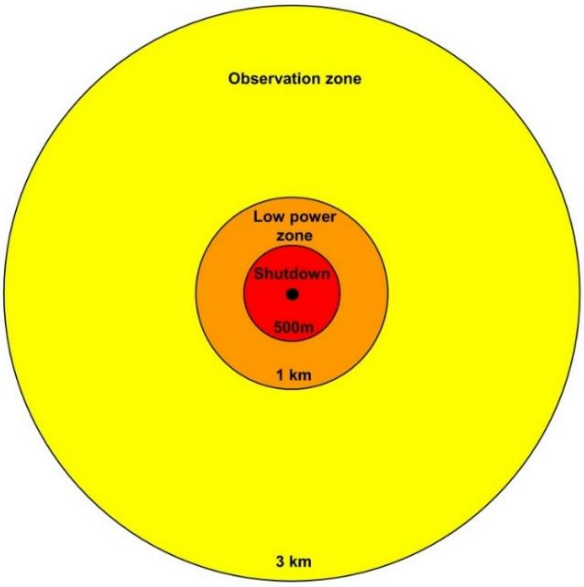


Diagram 1: Precaution zones surrounding the acoustic source for surveys that meet the criteria for a **1km low power zone**.

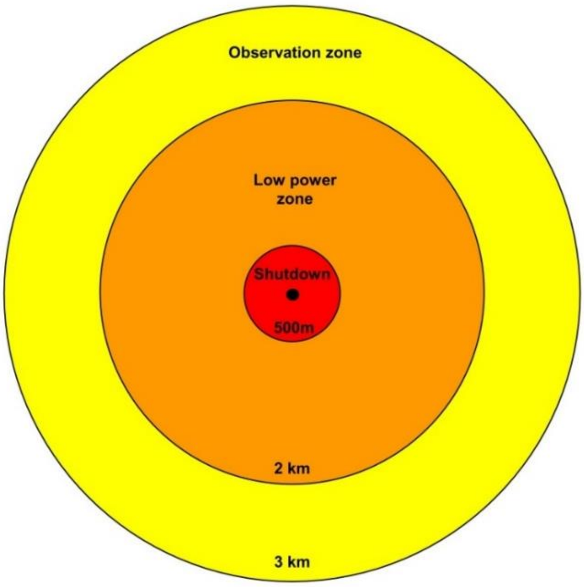


Diagram 2: Precaution zones surrounding the acoustic source for all other surveys (**2km low power zone**)

Source: EPBC Act Policy Statement 2.1 (DoEWHA, 2008)

Figure 3 Policy Statement 2.1 – Recommended Precautionary Zones

Each of the three zones has differing requirements, as follows:

- Observation zone – whales and their movements should be monitored to determine whether they are approaching or entering the 'Low-power Zone';
- Low-power zone – when a whale is sighted within, or is about to enter, this zone, the acoustic source should immediately be powered down to the lowest possible setting; and
- Shut-down zone – when a whale is sighted within, or is about to enter, this zone, the acoustic source must immediately be shut-down completely.

SLB has undertaken Underwater Acoustic Modelling (**UAM**) (**Appendix A**, **Section 7.2.1.2**) which has confirmed that the Sound Exposure Level (**SEL**) exceeds the 160 dB re 1 μPa^2s, for 95% of seismic shots at 1 km range, so SLB will implement the more stringent precautionary zone requirements of the Policy Statement 2.1 (**Figure 3**). However, based on the UAM results and sensitivities in and surrounding the OA, additional management procedures will be implemented (**Section 7.2.5**).

2.1.2.1.5 Management Procedures

In addition to the precautionary zones discussed above, Policy Statement 2.1 includes a number of management procedures which should be followed by all Seismic Survey Vessels (**Seismic Vessel**) conducting surveys in Australian waters irrespective of location and time of year. These management procedures are split into 'Standard Management Procedures' and 'Additional Management Procedures' under Section 6.2 of Policy Statement 2.1.

The Standard Management Procedures include:

- Pre-survey planning – ideally, no MSS will be planned to be conducted when whales are likely to be breeding, calving, resting or feeding; if an MSS is proposed to occur during this period, careful consideration of the survey and associated control measures will need to be undertaken;
- Trained crew – sufficiently trained crew, including people with proven experience in whale observation, distance estimation and reporting, are required to undertake relevant requirements during the survey operations;
- During survey – all Seismic Vessels operating in Australian waters are required to follow basic procedures during surveys irrespective of location and time of the year, including:
- Pre-start-up visual observations;
- Soft-start;
- Start-up delay;
- Operations;
- Power-down and stop work; and
- Compliance and sighting reports – a record of procedures employed during operations is required, including information on any whales (or other species) sighted during the survey. This information may be useful for future operations.

When an MSS is proposed to operate in areas where the likelihood of encountering whales is moderate to high (discussed in **Section 2.1.2.1.1**) then additional management procedures are required to ensure that impacts and interference are avoided and/or minimised. Suggested additional management procedures under Section 6.2 of Policy Statement 2.1 include:

- Marine Fauna Observer (**MFO**)/Marine Mammal Observer (**MMO**) – MFO/MMOs should be trained and experienced in whale identification and behaviour, distance estimation, be capable of making accurate identifications and observations of whales in Australian waters, and can assist other observers on the Seismic Vessel;
- Night-time/poor visibility – appropriate management measures to detect (or predict) whale presence should be included to reduce the likelihood of encounters, including limiting initiation of Soft-start Procedures, daylight spotter vessel or aircraft and pre-survey research;
- Spotter vessel(s) and aircraft – a spotter vessel/aircraft could be used to assist in detecting the presence of whales, including during night-time/poor visibility operations;
- Increase precaution zones and buffer zones – in some locations and circumstances an increased distance for the instigation of power-down procedures (discussed above) is advisable;
- Passive Acoustic Monitoring (**PAM**) – deployment of PAM to detect whales in real-time may provide an additional method of detecting whales during surveys, and particularly during night-time/poor visibility operations; and
- Adaptive management – adaptive management procedures should be considered to manage the potential increased likelihood of encountering whales; for example, ceasing night-time operations if there are three consecutive days on which operators experience three or more whale-instigated shut-down/power down situations.

An assessment of the likelihood of encountering whales has been undertaken within **Section 4.5.6**, based on the 'presence ranking' (as assigned by the Protected Matters Database for both the OA and EMBA) which has concluded that whales are known to occur within the OA and EMBA. Therefore, additional management procedures will be required, and the additional procedures that will be included are discussed in detail within **Section 7.2**

2.1.2.2 Environment Protection and Biodiversity Conservation Regulations 2000

The Environment Protection and Biodiversity Conservation Regulations 2000 (**EPBC Regulations**) implement the provisions of the EPBC Act and provide additional measures to control a range of activities, including the use of vehicles and vessels, littering, commercial activities, research, and commercial and recreational fishing. In particular, Part 8 of these regulations relates to interacting with cetaceans and whale watching. The relevant provisions of Part 8 have been considered when determining the impacts and risks associated with the Seismic Survey (**Section 7**).

2.1.2.3 EPBC Act Management Plans

When a native species or ecological community is listed as threatened under the EPBC Act, conservation advice is developed to assist with its recovery. Conservation advice provides guidance on the immediate recovery and threat abatement activities that can be undertaken to ensure the conservation of a newly listed species or ecological community.

The Minister for the Environment may make or adopt and implement recovery plans for threatened fauna, threatened flora (other than conservation dependent species) and Threatened Ecological Communities (**TEC**) listed under the EPBC Act. Recovery plans define the research and management actions necessary to stop the decline of, and support the recovery of, listed threatened species or TECs. The aim of a recovery plan is to maximise the long-term survival in the wild of a threatened species or ecological community.

The Seismic Survey will be conducted in a manner that is consistent with the conservation advice and recovery plans for species with the potential to be present in the OA. **Section 4.5** describes the species that are listed as threatened and/or migratory under the EPBC Act, which have been identified to occur within the Environment that May Be Affected (**EMBA**) (see **Section 4.1** for a description on how this was established) and identifies the relevant conservation advices and recovery plans. In addition, any relevant measures contained within the conservation advice and recovery plans have been considered as part of the assessment of impacts and risks that may occur as a result of the Seismic Survey (**Section 7**).

2.1.3 Other Relevant Legislation

Regulation 13(4) of the Environment Regulations requires a description of the relevant legislative requirements that apply to the activity and are relevant to the environment management of the activity. A number of legislative instruments exist which are relevant to the Seismic Survey; these are outlined below along with a discussion on how each of these requirements will be achieved.

The key pieces of Commonwealth legislation (other than the OPGGS Act and EPBC Act discussed above) that are relevant to the environmental management of the Seismic Survey are outlined within **Table 4**.

Although the Seismic Survey is located within Commonwealth waters, and hence falls under the Commonwealth legislation, in the unlikely event of a hydrocarbon spill occurring and entering State waters, State legislation would be triggered. As the risk of this unplanned event occurring is considered to be remote (**Section 8.2**) a full assessment of all of the State legislation has not been conducted; however, **Section 10.10** provides an overview of SLBs arrangements for a response to the unlikely event of a hydrocarbon spill, including how the relevant statutory plans will be implemented, should the spill enter State waters.

Table 4 Summary of Key Commonwealth Legislation Relevant to the Seismic Survey

Legislation	Applicability
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	This Act can protect areas and objects that are of particular significance to Aboriginal and Torres Strait Islander people. The Environment Minister can make a declaration to protect an area, object or class of object from a threat of injury or desecration after receiving an application from an Aboriginal or Torres Strait Islander person or group. In addition, this Act requires the discovery of Aboriginal remains to be reported to the Environment Minister, giving particulars of the remains and of their location. An assessment of Aboriginal heritage sites is contained within **Section 4.6.1**.
Australian Heritage Council Act 2003	The Australian Heritage Council Act established the Australian Heritage Council as an independent expert advisory body on heritage matters. The main responsibilities of the Australian Heritage Council relate to assessing places for the National Heritage List and the Commonwealth Heritage List. An assessment of the heritage values associated with the OA is outlined within **Section 4.6.2**.
Australian Maritime Safety Authority Act 1990	This Act established the Australian Maritime Safety Authority (**AMSA**), which has the responsibility of protecting the marine environment from pollution from ships, and other environment damage resulting from shipping activities. These responsibilities include being the lead agency when responding to hydrocarbon spills within the marine environment under the National Plan for Maritime Environmental Emergencies (known as the **National Plan**). Given the Seismic Survey will take place in the marine environment, there is always a remote risk of pollution or other incidents as a result of the operations. The potential risks from an unplanned activity occurring in association with the Seismic Survey is assessed within **Section 8**. This assessment also provides the measures that will be implemented throughout the survey to reduce these risks to **ALARP** and an **Acceptable Level**.
Biosecurity Act 2015 Biosecurity Regulations 2016 Biosecurity Amendment (Biofouling Management) Regulations 2021	This Act details how biosecurity threats to plant, animal and human health in Australia and its external territories are managed. Section 4 of this Act describes the objectives, which are: *(a) To provide for managing the following:* *(i) Biosecurity risks;* *(ii) The risk of contagion of a listed human disease or any other infectious human disease;* *(iii) The risk of human diseases or any other infectious human diseases entering Australian territory or a part of Australian territory, or emerging, establishing themselves or spreading in Australian territory or a part of Australian territory;* *(iv) Risks related to ballast water;* *(v) Biosecurity emergencies and human biosecurity emergencies;* *(b) To give effect to Australia's international rights and obligations, including under the International Health Regulations, the SPS Agreement, the Ballast Water Convention, the United Nations Convention on the Law of the Sea and the Biodiversity Convention.* The Biosecurity Amendment (Biofouling Management) Regulations 2021 entered into force on 15 June 2022 and requires all vessels to provide information on biofouling management practices prior to arriving in Australia. This is achieved through the Pre-Arrival Report (**PAR**) which now also includes mandatory questions relating to biofouling management practices. Vessel operators can demonstrate proactive management of biofouling by implementing one of three accepted proactive biofouling management options or answer further pre-arrival questions to inform assessments of the biosecurity risk associated with biofouling on vessels. There are a number of relevant legislative documents that have been prepared to deal with the issue of biosecurity (discussed in **Section 2.2**); all of which have been considered as part of the preparation of this EP, specifically in relation to the assessment of environmental risks associated with invasive marine species (**Section 8**).

Legislation	Applicability
Environment Protection (Sea Dumping) Act 1981	The Environment Protection (Sea Dumping) Act 1981 is administered by the Australian Government Department of the Environment and Energy (**DoEE**) and is aimed at protecting the waters surrounding Australia's coastlines from wastes and pollution dumped at sea. In addition, this Act fulfils Australia's international obligations under the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972, and 1996 Protocol (**the London Protocol**). The aim of this Act is to minimise pollution threats by: • Prohibiting ocean disposal of waste considered too harmful to be released into the marine environment; and • Regulating permitted waste disposal to ensure environmental impacts are minimised. Since the proposed Seismic Survey will involve the use of a Seismic Vessel within Australian waters, the management and operation of the vessel will be subject to this Act. Although no waste or other matter (other than routine vessel discharges e.g. appropriately treated sewage) is proposed to be discharged within Australian waters as part of this EP, there is always a remote chance of an accident occurring where such waste or equipment could be lost overboard. **Section 8.2** outlines the potential risks and associated impacts if an accidental discharge occurs, along with the measures that SLB will implement to reduce the risk to **ALARP** and within **Acceptable Levels**.
Navigation Act 2012	This act covers international ship and seafarer safety, shipping aspects of protecting the marine environment and the actions of seafarers in Australian waters. The Act gives effect to the relevant aspects of the International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978 (**MARPOL**), the United Nations Convention on the Law of the Sea 1982 (**UNCLOS**) and the International Regulations for Preventing Collisions at Sea 1972 (**COLREGS**), among other international treaties, details of which are outlined below: • MARPOL is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. The Annexes of MARPOL that Australia is a party to are given effect to by current legislation; • UNCLOS lays down a comprehensive regime of law and order in the world's oceans and seas establishing rules governing all uses of the oceans and their resources; and • COLREGS set out the navigational rules to be followed by ships and vessels at sea to prevent collisions. These Regulations will be important in maintaining safe operating procedures to ensure collisions don't occur during the survey. In addition to the above international treaties, several Marine Orders are enacted under the Navigation Act 2012 which relate to offshore petroleum activities, including: • Marine Order Part 21: Safety and emergency arrangements; • Marine Order Part 27: Safety of navigation and radio equipment; • Marine Order Part 28: Operations standards and procedures; • Marine Order Part 30: Prevention of collisions; • Marine Order Part 58: Safe management of vessels. Since the Seismic Vessel proposed to be used for the Seismic Survey will be operating within Australian waters, the management and operation of the vessel will be subject to this Act and the associated Marine Orders. The relevant aspects of this Act and subsequent Marine Orders, along with the international treaties that provide control measures to avoid potential risks associated with this activity are discussed within **Section 8**.
Ozone Protection & Synthetic Greenhouse Gas Management Act 1989	This Act regulates the manufacture, importation and use of ozone depleting substances (**ODS**) which are typically used in fire-fighting equipment and refrigerants. The use of these substances is discussed within **Section 7.4** which stipulates that no ODS will be deliberately released.

Legislation	Applicability
Protection of the Sea (Civil Liability of Bunker Oil Pollution Damage) Act 2008	This Act establishes a liability and compensation regime to apply in cases of pollution damage following the escape of bunker oil from a ship that is not an oil tanker. This Act prescribes that ship owners are strictly liable for pollution damage resulting from the escape or discharge of bunker oil from their ships; resulting in the obligation on ships over 1,000 gross tonnages to carry insurance certificates when leaving/entering Australian ports. The Seismic Vessel undertaking the Seismic Survey will hold the necessary insurance certificates.
Protection of the Sea (Harmful Anti-fouling Systems) Act 2006	This Act was developed as part of Australia's commitment to MARPOL and the International Convention on the Control of Harmful Anti-fouling Systems on Ships and regulates the use of anti-fouling compounds and systems in Australian waters. The vessel to be used for the Seismic Survey will have an anti-fouling management regime in place that is consistent with this Act.
Protection of the Sea (Prevention of Pollution from Ships) Act 1983 Maritime Legislation Amendment (Prevention of Air Pollution from Ships) Act 2007	MARPOL includes regulations aimed at preventing both accidental pollution and pollution from routine vessel operations. Australia implements MARPOL through the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (**PSPPS Act**) and the Navigation Act 2012 (discussed above). The PSPPS Act (and the Navigation Act), along with the following Commonwealth legislation gives effect to MARPOL: • Marine Order 91: Marine pollution prevention – oil; • Marine Order 93: Marine pollution prevention – noxious liquid substances; • Marine Order 94: Marine pollution prevention – packaged harmful substances; • Marine Order 95: Marine pollution prevention – garbage; • Marine Order 96: Marine pollution prevention – sewage; • Marine Order 97: Marine pollution prevention – air pollution; and • Marine Order 98: Marine pollution prevention – anti-fouling systems. The PSPPS Act, and the associated legislation listed above have been considered as part of the impact and risk assessment detailed within **Section 7**.
Underwater Cultural Heritage Act 2018	This Act came into effect on 1 July 2019 replacing the Historic Shipwrecks Act 1976 and continues to protect Australia's shipwrecks. This Act has also been broadened to protect sunken aircraft and other types of underwater cultural heritage including Australia's Aboriginal and Torres Strait Islander Underwater Cultural Heritage in Commonwealth waters. In addition to the general protection provided to underwater heritage sites, this Act also provides for areas containing protected underwater heritage to be declared a protected zone. These may be established for a number of reasons including conservation, management or public safety. Most protected zones cover an area of around 200 hectares, although there is flexibility to declare a larger zone if necessary. The nearest underwater protected zone is over 400 km to the east of the OA.

2.2 Relevant Guidelines, Standards and Codes

Australian Ballast Water Management Requirements (Version 8)

These requirements include legislative obligations under the Biosecurity Act 2015, and the International Convention for the Control and Management of Ships' Ballast Water and Sediments regarding the management of ballast water and ballast tank sediment when operating within Australian waters. These requirements, along with the Biosecurity Act discussed in **Table 4**, have been provided for in relation to the assessment of environmental risks associated with invasive marine species (**Section 8**).

Australian Biofouling Management Requirements (Version 1)

These requirements outline the obligations placed on vessel operators for the management of biofouling when operating vessels under biosecurity control within Australian territorial seas. Under these requirements, all vessel operators intending to enter Australian territorial waters must provide information relating to biofouling management through the mandatory PAR. Information provided by vessel operators in the PAR process may be inspected to verify its accuracy and/or inspections of vessels' submerged hull and niche areas may be conducted. These requirements have been provided for in relation to the assessment of environmental risks associated with invasive marine species (**Section 8**).

Code of Environmental Practice 2008 – Australian Petroleum Production and Exploration Association (APPEA)

This Code provides guidance on ensuring that exploration and production operations are conducted using effective management in order to be sustainable within the Australian environment. This includes the need to avoid or minimise and manage impacts to the environment, focusing on four basic recommendations:

- Assess the risk to, and impacts on, the environment as an integral part of the planning process;
- Reduce the impact of operations on the environment, public health and safety to **ALARP** and to an **Acceptable Level** by using the best available technology and management practises;
- Consult with relevant persons regarding industry activities; and
- Develop and maintain a corporate culture of environmental awareness and commitment that supports the necessary management practices and technology, and their continuous improvement.

These recommendations, which effectively mirror the requirements within the Environment Regulations, have been considered when assessing the potential impacts and risks from the Seismic Survey during the development of this EP (**Sections 7** and **8**, respectively).

Convention on the Conservation of Migratory Species of Wild Animals

The Convention on the Conservation of Migratory Species of Wild Animals (known as the **Bonn Convention**) provides a global platform for the conservation and sustainable use of migratory animals and their habitats. The Bonn Convention was entered into force in 1983, with Australia being a party to the Convention since September 1991. The Bonn Convention includes obligations for parties to it, including:

- Acknowledging the importance of conserving migratory species;
- Promote, cooperate and support research relating to migratory species;

- For endangered species, endeavour to take measures to conserve the species and its habitat, prevent the adverse effects of activities that impede or prevent migration, prevent or minimise factors that endanger the species where possible, and make the taking of the species prohibited (subject to limited exceptions); and
- For species that are defined as having an 'unfavourable conservation status', endeavour to conclude agreements which would benefit and prioritise those species (Parliament of Australia, 2018).

The species of relevance from the Bonn Convention and the associated obligations are addressed under the EPBC Act. An assessment of those migratory species relevant to the Seismic Survey are outlined throughout **Section 4.5**.

Convention on Oil Pollution Preparedness, Response and Cooperation 1990

Parties to the International Convention on Oil Pollution Preparedness, Response and Co-operation (**OPRC**) are required to establish measures for dealing with pollution incidents, either nationally or in co-operation with other countries. The OPRC comprises national arrangements for responding to oil pollution incidents from ships, offshore oil facilities, seaports and oil handling facilities. The convention recognises that in the event of a pollution incident, prompt and effective action is essential.

The OPRC requires ships to carry Shipboard Oil Pollution Emergency Plans (**SOPEP**); in addition, operators of offshore units under the jurisdiction of the parties to the OPRC are required to have Oil Pollution Emergency Plans (**OPEP**), or similar arrangements which must be co-ordinated with national systems for responding promptly and effectively to oil pollution incidents. The vessel contracted to undertake the Seismic Survey will have a SOPEP in place; and in the unlikely event of a spill occurs from a vessel collision/sinking, SLB will implement the response strategy in accordance with the SOPEP, as discussed within **Section 8.2**.

Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971

This convention is commonly known as the **Ramsar Convention** (due to it being signed in the Iranian town of Ramsar in 1971). The Ramsar Convention's broad aims are to halt the worldwide loss of wetlands and to conserve, through wise use and management, those that remain. This has broadened over time to cover all aspects of wetland conservation and wise use (broadly defined as maintaining the ecological character of a wetland), recognising that wetland ecosystems are important for both biodiversity conservation and the well-being of human communities (DoEE, 2018a).

The EPBC Act recognises all wetlands listed under the Ramsar Convention as matters of NES which means approvals are required for actions that will have or are likely to have a significant impact on the ecological character of a Ramsar listed wetland. An assessment of the wetlands in or near the EMBA is outlined within **Section 4.4.6**, with any potential impacts and risks from the Seismic Survey being assessed throughout **Sections 7** and **8**.

International Convention for the Regulation of Whaling

The International Convention for the Regulation of Whaling is the International Whaling Commission's founding document and was signed in 1946. Obligations under this convention include the complete protection of certain species, and the establishment of whale sanctuaries. All of the Commonwealth waters of Australia are assigned as the Australian Whale Sanctuary (**Section 4.4.5**).

International Standards of Training, Certification and Watch-keeping for Seafarers, 1978

International Convention of Standards of Training, Certification and Watch Keeping for Seafarers (**STCW Convention**), 1978, sets the mandatory minimum standards of training, certification and watchkeeping for masters, officers and watch personnel on seagoing merchant ships registered under the flag of a country party to the convention. As the survey vessels proposed to be used for the Seismic Survey will be operating within Australian waters, the masters, officers and watch personnel of the vessels will be subject to this convention. Aspects of the survey vessel operations that relate to this convention are discussed within **Sections 7** and **8**.

National Biofouling Management Guidance for the Petroleum Production and Exploration Industry 2009

This guidance document has been developed to provide useful tools for operations within the petroleum production and exploration industry to minimise the growth of biofouling on vessels, infrastructure and submersible equipment to reduce the risk of spreading marine pests around the Australian coastline. This guidance document has been utilised in determining the **Acceptable Levels** of risks associated with the Seismic Survey, and the environmental performance outcomes (**EPO**) and EPSs (**Section 8**).

United Nations Convention on Biological Diversity

Australia is a party to the United Nations Convention on Biological Diversity which has three main objectives which requires the conservation of biological diversity, the sustainable use of the components of biological diversity and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources (CBD, 2018).

This Convention covers a range of topics and requirements which are subsequently implemented in Australia via different means, including Australia's Biodiversity Conservation Strategy 2010-2030 which is the guiding framework for the conservation of Australia's national biodiversity to 2030. An assessment of the biological environment is outlined within **Section 4.5**, with any potential impacts and risks from the Seismic Survey being assessed throughout **Sections 7** and **8**.

United Nations Declaration on the Rights of Indigenous Peoples

The United Nations Declaration on the Rights of Indigenous Peoples was adopted by the General Assembly on 13 September 2007, with the Australian Government announcing its support on 3 April 2009. This Declaration establishes a universal framework of minimum standards for the survival, dignity and well-being of the indigenous peoples of the world and elaborates on the human rights standards and fundamental freedoms as they apply to the specific situation of indigenous peoples (United Nations, 2018). **Section 4.6.1** provides an assessment of the aboriginal heritage associated with the OA to provide an understanding of potential impacts on that heritage from the Seismic Survey.

2.3 Relevant NOPSEMA Guidance Documents

Various guidance documents prepared by NOPSEMA have been utilised through the development of this EP to ensure that it meets all the requirements of the Environment Regulations and the expectations of NOPSEMA. These documents include:

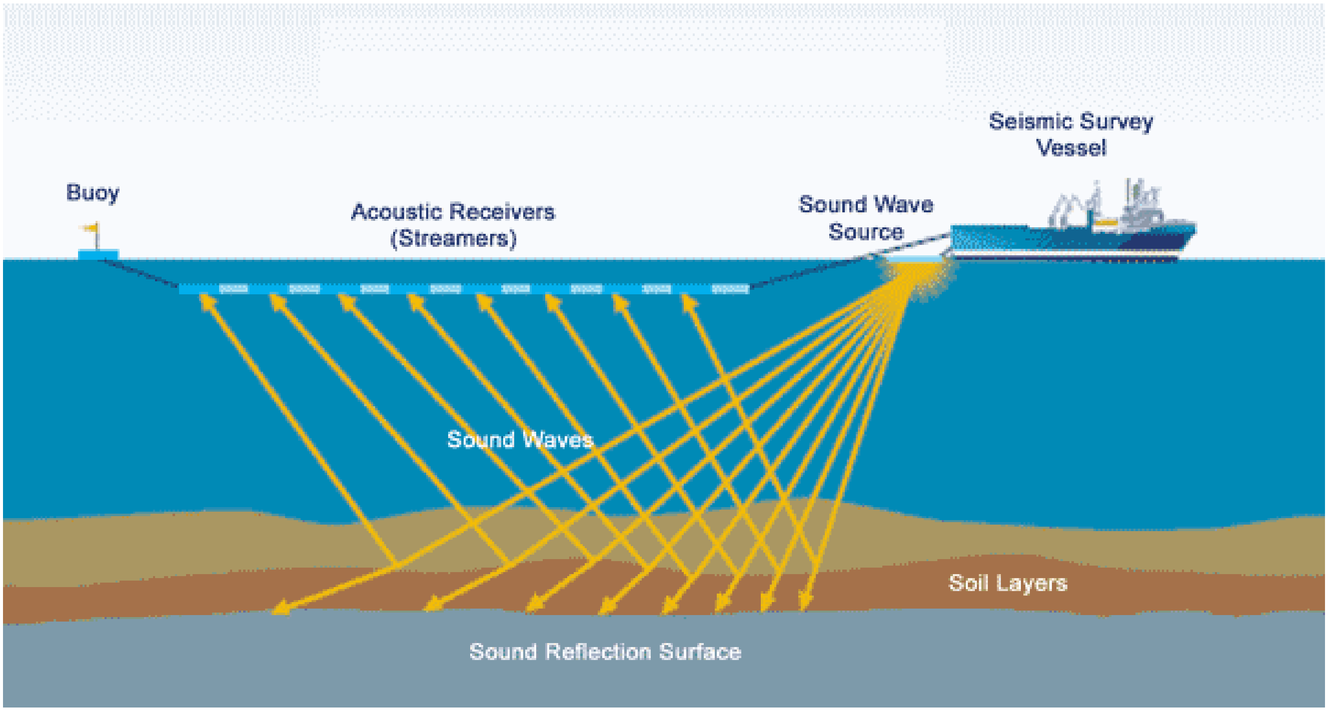
- Guidance Notes:
  - ALARP (N-04300-GN0166 A138249, August 2022);
  - Environment plan content requirements (N-04750-GN1344 A339814, December 2022);
  - Responding to Public Comment on Environment Plans (N-04750-GN1847 A662607, July 2022);
  - Petroleum Activities and Australian Marine Parks (N-04750-GN 1785 A620236, June 2023);
  - Oil Pollution Risk Management (N-04750-GN1488 A382148, July 2021);
  - Notification and Reporting of Environmental Incidents (N-03000-GN0926 A710941, September 2023);
  - Control measures and performance standards (N-04300-GN0271 A336398, June 2020);
- Guidelines:
  - Consultation in the Course of Preparing an Environment Plan (N-04750-GL2086 A900179, May 2023);
  - Consultations with Agencies with Responsibilities in the Commonwealth Marine Area (N-04750-GL1887 A705589, January 2023);
  - Making Submissions to NOPSEMA (N-04000-GL0225, A15266, July 2022);
  - Environment Plan Decision Making (N-04750-GL1721, A524696, December 2022);
- Policy:
  - Environment Plan Assessment (N-04750-PL1347, A662608. December 2022);
  - Financial Assurance for Petroleum Titles (N-04730-PL1780, May 2020)
- Forms:
  - Environment Plan Summary Statement (N-04750-FM1848, A662605, September 2020);
  - Titleholder Report on Public Comment (N-04750-FM1896, A662604, September 2020);
- Environment Bulletins:
  - Oil spill modelling (A652993, April 2019).
- Information Papers:
  - Operational and Scientific Monitoring Programs (N-04700-IP1349, A343826, October 2020); and
  - Acoustic Impact Evaluation and Management (N-04750-IP1765, A625748, February 2023).
- Guidance Framework:
  - Supporting Cooperative Coexistence of Seismic Surveys and Commercial Fisheries in Australia’s Commonwealth Marine Area (2022).

3 Project Description

3.1 Survey Overview

As defined in **Section 1.1**, SLB is proposing to carry out the Bonaparte Multiclient three-dimensional (3D) Marine Seismic Survey to collect high-quality geophysical data regarding rock formations and structures beneath the seabed. SLB plans to conduct the Seismic Survey in the Bonaparte Basin within the Commonwealth waters adjacent to Western Australia (**WA**). As mentioned in **Section 1.2**, the objective of the Seismic Survey is to provide an improved subsurface image of the eastern flank of the Vulcan Sub-basin and Londonderry High which will provide an improved understanding of the subsurface. As a result, the new seismic data will provide improved confidence in mapping the subsurface geological structure to aid in the identification and de-risking of petroleum prospectively across the OA.

During the survey, a Seismic Vessel will tow an acoustic source array and a series of streamers within the OA, as defined in **Section 3.2.1**. MSSs use data acquired through the use of a controlled acoustic source mechanically generating a sound wave that is transmitted downwards towards and into the seabed. The sound wave source uses compressed air to create a pulse of acoustic energy. The pulse of acoustic energy travels through the water column and into the seabed where energy is reflected at different speeds and intensities depending on the sediment type and/or density of the various sedimentary layers. The reflected acoustic signals are detected by an array of sensitive hydrophones located in each streamer, which are towed behind the Seismic Vessel (**Figure 4**). These sound signals are then analysed and processed into visual images of the subsurface structure of the seabed using powerful on-board computers and software. The Seismic Vessel will be assisted by a Support Vessel, a Chase Vessel and helicopter operations.



Source: www.fishsafe.eu

Figure 4 Schematic of an MSS

A summary of the general survey programme is provided in **Table 5**. The following sections outline specific details of the Seismic Survey.

Table 5 Summary of Seismic Survey General Parameters

General Programme Parameter	Description
Location	Northern Western Australia, Offshore
Operational Area	25,827 km^2
Acquisition Area	12,000 km^2
Maximum Sail Line Length within a swath	~155 km
Sail Line Orientation	North East/South West at 159/339°; North West/South East at 26/206°
Water Depths in Acquisition Area	20 – 200 m
Timing	Q4 2023 commencement
Planned Survey Duration	190 days, including continency.

Note: The Acquisition Area covers an area greater than the proposed sail lines, and although the Acquisition Area has water depths ranging from 20 to 200 m, the shallowest depth that the acoustic source will be activated is 60 m as outlined in **Section 7.1.4**.

3.2 Survey Location

The OA is located off the coast of northern Western Australia, in the marine waters between continental Australia and Indonesia and Timor-Leste. The proposed Seismic Survey is to be undertaken in an area with a complex jurisdictional setting as shown in **Figure 1**. The southern half of the OA is located within the Australian Exclusive Economic Zone (**EEZ**) (between 12 and 200 NM from shore) and the northern half is located within the Indonesian EEZ. Importantly, the Australia-Indonesia Maritime Delimitation incorporates an area of overlapping jurisdiction which treats the seabed and water column separately in accordance with the *Perth Treaty 1997*. Within the area of overlap, the seabed and its associated resources, fall under the jurisdiction of Australia. The overlying water column (including fisheries resources) fall under the jurisdiction of Indonesia. To this end, exploration of seabed resources within the OA are wholly regulated under Australian jurisdiction.

Immediately beyond the eastern boundary of the OA, is the maritime boundary between Australia and Timor-Leste.

3.2.1 Operational Area

Regionally, the OA is located ~200 km north of Port Warrender and Kulumburu, Western Australia, and ~175 km northeast of Ashmore Island and comprises water depths in the order of 20-200 m. The OA is approximately 25,827 km^2, with approximately 50% of the total area constituting >100 m deep.

The OA includes both the Acquisition Area and a surrounding buffer that could be used for operational purposes (see **Figure 5**). The coordinates of the OA perimeter are provided in **Table 6**.

Activities that will take place within the OA (and outside of the Acquisition Area) will include, streamer deployment and retrieval, maintenance, recovery, refuelling and vessel manoeuvring. Soft-Starts (see **Section 3.4.3**) may occur within the Operational Area, for example during initial deployment of the streamers and acoustic source.

Refuelling activities within the OA will only take place beyond a 5 km buffer around any marine park boundary or shallow water feature less than 40 m water depth. Once the Survey Vessel is outside of the Operational Area, all seismic equipment will be stowed.

Table 6 Coordinates of the OA

Point	Longitude	Latitude
1	125° 33’ 9.095” E	10° 48’ 48.203” S
2	126° 10’ 28.567” E	11° 6’ 43.891” S
3	126° 14’ 5.936” E	11° 22’ 33.467” S
4	126° 3’ 11.962” E	11° 28’ 1.296” S
5	126° 2’ 23.558” E	12° 35’ 32.124” S
6	124° 32’ 58.906” E	12° 34’ 18.924” S
7	124° 34’ 9.162” E	11° 47’ 27.660” S

Note: Coordinates are in WGS84.

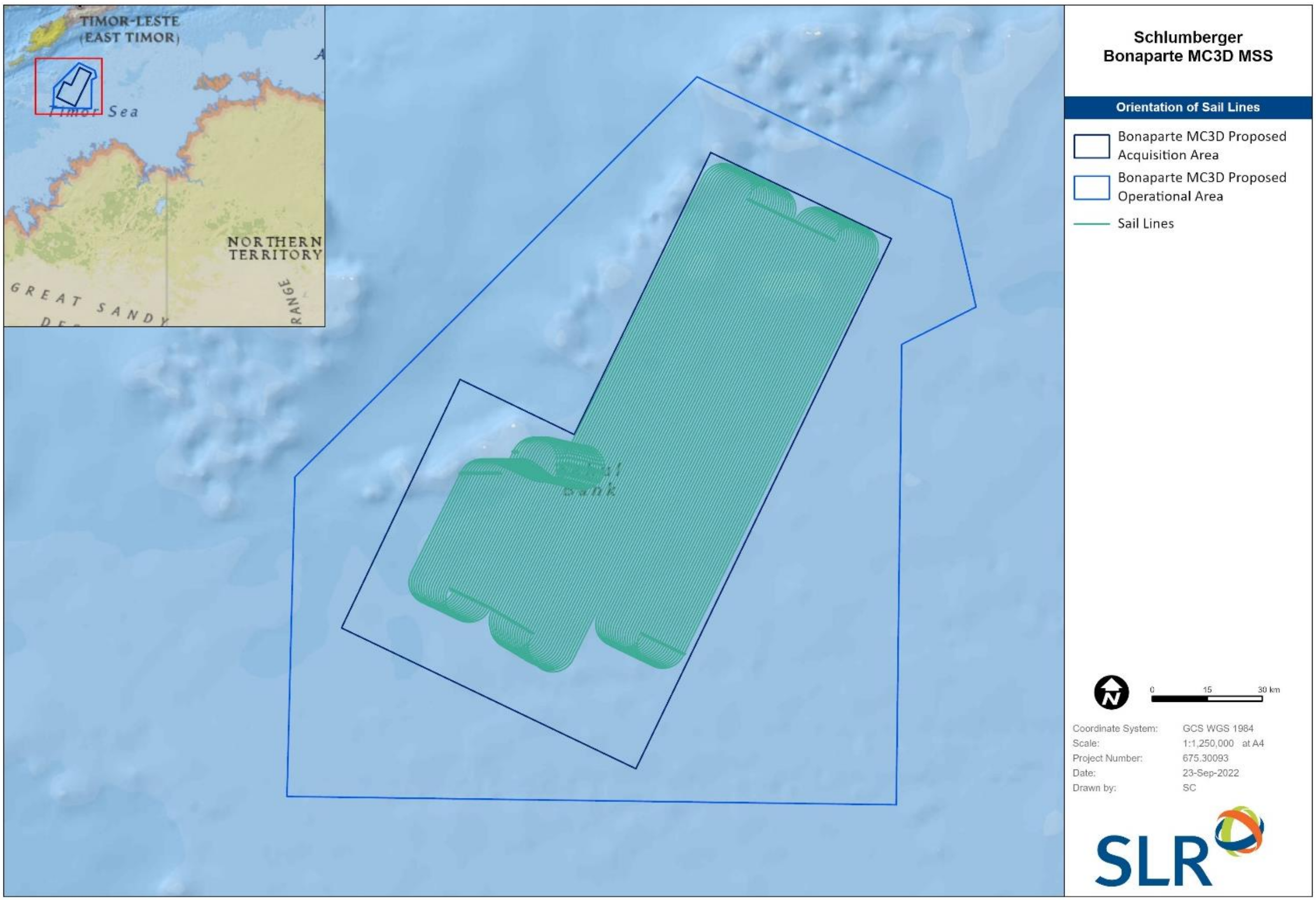


Figure 5 Location of the OA and Orientation of Survey Lines

3.2.2 Acquisition Area

The Acquisition Area (**AA**) is where the seismic data is obtained and covers approximately 12,000 km^2, with approximately 50%, of the total area constituting depth to seabed >100 m. To support effective delivery of the Seismic Survey, Softstart Procedures will also occur within the acquisition area. A description of Soft-start Procedures is provided in **Section 3.4.3**.

During data acquisition, the Seismic Vessel traverses the AA along a series of predetermined parallel lines called sail lines. Depending on the final activity specifications of the Seismic Survey, there could be between approximately 106 and 206 sail lines proposed to be acquired, with lines oriented at either 26/206° or 159/339°, respectively (**Table 5** and **Figure 5**). Continuous line acquisition will be undertaken through the Seismic Survey, which is essentially where the acoustic source will remain active through the line turns as data will be acquired through these turns. This mode of acquisition results in a 'racetrack' survey pattern (**Figure 5**) and avoids having to shut down the source at the end of each line and then commencing start up procedures. As a result, this will reduce the duration of the Seismic Survey. This process is repeated until the required full-fold coverage is completed across the Acquisition Area. To this end, the area over which the acoustic source will be active represents only a portion of the total OA.

3.3 Timing and Duration

The Seismic Survey may commence as early as November 2022 and will be completed before 30 June 2024. As a result, the duration of validity of this EP is between 1 November 2022 and 30 June 2024. It is estimated to take between approximately 120 to 190 days to acquire 12,000 km^2, including contingency time for potential vessel or equipment down time and adverse weather conditions. Though the exact survey duration is dependent upon final activity scope, up to a maximum of 10,000 km^2 may be acquired per calendar year between 2022 and 2024. The precise timing of the survey commencement is subject to NOPSEMA's acceptance this EP, weather conditions, vessel availability, and other operational considerations. However, the survey programme and management procedures will consider the seasonality of environmental sensitivities, wherever practicable.

To minimise survey duration, geophysical data will be acquired 24 hours a day, seven days per week utilising continuous line acquisition. When recording the data, the Seismic Vessel traverses the AA along a series of predetermined sail lines at a speed of approximately 4-5 knots (7-9 km/h). Each survey line, with up to 12 streamers being towed behind the Seismic Vessel (also referred to herein as 'swath') is up to 155 kilometres long and could take up to approximately 32 hours to complete. Data for a pre-determined swath only needs to be acquired once unless there is a stop in data acquisition due to a marine mammal mitigation procedure. Therefore, where no infill is required, for example due to adaptive management measures, the Seismic Vessel will not need to collect data in that area again.

For completeness, this EP has been developed with consideration to all sensitivities, seasonality and receptors that could be influenced by the Seismic Survey commencing in November 2022 and extending until 30 June 2024.

3.4 The Bonaparte Basin Seismic Survey Specification

3.4.1 Acoustic Source Configuration

The proposed Seismic Survey will comprise a single Seismic Vessel towing up to twelve seismic streamers with 120 m spacings up to 8 km long, at a speed of approximately 4 – 5 knots (7-9 km/h). The acquisition parameters are provided in **Table 7**, while **Figure 6** indicates the source array proposed for the Seismic Survey.

Table 7 Acquisition Parameters

Parameter	Seismic Survey Parameters
Volume	3,000 in^3
Nominal working pressure	2,000 psi
Source depth	8 m
Vessel speed	4-5 knots
SP Interval	16.667 m
Number of streamers	12
Streamer length	Up to 8,000 m (8 km)
Spacings between streamers	120 m
Streamer depth	10-20 m
Sail line spacing	Approximately 720 m
Full-fold Acquisition Area	Approximately 12,000 km^2
Time to traverse a single sail line	Up to approximately 32 hours
Total expected duration	190 days, including continency

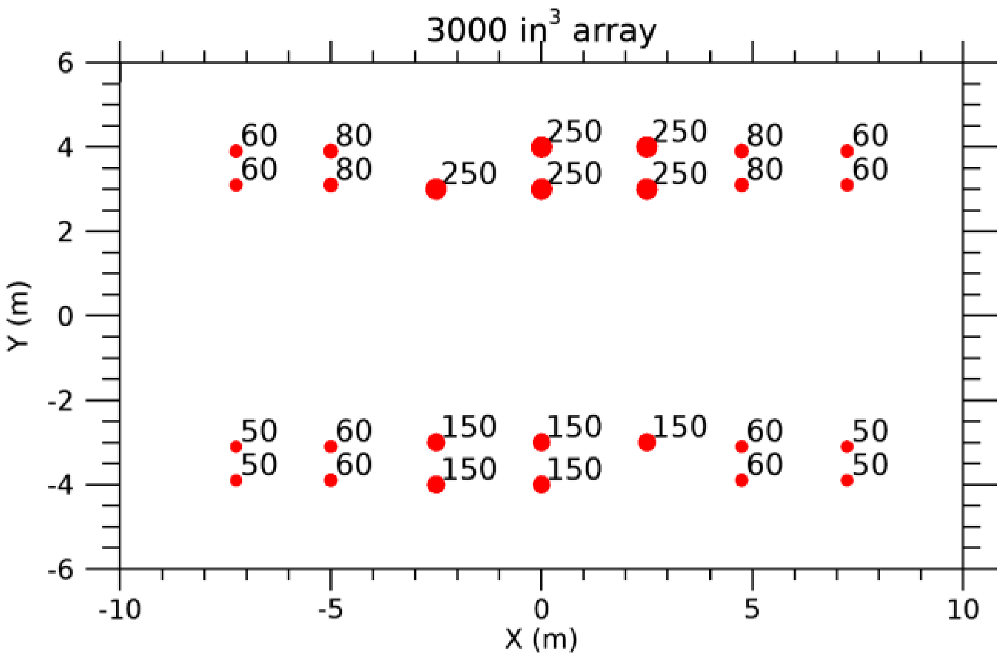


Figure 6 Acoustic Source Array Proposed for the Seismic Survey

The acoustic source will have an effective volume of up to 3,000 in^3 and will comprise of two sub-arrays, with thirteen acoustic sources per sub-array (26 in total). The source is attached to a hanger by chains of a fixed length and the hanger is attached by ropes to a surface buoy for flotation. The acoustic source array will be towed approximately 555 m behind the Seismic Vessel on an umbilical line at a depth of 8 m below the sea surface.

The acoustic source comprises two high pressure chambers; an upper control chamber and a discharge chamber. High pressure air (~2,000 psi) from compressors on-board the Seismic Vessel is continuously fed to the source, forcing a piston downwards and filling the chambers with high-pressure air while the piston remains in the closed position.

The acoustic source is activated by sending an electrical pulse to a valve which opens, and the piston is forced upwards, allowing the high-pressure air in the lower chamber to discharge to the surrounding water. The discharged air forms a spherical bubble, which oscillates according to the operating pressure, the depth of operation, the water temperature and the discharge volume, ultimately forming a pressure wave. Following this discharge, the piston is forced back down to its original position by the high-pressure air in the control chamber, allowing the sequence to be repeated. The compressors are capable of re-charging the acoustic source rapidly and continuously enabling the source arrays to be fired every few seconds. The proposed firing interval for the Seismic Survey is every 16.7 m, which translates to the release of the acoustic source every ~7 seconds.

The required size of the acoustic source volumes is determined by a number of factors such as the objectives of the survey, complexity of seabed geology and the water depths of the OA and are designed to provide sufficient seismic energy to 'illuminate' the geological objective of the survey (OGP, 2011). SLB considered a number of different source volumes used in preceding surveys in the area as part of a survey design and modelling exercise in order to determine the most appropriate size to minimise impacts while achieving the objectives for the Seismic Survey. The preferred source size for illumination was an array with a volume of 3,000 in^3. This is in line with source volumes used in recent marine seismic surveys in the area and sufficient to achieve the goals of the survey and reach the deep targets that SLB is trying to assess in the deep waters. In summary, the selected size was found to be sufficient for the required data resolution and achieving objectives, while minimizing impacts.

Acoustic arrays are designed to direct most of the sound energy vertically downwards, although some residual energy dissipates horizontally into the surrounding water. The amplitude of sound waves generally declines with lateral distance from the acoustic source, and the weakening of the signal with distance (attenuation) is frequency dependent, with stronger attenuation occurring at higher frequencies. The decay of sound in the sea is dependent on the local environmental conditions such as water temperature, water depth, seabed characteristics and depth at which the acoustic signal is generated.

Acoustic arrays used by the oil and gas industry are designed to emit most of their energy at low frequencies, typically ranging between 10 – 300 Hz with declining energy at frequencies above 200 Hz (APPEA 2015, Popper *et al.*, 2014). Array source sound pressure levels can range from ~241 – 265 dB peak-to-peak at one metre when measured relative to a reference pressure of one micro-Pascal (re 1 µPa m_{p-p}) (Richardson *et al.*, 1995). The overall source level amplitude of a system depends on how many elements are in each array and interaction between elements.

Peak-to-peak pressure is the primary output from the acoustic source (measured by pressure units of bar/m) caused by the expanding high pressure at release, which is measured at a stated reference point (usually 1 m from the source). Using standardised measuring protocols (peak-to-peak) and a reference point enables a comparison of the pressure produced by different acoustic sources. While the units for source level pressure are often reported in bar/m these values have little biological/environmental meaning and sound levels in the water emanating from an acoustic source involved with an MSS are more often presented as dB, calculated from peak-to-peak pressure measurements.

A detailed description of the modelled source signature determined to represent the seismic array is provided in **Section 7.2.1**, including source levels outputs with various directivity. The modelled source signature was characterised by the following maximum levels:

- Peak sound pressure level (**PK**) –256 dB re 1 µPa @ 1 m;
- Sound Exposure Level (**SEL**) of 231 dB re 1 µPa^2.s @ 1 m.

The source signature modelling enabled conversion between the different parameters (i.e. SEL vs PK), in accordance with the different metrics which define the threshold criteria for sensitive receptors. Using this information, the sound fields from single pulses and accumulated SEL are calculated and used to inform the assessment of potential effects (**Section 7.2**). This source signature simulation, including predictive source levels and directivity, was conducted using JASCOs Airgun Array Source Model and performed by JASCO (**Appendix A**).

3.4.2 Streamer Configuration

A streamer array and associated tail buoys are towed behind the Seismic Vessel (**Figure 4**). When the acoustic source is activated, hydrophones within the streamers detect the low-level sound waves that are reflected back up from the geological formations below the seabed. The hydrophones convert the reflected pressure signals into electrical signals that are digitised and transmitted along the streamers to the recording system on-board the Seismic Vessel. The streamer array will comprise of up to 12 individual streamers, each spaced 120 m apart and will have a tail buoy on the end of each streamer to mark its location (**Figure 7**). The streamers will be up to 8 km long which allow for the time delay to adequately capture signals reflected from deep, target subsurface lithologies.

Both the acoustic source and the streamers are towed beneath the surface (**Figure 4**). Towing the streamers underwater reduces the potential for acoustic interference from the sea surface. The deeper a streamer is towed, the lower the background surface noise recorded; however, this can also result in a narrower bandwidth of received data. Typical streamer operating depths range from 4 – 5 m for shallow, high-resolution surveys in relatively good weather but can be 8 – 12 m for deeper penetration below the seabed and lower frequency targets in more open waters. For the Seismic Survey, SLB will have a streamer depth of 10-20 m. Streamer depth is controlled from the Seismic Vessel utilising units called 'birds', which provide an accuracy of +/-1 m for the required operating depth (OGP, 2011). Electronically controlled 'wings' on the birds pivot in response to changes in pressure (depth) as detected by a pressure transducer inside each bird, automatically pivoting the wings up or down if the streamers pulls too deep or shallow (OGP, 2011).

The tail buoy (**Figure 7**) is a large hydrodynamically-shaped buoy that is towed at the rear end of each streamer where it serves several functions:

- Keeping the streamer straight;
- Keeping the rear of the streamer up/afloat;

- Providing a visual reference for the end of each streamer for the vessel and survey crew (which allows the crew to determine that correct coverage is being met); and
- Holding a flag, radar reflector and flashing light and an Automated Identification System (**AIS**) transponder to allow other vessels to locate the rear of the streamers.

Each of the 12 streamers used within the Seismic Survey will be towed with a tail buoy for each comprising a radar reflector and flashing light to mark the end of the array. The tail buoy will also be fitted with marine fauna deflectors on the front, ensure marine fauna, in particular marine turtles, are not injured or trapped within the tail buoy.

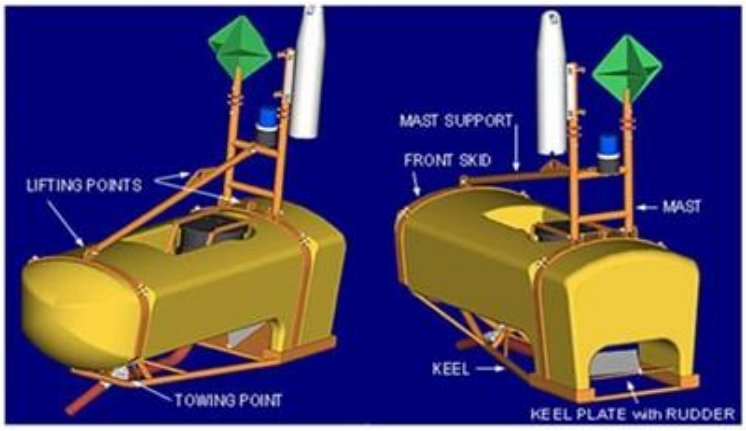


Figure 7 Example of a Seismic Streamer Tail Buoy, with Light, Radar Reflector, and AIS Transponder

3.4.3 Sail Lines, Line Turns and Infill Lines

The proposed Seismic Survey will acquire data along a series of adjacent and parallel lines, termed sail lines. As the vessel manoeuvres from a completed sail line to reach the adjacent, the acoustic source will remain active, and data will continue to be acquired forming a 'racetrack' survey pattern. As indicated in **Section 3.2.2**, this approach is defined as continuous line acquisitions and these manoeuvres between adjacent and parallel sail lines constitute line-turns. The number and density of sail lines (termed the line plan) and acquisition geometry are carefully designed to allow suitable coverage of target areas within the Acquisition Area, whilst optimising the efficiency of the survey.

Between approximately 106 and 206 sail lines are proposed to be acquired for the Seismic Survey, depending on the final activity specifications, with lines oriented at either 26/206° or 159/339°, respectively. Sail lines will be spaced at 720 m intervals, to provide full-fold coverage of seismic data resulting in a total AA of 12,000km² (**Figure 5**). During data acquisition, the Seismic Vessel will travel at approximately 4 – 5 knots (7 – 9 km/h), and with sail line lengths of approximately 140 km, the survey of each line will take approximately 32 hours (assuming no delays, shut-downs or deviations are required).

The Seismic Vessel has limited ability to manoeuvre whilst towing the streamer and acoustic array, which is mitigated through the presence of a Support Vessel and Chase Vessel for the duration of the Seismic Survey to ensure the area ahead of the survey vessel is clear and engage with any fishers in the area.

During the Seismic Survey, there may be situations where the acoustic source must be shut down. For example, in response to a marine mammal entering the shut-down zone, such as a pygmy blue whale sighting (see **Section 7.2.5**). In the event the shutdown procedures are enacted, the Seismic Vessel will return to acquire the un-surveyed portion of the sail line at a later time. These return acquisitions are termed infill lines.

Any infill lines required would be completed on a different day, with a minimum 24-hr delay to mitigate cumulative effects arising from infill lines completed in quick succession.

Prior to commencing the survey or after a break in the source being active, a soft-start will be undertaken. A basic Soft-start Procedure consists of gradually increasing the source's power, starting with the lowest capacity acoustic source and progressively adding to it, until operating level is achieved. Soft-starts will occur over a minimum period of at least 30 minutes and take no more than 40 minutes (note that soft-starts over a period of 30 minutes are a requirement of the EPBC Act Policy Statement 2.1).

Sail lines, line turns and infill lines will all be constrained to the Acquisition Area, as shown in **Figure 5**. The AA and associated buffer which constitute the OA are bounded by the coordinates provided in **Table 6**.

3.4.4 Project Vessels

3.4.4.1 Seismic Survey Vessel

The selection of the Seismic Vessel to undertake the Seismic Survey has not yet been finalised so specific vessel details cannot be provided. However, for the purpose of this application and the risk assessment completed throughout this EP, specifications of a typical Seismic Vessel, Support Vessel, and Chase Vessel are provided in **Table 8** and discussed further in **Section 3.4.4.2**. The planning, consultation process, risk assessments and implementation strategy have been based on these specifications and if the contracted vessels differ from these, a re-assessment of these aspects will be carried out. If a change in vessel specification occurs and it has the potential to increase or change the level of impact or risk of the Seismic Survey, a management of change process would be undertaken (as per **Section 10.4.7**).

Table 8 Typical Specifications of the Seismic Vessel, Support Vessel and Chase Vessel

Specification	Seismic Survey Vessel	Support/Chase Vessel
Length	108.3 m	64 m
Width	28 m	16 m
Draught (max)	7.5 m	5.4 m
Operational speed	4 – 5 knots	5 – 10 knots
Double hull	No	No
Accommodation	Up to 69 persons	Up to 54 persons
Fuel type	Marine Gas Oil (**MGO**)	MGO
Fuel capacity (total)	2,500 m^3 (95% full)	999 m^3
Largest fuel tank	257.4 m^3	133 m^3
Fuel consumption	28 m^3/day	4 m^3/day
Incineration	65 L sludge/hr	N/A
Treated sewage	15 m^3/day max	4.2 m^3/day max
Bilge water	2.5 m^3/hr	0.5 m^3/hr

3.4.4.2 Support Vessel and Chase Vessel

During the survey there will be one Support Vessel and one Chase Vessel accompanying the Seismic Vessel at all times. The role of the Support Vessel and Chase Vessel is to manage any possible interactions between the Seismic Vessel, the seismic array (acoustic source and streamers), and other vessels, receptors or activities occurring in the area. The consultation process and advanced notification has and will be implemented to ensure all users of the area are aware of the survey. Effective communication of the survey's location and proposed activities will continue throughout the Seismic Survey to help to reduce potential conflict between the survey and relevant persons/marine users at all times.

Both the Support Vessel and Chase Vessel will be positioned at a safe distance from the Seismic Vessel and towed seismic array and will maintain 24-hour watch, using visual and electronic means, for other vessels or activities which might be approaching or in the path of the Seismic Vessel. The Support Vessel will undertake refuelling operations for the Seismic Vessel (**Section 3.4.5**) and may also re-supply the Seismic Vessel during the Seismic Survey; however, it is likely a smaller vessel will fill this role providing fresh stores every 2 – 3 weeks.

Importantly, during acquisition two MFOs/MMOs will be stationed on the Chase Vessel, which will travel as far as practicable ahead of the Seismic Vessel and will conduct visual surveillance for marine mammals during the daylight hours (**Section 7.1.4** and **7.2.5**). It is noted that the requirement for being as far as practicable ahead of the Seismic Vessel is defined as an 180° arc ahead of the Seismic Vessel, noting that the Chase Vessel should focus on the portion of the arc closest to the blue whale migratory BIA and buffer when relevant.

In addition to the Support Vessel and Chase Vessel, helicopters may be utilised to transport equipment, supplies and crew to and from the Seismic Vessel during the Seismic Survey, and also provide emergency medical evacuation, if required.

At the time of submission of this EP, the specific Support Vessel and Chase Vessel have not been contracted. However, both vessels will be smaller than the Seismic Vessel, of suitable class for safely operating in the offshore environment comprising the OA, be crewed by competent persons, have all required operational procedures and systems in-place, and carry all required communication and safety equipment. SLB will undertake a vessel audit before commencement of the Seismic Survey to ensure all relevant EPSs will be met onboard the vessels and any potential risks will be reduced to ALARP and Acceptable Levels.

3.4.5 Refuelling Operations & Crew Changes

All crew changes and refuelling (bunkering) for the survey vessels will be undertaken at-sea. To reduce the risk of a fuel spill event, at-sea refuelling operations will occur within the OA and in accordance with the control measures outlined in **Section 8.4** and **Section 8.5**.

To reduce the number of transfers required, the vessels will take on fresh provisions for the next swing offshore during crew changes and bunkering. These provisions will not last the duration of each swing, so a vessel will visit the Seismic Vessel every 2 – 3 weeks to deliver fresh provisions given they would perish and not last the duration if all fresh supplies were taken at once. Crew change, and bunkering operations will take place every five weeks.

3.4.6 Helicopter

In the event of an emergency, helicopters may be used to support recovery and transfer of crew. Helicopters are predicted to operate out of the Kalumburu Helipad.

4 Existing Environment

This section describes the key physical, biological, socio-economic and cultural characteristics of the existing environment and the sensitivities and receptors that may be affected, both from planned activities and unplanned events associated with the Seismic Survey. Consequently, the description of the existing environment applies to two areas:

- The OA, as presented in **Figure 1** and described in **Section 3.2.1**.
- The EMBA, as shown in **Figure 8** and further described in **Section 4.1**.

4.1 Environment that May Be Affected

Most planned activities and unplanned events associated with the Seismic Survey may affect the environment up to a few hundred metres from the source location. However, a significant unplanned event, such as a vessel hydrocarbon spill, has the potential to impact the existing environment substantially beyond that seen through impacts from planned activities. Therefore, the EMBA was derived utilising stochastic hydrocarbon dispersion and fate modelling which is described in detail within **Section 8.2**.

SLB commissioned Oceanum and Calypso Science to model the oceanic dispersal and beaching potential of a hydrocarbon spill from the unlikely situation of a spill event during the proposed Seismic Survey (**Section 8.2**, **Appendix B**). This modelling simulated the occurrence of 100 realistic spill events of 1,000 m^3 of marine gas oil (**MGO**) from three locations within the OA, randomly distributed over the previous decade. An output of this modelling was the maximum extent at which various environmental thresholds were reached, including for floating, entrained, dissolved and shoreline accumulations of hydrocarbons.

The extent of the EMBA (**Figure 8**) was based on a combination of the maximum extent of the spill trajectory at which entrained hydrocarbons were above the low threshold from each of the three modelled release locations. Utilising the maximum extent from all three spill locations results in a worst-case scenario for the spatial extent of impacts from the Seismic Survey.

Acoustic modelling shows that noise levels exceeding predefined impact thresholds do not exceed the boundary of the unplanned vessel hydrocarbon spill EMBA detailed above. Therefore, the unplanned hydrocarbon EMBA represents the overall EMBA for the activities associated with the proposed Seismic Survey.

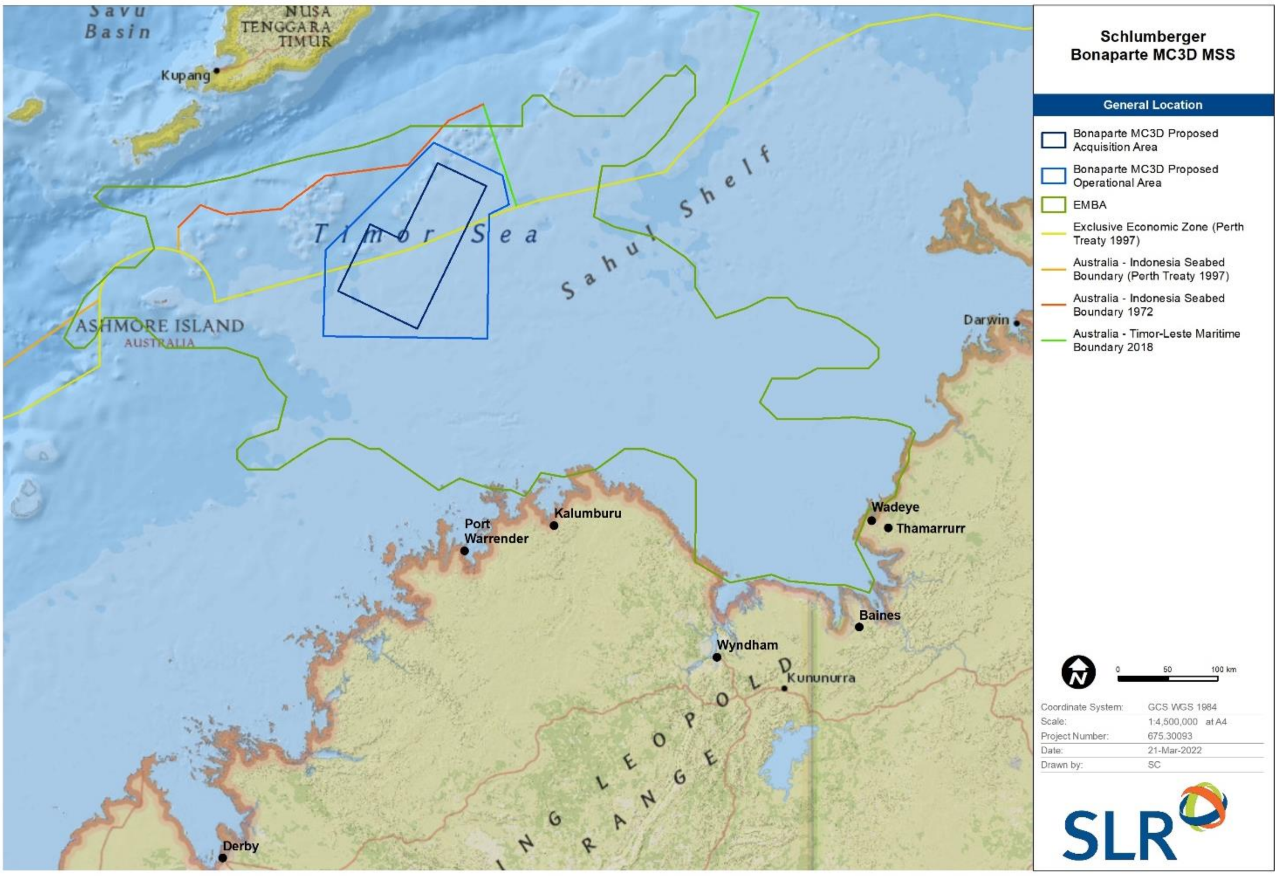


Figure 8 EMBA Associated with the proposed Seismic Survey

4.1.1 Environmental Values and Sensitivities

As required by Regulation 13(3) of the Environment Regulations, a comprehensive description of the environmental values and key sensitivities within the EMBA has been provided within the following sections. These sections have been guided by the results of a search utilising the Protected Matters Search Tool from the Department of Climate Change, Energy, the Environment and Water (**DoCCEEW**). The full results from this search are found within **Appendix C**.

4.2 Regional Environment

4.2.1 Marine Regions

In 2008, the Australian Government conducted marine bioregional planning to facilitate consistent and improved decision-making processes under the EPBC Act. Six discrete marine regions were identified and designated through the marine bioregional planning process. Marine bioregional plans have been developed for four of the six bioregions and describe the marine environment and conservation values of each region, set out broad biodiversity objectives, identify regional priorities and outline strategies and actions to address these priorities. The plans are intended to support ecologically sustainable use of ocean resources by marine-based industries while conserving a healthy and resilient marine environment.

The OA and EMBA are located within the North-west Marine Region (**NWMR**); in addition, the EMBA also overlaps with the North Marine Region (**NMR**) as shown in **Figure 9**.

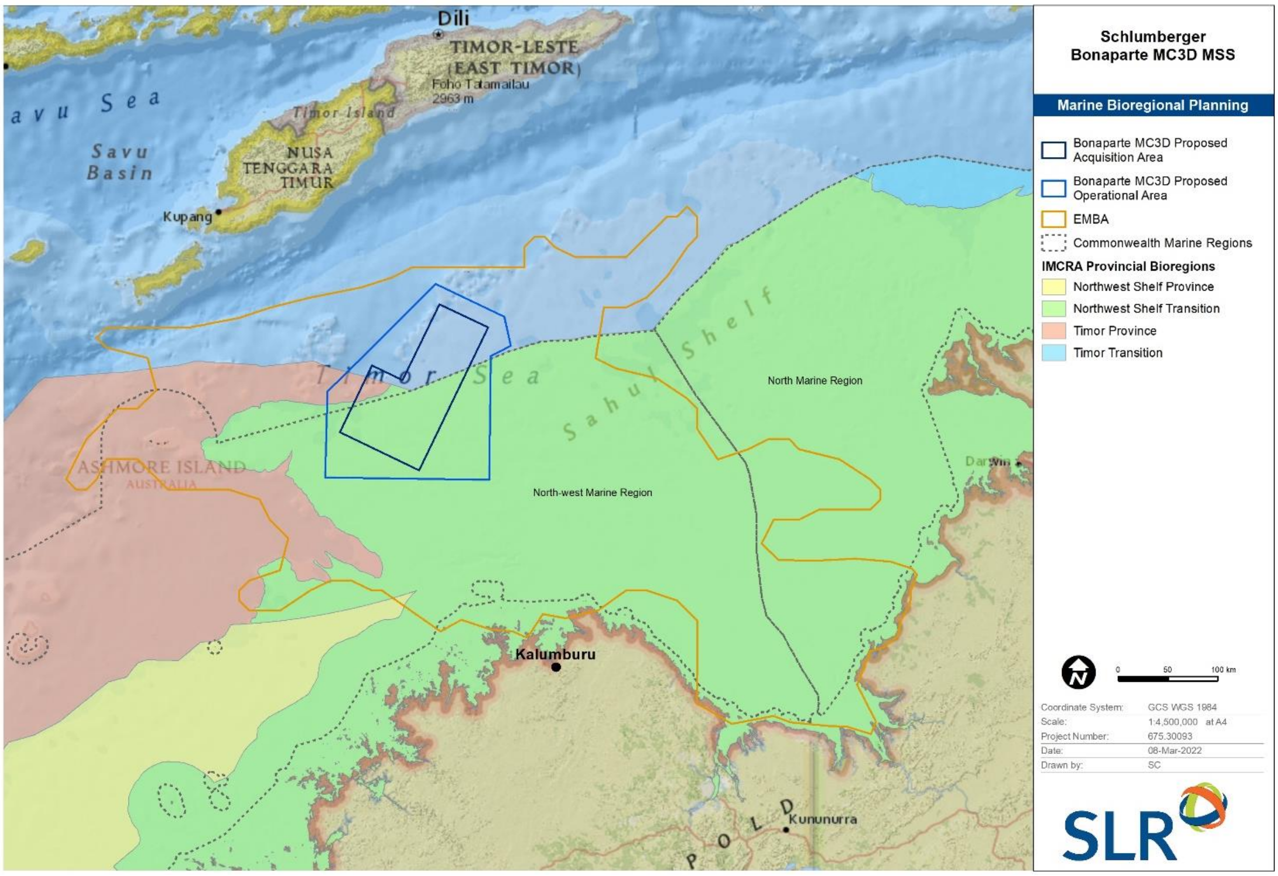


Figure 9 Marine Bioregional Planning in relation to the EMBA

4.2.1.1 North-west Marine Region

The NWMR comprises Commonwealth waters extending from the border of WA and Northern Territories (**NT**) to Kalbarri, south of Shark Bay. The region includes extensive areas of continental shelf and continental slope, highly variable tidal regions and high cyclone incidence. The NWMR is characterised by shallow-water tropical marine ecosystems with high species richness, due in part to the interaction between seafloor features and the prevailing currents of the region and the diversity of habitat available. Hard habitats such as the limestone pavements of the Northwest Shelf and pinnacles and reefs on the edge of the shelves support a high diversity of benthic filter feeders and producers. Soft-bottom substrates support infaunal communities in the Joseph Bonaparte Gulf (**JBG**) and deep sessile communities of filter and deposit feeders in the abyssal plains. The region is also home to globally significant populations of internationally threatened species and protected species established under the EPBC Act, including cetaceans, dugong, marine reptiles, seabirds, shorebirds, sharks, sawfish and Syngnathidae.

Key physical features of the marine region include (DSEWPC, 2012a):

- Extensive areas of continental shelf and slope, plateaux and terraces including the Northwest and Sahul shelfs, the Exmouth and Scott plateaux, the Wallaby Saddle and the Rowley Terrace;
- The narrowest continental shelf on Australia’s coastal margin, which occurs near Northwest Cape where the shelf is just 7 km wide;
- Coralline algal reefs, and carbonate pinnacles and shoals in the far north of the region;
- Coral reefs including Ashmore, Hibernia, Scott, Seringapatam, Ningaloo and the Rowley Shoals, all of which have a high diversity of corals and associated fish and other species of both commercial and conservation importance;
- The JBG, a muddy basin with sparse coverage of sessile filter-feeding organisms and mobile invertebrates;
- A number of major canyons on the continental slope that act as conduits for sediment and nutrient transport, including Cape Range, Cloates, Carnarvon and Swan canyons;
- Two areas of abyssal plain (Cuvier and Argo) with depths in excess of 5,000 m; and
- The Indonesian Throughflow (**ITF**), a low-salinity water mass that is one of the major elements of the global transfer of heat and water between oceans and which plays a key role in initiating the Leeuwin Currents.

4.2.1.2 North Marine Region

The NMR comprises Commonwealth waters from west Cape York Peninsula to the WA – NT border. The area includes tropical waters of the Gulf of Carpentaria, Arafura Sea and the Timor Sea and abuts the coastal waters of Queensland and NT. The NMR is known for its high diversity of tropical species but relatively low endemism. The NMR is increasingly recognised as an area of global conservation significance for marine species and as an important aggregation area and stopover habitat for migratory birds, where waters provide important bird, marine turtle and dugong breeding, feeding and nursery sites.

Key physical features of the NMR within proximity to the OA and EMBA include (DSEWPC, 2012b):

- A wide continental shelf with water depths generally less than 70 m, although water depths range from approximately 10 m to a maximum known depth of 357 m;
- The Van Diemen Rise, characterised by complex geomorphology with features including shelves, shoals, banks, terraces and valleys like the Malita Shelf Valley, which provides a significant connection between the JBG and the Timor Trough;
- To the north of the NMR, a series of shallow canyons approximately 80–100 m deep and 20 km wide that lead into the Arafura Depression, which consists mainly of calcium carbonate–based sediments (e.g. carbonate sand and subfossil shell fragments);
- Numerous limestone pinnacles up to tens of kms in length and width, which lie within the Bonaparte Basin;
- The Arafura Shelf, an area of continental shelf up to 350 km wide and mostly 50 – 80 m deep that is characterised by sea-floor features such as canyons, terraces, the Arafura Sill and the Arafura Depression;
- Currents driven largely by strong winds and tides, with only minor influences from oceanographic currents such as the IFT and the South Equatorial Current; and
- Complex weather cycles and a tropical monsoonal climate, with high temperatures, heavy seasonal yet variable rainfall and cyclones, alternated with extended rain-free periods.

4.2.2 Provincial Bioregions

The Integrated Marine and Coastal Regionalisation of Australia is a biogeographic regionalization of Australia's marine jurisdiction based on spatial patterns in the benthic and pelagic environment and at scales appropriate to support effective marine planning. Provincial bioregions are principally based on the broad-scale distribution of demersal fish.

As seen in **Figure 9**, the OA overlaps the Northwest Shelf Transition. Additionally, the EMBA overlaps the Northwest Shelf Province and Timor Province. A brief description of these three provinces is contained in the following sections.

4.2.2.1 Northwest Shelf Province

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

- Located mostly on the continental shelf between Northwest Cape and Cape Bougainville;
- Water depths range between 0 – 200 m;
- Dynamic oceanographic environment, influenced by strong tides, cyclonic storms, long-period swells and internal tides. Warm, oligotrophic waters derived from the ITF; and
- The biological communities include diverse benthic and pelagic fish communities associated with different depth ranges, seabird breeding sites and cetacean (humpback whale) migration route.

4.2.2.2 Northwest Shelf Transition

The Northwest Shelf Transition, which straddles both the NWMR and NMR, is characterised by the following biophysical features (DSEWPC, 2012a):

- Located mostly on the continental shelf, with some small areas extending onto the continental slope;
- Water depths range between 0 – 330 m, with the majority of the bioregion occurring in depths of 10 - 100 m;
- The ITF is the dominant oceanographic feature and dominates the majority of the water column;
- The strength of the ITF and its influence in the bioregion varies seasonally in association with the Northwest Monsoon;
- Contains a variety of geomorphic features, including terraces, plateaus, sand banks, canyons and reefs; and
- The biological communities of the Northwest Shelf Transition are typical of Indo-west Pacific tropical flora and fauna and occur across a range of soft-bottom and harder substrate habitats.

4.2.2.3 Timor Province

The Timor Province, within the NWMR, is characterised by the following biophysical features (DEWHA 2008b):

- Covers almost 15% of the NWMR, predominantly covering the continental slope and abyss between Broome and Cape Bougainville;
- Water depths range from 200 m near the shelf break to over 5,920 m over the Argo Abyssal Plain;
- Major geomorphic features include the Scott Plateau, the Ashmore Terrace, part of the Rowley Terrace and the Bowers Canyon;
- Important features include Ashmore Reef, Cartier Island, Seringapatam Reef and Scott Reef;
- Dominated by warm, oligotrophic waters derived from the ITF. The thermocline in the water column in particularly pronounced and associated with the generation of internal tides;
- Several distinct habitats and biological communities occur within the region, and the reefs and islands are regarded as biodiversity hotspots. A high level of endemicity exists in the demersal fish communities of the continental slope in the Timor Province.

4.3 Physical Environment

4.3.1 Meteorology

The region experiences monsoonal climate patterns comprising two distinct seasons, the Northwest Monsoon or "wet season" (late October to mid-March) and the Southeast Monsoon or "dry season" (May to mid-October). The Northwest Monsoon is characterised by high cloud cover, high temperatures and regular and high rainfall, particularly over coastal areas and during cyclones. Conversely, the Southeast Monsoon originates from the Southern Hemisphere high-pressure belt and is relatively dry and cool (DSEWPC, 2012a).

The high incidence of cyclones within the region can result in severe storms, characterised by gale force winds and a rapid rise in water levels. These can generate large swell and storm surges. Tropical cyclones usually form in an active monsoon trough, between December and April (BoM, 2022a). On average, about five cyclones occur each year in the NWMR, two of which make landfall and one of which is severe (Category 3 or higher). The chance of a severe cyclone occurring is highest in March and April (BoM, 2022a).

The Kalumburu, Truscott and Troughton Island weather stations are located within the nearshore and marine environment of the NWMR, providing an overview of local climatic conditions. A summary of the seasonal ranges in mean temperature, rainfall and wind speed observations are provided in **Table 9.**

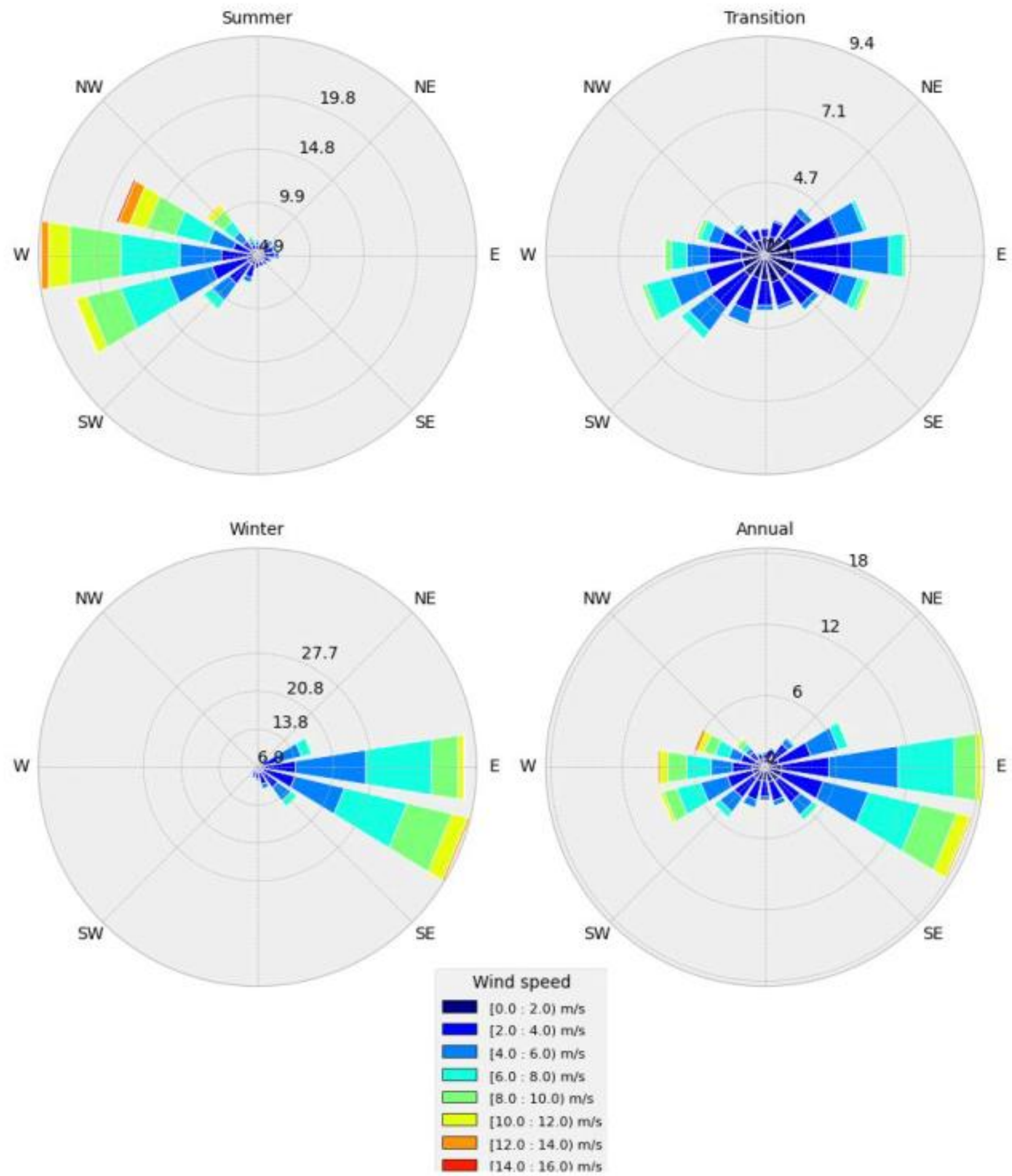
Table 9 Seasonal Mean Temperature, Rainfall and Wind Speed Ranges

Weather Station	Distance from OA	Season	Temperature (° C)	Monthly Rainfall (mm)	Wind Speed (km/hr)
Kalumburu ID 001019	300 + km SSE	Wet	21.2 – 37.3	36.1 – 336.8	8.0 – 19.2
		Dry	13.9 – 36.0	0.3 – 35.7	9.5 – 21.5
Truscott Airbase ID 001020	200 + km SSE	Wet	32.2 – 35.2	18.3 – 340.9	NA
		Dry	30.4 – 33.5	0.3 – 67.6	NA
Troughton Island ID 001007	200 + km SSE	Wet	26.3 – 33.1	10.8 – 278.6	13.7 – 22.6
		Dry	22.3 – 31.9	0.3 – 37.3	11.9 – 22.5

Source: All data obtained via BoM (Climate Data Online), (BoM, 2022b) accessed 26 January 2022. Wind Speed ranges include both 9AM and 3PM observations.

4.3.2 Wind

High resolution surface wind data collected from 2008 to 2017 (inclusive), across the OA, derived from the European Centre for Medium range Weather Forecasting (ECMWF, 2019) were hindcast for the purpose of facilitating Oil Spill Modelling (Calypso Science, 2022). **Figure 10** illustrates the seasonal and annual wind rose distributions across the monitoring period, which clearly indicate a seasonal reversal in prevailing wind direction and speed whereby moderate eastern winds dominate the region throughout summer and strong westerly winds prevail in winter. Under extreme cyclone conditions, winds can reach 180 km/h (Condie *et al*., 2006).



Note: The wind directional convention is 'coming from'

Figure 10 Annual and Seasonal Wind Roses at the Centre of the OA, from Hindcast Data 2008-2017

4.3.3 Air Quality

There is no publicly available data on air quality within the proposed OA. However, given the distance from land and limited development within the OA, air quality is expected to be relatively high. Potential sources of air pollution include those associated with anthropogenic emissions generated by shipping activity and oil and gas operations. These are considered to be localised in relation to the regional setting.

4.3.4 Oceanography

4.3.4.1 Currents

Three oceanic currents dominate circulation in the offshore waters between northwest WA and Indonesia: the ITF, the Holloway Current and the Leeuwin Current. The ITF influences the Timor Sea region, transporting warm, low saline waters from the Pacific Ocean into the Indian Ocean. The strength of the ITF is seasonal; it is weakened during the wet season when the strong south-westerly winds cause intermittent reversals of the currents (Brewer *et al*., 2007). The strengthening of the ITF in the dry season coincides with the development of the prevailing south-westerly flowing Holloway Current, which transports waters from the Banda and Arafura seas and the Gulf of Carpentaria southwards along the shelf (DEWHA, 2008b). The Holloway current is a surface current that flows parallel to the coastline and provides a conduit to transport ITF waters from Norther Australia into the Leeuwin current (Bahmanpour *et al*., n.d.). The region is also impacted by El Nino Southern Oscillation cycles, with weakened ITF and a lower incidence of tropical cyclones under El Nino conditions (Condie *et al*., 2006).

Hindcast current conditions produced by Calypso Science (2022) across the OA are generally reflective of changes in surface winds, with the maximum current speed observed during winter when strong southeasterly winds dominate the region. Maximum current speeds reported through the modelling ranged between 0.4 and 0.7 m/s across both summer and winter. Under extreme cyclone conditions, ocean currents can exceed 3 m/s (Condie *et al*., 2006).

In the southeast portion of the EMBA, circulation is influenced primarily by large tidal currents and less by ocean currents. Here, circulation occurs in a clockwise direction and current speeds increase towards the shoreline and become increasingly directed longshore.

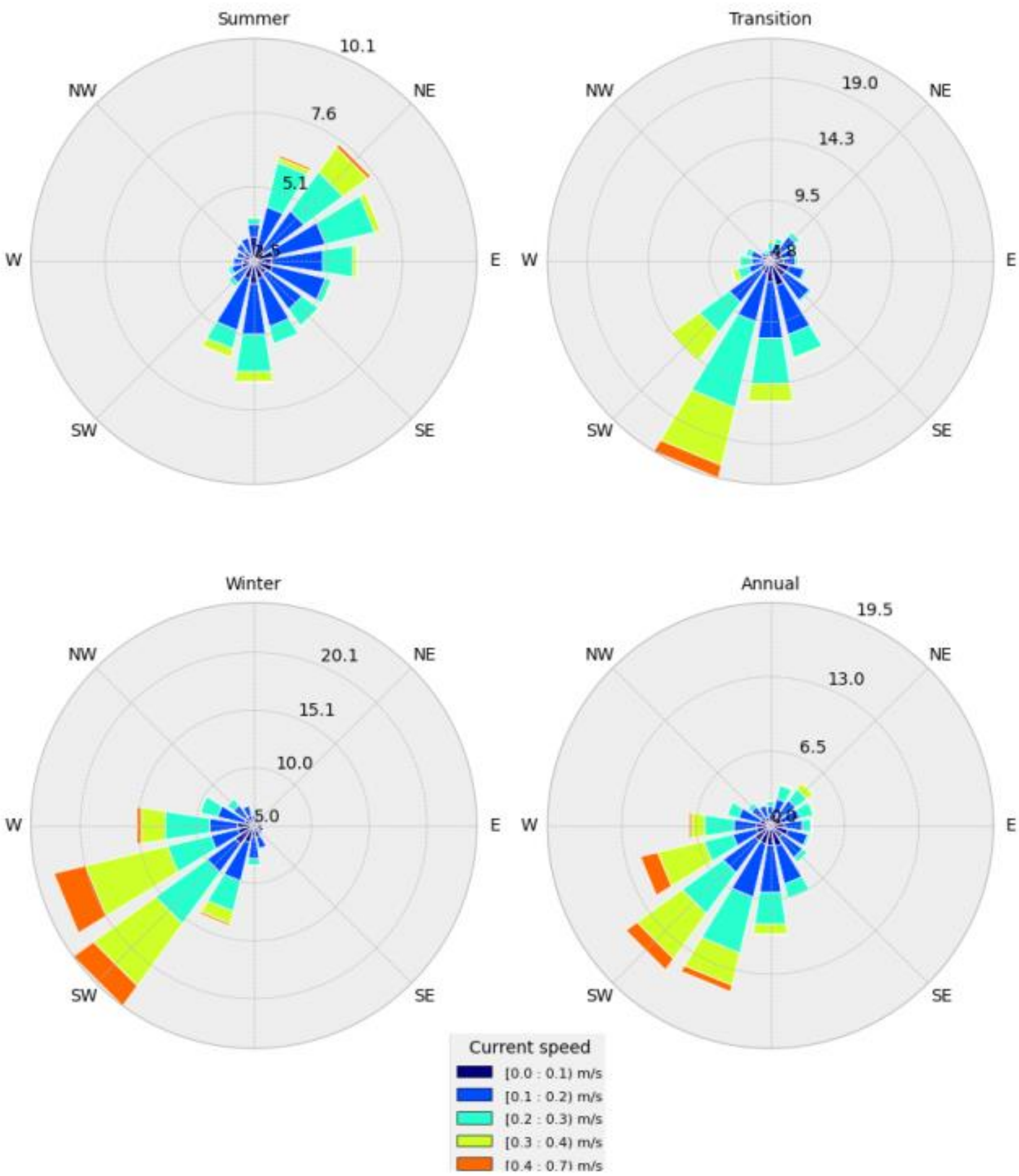
4.3.4.2 Tides

The North-west Marine Region has some of the largest tides along a coastline adjoining an open ocean in the world (DEWHA, 2008b). Tides increase in amplitude from south to north, corresponding with the increasing width of the shelf (Holloway, 1983). Tides within the OA and broader EMBA are semi-diurnal, comprising of two high tides and two low tides per day, with well-developed spring to neap tidal variation (DSEWPC, 2012a). Within the EMBA, tides are expected to range from 2 -3 m offshore (micro-tidal) rising to 3 – 4 inshore (meso-tidal) with the exception of the area overlapping the JBG, which is subject to the highest tidal range in the region. Here, tidal range can reach up to 7 – 8 m during the spring tide (CSIRO, 2005).

The combination of large tides and strong stratification also generates large internal tides over the upper slope. A shock forms on the leading face of the internal tide and propagates onshore as it dissipates over the outer shelf (Holloway, 1984 and 1987). These tides generate internal waves, further described in **Section 4.3.4.3**.

4.3.4.3 Waves

Surface waves may comprise locally generated wind waves or distant generated swell waves. Locally generated wind waves of the North-West Shelf are characterized by low mean heights and smaller periods (Hayes *et al*., 2005). Modelled wave conditions generated from surface wind speed measurements collected for the period 1997 – 2000, inclusive, indicate a mean wave height of 1 – 2 m with mean periods of 6 -8 seconds across the OA (Hayes *et al*., 2005). **Figure 11** illustrates the seasonal and annual rose plots for the distribution of surface currents (tidal and non-tidal) at the centre of the OA, based on hindcast data from 2008-2017. The roses clearly indicate a seasonal reversal in prevailing current direction whereby north to southeasterly currents dominate the region throughout summer and south-westerly currents prevail in winter.



Note: The current directional convention is 'going to'.

Figure 11 Annual and Seasonal Current Roses for the Sea Surface (Tidal and Non-tidal) at the Centre of the OA, from Hindcast Data 2008-2017

In general, mean sea swells are larger during the dry winter season than the summer wet season, as a result of the strong easterly wind-generated seas and larger winter swell from the Southern and Indian Oceans. Occasional monsoonal storms and cyclones can result in much larges waves and swell. Extreme winds associated with cyclones can generate maximum wave heights up to 21 m from any direction (RPS Metocean, 2008).

Regionally significant features also include the occurrence of internal waves, generated by the interaction between waves and seafloor topography. Internal tides occur at the delineation between water bodies with marked differences in density, such as at the thermocline. When water moving along the thermocline as a result of the internal tide intersects topographic features associated with significant changes in water depth, such as a continental shelf break, internal waves are generated. Internal waves are large in amplitude, reaching up to 75 m in height, and encourage vertical mixing (DEWHA, 2008b; Condie *et al*., 2006).

4.3.4.4 Thermoclines and Sea Surface Temperature

Sea temperature in the central Timor Sea typically range between 26 ^{o} and 30^{o} C at the surface, decreasing to 22^{o} and 25^{o} C at the seafloor. The sup-tropical water temperatures in the region are largely influenced by the ITF and a highly pronounced thermocline which is controlled by the ITF (Brewer *et al*., 2007). During the Northwest Monsoon, a thermocline flow of relatively cool water dominates resulting in the tropical Indian Ocean being cooled rather than warmed.

Water quality monitoring at the Montara Venture reported surface water temperatures ranging from 28.0^{o} to 28.7^{o} C, with a slight reduction of <1^{o} C at 20 m depth. Salinity of surface waters were consistently reported around 33.9 PSU, with low variability (Jacobs, 2017). This is broadly consistent with modelled seawater salinity profiles generated for the Bonaparte Basin, which indicate that there is little variation in salinity through the water column, monthly, or seasonally (RPS, 2011).

4.3.4.5 Water Quality

Water quality within the NWMR is regulated by the ITF, a low-salinity water mass that plays a key role in initiating the Leeuwin Current (DSEWPC, 2012a; **Section 4.3.4.1**) and brings in oligotrophic (low in nutrients) waters from the western Pacific Ocean through to the Indian Ocean (DEWHA, 2008b).

Localised elevations in nutrient conditions occur consistent with local and regional upwelling activity, typically associated with the seasonal weakening of the Leeuwin Current and where seabed topographic features force the surrounding deeper, cooler, nutrient rich waters to the surface (DEWHA, 2008b). Upwelling of nutrient-rich waters may increase phytoplankton productivity in the photic zone, which may in-turn increase local turbidity (Semeniuk *et al*., 1982; Wilso *et al*., 2003). However, understanding of the nature and spatial distribution of biological productivity in the region is limited (DEWHA, 2008b). Periodic events, such as major sediment transport associated with tropical cyclones, may also influence turbidity on a regional scale (Brewer *et al*., 2007).

Water quality profiles recorded within the EMBA during marine baseline studies conducted by ERM (2010 – 2011), O2 Marine (2018) and Jacobs (2017) were consistent with those expected to occur within the tropical offshore environment. The marine baseline studies undertaken by ERM in 2010 and 2011 showed that water quality in the Bonaparte Basin is relatively pristine. The surveys measured dissolved oxygen concentrations and total suspended solids. The reported dissolved oxygen concentrations ranged from a minimum of 3.64 mg/L (49.8%) near the seabed to 7.80 mg/L (117.2%) at the sea surface, where dissolved oxygen was consistently found to decrease with depth. This is often linked to higher photosynthetic activity at the seawater surface and wave/wind generated mixing. These values are typical of unpolluted seawater (ERM 2011). The reported total suspended solids levels were low across the area during the time of sampling. The data represents relatively low suspended solid values as would be expected for offshore waters in the region (ERM 2011). Likewise, marine baseline studies undertaken by O2 Marine in 2018 within petroleum permit area AC-RL7, located within the western portion of the OA, indicated concentrations did not exceed the ANZG values for any of the water quality parameters tested (ANZG – Australian and New Zealand Guidelines for Fresh and Marine Water Quality).

4.3.5 Geology

The OA is located wholly within the Bonaparte Basin, the easternmost basin comprising the Northwest Shelf, offshore of the North and Northwest Region of Australia. The Bonaparte Basin belongs to series of extensional basins, which formed during late Paleozoic-early Meszoic rifting in the context of the Gondwana break-up. The fan-shaped basin originated from the Cambrian, forming during two phases of Palaeozoic extension and Mesozoic (Late Triassic) compression (Geoscience Australia, 2021).

The basin emerges from continental Australia at the JBG and extends into the waters of the Timor Sea. The basin is bounded to the north by the Timor Trough and to the west it is contiguous with the Browse Basin. The basin encompasses 270,000 km² and consists predominantly of interbedded shale and sandstone and late cretaceous to tertiary aged carbonates (Geoscience Australia, 2021).

The Bonaparte Basin contains several sub-basins and regional structural elements, each of which represent a distinct geological domain. The following four geological domains overlap the OA:

- Vulcan Sub-basin;
- Ashmore Platform;
- Londonderry High; and
- Sahul Syncline.

These sub-basins and structures vary in thickness, ranging from 2.0 km within the Ashmore Platform to 10.0 km within the Vulcan Sub-basin extent.

4.3.6 Geomorphology and Bathymetry

The Northwest Shelf can be further divided into several distinct provinces, based on the geomorphic characteristics of the seabed. Of relevance is the Sahul Shelf province, a shallow platform of complex topography which underlies the OA, which consists of a series of rises, depressions, banks/shoals, terraces and channels.

An extensive system of drowned carbonate banks and shoals exist within and immediately beyond the OA. Shoals and banks within the OA form abrupt geological features which rise steeply (at a gradient of 0.1) from depths of approximately 150 m to emerge within 30 m of the water's surface, allowing light dependent organisms to thrive (**Figure 12**) (Haris *et al.*, 2003). The plateau of each shoal is typically ovate, covers approximately 10 -15 km² and consists of hard substrate which provides critical benthic habitat to which organisms can adhere in an otherwise soft sediment environment. Individual banks are intersected by narrow channels up to 150 m in depth.

A subset of banks and shoals identified within the OA and EMBA are further described in **Table 10**, along with outlining the available information on the banks and shoals which have been surveyed, as described by Australian Institute of Marine Science (**AIMS**), 2012; CSIRO, 2009; and AIMS, 2017.

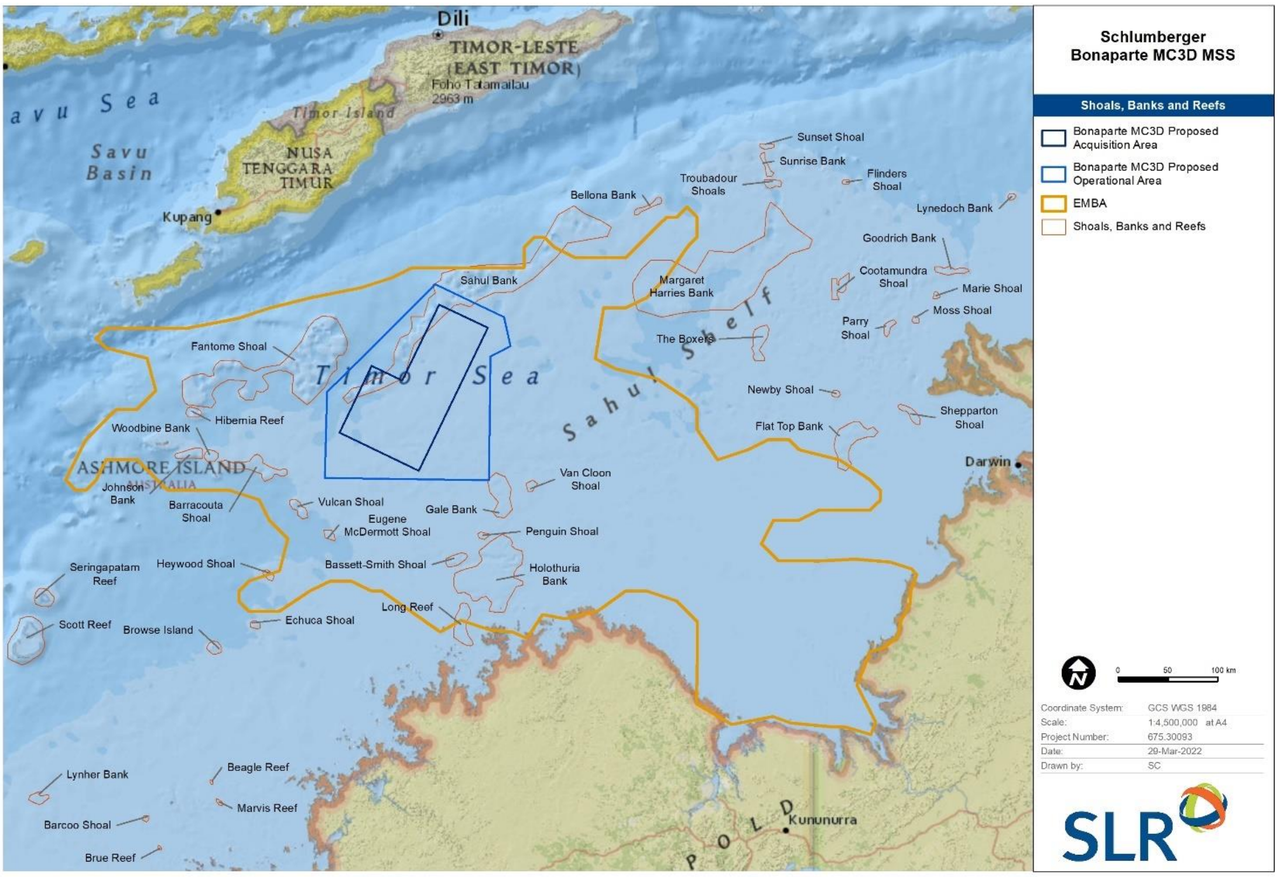


Figure 12 Shoals, Banks and Reefs in the vicinity of the EMBA

A portion of these carbonate banks and terraces form part of the Sahul Shelf Key Ecological Feature (**KEF**), which overlaps the southeast portion of the OA, and is regionally important in enhancing productivity. Roughly 24% (approx. 9,900 km^2 of approx. 41,150m^2 total) of the Sahul Shelf KEF overlaps with the OA. The carbonate bank and terrace system of the Sahul Shelf KEF is further described in **Section 4.4.3.**

The region comprises large areas of seabed that are dominated by soft sediments, such as those within continental shelf and plateau environments abutting the network of carbonate banks and shoals. The soft sediments typically consist of sandy and muddy substrate, occasionally made up of patches of coarser sediments (DEWHA, 2008b). Both the identified banks/shoals and the Sahul Shelf system provide a variety of carbonate substrates (Heyward *et al*., 2011) compared to the surrounding sandy and muddy substrate characteristic of deeper waters within the OA, particularly between the 100 m and 200 m isobaths (**Figure 13**).

Depth to seabed within the OA ranges from approximately 20 m to 200 m (Haris *et al*., 2003). However, over 95% of the OA constitutes water depths greater than 60 m (**Figure 13**).

Table 10 Subset of Banks, Shoals and Reefs identified within the OA and EMBA

Banks/Shoals	Location and Description
Heywood Shoal	Heywood Shoal is located 110 km southwest of the OA, but within the EMBA. The shoal is ovate and covers an area of approximately 32 km^2. Video surveys conducted in 2010 and 2011 indicate it is characterized by high cover of algae (48.3 %) and bare substrate (31.5%) such as sand, bare rock and rubble. Hard coral constituted 9.6% of benthic cover, with fungiidae and euphylliidae the most abundant coral families (Heyward *et al*., 2011).
Eugene McDermott Shoal	Eugene McDermott Shoal is located 52 km south of the OA, but within the EMBA. The shoal is ovate and covers approximately 5.6 km^2. Video surveys conducted in 2010 and 2011 indicate it is characterized by high cover of algae (43.4%), hard coral (17.7%) and bare substrate (16.4%) such as sand, bare rock and rubble. Algal composition was dominated by coralline and turf forms. Most major coral families were resented on the shoal, with Acroporidate and Poritidae were the most abundant (Heyward *et al*., 2011).
Vulcan Shoal	Vulcan Shoal is located 35 km southwest of the OA, but within the EMBA. The shoal covers approximately 12.5 km^2. Video surveys conducted in 2020 and 2011 indicate it is characterized by high cover of algae (38.8%) and bare substrate (33.5%) such as sand, bare rock and rubble. Of note, is that dense seagrass beds were observed at Vulcan Shoal within the 2010 surveys and constituted the only seagrass recorded across the monitoring program (Heyward *et al*., 2011).
Barracouta Shoals (East and West)	The Barracouta shoals are located 37 km west of the OA, but within the EMBA and cover a combined area of 8.6 km^2 (West: 2.8 km^2; East: 5.7 km^2). Benthic cover at both shoals is predominated by algae and bare substrate. Distinctions in benthic cover between the two shoals occurred for communities such as hard coral, sponges and soft corals which were, though minor contributors to seabed cover in each case, more prevalent at Barracouta East Shoal. Major taxonomic groups for each benthic community were similar between the two shoals (Heyward *et al*., 2011).
Woodbine Bank	Woodbine Bank is located 106 km west of the OA, but within the EMBA. Video surveys conducted in 2015 reported It is characterised by *Halimeda* sand with areas of reef habitat, namely along the southern shoal margins and covers an area of approximately 94 km^2 (CSIRO 1999)
Hibernia Reef	Hibernia Reef is located 124 km west of the OA, but within the EMBA. Towed video surveys indicate it is characterised by deep lagoon and deep reef flat habitat, comprising high cover of hard (13%) and soft corals and algae (38.5%) with some coral rubble present. Hibernia Reef covers an area of approximately 11 km^2 (CSIRO 1999).
Fantome Shoal	Fantome Shoal is located 7 km west of the OA, but within the EMBA.
Sahul Banks	The Sahul Banks are located within the northeast portion of the OA.

Banks/Shoals	Location and Description
Margaret Harries Banks	Margaret Harries Banks is located 130 km northeast of the OA, but within the EMBA. Towed video surveys conducted in 2015 identified benthic habitat dominated by limestone and hard coral outcrops, with some rubble present. Forms of low relief algae were also identified, comprising varying densities of *Halimeda* (Woodside, 2021).
Gale Bank	Gale Bank is located in the southeast corner of the OA.
Van Cloon Shoal	Van Cloon Shoal is located 36 km east of the OA, but within the EMBA.
Flat Top Bank	Flat Top Bank is located 340 km east of the OA, partially within the EMBA.
Penguin Shoal	Penguin Shoal is located 52 km south of the OA, but within the EMBA.
Basset-Smith Shoal	Basset-Smith Should is located 73 km south of the OA, but within the EMBA.
Holothuria Banks	Holothuria Banks are located 57 km south of the OA, but within the EMBA.
Long Reef	Long Reef is located 123 km south of the OA, but within the EMBA.
Johnson Bank	Johnson Bank is located 121 west of the OA, but within the EMBA. Video surveys conducted in 2015 reported It is characterised by *Halimeda* sand with areas of reef habitat, namely along the southern shoal margins, and covers an area of approximately 138 km² (Skewes, 1999b).

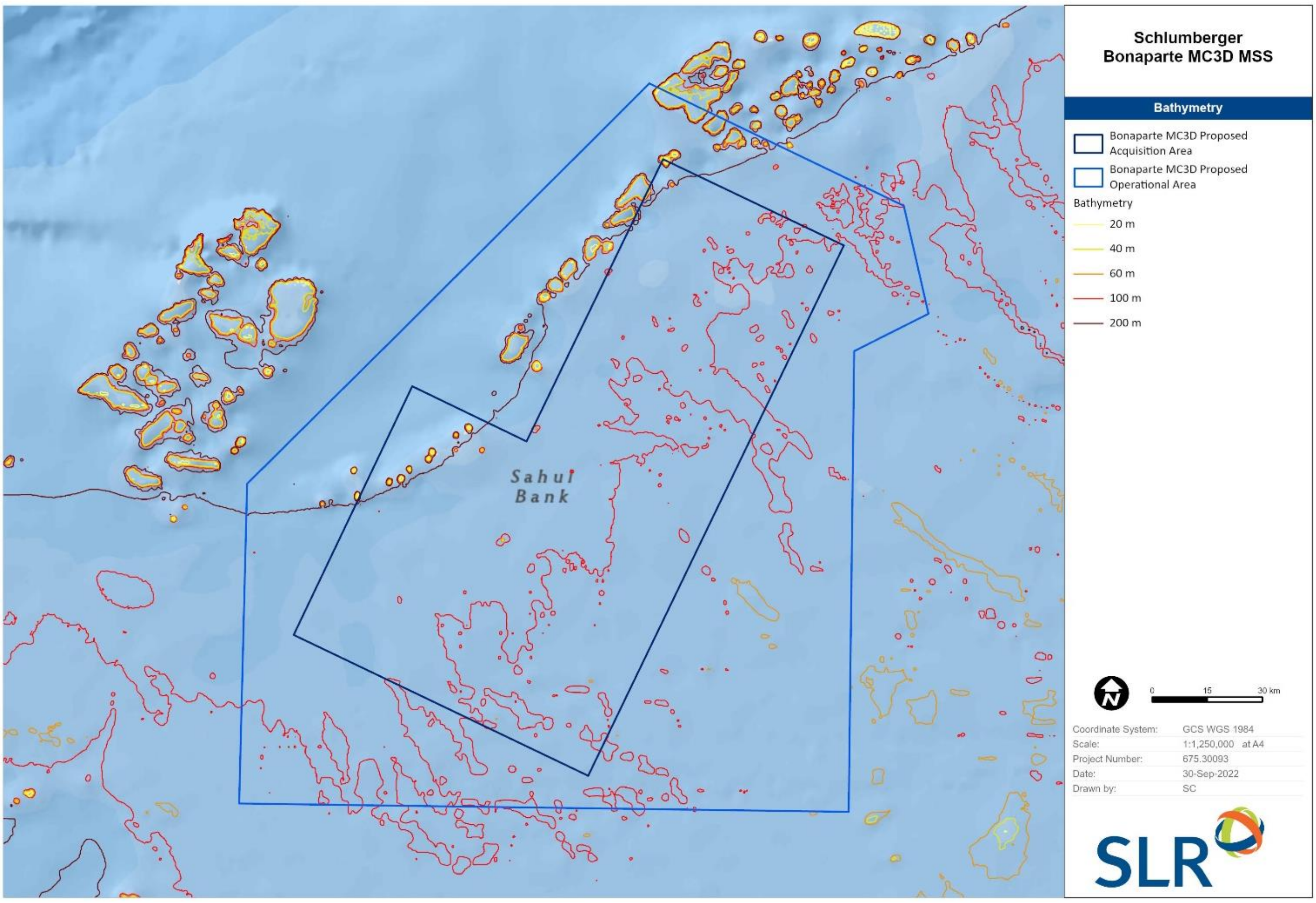


Figure 13 Bathymetry in the OA

4.3.7 Sedimentology

The sedimentology of the wider NWMR and relevant sections of the NMR is varied, owing to the diversity of geological and topographical features which it comprises. Regional sedimentology is broadly characterized by calcareous sediment consisting of varying proportions of gravel, sand and silt. Sediments show a broad zoning and fining with water depth, grading from sand and gravel dominant on the shelf to muds on the slope and abyssal plain/deep ocean floor (CSIRO, 2015; Baker *et al*., 2008).

Sediments of the middle shelf region, which underly the OA, are predominantly influenced by tidal processes. Sediment transport is driven by a combination of processes from the inner and outer shelf including winds, tides and waves and coastal turbidity.

Limited sampling data interpolated by Baker *et al*., (2008) suggest surficial sediments of the OA comprise broadly similar proportions of carbonaceous sand and mud, characterized as muddy sand. This is broadly consistent with measurements reported through the Australian Government's Marine Sediments (MARS) database (Heap, 2009), which indicate silty sand is present throughout the OA. Sediment composition is expected to be largely homogenous, with changes in the proportion of mud, sand and bulk carbonate content to occur in accordance with changes in the spatial extent of prevailing geomorphology (i.e. in broad accordance with the boundaries of banks/shoals, terraces and shelf environments).

4.3.8 Sediment Quality

Sediment quality was undertaken during multiple surveys to characterise the marine sediments within the Montara and Ichthys Fields located immediately beyond and surrounding the OA, respectively. The reported concentrations of metals, metalloids, hydrocarbons and phenolic compounds in sediment samples were either below the laboratory limit of reporting and/or the ANZG Sediment Quality Guidelines detailed in Simpson *et al*., 2013 or attributed to biogenic sources (Ross *et al*., 2017; Jacobs, 2017).

No sediment quality data collected within the OA was available for review at the time of reporting.

4.3.9 Ambient Noise

Ambient noise refers to all-encompassing sound at a given place and usually comprises a composite of sound from many sources originating from the immediate surrounds and vast distances (McPherson *et al.*, 2019). Within the marine environment, ambient noise is characterised by a mix of anthropogenic and natural sounds, with the latter broken down into physical sources such as wave activity, rain, tidal turbulence, movement of sediments on the seabed and earthquakes, and biological sources such as fauna that produce sound. Animals such as invertebrates, fish and marine mammals produce sound through various modes of action such as physical movement, choruses, and vocalisations, respectively (Kent *et al.*, 2016). Consequently, ambient noise levels will vary spatially and temporally based on their prevailing environmental characteristics including between deep waters versus coastal waters and across different diel cycles (Cato and McCauley, 2002; Harland *et al.*, 2005).

Underwater noise monitoring conducted within the Timor Sea, approximately 300 km north of Darwin (McPherson *et al.*, 2019), recorded ambient noise levels varying between 80 and 115 dB re 1 µPa (96 dB re 1 µPa average). Variations in ambient sound were primarily affected by weather events, with notable contributions from fish, whales and occasional anthropogenic noise sources.

Ambient noise monitoring was conducted at other offshore locations in the region, including within the Browse Basin approximately 250 km from the OA. Monitoring data was collected by the Centre for Marine Science and Technology at Curtin University on behalf of INPEX Ltd, between September 2006 and September 2008. The monitoring revealed the average ambient noise level of 90 dB re 1 µPa under low sea states, although the level was greater than 100 dB re 1 µPa for 70% of the time as a result of the anthropogenic contributions (McCauley, 2009). Biological noise sources recorded within the surveyed area included regular fish choruses and several calls from humpback whales, blue whales, minke whales and other unidentified species (McCauley, 2009).

Results from the various surveys in the region are indicative of typical ambient noise levels within the OA and surrounding offshore waters which comprise the EMBA. Therefore, ambient noise levels in offshore, open water locations are expected to be between 90 and 100 dB re 1 µPa in low wind conditions. These levels may increase significantly during weather events, fish and whale vocalisations and as a result of vessel presence.

4.4 Marine Protected Areas and Sensitive Areas

4.4.1 Australian Marine Parks

The Australian Marine Park (**AMP**) Network has been established around Australia as part of the National Representative System of Marine Protected Areas which has the primary goal of establishing and effectively managing a comprehensive, adequate, and representative system of marine parks to contribute to the long-term conservation of marine ecosystems and protect marine biodiversity.

In accordance with the EPBC Act, the AMP Network, and any zones within it, must be assigned to an International Union for Conservation of Nature (**IUCN**) Category consistent with the management intent and objectives for that site. IUCN categories include the following:

- Ia – Strict Nature Reserve, no resource extraction;
- Ib- Wilderness Area, First Nations traditional harvesting and collection for scientific research allowed;
- II- National Park, First Nations traditional harvesting and collection for scientific research allowed;
- III – Natural Monument or Feature, First Nations traditional harvesting and collection for scientific research allowed;
- IV – Habitat/species Management Area, sustainable resource extraction allowed;
- V- Protected Landscape or Seascape, sustainable resource extraction allowed;
- VI- Protected Areas with Sustainable Use of Natural Resources, sustainable resource extraction allowed; and
- Y – Assigned, pending further information.

The OA does not overlap with any AMP boundaries (**Figure 14**); however, the EMBA overlaps with seven AMPs. A summary of the relevant AMP and IUCN Category are presented in **Table 11**, and are discussed in further details within the following sections**.**

Table 11 AMP of Relevance to the OA

AMP	IUCN Category Zone	Distance from OA
Oceanic Shoals Marine Park	Multiple Use Zone (IUCN VI)	1.5 km
	Special Use Zone (Trawl) (IUCN VI)	142 km
Ashmore Reef Marine Park	Sanctuary Zone (IUCN Ia)	140 km
	Recreational Use Zone (ICUN II)	167 km
Cartier Island Marine Park	Sanctuary Zone (IUCN Ia)	100 km
Kimberley Marine Park	Multiple Use Zone (IUCN VI)	69 km
	National Park Zone (IUCN IV)	290 km
	Habitat Protection Zone (IUCN IV)	324 km
Joseph Bonaparte Gulf Marine Park	Special Use Zone (IUCN VI)	335 km
	Multiple Use Zone (IUCN VI)	290 km

The Kimberley, Cartier Island and Ashmore Reef Marine Parks are formally managed under the guidance of the NWMR management framework, whilst the Oceanic Shoals and Joseph Bonaparte Gulf Marine Parks are formally managed under the NMR management framework.

A summary of the environmental, social and cultural values identified for each AMP are described below, in accordance with the North-west Marine Parks Network Management Plan (Director of National Parks, 2018a) and North Marine Parks Network Management Plan (Director of National Parks, 2018b)

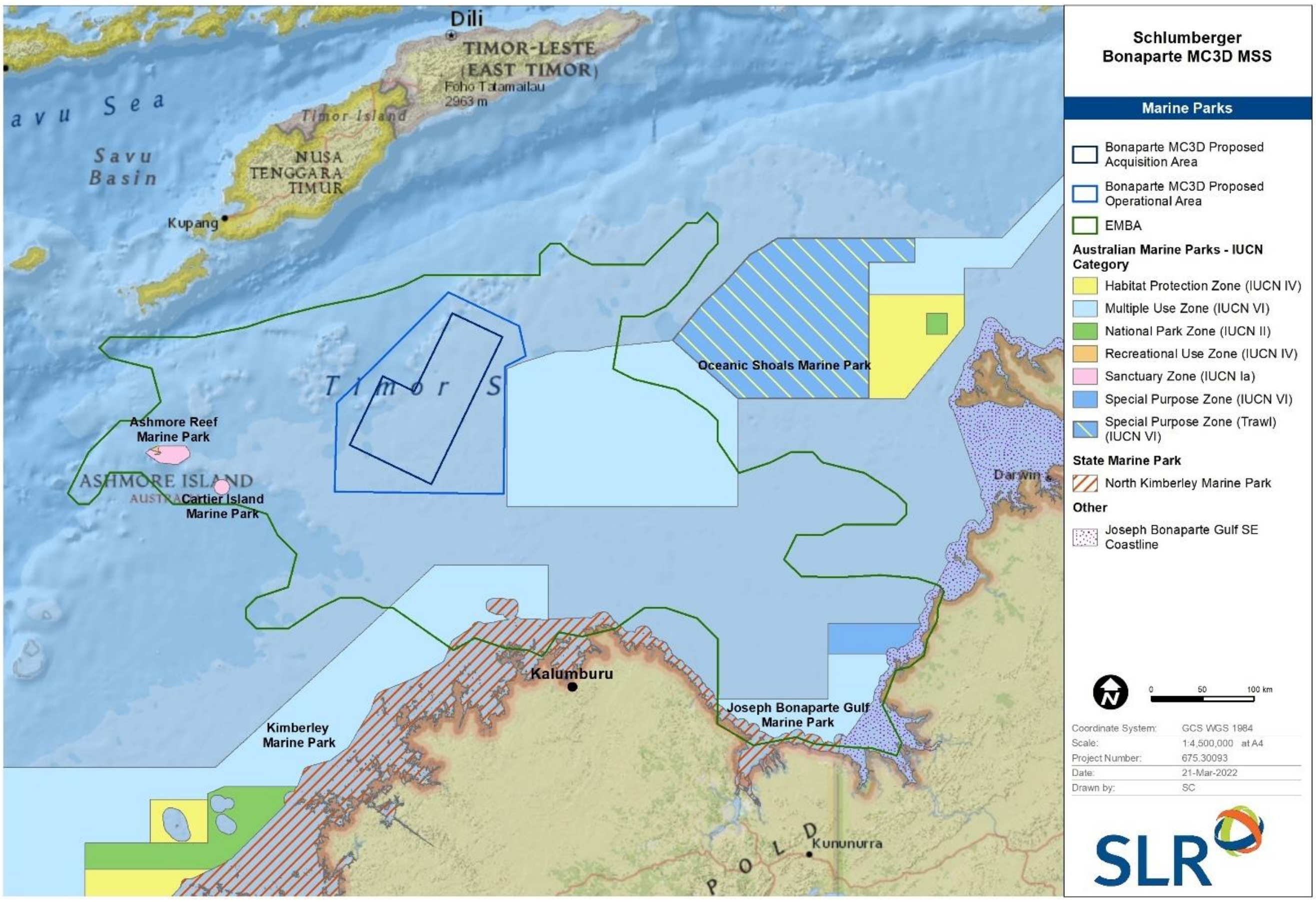


Figure 14 Marine Parks of Relevance to the Seismic Survey

4.4.1.1 Oceanic Shoals

The Oceanic Shoals Marine Park is located within the Timor Sea, extending southwest from its eastern-most point north of the Tiwi Islands and concluding offshore of the Bonaparte Archipelago. It extends to the limit of Australia’s EEZ. Immediately beyond the northern boundary of the park, is the maritime boundary with Timor-Leste.

The Oceanic Shoals Marine Park covers 71,743 km^2, with water depth ranging from 15 to 500 m. The Oceanic Shoals Marine Park comprises National Park, Habitat Protection, Multiple Use and Special Purpose (Trawl) zones IUCN categories; however, zones which overlap or are immediately adjacent to the EMBA comprise Multiple Use (IUCN IV) and Special Use (Trawl) (IUCN VI) only.

The Oceanic Shoals Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Transition. It contains four KEFs, including the Carbonate Bank and Terrace Systems of the Sahul Shelf which overlap the OA (see **Section 4.4.3**). This area is characterised by terraces, banks, channels and valleys which support a diverse range of sponges, soft coral, polychaetes, ascidians, turtles, snakes and sharks.

The Oceanic Shoals Marine Park supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. Biologically Important Areas (**BIAs**) within the Oceanic Shoals Marine Park include foraging and internesting habitat for various marine turtles (see **Section 4.5.5**).

Sea country within the marine park is valued for indigenous cultural identity, health and wellbeing. Social and economic values include commercial fishing and mining (Director of National Parks, 2018).

4.4.1.2 Ashmore Reef Marine Park

The Ashmore Reef Marine Park is situated within Australia's External Territory of Ashmore and Cartier Islands, between Australia and Indonesia, approximately 630 km north of Broome and 110 km south of the Indonesian Island of Roti.

The Ashmore Reef Marine Park covers an area of 583 km² and water depths from less than 15 m to 500m, and contains three emergent, vegetated sand cays: West, Middle and East Islands. The Ashmore and adjacent Cartier Island are located within an area subject to a Memorandum of Understanding (**MoU**) between Indonesian and Australia, known as the MoU Box (shown in **Figure 29**).

The Ashmore Reef Marine Park is considered a unique biodiversity hotspot with high natural value. The Ashmore Reef Marine Park is an area of enhanced biological productivity, supporting a range of pelagic and benthic marine species and an important biological steppingstone facilitating the transport of biological material to the reef systems along the WA Coast via the south-flowing Leeuwin Current which originates in the region. It comprises two KEFs (see **Figure 15** and **Table 12**), including:

- The Ashmore Reef and Cartier Island and surrounding Commonwealth waters; and
- The Continental Slope Demersal Fish Communities**.**

The reef ecosystems comprising the Ashmore Reef Marine Park support the highest number of coral species of any reef of the WA coast. Likewise, the Ashmore Reef Marine Park supports a range of species listed as threatened, migratory, marine or cetacean under the EPBC Act including marine turtles, dugongs, blue whales and sea snakes. Of note, is that the Ashmore Reef Marine Park supports breeding, foraging and resting habitat for a range of seabirds and migratory shorebirds.

Multiple BIAs overlap the Marine Park and are further described in **Section 4.4.4.**

Sea country within the marine park is valued for Indigenous cultural identity, health and wellbeing. The Marine Park also contains Indonesian artefacts and grave sites and Ashmore lagoon is still access as a rest or staging area for traditional Indonesian fishers travelling to and from fishing grounds within the MoU box.

The Marine Park supports tourism, recreation, and scientific research activities.

4.4.1.3 Cartier Island Marine Park

The Cartier Island Marine Park is located approximately 45 km southeast of Ashmore Reef Marine Park, and 610 km north of Broome, WA. The Marine Park covers an area of 172 km² and water depths from less than 15 m to 500 m. Cartier Island is managed under the same regulatory framework as Ashmore Island, is situated within the MoU area and is assigned an IUCN Sanctuary Zone. It is located 108 km west from the OA.

Overall, the key ecological features and natural values of Cartier Island Marine Park are broadly comparable to those cited for Ashmore Reef Marine Park, above. Notably distinctions include differences in the BIAs which overlap Cartier Island, including breeding and foraging habitat for seabirds, internesting, nesting and foraging habitat for marine turtles and foraging habitat for whale shakes. Additionally, the marine park is important for a range of other species and internationally significant for its abundance and diversity of sea snakes, some of which are listed species under the EPBC Act. In contrast, sea snake populations at Ashmore Reef have been in steep decline since 1998.

Sea country within the marine park is valued for Indigenous cultural identity, health and wellbeing. In contrast, no known Indonesian Indigenous artefacts exist at the site.

From a social and economic perspective, scientific research is an important activity in the Marine Park.

4.4.1.4 Kimberley Marine Park

The Kimberley Marine Park is approximately 100 km north of Broome, WA and the central part of the Kimberley Marine Park is adjacent to the Western Australia Camden Sound State Marine Park. It covers 74,469 km^2, with depths from less than 15 m to 800 m. The northernmost extent of the Kimberley Marine Park is located 70 km south of the OA. Whilst the Marine Park comprises National Park, Habitat Protection and Multiple Use Zones, the portion considered within the vicinity of the OA constitutes a Multiple Use Zone (IUCN IV) only.

The marine park provides connectivity between deeper offshore waters and the inshore waters of the comprises two key ecological features:

- The Ancient Coastline at 125 m depth contour, as described in **Section 4.4.3**; and
- The Continental Slop Demersal Fish Communities.

The Kimberley Marine Park is characterised by high numbers of marine mammals such as dolphins, whales and dugong. The humpback whale breeds and calves in the Kimberley Marine Park annually after undertaking an extensive migration from Antarctica whilst the pygmy blue whale migrate through the park on their annual migration between key breeding and foraging grounds. Three dolphin species (Australian snubfin dolphin, Info-Pacific humpback dolphin and spotted bottlenose dolphin) use the Kimberley Marine Park to forage within and travel to coastal waters to calve and raise their young in inshore, protected waters. BIAs within the Marine Park also include breeding and foraging habitat for seabirds, internesting and nesting habitat for marine turtles and foraging habitat for whale sharks.

Sea country within the marine park is valued for Indigenous cultural identity, health and wellbeing. The national heritage listing for the West Kimberley recognises the following key cultural heritage values:

- Wanjina Wunggurr Cultural Tradition which incorporates many sea country cultural sites;
- Log-raft maritime tradition, which involved using tides and currents to access warrurru (reefs) far offshore to fish;
- Interactions with Makassan trades around sea foods; and

- Important pearl resources that were used in traditional trade.

The park supports tourism, commercial fishing, mining, recreation, including fishing and traditional use.

4.4.2 State Marine Parks, Marine National Parks, Marine Sanctuaries, Marine Reserves and Fisheries Research Areas

Based on a review of the available State Government resources[1,2] relating to Marine Parks and Reserves, only one State Marine Park is located within the vicinity of the OA and overlaps the EMBA: the North Kimberley Marine Park.

The North Kimberley Marine Park is located in the Indian Ocean and the Timor Sea, in the waters of the Kimberley region in WA. The park extends northeast from York Sound, following the coastline, to the WA – NT border. The North Kimberley Marine Park covers approximately 18,450 km^2, extending from the mainland high water mark to the limit of State coastal waters.

The North Kimberley Marine Park comprises a complex array of coastal and marine habitats, connected through a variety of ecological processes. Rivers and estuaries are important features, influencing much of the coastline. Beyond this are thousands of islands with diverse and rich habitats, including many which support marine turtle nesting sites and breeding sites for seabirds and shorebirds. The productive deep waters that surround the islands and open sea reefs provide foraging habitat for marine mammals and pelagic finfish, such as mackerel (DPAW, 2016a). Complex coastal features such as intertidal reefs also are known to be important for dugongs, Australian snubfin dolphins and Australian humpback dolphins.

The North Kimberley Marine Park contains many places of cultural and spiritual importance to Traditional Owners, including those with artefacts, ceremonial and mythological paintings, fish traps, burial grounds, quarrying, man-made structures and middens. These values are further described in the North Kimberley Marine Park Management Plan (DPAW, 2016a) and herein, in **Section 4.6.1**.

The North Kimberley Marine Park supports a significant tourism industry, commercial fishing and recreational use.

At the time of this report, no Fisheries Research Areas were identified within the OA or EMBA.

[1]https://www.dpaw.wa.gov.au/management/marine/marine-parks-and-reserves
[2]https://www.fish.wa.gov.au/Sustainability-and-Environment/Aquatic-Biodiversity/Marine-Protected-Areas/Pages/default.aspx

4.4.3 Key Ecological Features

KEFs are the parts of the marine ecosystem that are considered to be of importance for a marine region's biodiversity or ecosystem function and integrity (DoEE, n.d.c). KEFs have been identified by the Australian Government on the basis of advice from technical experts regarding the ecological processes and characteristics of the area.

The OA overlaps with one KEF, the Carbonate Bank and Terrace System of the Sahul Shelf. There are five KEFs within the EMBA. A summary of the relevant KEFs within the OA and EMBA and area of overlap is described in **Table 12** and reflected in **Figure 15.**

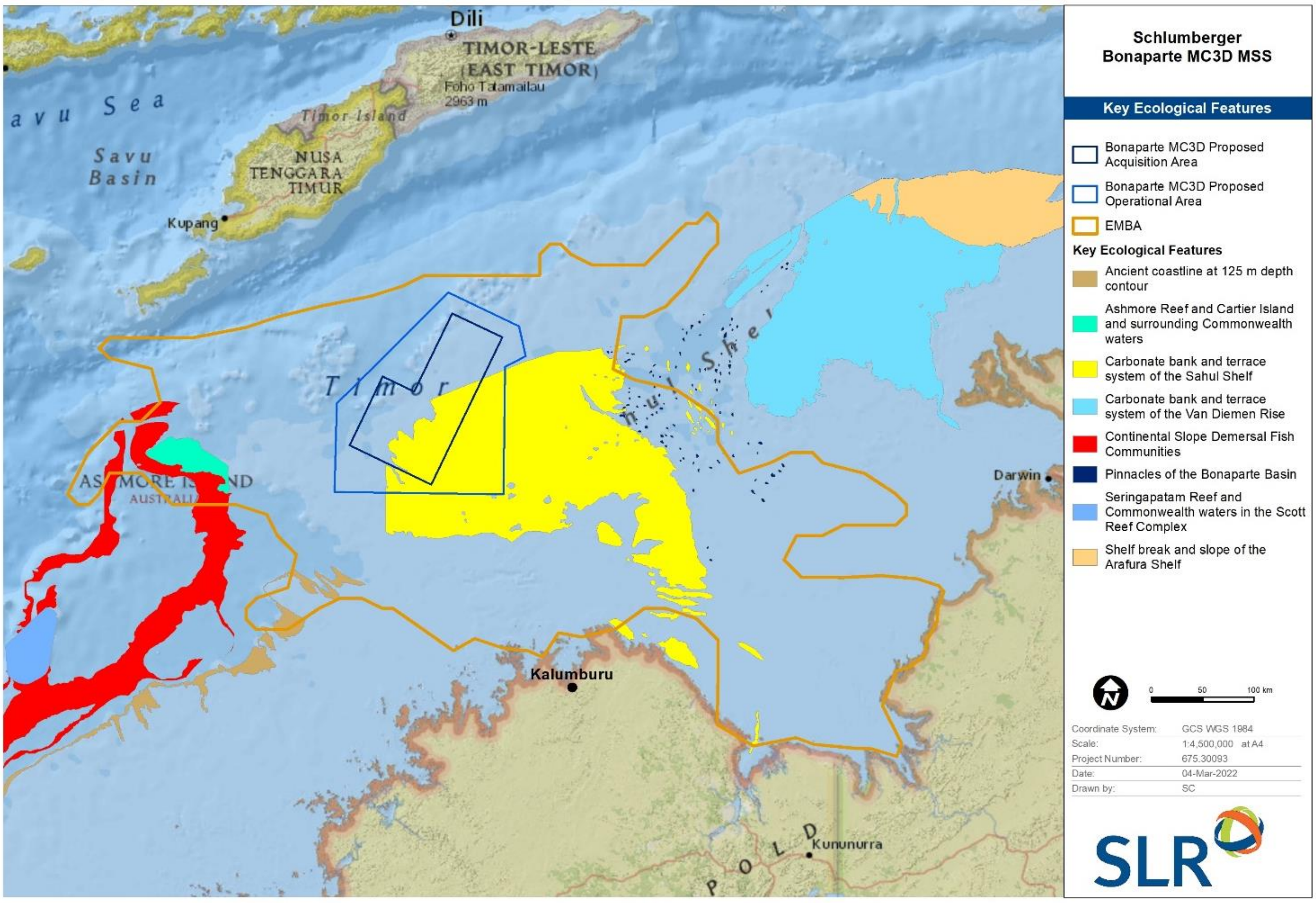


Figure 15 KEFs identified within the OA, EMBA and surrounding waters

Table 12 KEFs within the OA, EMBA and surrounding waters

KEF	Description	Values and/or Sensitivities
Carbonate bank and terrace system of the Sahul Shelf	• The carbonate banks and terraces comprising the KEF are part of a larger complex that occurs on the Van Diemens Rise, to the northeast. • The KEF covers an area of approximately 41,160 km². • The OA overlaps with approximately 9,900 km² (24%) of the KEF.	• Recognised for its role in enhancing biodiversity and local productivity relative to its surrounds, the KEF is a unique seafloor feature with ecological properties of regional significance. Biodiversity values apply to both benthic and pelagic habitats. • Rising steeply from depths of approximately 80 m, some banks emerge to within 30 m of the water's surface, the carbonate banks provide areas of shallow, hard substrate to which organisms can adhere allowing light dependant species to thrive (Brewer *et al*., 2007). • Prevailing geomorphologic and oceanographic conditions are thought to drive high nutrient conditions in the KEF. • Banks that rise to at least 45 m water depth support more biodiversity, such as communities of sessile benthic invertebrates including hard and soft corals, sponges, whips, fans and bryozoans (Brewer *et al*., 2007). • The banks are recognised as a biodiversity hotspot for sponges, comprising greater species diversity and contrasting communities than the surrounding seafloor. • The KEF is a known foraging area for flatback, olive ridley and loggerhead turtles (Donovan *et al*., 2008). • Humpback whales and green and freshwater sawfish are likely to occur in the area (Donovan *et al*., 2008).
Ancient Coastline at 125m Depth Contour	• The KEF consists of steps and terraces forming an escarpment along the NWS and Sahul Shelf at a water depth of 125 m. • The nearest part of the KEF is located approximately 73 km south of the OA.	• The KEF is a unique seafloor feature with ecological properties of regional significance. • Where the ancient, submerged coastline provides areas of hard substrate, it may contribute to high diversity and enhanced species richness relative to soft sediment habitat (DSEWPC, 2012a).

KEF	Description	Values and/or Sensitivities
		• Parts of the ancient coastline, comprising rocky escarpment, are considered to provide biological important habitat in an area otherwise made up of soft sediment. • Migratory pelagic species (e.g., humpback whales, blue whales and whale sharks) may use the KEF as a guide.
Pinnacles of the Bonaparte Basins	• Limestone pinnacles are located in the western JBG. • The nearest part of the KEF is located approximately 78 km east of the OA.	• The KEF is a unique seafloor feature with ecological properties of regional significance to both the benthic and pelagic habitats (DSEWPC, 2012a). • Pinnacles typically rise steeply form depths of about 80 m and emerge to within 30 m of the water surface, allowing light dependent organisms to thrive (Brewer *et al*., 2007). • The pinnacles provide areas of hard substrate in an otherwise soft sediment environment and are, therefore, important for sessile species. • Pinnacles that rise to at least 45 m water depth support more biodiversity, such as communities of sessile benthic invertebrates including hard and soft corals, sponges, whips, fans and bryozoans (Brewer *et al*., 2007, Nichol *et al*., 2013). • The banks are recognised as a biodiversity hotspot for sponges, comprising greater species diversity and contrasting communities than the surrounding seafloor. • Demersal fish communities occur in larger and more diverse populations on shallower, less turbid pinnacles (Nichol *et al*., 2013, NERP MBH, 2014). • The pinnacles are thought to be a feeding area for flatback, loggerhead and olive ridley turtles, while green turtles may traverse the area. Freshwater and green sawfish as well as humpback whales may also occur in the area (Donovan *et al*., 2008).
Continental Slope Demersal Fish Communities	• This KEF is located along the Australian continental slope, between the North-west Cape and the Montebello Trough.	• The continental slope demersal fish communities KEF provides important habitat for demersal fish communities and is characterised by high endemism and species diversity (DEWHA, 2008b).

KEF	Description	Values and/or Sensitivities
	• The nearest part of the KEF is located approximately 93 km west of the OA.	• The KEF supports two distinct demersal community types (biomes) associated with the upper slope (water depth of 225 – 500 m) and the mid-slope (750 – 1,000 m) (DoCCEEW, 2021). • Demersal slope communities are thought to rely on bacteria and detritus-based systems comprised of infauna and epifauna, which in turn become prey for a range of teleost fish, molluscs and crustaceans. (Brewer *et al*., 2007). Higher-order consumers may include carnivorous fish, deep-water sharks, large squid and toothed whales (Brewer *et al*., 2007).
Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	• Ashmore Reef and Cartier Island are situated on the shallow upper slope of the Sahul Shelf. They form part of a series of submerged reef platforms along the outer edge of the continental slope of the NWMR. • The nearest part of the KEF is located approximately 100 km west of the OA.	• The combined area constitutes a KEF owing to its ecological function, integrity and biodiversity values which apply to both benthic and pelagic habitats. • The KEF is recognised as a regionally important site for feeding and breeding aggregations of birds and other marine life, including a high diversity of sea snakes, genetically distinct breeding population of green turtles and foraging grounds for green, loggerhead and hawksbill turtles (Limpus, 2008). • The emergent reefs are areas of enhance primary productivity in an otherwise low-nutrient environment. Localised upwelling and turbulent mixing in the surrounding Commonwealth waters provide nutrients to support the reef structure and ecology (DEWHA, 2008b). • Ashmore Reef is the largest of only three emergent oceanic reefs present in the northeastern Indian Ocean and is the only oceanic reef in the region with vegetated island. • Ashmore Reef supports the highest number of coral species of any reef off the west Australian coast. • The reef system is an important staging post for seabirds and migratory shorebirds. As such, it has been designated as a Ramsar site of international importance.

KEF	Description	Values and/or Sensitivities
Carbonate bank and terrace system of the Van Diemen Rise	• The carbonate banks and terrace system of the Van Diemen Rise comprise part of a larger system associated with the Sahul Banks to the north and Londonderry Rise to the east. • The nearest part of the KEF is located approximately 198 km east of the OA and outside of the EMBA.	• This key ecological feature is recognised for its ecological role in enhancing biodiversity and local productivity, relative to its' surrounds. • The Van Diemen Rise system is characterised by terrace, banks, channels and valleys. Channel systems range from approximately 60 -15 m to between 10 – 40 m in depth (Anderson *et al*., 2011) and supports sponge and octocoral gardens by providing epifauna habitat in an otherwise flat environment (Przeslawski *et al*., 2011). • The KEF is recognised as a sponge biodiversity hotspot (Przeslawski *et al*., 2014), with sponge diversity generally highest further offshore and on raised geomorphic features, particularly banks. • Localised areas of dense hard corals were found on the banks of the Van Diemen Rise and are considered to occur rarely throughout the broader JBG. • Pelagic fish such as mackerel, red snapper and a distinct gene pool of goldband snapper are found in the Van Diemen Rise (Blaber *et al*., 2005; Salini *et al*., 2006). • Olive ridley turtles, sea snakes and sharks are reported to occur in the area (DoCCEEW, 2022b).
Shelf break and slope of the Arafura Shelf	• The shelf break and slope of the Arafura Shelf is characterised by continental slope and the presence of patch reefs and hard substrate pinnacles (Harris *et al*.; 2005). Seaward of the Van Diemen Rise, the shelf edge occurs at water depths of 12- -180 m. On the outer shelf and upper shelf slope, carbonate sediments are mixed with terrigenous clays from Indonesian rivers.	• This key ecological feature is recognised for its ecological functioning and productivity. It also forms part of a unique biogeographic province with regard to biodiversity (DSEWPC, 2012a). • Prevailing oceanographic processes, including the ITF and surface wind-driven circulation, are thought to strongly influence ecological processes. The transport of warm water associated with the ITF is likely to influence pelagic dispersal of nutrients, species and biological productivity. Pelagic dispersal in turn drives long-term patterns of transport and dispersal of larvae, juvenile and migrating adult organisms within the area.

KEF	Description	Values and/or Sensitivities
	• The nearest part of the KEF is located approximately 347 km northeast of the OA and outside of the EMBA.	• The shelf break and slope are situated in a major biogeographic crossroad where biota is largely affiliated with the Timor-Indonesian-Malay region (Hooper and Ekins 2005). Primary production of phytoplankton is likely to form the basis of offshore food webs (DEWHA ,2007).

4.4.4 Biologically Important Areas

BIAs are regions where a particular species is known or likely to display important behaviours such as breeding, foraging, nesting or migration (DoEE, n.d.c). Whilst BIAs are not matters of national environmental significance and have no legal status, they provide useful biological information intended to help inform regulatory and management decisions under the EPBC Act.

Based on the BIA maps and descriptions reported via the Australian Government Conservation Values Atlas[3], BIAs associated with 21 different threatened or migratory species were identified as potentially occurring within the OA and EMBA. The species with BIAs that overlap the OA include the Pygmy Blue whale, Whale shark and Flatback Turtle.

A brief summary of the relevant BIA and locational information is provided in **Table 13**. Further information on these BIAs is provided in the individual species descriptions in **Section 4.5.3** to **Section 4.5.7**, where relevant.

Table 13 Marine Threatened and Migratory Species BIAs within the OA and EMBA

Class	Species	BIA activity	Distribution of BIAs	Distance of closest BIA from OA (km)
Sharks and Rays	Whale Shark	Foraging	NWS 200 m isobath	Overlaps OA
Mammals	Pygmy Blue Whale	Distribution	South and West Australian Waters	Overlaps OA
		Migration	WA waters	Overlaps OA
		Foraging	South Australian Waters, localised areas within WA waters	294 km southwest of OA
	Humpback Whale	Calving, resting	Northwest WA and Queensland waters	210 km south of OA
		Migration	Western and Eastern Australian Waters	210 km south of OA
	Australian Snubfin Dolphin	Breeding	Northern Australian Waters	129 km south of OA
		Foraging (various)	Northern Australian Waters	129 km south of OA
	Indo-Pacific Humpback Dolphin	Calving	Northern Australian Waters	193 km south of OA
		Foraging (various)	Northern Australian Waters	129 km south of OA
	Indo-Pacific/Spotted Bottlenose Dolphin	Calving	Northern and Eastern Australian Waters	285 km south of OA
		Foraging (various)	Northern and Eastern Australian Waters	285 km south of OA
	Dugong	Breeding, Calving, Nursing	Western Australian Waters	155 km west of OA

[3] https://www.awe.gov.au/environment/marine/marine-species/bias, accessed 15 February 2022

Class	Species	BIA activity	Distribution of BIAs	Distance of closest BIA from OA (km)
		Foraging (various)	Northern and Western Australian Waters	155 km west of OA
Reptiles	Flatback Turtle	Breeding (various)	Northern Australia	240 km southeast of OA
		Foraging (2 BIAs)	Northern Australian Waters	Overlaps OA 9 km east of OA
	Green Turtle	Breeding (various)	Northern Australia	87 km west of OA
		Foraging	Northern Australian Waters	153 km west of OA
	Hawksbill Turtle	Breeding (various)	Northern Australia	139 km west of OA
		Foraging	Northern Australian Waters	107 km west of OA
	Loggerhead Turtle	Foraging	Northern Australian Waters	9 km east of OA
	Olive Ridley Turtle	Foraging	Northern Australian Waters	9 km east of OA
		Breeding (various)	Northern Australia	414 km east of OA
Marine Birds	Brown Booby	Breeding, Foraging	Northern Australia	114 km west of OA
	Greater Frigatebird	Breeding, Foraging	Northern Australia	50 km west of OA
	Lesser Crested Tern	Breeding	Northern and Western Australia	87 km southwest of OA
	Lesser Frigatebird	Breeding, Foraging	Northern Australia	17 km south of OA
	Little Tern	Resting	Northwest Australia	146 km west of OA
		Breeding	Northwest Australia	156 km south of OA
	Red-footed Booby	Breeding, Foraging	Northern Australia	50 km west of OA
	Roseate Tern	Resting	Northern and Western Australia	148 km south and west of OA
		Breeding	Northern and Western Australia	125 km southwest of OA
	Wedge-tailed Shearwater	Breeding, Foraging	Northern, Western and Eastern Australia	56 km west of OA
	White-tailed Tropicbird	Breeding	Northwest Australia	60 km west of OA

4.4.5 The Australian Whale Sanctuary

The Australian Whale Sanctuary has been established to protect all whales and dolphins found in Australian waters, which are protected under the EPBC Act 1999. The Sanctuary includes all Commonwealth waters from the three nautical mile State Waters limit out to the boundary of the Exclusive Economic Zone. All States and Territories provide similar protection for cetaceans within Coastal Waters (up to 3NM), and it is the responsibility of the state and territory governments to protect whales and dolphins. The OA and EMBA, therefore, overlap the Australian Whale Sanctuary.

Within the Sanctuary it is an offence to kill, injure or interfere with a cetacean and severe penalties apply to anyone convicted of such offences. In all Australian waters, activities with the potential to significant impact on listed or migratory species, such as cetaceans, are regulated under the EPBC Act 1999 (see **Section 2.1.2**). Migratory species within the EPBC Act are those that are listed under international agreements as species whose protection requires or would significantly benefit from international cooperation. Any such proposed activity should therefore be referred to the Minister for the Environment and Heritage for assessment.

Australia is a signatory to the International Convention for the Regulation of Whaling. Obligations under this Convention include provision for the conservation of whales through the complete protection of select species, and the designation of whale sanctuaries (Director of National Parks, 2013).

4.4.6 Ramsar Wetlands of International Importance

The Ramsar Convention on Wetlands is an intergovernmental treaty that aims to conserve wetlands of international importance. Ramsar wetlands are recognised as a matter of national environmental significance under the EPBC Act (DoEE, n.d.).

No Ramsar wetlands occur within the OA; however, the Ashmore Reef National Nature Reserve Ramsar site is located within the EMBA, approximately 140 km west of the OA (**Figure 16**).

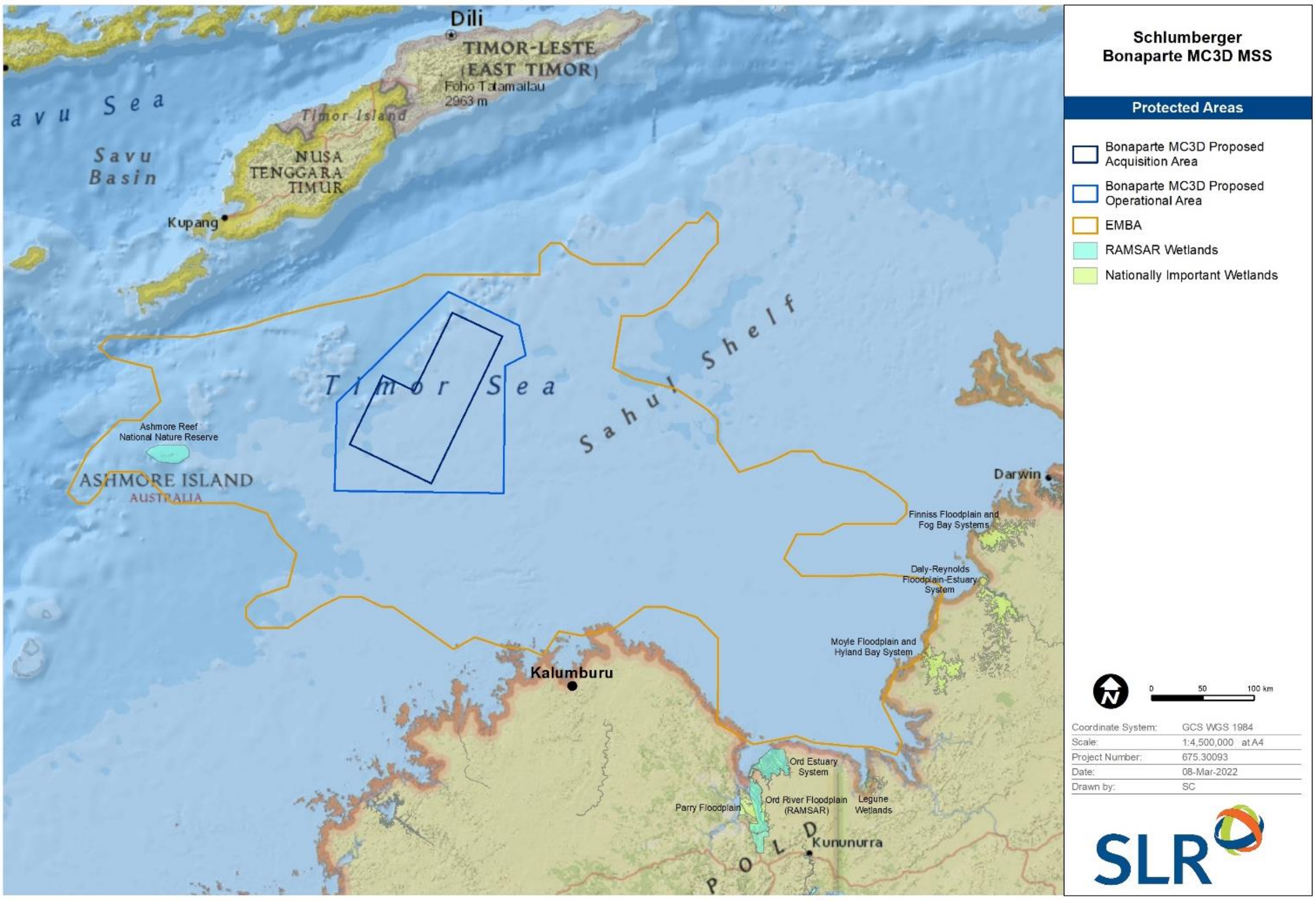


Figure 16 Ramsar and Nationally Important Wetlands of relevance to the OA and EMBA

Following the designation of the Ashmore Reef Marine Park as a Ramsar site in 2002, a final Ecological Character Description of the site was published in 2013. A summary of the components and process identified therein as important to the ecological character of the Ashmore Reef Ramsar Site and, in the case of Critical components, for which Limits of Acceptable Change (**LAC**) have been derived (see **Table 14**). Critical and Supporting components and processes were selected on the basis of their role in maintaining the ecological character of the site, the ecosystem services they support and the Ramsar criteria for which the site is listed (Hale and Butcher, 2013).

Table 14 Components and Processes Important for Maintaining the Ecological Character of the Ashmore Reef Ramsar Site

Component/Process	Description
Supporting	
Climate	• Arid tropical monsoonal climate; • Located outside of the main belt of tropical cyclones in the Timor Sea.
Geomorphic Setting	• Located in an area of high oil and gas reserves, with active hydrocarbon seeps (O'Brien *et al*., 2002); • Geomorphic groups within the site include reef slope, reef crest, reef flat, back reef sands, lagoons and islands (Glenn and Collins, 2005).
Tides and currents	• Strong seasonal influences of the ITF and Holloway currents (DEWHA, 2008b); • Internal waves area f feature of the region and Ashmore Reef Ramsar site may act to break these resulting in increased nutrients from bottom waters.
Water Quality	• Seasonal variations in temperature and salinity in ocean and lagoon water (Weinberg *et al*., 2009); • Water clarity, turbidity and other water quality parameters remain a knowledge gap.
Vegetation	• Give species of seagrass recorded with T*halassia hemprichii* dominant, comprising over 85% of total cover; • Total cover of 470 ha, but much of this is sparse and there is only 200 ha with a mean cover of greater than 10%; • Over 3,000 ha of macroalgae, mostly on the reef slope and crest areas; • Algae are dominated by turf and coralline algae with fleshy macroalgae comprising typically <10% of the total algal cover (Skewes *et al*., 1999b).
Critical	
Marine invertebrates	• 275 species of hard coral, covering an area of around 700 ha (Vernon, 1993; Griffith, 1997; Skewes *et al*., 1999a); • 39 taxa of soft coral, covering an area of around 300 ha (Marsh, 1993; Skewes *et al*., 1999b); • Total coral cover was low around the time of listing following the 1998 bleaching event but recovered in recent years to baseline levels (Ceccarelli *et al*., 2011); • Over 600 species of mollusc, including two endemic species (Wells, 1993; Willan, 2005); • Over 180 species of echinoderm, including 18 species of sea cucumber (Marsh *et al*., 1993; Skewes *et al*., 1999a); • Sea cucumber density is highly variable, but on average exceeds 30 per ha (Skewes *et al*., 1999a); • 99 species of decapod crustacean (Morgan and Berry, 1993).

Component/Process	Description
Fish	• Over 750 species of fish, including five species of fish and three species of shark listed as threatened (Allen, 1993; Russel *et al.*, 2005); • Predominantly shallow water, benthic taxa that are common throughout the Indo-Pacific; • Density of small reef fishes is around 20,000 to 40,000 per ha (Kospartov *et al.*, 2006; Heyward *et al.*, 2012); • Low density of sharks (less than one per ha) (Skewes *et al.*, 1999a; Richards *et al.*, 2009; Heyward *et al.*, 2012).
Seasnakes	• Prior to listing there was a high diversity and population, peaking in 1998 with an estimate total population of 40,000 snakes in the site (Guinea and Whiting, 2005); • However, by the time of the listing in 2002 the site was on a downward trajectory with regard to diversity and abundance was low (Guinea, 2008).
Turtles	• Three species of marine turtle: green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and loggerhead (*Caretta caretta*), all of which are listed threatened species; • Green turtles are the most abundant, with a total estimated population of around 10,000 individuals; • Nesting by two species: green turtles and hawksbill turtles (Whiting and Guinea, 2005).
Seabirds and Shorebirds	• 72 species of wetland dependant bird recorded within the Ramsar site; • 47 species listed under international migratory agreements; • Average of around 48,000 seabirds and shorebirds annually; • Six species are regularly record in numbers great than 1% of the population; • Nesting of 20 species, 14 of which regularly breed in the site (Milton, 2005; Clarke, 2010).
Dugong	• Small but significant population that may breed within the site (Whiting and Guinea 2005); • Data deficient.

4.4.7 Nationally Important Wetlands

There are no national important wetlands within the OA. One Nationally Important Wetland, the Moyle Floodplain and Hyland Bay System, was identified along the southern boundary of the EMBA (see **Figure 16**). However, as there is limited to no overlap between the two boundaries, this environmental value is not further described.

4.4.8 World, Commonwealth and National Heritage Places

World heritage sites are natural or man-made sites, areas, or structures recognised as being of outstanding universal value by the United Nations Educational, Scientific and Cultural Organisation (**UNESCO**). No listed World Heritage or National Heritage places were identified within the OA or the EMBA. However, the West Kimberley National Heritage Place is located south of the OA, extending from Wyndham to Derby and including inland, riverine, estuarine and coastal environments.

No Commonwealth Heritage listed places occur within the OA. The closest Commonwealth Heritage site is Ashmore Reef National Nature Reserve, located 140 km west of the OA but within the wider socio-cultural EMBA. It is managed under the Ashmore Reef National Nature Reserve and Cartier Island Marine Reserve Management Plans (Commonwealth of Australia 2002)[4]. The Ashmore Reef Marine Park is designated as a Commonwealth Heritage List site under Criterion A (Process), Criterion B (Rarity) and Criterion C (Research) for several values, including:

- Faunal diversity, including species not previously, or only rarely, recorded in WA and potentially endemic species;
- Staging point for migratory waders and high concentrations of breeding seabirds;
- Habitat for sea snakes, including one species endemic to the reef;
- Breeding and feeding habitat for green turtles and hawksbill turtles;
- Higher diversity of marine habitats compared with other Northwest Shelf reefs;
- Significant for its history of human occupation and use; archaeological significance; and
- Important scientific reference area.

No other Commonwealth Heritage listed places were identified within the EMBA.

4.4.9 Threatened Ecological Communities

There are no TECs within the OA or the EMBA.

[4] The names of the Ashmore Reef National Nature Reserve and Cartier Island Marine Reserve have subsequently changed to the Ashmore Marine Park and Cartier Island Marine Park, respectively, however the Management Plans use the former names.

4.5 Biological Environment

4.5.1 Plankton and Primary Producers

The term ‘plankton’ describes the drifting organisms that inhabit aquatic environments. Plankton travel with the ocean currents and although some plankton can move vertically within the water column, their horizontal distribution is primarily determined by the surrounding currents. This assessment considers two broad functional planktonic groups:

- Phytoplankton – free-floating organisms ranging from 0.2 to 200 mm in size, capable of photosynthesis, which includes diatoms and dinoflagellates. Phytoplankton fulfil the primary producer role in the ocean and form the basis of the marine food web; and
- Zooplankton – free-floating animals which includes copepods, jellyfish and larval stages of larger animals.

Oceanic productivity occurs when phytoplankton (or algae/seagrasses) photosynthesise and form the basis of the marine food web. The amount of productivity results from many factors including currents, climate and bathymetry. Nutrient rich waters and areas of upwelling enhance productivity and such conditions are ideal for the growth of plankton and plankton-consuming animals. Areas of high productivity are associated with aggregations of marine organisms (Hosack and Dambacher, 2012).

Within the NWMR, surface waters typically have low nutrient availability, owing to the dominance of the ITF which transports warm oligotrophic, low-salinity water from the Pacific Ocean to the Indian Ocean. The interplay between environmental conditions such as bathymetry, prevailing oceanographic processes, seasonality and the presence of complex geomorphic features drive localised increases in productivity. The weakening of the ITF and Leeuwin Current in the dry season, along with seasonal reversal in wind and cyclones, results in seasonally enhanced productivity through increased mixing with the underlying deep, cold, nutrient-rich waters.

Within the OA and EMBA, there are two notable features that promote enhanced primary productivity:

- Carbonate bank and terrace system of the Sahul Shelf; and
- Ashmore Reef and Cartier Island and surrounding Commonwealth waters, where localised upwelling and turbulent mixing in the Commonwealth waters around the reef systems provide nutrients.

4.5.1.1 Phytoplankton

In general, higher phytoplankton concentrations (as indicated by surface chlorophyll concentrations) occur during the winter months (June to August) and are lower in summer (December to February) (Brewer *et al.*, 2007).

Phytoplankton assemblages were surveyed by Environmental Resources Management (**ERM**) in 2021 and 2011 in the JBG, located east of the OA. These data were considered broadly representative of plankton assemblages which may be expected to occur within the OA. Consistent with the limited survey data which has been collected along the North-west Shelf, phytoplankton assemblages were dominated by cyanobacteria during the 2010 wet season survey and diatoms (Bacillariophyceae) during the dry season, which comprised 99.7% of identified algal cells. During the 2011 dry season survey, diatoms (Bacillariophyceae) dominated the phytoplankton assemblage. Overall, phytoplankton densities were typical of offshore oceanic waters and indicative of a classically oligotrophic (low nutrient) system, as is the case across offshore WA and the Timor Sea (ERM, 2011). These findings were consistent with the limited survey data which has been collected along the Northwest Shelf and within the OA (Eriksen *et al*., 2019; Conoco Phillips, 2018)

4.5.1.2 Larval fish and zooplankton

The Kimberley has one of the least studied marine pelagic ecosystems off Australia and, in particular, the nature and extent of zooplankton is poorly known. Limited sampling undertaken within the JBG (ERM, 2011) and the Dampier Peninsular (Holliday *et al*., 2011) indicated that copepods represented the most dominant group within the macro-zooplankton assemblage. Holliday *et al*. (2011) found that euphausiids were also ubiquitous, however, higher concentrations were recorded for coastal waters, compared to shelf and oceanic waters. *Pseudeuphausia latifrons* was the dominant krill species in shelf waters. Whereas the more speciose oceanic assemblages were dominated by the species of the genus *Stylocheiron*.

ERM observed seasonal variation in the density of macro-zooplankton across the 2010 wet season and 2011 dry season monitoring periods, with an overall greater density recorded during the 2010 wet season. The greater density of macro-zooplankton may be indicative of higher primary productivity in the summer months fuelling population increases of the zooplankton (secondary productivity) at this time. Zooplankton density varied at the level of the assemblage with statistically distinct assemblages found within both the 2010 wet season and 2011 dry season (ERM, 2011).

Besides the common macro-zooplankton taxa such as copepods, euphasiids and chateognaths, the diversity of zooplankton within the Kimberley is enhanced by the occurrence of pelagic larval stages of a number of benthic invertebrates and fish (Eriksen *et al*., 2019, Holliday *et al*., 2011). Sampling undertaken by ERM (2011) indicated that larval fishes in the JBG were found to be dominated by Serranidae (cods) and Lutjanidae (snappers), both of which are commercially targeted species in the region. Similarly, Holliday *et al*., (2011) reported the occurrence of Lutjanidae, Serranidae and Scombridae throughout the Kimberley shelf and offshore waters during autumn.

Larval fish density varied seasonally with the 2011 dry season recording highest densities of larval fishes in the zooplankton. This seasonal effect is consistent with the notion of an extended spawning season (and possibly planktonic larval duration) of the species dominating the larval fish assemblage in the area (ERM, 2011).

Beckley *et al*. (2018) investigated the ichthyoplankton (larval fish) assemblages of the Kimberley region (south of the Operational Area) and collected larvae representing 92 neritic and 21 mesopelagic teleost families. Ichthyoplankton assemblages were correlated with changes in environmental variables (e.g. water depth, seawater density, mixed layer depth), and coastal assemblages were significantly different from offshore assemblages. Coastal fishes that were probably spawned in the study area, such as anchovies (Engraulidae), gobies (Gobidae) and threadfin breams (Nemipteridae) were highly abundant in inner shelf waters. Snappers (Lutjanidae) and groupers (Serranidae) increased in abundance in mid-shelf waters, and lanternfishes (Myctophidae) and other meso-pelagic families were dominant in oceanic waters (Beckley *et al*., 2018). Larvae of neritic, reef-associated taxa were collected at oceanic sampling stations, likely a reflection of the proximity to isolated oceanic atolls/coral reefs.

4.5.2 Benthic Habitats and Communities

The benthic ecosystem relates to the seafloor, its substrates and colonising biota (benthos). Benthos represents a large component of marine biodiversity and ecosystem productivity. The composition and distribution of benthic habitat and communities is influenced by many environmental factors, including substrate and sediment characteristics, depth, water temperature, wave action, currents and food availability.

4.5.2.1 Banks, Shoals and Reef Communities

Due to the remoteness of the region, information on benthic habitats and communities within the bank and terrace systems comprising the southeastern portion of the OA is limited. However, the extensive network of limestone banks consisting of hard substrate are expected to support a diverse range of sessile benthos such as hard and soft corals, gorgonians, encrusting sponges and macroalgae; and consequently, a more reef associated fish and elasmobranch fauna (Brewer *et al.*, 2007). See banks, shoals and reefs located within EMBA in **Section 4.3.6**, **Figure 12** and **Table 10**.

Studies conducted by AIMS between 2010 – 2016 indicate that shoals in the Timor Sea support diverse tropical ecosystems analogous to that of coral reefs (AIMS, 2016). Shoals were characterised by high levels of biological variation within and between shoals, even where physical constraints such as depth and seabed morphology were broadly comparable between sites. Based on the findings of these studies, benthic primary producers such as algae and reef building corals are the predominant community to depths of 50 – 60 m. At all of the shoals studied, algae were the most abundant benthic community with respect to percentage cover, ranging from 38.8 % at Vulcan Shoal to 53.8% at Wave Governor Bank Shoal (located nearby Cartier Island), followed by hard coral, which ranged from 6.1% at Barracouta West Shoal to 17.7% at Eugene McDermott Shoal. Hard coral assemblages varied between shoals, but broadly grouped into shallower shoals consisting of Acropora (a diverse number of branching and tabulate, fast-growing corals) and Portitidae, while deeper shoals were strongly characterised by an abundance of mushroom coral species in the family Fungiidae. The benthic communities observed are typical of shallow tropical reef systems studied elsewhere, with many coral and algal species shared between the shoals and emergent coral reefs in the region.

4.5.2.2 Soft Sediment Habitat

Benthic habitat mapping and macrofauna sampling was undertaken by ERM in 2010 – 2011 and O2 Marine in 2017, within permit area AC/RL7 which overlaps a small portion of the OA at its northwestern apex (ERM 2012, O2 Marine 2018). Within the AC/RL7 permit area, surveyed benthic habitat comprised of white sandy substate and shell grit. Sites were characterised by homogeneous, flat and featureless soft-sediment habitats. Epibenthic macrofauna were sparse, with sea stars and small bony fish the only fauna recorded. The absence of hard substrate is considered a limiting factor for recruitment of epibenthic organisms. In both surveys, Annelida (polychaete bristleworms) and Malacostracea (crabs, shrimp) were recorded as the two most abundant taxa. Also reported were sea squirts, ostracods, sea spiders, echinoderms, molluscs, bryozoa, round worms ribbon worms, peanut worms, flatworms, sea anemones and sponges. These findings are considered to be broadly representative of soft sediment habitats which may be expected to occur throughout the OA, given the similar water depths and geomorphology.

4.5.3 Bony Fish and Elasmobranchs

4.5.3.1 Bony Fish

The fish fauna of the continental shelf off the Pilbara coast is a mixture of tropical reef associated and open-seabed fish species consistent with the variety of habitats found there (Looby, 1997). Species of fish that inhabit the OA and EMBA are represented by demersal, pelagic species, and migratory taxa. Coral reefs within the OA and EMBA, like those throughout the Indo-Pacific support a range of fish species including coral trout, emperors (Lethrinidae), snappers (Lutjanidae), as well as larger pelagic species such as trevally (Carangidae), dolphinfish (Coryphaenidae), marlin and sailfish (Istiophoridae) (DEWHA, 2008a). A survey completed in permit area AC/RL7, that overlaps a portion of the OA, reported that the deeper, generally featureless substrate areas contained relatively lower abundance and diversity of fish taxa compared to coral reef habitats (ERM, 2012; O2 Marine, 2018).

Many of the non-pelagic fish species recorded within the OA and EMBA tend to be associated with relatively complex habitats such as coral reefs, sponge gardens, and rocky outcrops (Meekan *et al*., 2020). Generally, greater structural complexity of the seafloor, higher proportion of benthic cover and morphological composition of hard corals rather than the total area of habitat available has been reported to be a key driver of species richness and abundance (Moore *et al.,* 2017; Abdul Wahab *et al.,* 2018; Currey-Randell *et al.,* 2021). Moreover, fish species richness also generally declines with increasing water depth (Currey-Randell *et al.,* 2021). Complex habitats are likely to be abundant within the Carbonate bank and terrace system of the Sahul Shelf KEF, which is recognised for its role in enhancing local biodiversity and productivity.

Within complex habitats some species from a diverse range of family such as Lethrinidae, Apogonidae, and Chaetodontidae that have been reported within the OA and EMBA can display high site fidelity at multiple spatial scales over various time periods (Chateau and Wantiez 2006; Nanami and Yamada 2009; Gardiner and Jones, 2016). Acoustically tagged red emperor within the NWMR have been reported to remain within an area of approximately 0.15 km^2 for more than six months (Meekan *et al*., 2020). Habitat requirements can also vary within families of fish with some species such as spangled emperor (*Lethrinus nebulosus*) having a high dependence on reef habitat while the very closely related blue spot emperor (Lethrinus spp) found both on reef and on clear, featureless seabed (Looby, 1997).

4.5.3.1.1 Commercially Relevant Species

Various managed commercial fisheries which target a range of bony fish species operate within or in proximity to the OA and EMBA and (see **Section 4.7.3**).

Fish species caught using baited traps deployed in the Northern Demersal Scalefish Managed Fishery (**NDSMF**) that operates within the OM and EMBA (see **Section 4.7.3.2.1**) include target taxa such as red emperor and goldband snapper (*Pristipomoides multidens*) (which made up 57% of the total catch by weight in 2022) as well as non-targeted retained taxa including scarlet perch (*Lutjanus malabaricus*), spangled emperor (*Lethrinus nebulosus*), species cods and groupers (Family Serranidae) and not retained taxa primarily consisting of triggerfish (Balistidae), bannerfish (Chaetodontidae), squirrelfish (Holocentridae) and lionfish (Scorpaenidae) (Newman *et al*., 2008). Most fish caught within the NDSMF show a degree of site fidelity and are generally associated and more abundant in areas that provide complex habitats. Red emperor and goldband snapper (primary targeted species caught in the NDSMF) spawn from August to May and September to May respectively. The NDSMF operates throughout the year within the OA and EMBA however fishing effort is highest between October and March (DPIRD, 2022).

Fish species caught in the Mackerel Managed Fishery within the region that overlaps with the OA and EMBA (see **Section 4.7.3.2.2**) are generally pelagic and primarily consists of Spanish mackerel (*Scomberomorus commerson*) while other Scombridae species as well as wahoo (*Acanthocybium solandri*), cobia (*Rachycentron canadum*), bonito (*Sarda australis*), blue- and yellowfin tuna (*Thunnus tonggol and T. albacares*), skipjack tuna (*Katsuwonus pelamis*), dolphinfish (*Coryphaena hippurus*), smaller sharks, various species of trevally and the occasional reef fish are caught less frequently using the highly specialised fishing gears deployed by this fishery (Mackie *et al.*, 2010). There is a single genetic stock of Spanish mackerel along the Western Australia and the Northern Territory which is likely the result of along shore-dispersal of pelagic eggs and larvae within the Leeuwin current. Spanish mackerel are fast swimming opportunistic predators that feed in the water column and mainly consume fish and cephalopods. The peak reproductive period for Spanish mackerel is between September to January in the Kimberley region with larvae remaining in the plankton for less than three weeks (Mackie *et al.*, 2003).

4.5.3.1.2 Listed Species

An EPBC Act Protected Matters Database search (3 March 2022) (**Appendix C**) identified Southern Bluefin Tuna (*Thunnus maccoyii*) as a species known to occur in the region, listed as Conservation Dependent under the EPBC Act. The EPBC Act Protected Matters Database search also identified 25 pipefish species, five seahorse species, three pipehorse species and one seadragon – none of which are listed as threatened or migratory under the EPBC Act, may occur within the EMBA.

4.5.3.1.2.1 Southern bluefin tuna

Southern bluefin tuna (**SBT**) are large pelagic migratory fish that can reach up to 2.25 m in length and 200 kg in weight. These slow-growing apex predators have a long lifespan, living for over 40 years, feed opportunistically on a wide variety of prey including fish, crustaceans, cephalopods and salps, and reach sexual maturity at between 11 – 12 years of age (DAWE, 2022).

In Australia, SBT occurs from northwestern Australia to south Australian waters, including Tasmania, and to north New South Wales. Only one spawning ground is known, which lies in the Indian Ocean between northern WA and Java (Caton, 1991; Basson *et al.,* 2012) (**Figure 17**), located 125 km southwest of EMBA. Within this area Southern bluefin tuna spawn from August to April, close to the surface of warm waters (>24°C). as part of the consultation process with ASBTIA, they confirmed that they do not fish in the area of the proposed survey, nor is the area within what they believe to be spawning grounds for the SBT stocks and as a result of this, along with no fishing activity, they removed themselves form the consultation process.

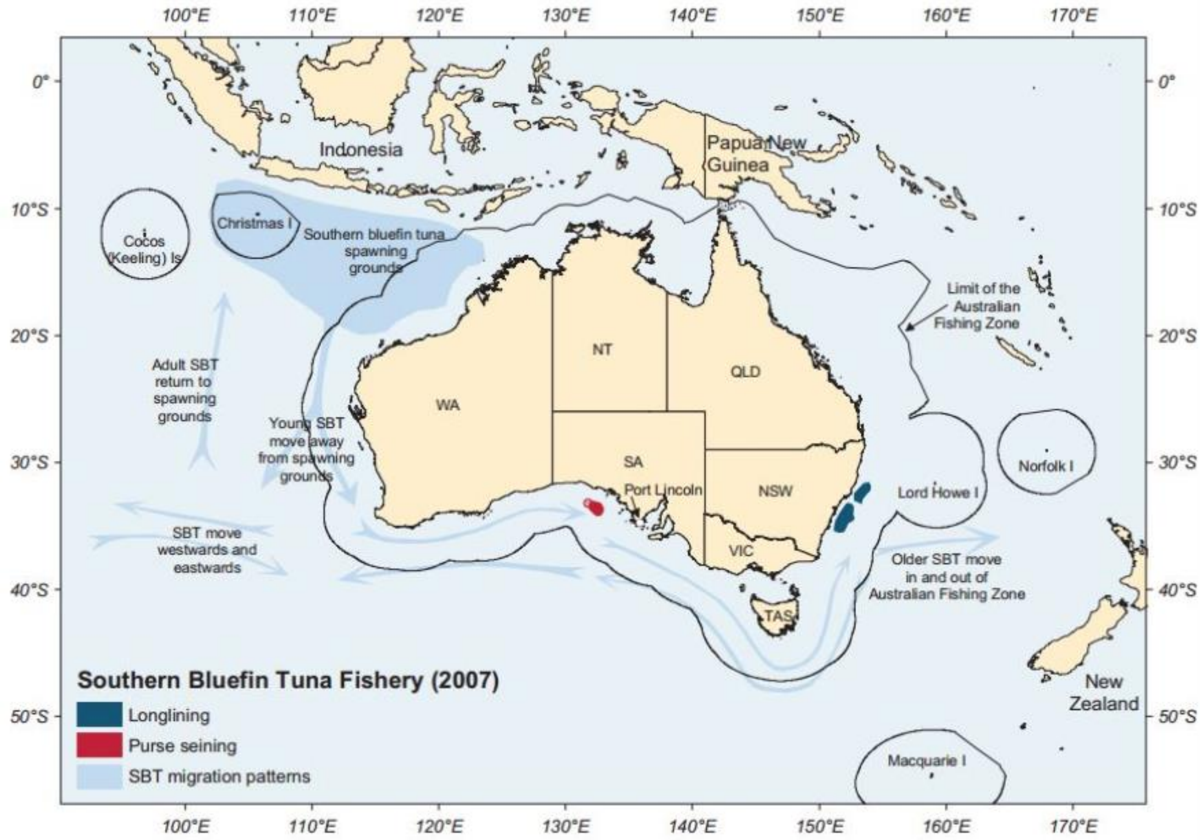
Following spawning and young of the year SBT migrate along the West Coast of Australia before passing through the Great Australian Bight then head to the east into the Tasman Sea, or west into the Indian Ocean (Basson *et al*., 2012). Migrating SBT tend to be found in deeper waters seaward of the continental shelf but will come in very close to shore in locations where the deep-water/shelf is close to shore. Over the summer period (December – April), SBT, of a range of ages and sizes are found to aggregate in large schools near the surface in the coastal waters off the southern coast of Australia, but tend to migrate to spend winters in deeper, temperate oceanic waters (DAWE, 2022). As part of the stakeholder engagement programme, the Australian Southern Bluefin Tuna Industry Association were contacted who confirmed the OA is not used for feeding or breeding by SBT (see **Section 4.7.3.1.5**) (**Appendix I**).

Through consultation with Tuna Australia, concerns were raised in relation to marine seismic surveys on SBT larval spawn. Reference was made to a 10-day Japanese cruise that was undertaken in December 2019 which assessed the distribution of small age 0 SBT in the northwestern coast of Western Australia (Itoh & Tsuda, 2019).

In the 1980's and 1990's the Japanese Fisheries Agency carried out several research surveys off the western coast of Western Australia targeting SBT by trolling. Based on the results, the distribution of age 1 fish was confirmed mainly off Perth, and a total of 11 small age 0 fish of 25 cm or less were collected. Given no surveys had been conducted since, Itoh & Tsuda (2019) conducted the survey to obtain information on the distribution of small age 0 fish.

The 2019 study was conducted long a 390 km section of coastline from Shark Bay to Exmouth, with trolling operations undertaken from 6am to 5 pm with five lines with small plastic lures. The study area is located approximately 1,700 km to the south of the OA.

Two southern bluefin tuna were caught, one of which was 24.4 cm in length and considered to be a small age 0 fish which identifies that the study method is feasible for catching age 0 SBT in this region.



Source: AFMA, 2018a

Figure 17 Southern Bluefin Tuna Spawning Grounds and Migration Routes

4.5.3.1.2.2 Syngnathids

Syngnathids (seahorses, pipefishes, seadragons, pipehorses) are found worldwide in marine tropical to temperate waters, mostly in depths above 50 m. Some species are trawled in deeper shelf and upper slope waters, and several live in estuarine and freshwater environments. Syngnathids are mostly benthic on coastal reefs, amongst marine algae and seagrass beds, or on sandy and rubble substrates and in caves and crevices (Bray, 2021).

Based on a review of information on habitat and depth range preferences of the 34 syngnathid species identified in the protected matters search, six it was considered that six species may be present within the OA (**Table 15**). Most of the syngnathid species identified by the protected matters search are associated with reef habitats and have not been recorded in depths greater than 50 m. As such these species were not considered likely to occur within the OA (**Table 15**).

Table 15 Summary of Habitat Preference and Depth Range for Syngnathid Species that were identified using the Protected Matters Search Tool to be within the OA and EMBA

Species	Depth and habitat preference	Depth Range (m)	Likely to be within the OA
Mud pipefish *Halicampus grayi*	Deep Inhabits silty and muddy soft bottoms on the continental shelf from inshore bays to deep offshore areas.	0 – 100	Possible
Thorny seahorse *Hippocampus histrix*	Deep Inhabits areas with both hard and soft bottoms, often attached to soft corals or sponges and rocky reef areas.	5 – 95	Possible
Hedgehog seahorse *Hippocampus spinosissimus*	Deep Benthic in inner reef waters on rubble substrates and in sponge and seagrass habitats near coral reefs.	20 – 70	Possible
Pallid pipehorse *Solegnathus hardwickii*	Deep Mostly known from trawled specimens captured in depths of up to 180 m.	12 – 180	Possible
Gunther's pipehorse, *Solegnathus lettiensis*	Deep/shelf Benthic inhabitant of outer continental shelf waters and has been captured from depths up to 180 m.	42 – 180	Possible
Straightstick pipefish, *Trachyrhamphus longirostris*	Deep Most specimens have been trawled or dredged from muddy to sandy-bottom habitats in depths up to 90 m.	15 – 90	Possible
Barbed pipefish *Bhanotia fasciolata*	Low reef Demersal individuals are most common in reef and tidepool habitats.	3 – 25	Unlikely
Three-keel pipefish *Campichthys tricarinatus*	Low reef Occurs in inshore reef habitats.	3 – 10	Unlikely
Pacific Short-bodied pipefish, *Choeroichthys brachysoma*	Low reef Commonly occurs in seagrass, reef and coral habitats in depths of less than 5 m.	< 5	Unlikely
Pig-snouted pipefish *Choeroichthys suillus*	Low reef Occurs in inshore reef habitats.	1 – 15	Unlikely
Redbanded pipefish *Corythoichthys amplexus*	Low reef This species prefers protected coral habitats and shallow reefs.	0 – 30	Unlikely
Reticulate pipefish *Corythoichthys flavofasciatus*	Low reef Association with fringing coral reefs, rocky shores, pools and caves.	0 – 30	Unlikely
Australian Messmate pipefish *Corythoichthys intestinalis*	Low reef They occur on sheltered coastal reefs. Associated with sand, coral or 'grass' bottoms.	0 – 10	Unlikely
Schultz's pipefish *Corythoichthys schultzi*	Low reef Common on rubble and in corals.	0 – 30	Unlikely

Species	Depth and habitat preference	Depth Range (m)	Likely to be within the OA
Roughridge pipefish *Cosmocampus banneri*	Low reef Occurs on coral reefs lagoons, rock and sand.	6 -30	Unlikely
Banded pipefish *Doryrhamphus dactyliophorus*	Low reef Free-swimming fishes that are usually found at the front of caves or reef overhangs.	10 – 25	Unlikely
Bluestripe pipefish *Doryrhamphus excisus*	Low reef Free-swimming benthic fishes found in various reef habitats in coastal to outer reefs, and close to small caves.	0 – 50	Unlikely
Cleaner pipefish *Doryrhamphus janssi*	Low reef Found in various reef habitats in coastal to outer reefs, and usually close to small caves or narrow crevices.	5 – 30	Unlikely
Tiger pipefish *Filicampus tigris*	Low reef Usually seen in estuaries on rubbly, sandy or weedy bottoms.	2 – 30	Unlikely
Brock's pipefish *Halicampus brocki*	Low reef Occurs on coral and rocky reefs with algae.	3 – 45	Unlikely
Ridgenose pipefish *Halicampus dunckeri*	Low reef A reef associated species usually found on sandy and algal-rubble habitats.	1 – 25	Unlikely
Spiny-snout pipefish *Halicampus spinirostris*	Low reef Inhabits shallow coral rubble areas in lagoons and intertidal zones of inshore coral reefs.	5 – 10	Unlikely
Ribboned pipehorse *Haliichthys taeniophorus*	Low reef Inhabits a variety of inshore shallow water areas including coral reefs, rocky, sandy and muddy substrates.	0 – 18	Unlikely
Beady pipefish *Hippichthys penicillus*	Shallow Found in lower reaches of streams and rivers and seagrass beds in estuaries.	0 – 5	Unlikely
Spotted seahorse *Hippocampus kuda*	Low reef Inhabits coastal bays, harbours and lagoons, sandy sediments in rocky littoral zones, and shallow reef flats.	0 – 50	Unlikely
Flat-face seahorse *Hippocampus planifrons*	Low reef Inhabits algal and rubble reefs in shallow bays from the intertidal.	0 – 20	Unlikely
Tidepool pipefish *Micrognathus micronotopterus*	Low reef Usually inhabits shallow inshore reefs and tidepools.	1 – 10	Unlikely
Robust ghost pipefish *Solenostomus cyanopterus*	Low reef Inhabits shallow protected coral and rocky reefs, along with deep, clear estuaries with seagrass or macro-algae.	0 – 28	Unlikely

Species	Depth and habitat preference	Depth Range (m)	Likely to be within the OA
Double-end pipehorse *Syngnathoides biaculeatus*	Low reef Inhabits shallow, protected waters of bays, lagoons and estuaries.	0 – 10	Unlikely
Blue-speckled Pipefish *Hippichthys cyanospilos*	Low reef Inhabiting brackish shallow-water environments in estuaries and lower reaches of coastal rivers and streams.	0 – 5	Unlikely
Short-keel Pipefish *Hippichthys parvicarinatus*	Low reef Inhabits coastal fresh and brackish habitats.	0 – 5	Unlikely
Reef-top Pipefish *Corythoichthys haematopterus*	Low reef Inhabits protected rubble and sandy areas in shallow reef lagoons, reef flats and slopes.	1 – 20	Unlikely
Girdled Pipefish *Festucalex cinctus*	Low reef Usually inhabits sheltered coastal bays and estuaries.	1 – 30	Unlikely
Western Spiny Seahorse *Hippocampus angustus*	Low reef Inhabits sheltered algal-covered reefs and seagrass beds.	10 – 30	Unlikely

Sources: DoEE (2019); Bray and Thompson (2022); Austin and Pollom (2019); Froese and Pauly (2022)

4.5.3.2 Elasmobranchs

The NWMR and NMR are inhabited by a diversity of elasmobranch species that typically perform an important ecological role as a higher-order predator (DEWHA, 2008a). Species of elasmobranchs that have been reported associated with shoals and oceanic bank habitats present within the EMBA albeit at relatively low abundances include but are not limited to the great hammerhead (*Sphyrna mokarran*), Tawny nurse shark (*Nebrius ferrugineus*), Sicklefin lemon shark (*Negaprion acutidens*), Bowmouth guitarfish (*Rhina ancylostoma*), Round ribbontail ray (*Taeniura meyeni*), Spotted eagle ray (*Aetobatus narinari*), Silvertip shark (*Carcharhinus albimarginatus*), Blacktail reef shark (*Carcharhinus amblyrhynchos*), Tiger shark (*Galeocerdo cuvier*), Ribbontail stingray (*Taeniura lymma*) and Whitetip reef shark (*Triaenodon obesus*) (Moore *et al.*, 2017).

4.5.3.2.1 Listed Species

Thirteen different threatened and/or migratory shark and ray species were identified by a search of the EPBC Act Protected Matters Database (3 March 2022) as potentially occurring in the OA and/or the wider EMBA (**Table 16**). A description of the identified sharks and rays species identified in the EPBC Act Protected Matters search is provided in **Table 16**.

Table 16 EPBC Act List of Threatened and Migratory Species Known to/ Likely to Occur within the OA and Wider EMBA

Species	EPBC Act Status/ Migratory Status	Description of Species and Potential to Occur within the OA and EMBA
Great White Shark *Carcharodon carcharias*	V M	The Great white shark grows to a minimum of 6 m in length and can weigh up to 3,000 kg (Mollet and Cailliet, 1996; Last and Stevens, 2009). The white shark is widely, but sparsely, distributed in all seas in both hemispheres. They have been sighted in all Australian coastal areas apart from in the NT. It is most frequently observed and captured in coastal temperate and subtropical regions. Accurate population assessments are not yet possible for any region (Bruce, 2008). Great white sharks are frequently recorded in waters around fur seal and sea lion colonies (DoEE, 2022). There are no known aggregation sites for great white sharks in the NWMR, and this species is most likely to be found south of North West Cape, probably in low densities. Due to the species preference for cold temperate waters and feeding grounds in waters around seal colonies further south, the presence of the species within the OA and EMBA is likely to be infrequent. **Relevant management plan**: Recovery Plan for the White Shark (*Carcharodon carcharias*). The overarching objective of the 10 specific objectives of this recovery plan is to assist the recovery of the white shark in the wild, throughout its range in Australian waters, with a view to: 1) improving the population status, leading to future removal of the white shark from the threatened species list of the EPBC Act 2) ensuring that anthropogenic activities do not hinder the recovery of the white shark in the near future, or impact on the long term conservation status of the species. https://www.dcceew.gov.au/sites/default/files/documents/white-shark.pdf **Key threats**: 1) Mortality related to incidental (accidental or illegal) capture by commercial and recreational fisheries, including issues of post release mortality; 2) Mortality related to shark control activities such as beach meshing or drumlining (east coast population). Exposure to underwater noise is not identified as a threat to the recovery of the species.

Species	EPBC Act Status/ Migratory Status	Description of Species and Potential to Occur within the OA and EMBA
Northern river shark *Glyphis garricki*	E N/A	The northern river shark is known to occur in WA and the NT. Northern river sharks are elasmobranchs capable of living and moving between freshwater and seawater. Within Australia, northern river sharks are known to occur in rivers, tidal sections, inshore and offshore marine habitats (DoE, 2014; Pillans *et al.*, 2009). Given the species preferred estuarine habitat, the presence of the species within the OA is unexpected however it may occur at low abundance. The species may be present in the coastal region of the EMBA. **Relevant management plan**: Sawfish and River Sharks – Multispecies Recovery Plan 2015. The overarching objective of the 10 specific objectives of this recovery plan is to assist the recovery of the Northern river shark in the wild, throughout its range in Australian waters, with a view to: 1) improving the population status, leading to future removal of the Northern river shark from the threatened species list of the EPBC Act 2) ensuring that anthropogenic activities do not hinder the recovery of the Northern river shark in the near future, or impact on the long term conservation status of the species. https://www.dcceew.gov.au/sites/default/files/documents/sawfish-river-sharks-multispecies-recovery-plan.pdf **Key threats**: 1) Fishing activities including: being caught as by-catch in the commercial and recreational sectors; through Indigenous fishing; and illegal, unreported and unregulated fishing; 2) habitat degradation and modification.

Species	EPBC Act Status/ Migratory Status	Description of Species and Potential to Occur within the OA and EMBA
Freshwater sawfish *Pristis pristis*	V M	The Freshwater Sawfish is mainly confined to the main channels of large rivers of northern Australia, WA and Queensland (DAWE, 2022a). Juvenile freshwater sawfish mainly occur in rivers and estuaries, while mature animals tend to occur more often in coastal and offshore waters up to 25 m depth (Giles *et al.*, 2006; Stevens *et al.*, 2005). In northern Australia, this species appears to be confined to freshwater drainages and the upper reaches of estuaries, occasionally being found offshore. It is likely to occur within the carbonate bank and terrace system of the Sahul Shelf KEF. The nearest freshwater sawfish foraging BIA is at King Sound, located over 450 km away from the OA. Given the species preferred estuarine habitat, and the location of the foraging BIA, the presence of the species within the OA is unexpected however it may occur at low abundance. The species may be present in the coastal region of the EMBA. **Relevant management plan**: Sawfish and River Sharks – Multispecies Recovery Plan. The overarching objective of the 10 specific objectives of this recovery plan is to assist the recovery of the freshwater sawfish in the wild, throughout its range in Australian waters, with a view to: 1) improving the population status, leading to future removal of the freshwater sawfish from the threatened species list of the EPBC Act 2) ensuring that anthropogenic activities do not hinder the recovery of the freshwater sawfish in the near future, or impact on the long term conservation status of the species. https://www.dcceew.gov.au/sites/default/files/documents/sawfish-river-sharks-multispecies-recovery-plan.pdf **Key threats**: 1) Fishing activities including: being caught as by-catch in the commercial and recreational sectors; through Indigenous fishing; and illegal, unreported and unregulated fishing; 2) habitat degradation and modification.

Species	EPBC Act Status/ Migratory Status	Description of Species and Potential to Occur within the OA and EMBA
Green sawfish *Pristis zijsron*	V M	Green sawfish are distributed in coastal waters from Queensland across northern Australia to Shark Bay in WA, with some records being offshore in relatively deep water (Stevens *et al.*, 2005). Adult green sawfish appear to preference shallow inshore waters (Stevens *et al.*, 2005). The carbonate bank and terrace system of the Sahul Shelf KEF is known to support green sawfish (Donovan *et al.*, 2008). A portion of this KEF overlaps with the eastern portion of the OA. The closest foraging BIA for green sawfish in the area is located along the eastern shore of Camden Sound, over 385 km away from the OA and outside of the EMBA. Given green sawfish are known to occur in the JBG. The presence of the species within the OA is unexpected however it may occur at low abundance. The species may be present in the coastal region of the EMBA. **Relevant management plan**: Sawfish and River Sharks – Multispecies Recovery Plan. The overarching objective of the 10 specific objectives of this recovery plan is to assist the recovery of the green sawfish in the wild, throughout its range in Australian waters, with a view to: 1) improving the population status, leading to future removal of the green sawfish from the threatened species list of the EPBC Act 2) ensuring that anthropogenic activities do not hinder the recovery of the green sawfish in the near future, or impact on the long term conservation status of the species. https://www.dcceew.gov.au/sites/default/files/documents/sawfish-river-sharks-multispecies-recovery-plan.pdf **Key threats**: 1) Fishing activities including: being caught as by-catch in the commercial and recreational sectors; through Indigenous fishing; and illegal, unreported and unregulated fishing; 2) habitat degradation and modification.

Species	EPBC Act Status/ Migratory Status	Description of Species and Potential to Occur within the OA and EMBA
Narrow sawfish *Anoxypristis cuspidata*	N/A M	The exact distribution of the narrow sawfish is uncertain, but it is likely that its distributed from Australia to Japan and South Korea. (IUCN, 2017). The narrow sawfish occurs from inshore and estuarine areas to offshore habitat of up to at least 40 m depth (Peverell, 2005). Given the relatively shallow-water distribution of this species, it is unlikely to be present in the OA. The species may be present in higher numbers in the coastal region of the EMBA. **Relevant management plan**: Sawfish and River Sharks – Multispecies Recovery Plan. The overarching objective of the 10 specific objectives of this recovery plan is to assist the recovery of the narrow sawfish in the wild, throughout its range in Australian waters, with a view to: 1) improving the population status, leading to future removal of the narrow sawfish from the threatened species list of the EPBC Act 2) ensuring that anthropogenic activities do not hinder the recovery of the narrow sawfish in the near future, or impact on the long term conservation status of the species. https://www.dcceew.gov.au/sites/default/files/documents/sawfish-river-sharks-multispecies-recovery-plan.pdf **Key threats**: 1) Fishing activities including: being caught as by-catch in the commercial and recreational sectors; through Indigenous fishing; and illegal, unreported and unregulated fishing; 2) habitat degradation and modification.
Dwarf sawfish *Pristis clavata*	V M	The dwarf sawfish usually inhabits shallow coastal waters and estuarine habitats. Its distribution is thought to extend north from Cairns, across northern Australian waters to the Pilbara coast in WA (DoEE, 2022). The closest foraging BIA for dwarf sawfish in the area is located along the eastern shore of Camden Sound, over 300 km away from the OA and outside of the EMBA. Given the species preferred coastal habitat, and the location of the foraging BIA, the presence of the species within the OA is unexpected however it may occur at low abundance. The species may be present in the coastal region of the EMBA. **Relevant management plan**: Sawfish and River Sharks – Multispecies Recovery Plan. The overarching objective of the 10 specific objectives of this recovery plan is to assist the recovery of the dwarf sawfish in the wild, throughout its range in Australian waters, with a view to: 1) improving the population status, leading to future removal of the dwarf sawfish from the threatened species list of the EPBC Act 2) ensuring that anthropogenic activities do not hinder the recovery of the dwarf sawfish in the near future, or impact on the long term conservation status of the species. https://www.dcceew.gov.au/sites/default/files/documents/sawfish-river-sharks-multispecies-recovery-plan.pdf **Key threats**: 1) Fishing activities including: being caught as by-catch in the commercial and recreational sectors; through Indigenous fishing; and illegal, unreported and unregulated fishing; 2) habitat degradation and modification.

Whale Shark *Rhincodon typus*	V M	The Whale shark are the largest known living fish species, reaching up to 12 m in length, although more commonly measuring 4 – 10 m (Colman, 1997). It is estimated that whale sharks may live for over 100 years (Taylor, 1994). Whale Sharks is an oceanic and coastal, tropical to warm-temperate pelagic species that is generally encountered close to or at the surface but can make dives to around 1000 m in search of prey (DAWE, 2022a; Compagno, 1984). In Australia, the Whale Shark is most commonly seen in waters off northern WA, NT and Queensland (Compagno, 1984; Last and Stevens, 1994). There is a recovery plan in place that identifies actions to ensure this species long term viability and survival (DEH, 2005a). Whale shark foraging is noted to occur in the region, from Ningaloo Reef to waters in the Timor Sea (Sleeman *et al.*, 2010; Wilson *et al.*, 2006; Reynolds *et al.*, 2017). A BIA is designated for whale shark foraging, which is located within the OA and EMBA (**Figure 18**). The foraging BIA represents waters where solitary whale sharks may forage during the migration from Ningaloo, which occurs primarily in spring (September to November). According to the DoEE's Conservation Advice on whale sharks, the species is known to aggregate at Christmas Island (approximately 2,400 km away) between December and January and at Ningaloo Reef (approximately 1,800 km away) between March and July to feed on krill and baitfish associated with coral spawning events (DoEE, 2022). The whale shark migration between Christmas Island and Ningaloo Reef is expected to occur in deep waters away from the OA between January and March (Colman, 1997). They are strong but slow swimmers, typically travelling 24 km/day (Eckert *et al.*, 2002). The population participating in the Ningaloo aggregation is estimated to comprise between 300 and 500 individuals, although the total population size in the region is unknown (Meekan *et al.*, 2006). Due to the species widespread distribution and highly migratory nature, individuals are likely to be present in both the OA and EMBA in low numbers. **Relevant management plan**: No adopted EPBC documented recovery plan for whale shark. A Whale Shark Recovery Plan 2005-2010 is provided on the federal register of legislative instruments. The objective of the whale shark recovery plan 2005-2010 is to maintain existing levels of protection for the whale shark in Australia while working to increase the level of protection afforded to the whale shark within the Indian Ocean and Southeast Asian region to enable population growth so that the species can be removed from the threatened species list of the EPBC Act. https://www.legislation.gov.au/Details/F2005L02834/Download **Key threats**: The main threat to the whale shark occurs outside Australian waters and is commercial harvest by a number of other range states of the whale shark. The potential future threats to whale sharks visiting Australian waters are: competition with fisheries, habitat damage, pollution and marine debris, climatic and ocean change, predation, disease, and direct disturbance from tourism, research or interference. At present none of these potential threats appear to have an impact on the numbers of whale sharks visiting Australian waters. Underwater noise is not specifically listed as a threat to the species in the Whale Shark Recovery Plan 2005-2010. Sound from commercial vessels has been identified to disturb whale sharks (DpaW 2013).

Species	EPBC Act Status/ Migratory Status	Description of Species and Potential to Occur within the OA and EMBA
Shortfin mako shark *Lsurus oxyrinchu*	N/A M	The shortfin mako is a large pelagic and fast mackerel shark, reaching up to 4 m in length and exhibiting speed bursts of 18.8 ms-1. They are considered to be the fastest swimming shark species (Last and Stevens, 2009). Shortfin mako are highly migratory and occur globally in tropical and temperate waters above 16°C. It is widespread in Australian waters having been recorded in offshore waters all around the continent's coastline (Last and Stevens, 2009). Given the species distribution in deep offshore waters, the presence of the species within the OA and EMBA is expected to be low. **Relevant management plan**: No adopted EPBC documented recovery plan for shortfin mako http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=79073 **Key threats**: Globally, the main threat to the shortfin mako is historic and ongoing fishing pressure.
Longfin mako shark *Lsurus paucus*	N/A M	The longfin mako inhabits oceanic and pelagic habits and is a widely distributed, but rarely encountered, tropical ocean shark. This species appears to be cosmopolitan in tropical and warm temperate waters; however, at present, records are sporadic, and the complete distribution remains unclear (IUCN, 2017). In Australian waters, longfin mako sharks are found from WA, and north to Port Stephens in New South Wales (Last and Stevens 2009). Whilst assumed to be a deep-water shark, sightings on the ocean surface, and the species' diet, suggest a broader depth range (Rigby *et al.,* 2019). Given the species distribution in deep offshore waters, the presence of the species within the OA and EMBA is expected to be low. **Relevant management plan**: No adopted EPBC documented recovery plan for longfin mako http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82947
Oceanic whitetip shark *Carcharhinus longimanus*	N/A M	The oceanic whitetip shark is a deep-water pelagic species inhabiting tropical to warm-temperate waters (Compagno, 1984). Oceanic whitetip sharks prefer water temperatures above 20°C and can reach depths of >180 m (Castro *et al.*, 1999). Within Australian waters, the oceanic whitetip shark is found from WA, through parts of the NT and down to Sydney (Last and Stevens 2009). Given the species distribution in deep offshore waters, the presence of the species within the OA and EMBA is expected to be low. **Relevant management plan**: No adopted EPBC documented recovery plan for oceanic whitetip shark https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=84108

Species	EPBC Act Status/ Migratory Status	Description of Species and Potential to Occur within the OA and EMBA
Scalloped Hammerhead *Sphyrna lewini*	Conservation Dependent	The scalloped hammerhead is a migratory, schooling, coastal-pelagic, semi-oceanic species that travel within the EEZ of many coastal nations. These sharks aggregate in huge numbers, making them extremely vulnerable to commercial and illegal fishing. Known in Australian waters from about Geographe Bay, WA, around the tropical north, to Sydney, New South Wales. Elsewhere, widespread in tropical and warm temperate. They can range from the surface to more than 275 m deep, but juveniles are often found close inshore and in enclosed bays and estuaries. The Australian populations are dominated by juveniles and small adult males (Bray and Thompson, 2022). Given the species preferred coastal habitat, the presence of the species within the OA is expected to be low. The species may be present in the coastal region of the EMBA. **Relevant management plan**: No adopted EPBC documented recovery plan for scalloped hammerhead. https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85267 **Key threats**: Commercial, recreational and shark meshing bather protection fisheries are the primary threats to the Scalloped Hammerhead (NSW DPI, 2012).
Reef manta ray *Manta alfredi*	N/A M	The reef manta ray has a circumtropical and subtropical distribution, existing in the Pacific, Atlantic and Indian Oceans. Within this broad range, populations appear to be sparsely distributed and highly fragmented (Marshall *et al.*, 2018b). The reef manta ray is found around most of Australia's coast (DoEE, 2022). The reef manta is often resident in coastal areas (Marshall *et al.*, 2018b) and its movement patterns differs from site-specific to seasonal migrations of several hundred kilometres (Couturier *et al.*, 2011). Given the species is generally associated with nearshore environments, the presence of the species within the OA is expected to be limited. The species may be present in higher numbers within the coastal region of the EMBA. **Relevant management plan**: No adopted EPBC documented recovery plan for reef manta ray. https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=90034

Species	EPBC Act Status/ Migratory Status	Description of Species and Potential to Occur within the OA and EMBA
Giant manta ray *Manta birostris*	N/A M	The giant manta ray has a circum-tropical and semi-temperate distribution throughout the world's major oceans. Within this broad range, populations appear to be sparsely distributed and highly fragmented (Marshall *et al.*, 2018). The giant manta ray appears to be a seasonal visitor to coastal or offshore sites and are capable of large-scale movements of >1,000 km (Kashiwagi *et al.*, 2011). Whilst largely solitary, giant mantas can aggregate in large numbers to feed, mate or clean. The giant manta ray has a widespread distribution along the coast of Australia and is also known to seasonally migrate between aggregation sites (Marshall *et al.*, 2018b). The year-round population of giant manta rays present at Ningaloo Reef from May through to September. Given the species wide-distribution, the presence of the species within the OA is expected to be low. The species may be present in higher numbers in the coastal region of the EMBA. **Relevant management plan**: No adopted EPBC documented recovery plan for giant manta ray. https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=90033

Note: EPBC Act Status: CE = Critically Endangered, E= Endangered V= Vulnerable, M= Migratory

4.5.3.3 Elasmobranch Biologically Important Area

The OA overlaps with the northernmost section of a whale shark migration and foraging BIA (**Figure 18**). The whale shark BIA follows the continental shelf and extends from Ningaloo Marine Park (**NMP**) to waters in the north Kimberley region. Individuals observed at Ningaloo Reef have been shown to use both inshore and offshore habitats while migrating northwards (Reynolds *et al*., 2017; Sleeman *et al*., 2010). The foraging BIA represents waters where whale sharks may forage during the migration from Ningaloo, which occurs primarily in spring (September to November) after their seasonal aggregation.

The seasonal aggregation of whale sharks in the waters of NMP occurs each year between the months of March and July, although this timing can be variable and extend into August. The aggregation has been linked to productivity events associated with mass coral spawning episodes and the unique current system along the northwest coastline where the Leeuwin current and Ningaloo current interact. This aggregation is one of the largest in the world and its uniqueness has contributed to the Ningaloo Coast being inscribed on the World Heritage List, acknowledging it as one of the outstanding natural places in the world and reaffirming the whale shark as a conservation icon (DPAW, 2013).

Studies of the migratory patterns indicate that some individuals pass Scott Reef and Ashmore Reef (Wilson *et al.* 2006; Meekan and Radford 2010). Satellite tagging of 12 individuals from the Exmouth area between 2015 and 2016 for up to 155 days revealed that migratory behaviours and tracks are relatively unique amongst individuals and that they disperse over a wide area (**Figure 19**) (Reynolds *et al.,* 2016).

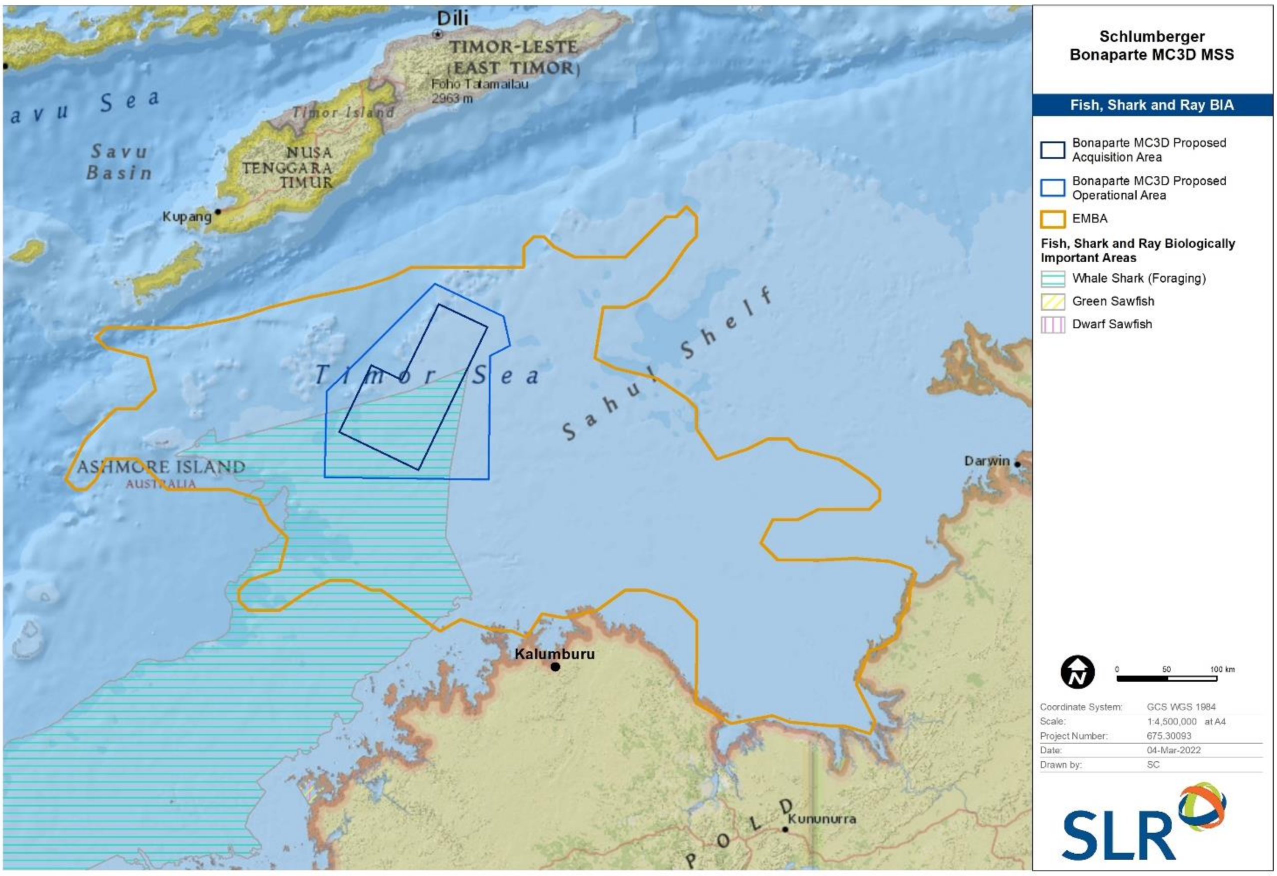


Figure 18 Biologically Important Area for Whale Shark

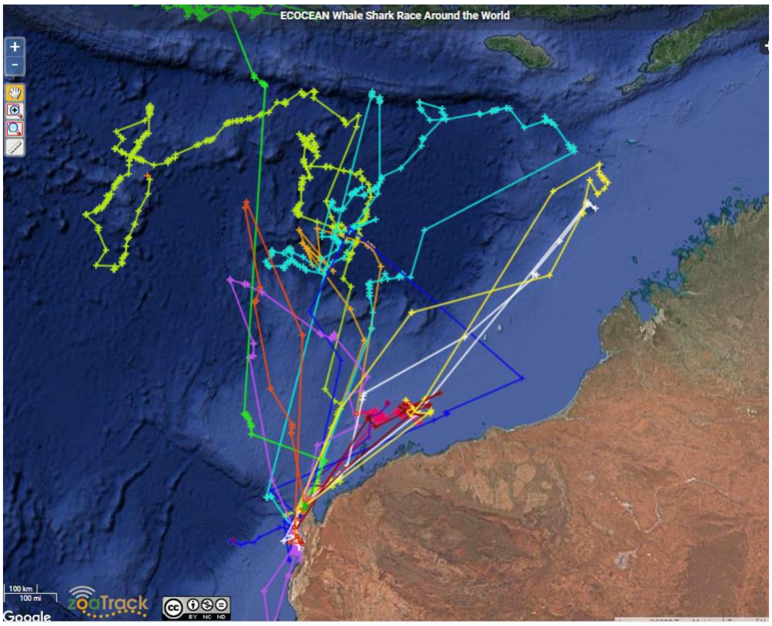


Figure 19 Satellite tagging data for whale shark movements off Exmouth. Source: Reynolds et al. (2016)

4.5.4 Cephalopods

All cephalopods consist of a mantle, head, and eight arms (and two long tentacles in the case of some squid). This class of animals includes cuttlefish, squid, octopus and nautilus. Cephalopods are highly significant ecologically within the marine environment, both as top-level predators and as prey for numerous vertebrates, including fish, seals, cetaceans and seabirds. Australian waters contain the highest diversity of cephalopods found anywhere in the world and, according to the Atlas of Living Australia (ALA, 2022), 22 species of cephalopods have been recorded within EMBA according to Atlas of Living Australia field guide, download generated 3 March 2022 (see results in **Appendix C**). The records vary from a few sightings up to approximately 50 records. Cephalopods, particularly squid, are an important food source for many fish, bird, elasmobranch and marine mammal species that inhabit the OA.

More than 30 cuttlefish species are known from Australian waters. Cuttlefish live in a range of habitats including reefs, sand, mud and among seagrass and seaweed. They have a lifespan of one to two years and are productive breeders. According to records in ALA field guide nine different cuttle fish species has been observed within EMBA (seven of them within OA). Cuttlefish occupy shallow depths up to approximately 1,000 m (ALA, 2022).

Twelve squid species have been recorded in the EMBA according to ALA field guide, nine of them within the OA. Squid have rapid growth rates and most live for up to only one year, dying shortly after spawning.

Octopuses mainly live on the seafloor and are the largest predators on reefs, feeding on crustaceans and shellfish (Te Ara, 2018). Only one octopus species (Banded Stringarm Octopus) is listed in the ALA field guide as having been recorded within the EMBA, not the OA. This species, and potentially other octopus species, could be present within the OA but are most likely to be affiliated with reefs and coastal waters.

There are six living species of Nautilus in Australian waters, none of which have been recorded in the OA or EMBA (ALA field guide). Nautiluses generally inhabit waters of around 300 m in depth rising to approximately 100 m during the night to feed, mate and lay eggs.

No cephalopod species are included in the EPBC Act List of Threatened Fauna.

4.5.5 Marine Reptiles

Many marine reptile species are known to occur in the NWMR and NMR, including marine turtles, sea snakes and saltwater crocodiles. Of the seven marine turtle species globally, six occur regularly in the NWMR and NMR and all are listed as vulnerable or endangered by the EPBC Act (DSEWPC, 2012; DSEWPC, 2012a). These regions also collectively support most of the 35 sea snake species that occur in Australia; with two of the sea snake species occurring here being listed as critically endangered. In particular, the Timor Sea is regarded as a sea snake biodiversity hotspot (Guinea and Whiting, 2005; Minton and Heatwole, 1975; Smith, 1926).

Whilst there is no emergent land within the OA to support nesting marine reptiles, many species forage within the OA, and both foraging and breeding behaviours occur within the EMBA. The closest known marine turtle nesting site occurs at Ashmore Reef (located approximately 106 km west of the OA). Ashmore Reef also provides important habitat to at least 14 species of sea snake (Cogger, 2000), and high levels of endemism are reported for this location (Lukoschek *et al*., 2013).

Results from the EPBC Act Protected Matters Database (3 March 2022) revealed that there are two threatened, and six threatened and migratory marine reptile species that may be present within the OA, in addition to one threatened and nine migratory species within the wider EMBA.

There are several BIAs for marine reptile species in the region, including within the OA, along the coastline and offshore islands adjacent to the OA, and within or close to the EMBA (**Figure 20**). These include:

- A small Flatback turtle foraging BIA overlaps with the OA.
- Flatback turtle nesting, inter-nesting[5] and inter-nesting buffer BIAs, with the nearest located 240 km southeast of the OA.
- Loggerhead turtle foraging BIA located approximately 9 km east of the OA.
- Green turtle foraging, mating, nesting and inter-nesting buffer BIAs, with the nearest located approximately 87 km west of the OA.
- Hawksbill turtle foraging, nesting and inter-nesting buffer BIAs, with the nearest located 107 km west of the OA.
- Olive Ridley turtle foraging BIA located approximately 9 km east of the OA.

While no ‘critical habitat’ as defined under Section 207A of the EPBC Act (Register of Critical Habitat) has been identified and listed for marine turtles, the Turtle Recovery Plan (Commonwealth of Australia, 2017b) identifies the areas shown in **Figure 21** as critical habitat and the associated seasonality for these locations is listed in **Table 17**. While the OA does not overlap with any identified critical marine turtle habitat, the EMBA overlaps with critical green turtle habitat at Ashmore Island and near Kalumburu, and flatback turtle habitat in the JBG.

A description of the distribution, preferred habitat and life stages of the identified threatened marine reptile species is provided in **Table 18,** including commentary on their likely presence in the OA and EMBA. **Table 19** lists those non-threatened marine reptile species that may also occur in the region.

[5] inter-nesting areas are where females live between laying successive clutches in the same season.

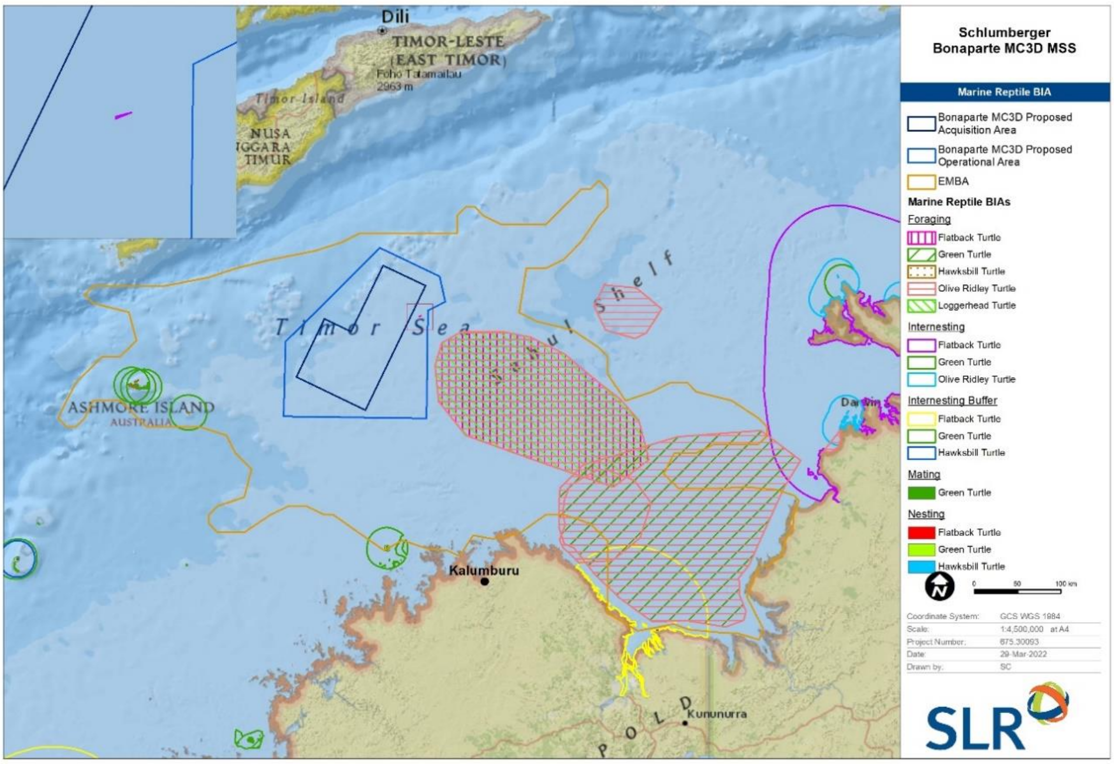


Figure 20 Biologically Important Areas for marine reptiles in the EMBA

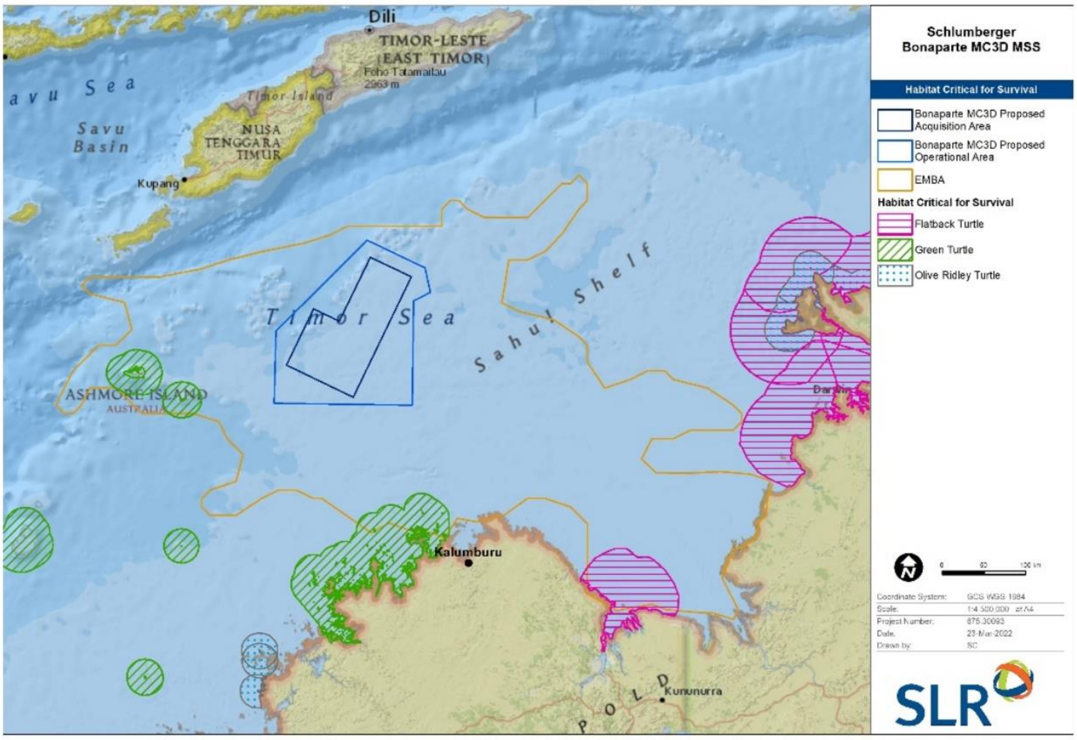


Figure 21 Marine Turtle 'Critical Habitat' as Identified by the Recovery Plan for Marine Turtles in Australia

Table 17 Relevant Nesting and Internesting Areas identified as Marine Turtle 'Critical Habitat'

	Genetic Stock	Nesting Location	Inter-nesting buffer	Season
Green Turtle	North West Shelf	Adele Island, Maret Island, Cassini Island, Lacepede Islands, Barrow Island, Montebello Islands (all with sandy beaches), Serrurier Island, Dampier Archipelago, Thevenard Island, Northwest Cape, Ningaloo coast.	20 km	Nov-Mar
	Ashmore Reef	Ashmore Reef and Cartier Reef.	20 km	Year round, peak Dec-Jan
	Scott-Browse	Scott Reef (Sandy Islet) and Browse Island.	20 km	Nov-Mar
Flatback Turtle	Arafura Sea	Field Island, Crab Island, Bare Sand Island, Tiwi Islands, Quail Island, Hawkesbury Point, Cobourg Peninsula, Wessel Islands, Gove Peninsula, Groote Eylandt Archipelago, Sir Edward Pellew Islands, Wellesley Islands, Deliverance Island, mainland beaches from Jardine River to Edward River, Crocodile Island Group.	60 km	Year round, peak Jun-Sep
	Cape Domett	Cape Domett, Lacrosse Island.	60 km	Year round, peak Jul-Sep
	Southwest Kimberley	Eighty Mile Beach, Eco Beach, Lacepede Islands.	60 km	Oct-Mar, peak Dec-Jan
	Unknown genetic stock Kimberley, WA	Maret Islands, Montilivet Islands, Cassini Island, Coronation Islands (includes Lamarck Island), Napier-Broome Bay Islands (West Governor Island, Sir Graham Moore Island – near Kalumbaru), Champagny, Darcy and Augustus Islands (Camden Sound).	60 km	May-Jul
Olive Ridley	Unknown genetic stock Kimberley, WA	Prior Point, Vulcan Island, Darcy Island, Llangi, Cape Leveque.	20 km	May-Jul

Table 18 EPBC Act List of Threatened and/or Migratory Marine Reptiles Potentially Occurring in the OA and/or EMBA

Common Name(s) Scientific Name	EPBC Act Protection Status	Distribution, Habitat and Life Stages	Records in OA/EMBA	Presence Within the OA and EMBA
Leaf-scaled sea snake *Aipysurus foliosquama*	CE	• Endemic to the NWMR being only found on reefs associated with the Sahul Shelf. Ashmore Reef and Hibernia Reef were population strongholds in the 1970s-1990s (Guinea, 1995; Guinea and Whiting, 2005; Minton and Heatwole, 1975); however, no sightings have been made here since 2001 (Guinea, 2007; Lukoschek, *et al.*, 2013). • This species occurs on the reef flats of shallow reefs (< 10 m), can be seen in tidal pools at low tide (Ehmann, 1992; McCosker, 1975; Guinea and Whiting, 2005). • Like all sea snakes, the leaf-scaled sea snake is long lived and slow growing, all reproduction stages occur at sea where live young are born after 6-7 months of gestation (DEWHA, 2008b).	OA & EMBA	Species MAY occur in OA and EMBA
Short-nosed sea snake *Aipysurus apraefrontalis*	CE	• Endemic to WA from Exmouth to Sahul Shelf, particularly Ashmore and Hibernia Reefs (DoE, 2022a). Whilst common in surveys during the 1990s, no sightings have occurred at Ashmore Reef since 1998 (Lokoschek *et al*., 2013). • Restricted to shallow reef flats (< 10 m) on the outer reef edge (Cogger, 2000; Guinea, 1993 and 1995). • Like all sea snakes, the leaf-scaled sea snake is long lived and slow growing, all reproduction stages occur at sea where live young are born after 6-7 months of gestation (DEWHA 2008b).	OA & EMBA	Species LIKELY to occur in OA Species KNOWN to occur in EMBA
Olive Ridley Turtle, Pacific Ridley Turtle *Lepidochelys olivacea*	E, M	• This is the most numerous marine turtle species in the world, but the least common in the NWMR (DSEWPC, 2012). In Australia, nesting primarily occurs in NT where nest densities are low but widespread (Chatto and Baker, 2008). Breeding does not routinely occur in WA, but hatchlings have been found near Cape Leveque (200 km north of Broome) in WA (NAILSMA, 2008). Papua New Guinea and Indonesia also support low density nesting (Spring, 1982; Limpus, 1997), but the Australian breeding population may be isolated (DoE, 2022b). The breeding population in NT is estimated to be 1,000-5,000 females (Taylor *et al*., 2006). • Sexual maturity occurs between 10 – 18 years of age (Zug *et al*., 2006). Nesting occurs on sandy beaches (from Mar to Oct) before hatchlings enter a pelagic phase using offshore currents (Musick and Limpus, 1997). Movements during this phase are not well understood. Foraging is typically associated with shallow benthic habitat in water depths of 11 – 40 m (Robins, 2002), but pelagic foraging in depths >100 m has been recorded (Whiting *et al*., 2005). Feeding occurs around the pinnacles of the Bonaparte Depression (Donovan *et al*., 2008).	OA & EMBA	Species KNOWN to occur in OA and EMBA Foraging, feeding or related behaviour known to occur within OA and EMBA

Common Name(s) Scientific Name	EPBC Act Protection Status	Distribution, Habitat and Life Stages	Records in OA/EMBA	Presence Within the OA and EMBA
Loggerhead Turtle *Caretta caretta*	E, M	• Australia supports 2-4% of the global population (DoE, 2022c) and WA supports largest population in Australia (Limpus, 2008). In WA, nesting routinely occurs from Shark Bay to North West Cape, but a single nest has been recorded from Ashmore Reef (Guinea, 1995) and small numbers of nests occur as far north as the Dampier Archipelago (WA DEC, 2009). Estimates from the 1990s suggest 1000-2000 breeding females in WA (Baldwin *et al.*, 2003). • Foraging areas are widely distributed in waters around Australia (SPRAT, 2022). The WA population forages from Shark Bay (WA) to Arnhem Land (NT) and across to the Indonesian Java Sea (Baldwin *et al.*, 2003). The carbonate banks of JBG and the pinnacles of the Bonaparte Depression are used as feeding grounds (Donovan *et al.*, 2008). • Nest on sandy beaches, before hatchlings disperse and spend c. 15 years at sea (Bjorndal *et al.*, 2000) where they forage in the top 5 m of the water column (Spotila, 2004). Breeding adults then develop site fidelity to both benthic foraging (out to depths of 55 m, Plotkin *et al.*, 1993) and nesting locations (Limpus, 2008). Nesting females are restricted to an 'inter-nesting' area within 10 km of the rookery during the breeding period (Tucker *et al.*, 1995). Breeds from November to March with a peak in late December/early January (Limpus 1985).	OA & EMBA	Species KNOWN to occur in OA and EMBA Foraging, feeding or related behaviour known to occur within OA and EMBA
Leatherback Turtle, Leathery Turtle, Luth *Dermochelys coriacea*	E, M	• Globally found in tropical, sub-tropical and temperate waters. Only two nesting attempts have been recorded in WA (Limpus, 2009), but low-density nesting is known from QL and NT (Limpus and MacLachlan, 1994). Coarse sandy beaches are preferred for nesting (Limpus *et al.*, 1984). Year-round nesting occurs in nearby Indonesia, Papua New Guinea and Solomon Islands (Benson *et al.*, 2011), but mortality rates here are high (Hamann *et al.*, 2006). • Forages year round over the Australian continental shelf pelagic habitat, but mostly in the south half of Australia (Hamann *et al.*, 2006). A foraging preference for steep bathymetry and converging currents is possible (Houghton *et al.*, 2006). Dives to over 1,000 m have been recorded (Houghton *et al.*, 2008). • Breeding females can lay up to five times over the nesting period (Spotila *et al.*, 1996), but only nest every 2-3 years. Hatchlings disperse widely, but juvenile movements are unknown (Lutz and Musick, 1996). Adults make large scale migrations to foraging areas in temperate seas (Benson *et al.*, 2007).	OA & EMBA	Species LIKELY to occur in OA and EMBA Foraging, feeding or related behaviour likely to occur within OA Breeding likely to occur within EMBA

Common Name(s) Scientific Name	EPBC Act Protection Status	Distribution, Habitat and Life Stages	Records in OA/EMBA	Presence Within the OA and EMBA
Flatback Turtle *Natator depressus*	V, M	• Nesting for the entire species is restricted to the northern half of Australia where four breeding populations are recognised – eastern QL, Torres Strait and Gulf of Carpentaria, NT and WA (Limpus, 2007). In the NT nesting occurs over the entire coastline. In WA, Cape Dommet and Lacrosse Island (in the JBG) are important nesting areas in winter (Bowlay and Whiting, 2007;Prince, 1994a). In addition to this and further south, another WA breeding stock is recognised (Exmouth Gulf to Lacapede Islands) where nesting occurs Dec – Mar (DSEWPC, 2012). This species is slow growing and breed only every 1-5 years (Limpus *et al*., 1983). • Foraging distribution in WA is not well known (Prince, 1998), but unlike other turtles flatback turtles lack a post-hatching dispersal phase (Walker and Parmenter, 1990) and instead have been reported to stay in coastal waters near their breeding beach (DSEWPC, 2012). The northern costal shelves on which they occur have a complex biological, oceanography and geomorphological setting. Qualitative information on their distribution suggests adults feed on soft bottom shelf habitat off northern Australia and into Papua New Guinea and Irian Jaya (Zangerl *et al*., 1988) to depths of over 40 m (Robins, 1995). Foraging turtles have been seen in the JBG and Bonaparte Depression (Donovan *et al*., 2008). • Using quantitative methods, Thums *et al*. (2017) identified important areas used by flatback turtles nesting on the Lacepede Islands. These animals migrated along the coast to foraging grounds on the mid-Sahul shelf. Distribution modelling indicated a preference for foraging and transiting in clear waters, 60 to 90 meters deep, and in association with complex, benthic geomorphology (banks, shoals, terraces, deep holes and valleys) thought to support a high abundance of sessile invertebrates, the likely targets of their foraging. The reported foraging areas comprising geomorphic complexity constitute, at least in part, the Sahul Shelf KEF.	OA & EMBA	Species KNOWN to occur in OA and EMBA Foraging, feeding or related behaviour known to occur within OA Breeding known to occur within EMBA
Green Turtle *Chelonia mydas*	V, M	• Found in tropical and subtropical waters globally. WA supports one of the largest populations (c 20,000) in the world (DEH, 2005) and this species is the most common breeding turtle in the NWMR (DSEWPC, 2012). The closest 'critical' nesting and inter-nesting area to the OA are the Lacepede Islands (Environment Australia, 2003), but moderate numbers (in the low hundreds) of nests also occur annually at Ashmore Reef and Cartier Islands (Whiting *et al*., 2000) which are closer. In WA three breeding stocks are recognised: Northwest Shelf, Scott Reef and Ashmore stocks (Dethmers *et al*., 2006). The Northwest Shelf breeding stock nests between Nov and Mar, but year-round nesting occurs on Scott Reef, Ashmore Reef and Cartier Islands, peaking in summer (DEH 2005). Small rookeries occur throughout the Bonaparte Archipelago (DSEWPC, 2012).	OA & EMBA	Species KNOWN to occur in OA and EMBA Foraging, feeding or related behaviour known to occur within OA Breeding known to occur within EMBA

Common Name(s) Scientific Name	EPBC Act Protection Status	Distribution, Habitat and Life Stages	Records in OA/EMBA	Presence Within the OA and EMBA
		• Hatchlings enter a 5-10 year pelagic phase before settling at shallow benthic foraging habitats, over sea grass beds or algae mats on which they feed (Robins *et al*., 2002). Tagging studies on Lacepede Islands show foraging occurs in the Kimberley region, Arnhem Land, the Gulf of Carpentaria and Indonesia (Prince, 1993; Prince, 1994b). Feeding is known to occur around the pinnacles of the Bonaparte Depression (Dethmer *et al*., 2006), and Ashmore Reef is an important feeding site (DSEWPC, 2012). • This species is late to sexually mature; 25-50 years (Chaloupka *et al*., 2001). Breeding females lay up to five clutches in a single season and breed every 1-9 years (DoE, 2022d). They remain within 5-10 km of their nesting beach during inter-nesting period (Pendoley, 2005).		
Hawksbill Turtle *Eretmochelys imbricata*	V, M	• Found in tropical, sub-tropical and temperate waters around the world (DOE, 2022e). Australia supports two genetically distinct populations: 1) on the Northwest Shelf of WA and 2) the Great Barrier Reef, Torres Strait and Arnhem Land. These populations represent two of the five most significant breeding populations globally (see Hoenner *et al*., 2016). • This species is very slow growing, reaching sexual maturity >31 years of age (Limpus, 1992). In WA nesting occurs year-round, with peak nest numbers from Oct to Jan (Limpus, 1995). Females nest every 2-4 years but can produce up to six clutches in a breeding season (Dobbs *et al*., 1999). Major nesting beaches occur on the offshore islands between the Dampier Archipelago (in the north) and Onslow (in the south). Nesting distribution is from North West Cape to Ningaloo (DSEWPC, 2012). • Like most turtles, they have an extended pelagic phase for the first 5-10 years they then settle on coral and rocky reefs where they have a wide omnivorous diet (Whiting, 2000). WA feeding grounds are typically 50-450 km from breeding grounds, but they can migrate up to 2,400 km between these sites. The area west of Cape Preston and south to Onslow is a key feeding area in WA (Pendoley, 2005), but feeding habitat is assumed throughout the NWMR (DSEWPC, 2012). Amalgamation of satellite tracking data by Udyawer *et al*. (2021) from 14 hawksbill turtles collected within the North Marine Region indicate individuals traverse the OA, though no migration or foraging was attributed to movements reported from these tracks.	OA & EMBA	Species LIKELY to occur in OA Species KNOWN to occur in EMBA Foraging, feeding or related behaviour likely to occur within OA and EMBA
Plains Death Adder *Acanthophis hawkei*	V	• Terrestrial snake species, that occur on the plains of northern Australia (DEPWS, 2021). Can be present in coastal floodplains which is why this species is identified as potentially present in the EMBA. Irrelevant to the Seismic Survey.	EMBA	Species MAY occur in EMBA

Common Name(s) Scientific Name	EPBC Act Protection Status	Distribution, Habitat and Life Stages	Records in OA/EMBA	Presence Within the OA and EMBA
Salt-water Crocodile, Estuarine Crocodile *Crocodylus porosus*	M	• This species occurs from King Sound (near Broome) and north through NT to QL (DoE, 2022f), inhabiting mostly tidal rivers, coastal floodplains, billabongs and swamps; however, they do also occur in coastal and offshore waters at times (Webb *et al*., 1987). In WA, river systems of the Kimberley support crocodiles, with concentrations in the Cambridge Gulf, Prince Regent River and Roe River (DoE, 2022). • Nesting occurs from Nov-May, typically in freshwater swamps without tidal influence (Webb *et al*., 1987). Hatchlings and juveniles remain close to their nests for the first year of life (Webb and Messel, 1978). Limited data exists regarding movements of adults, but relocated individuals have been recorded moving up to 280 km (Walsh and Whitehead, 1993). • Opportunistic predators, crocodiles < 180 cm eat smaller prey (mostly crabs, insects, lizards, snakes and fish), larger crocodiles are capable of eating larger mammals as well (Webb and Manolis, 1989).	EMBA	Species LIKELY to occur in EMBA

Note: EPBC Act Status: CE = Critically Endangered, E= Endangered V= Vulnerable, M= Migratory

Table 19 EPBC Act List of Non-Threatened Marine Reptiles Potentially Occurring in the OA and/or EMBA

Common Name(s), Scientific Name	Records in OA/EMBA	Presence Within the OA and EMBA
Spine-bellied sea snake, *Lapemis curtus*	OA & EMBA	Species MAY occur in OA and EMBA
Olive sea snake, *Aipysurus laevis*	OA & EMBA	Species MAY occur in OA and EMBA
Stokes' sea snake, *Astrotia stokesii*	OA & EMBA	Species MAY occur in OA and EMBA
Spectacled sea snake, *Disteira kingii*	OA & EMBA	Species MAY occur in OA and EMBA
Olive-headed sea snake, *Disteira major*	OA & EMBA	Species MAY occur in OA and EMBA
Turtle-headed sea snake, *Emydocephalus annulatus*	OA & EMBA	Species MAY occur in OA and EMBA
Beaked sea snake, *Enhydrina schistosa*	OA & EMBA	Species MAY occur in OA and EMBA
Yellow-bellied sea snake, *Pelamis platurus*	OA & EMBA	Species MAY occur in OA and EMBA
Spine-tailed sea snake, *Aipysurus eydouxii*	OA & EMBA	Species MAY occur in OA and EMBA
Dubois' sea snake, *Aipysurus duboisii*	OA & EMBA	Species MAY occur in OA and EMBA
Horned sea snake, *Acalyptophis peronii*	OA & EMBA	Species MAY occur in OA and EMBA
Elegant sea snake, *Hydrophis elegans*	OA & EMBA	Species MAY occur in OA and EMBA
Black-headed sea snake, *Hydrophis atriceps*	OA & EMBA	Species MAY occur in OA and EMBA
Spotted sea snake, Ornate Reef sea snake, *Chitulia ornata*	OA & EMBA	Species MAY occur in OA and EMBA
Black-headed sea snake, Slender-necked sea snake, *Leioselasma coggeri*	OA & EMBA	Species MAY occur in OA and EMBA
Dusky sea snake, *Aipysurus fuscus*	EMBA	Species KNOWN to occur in EMBA
Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile, *Crocodylus johnstoni*	EMBA	Species MAY occur in EMBA
Plain sea snake, *Chitulia inornata*	EMBA	Species MAY occur in EMBA
Large-headed sea snake, Pacific sea snake, *Leioselasma pacifica*	EMBA	Species MAY occur in EMBA
Black-ringed sea snake, *Hydrelaps darwiniensis*	EMBA	Species MAY occur in EMBA
Northern Mangrove sea snake, *Parahydrophis mertoni*	EMBA	Species MAY occur in EMBA
Small-headed sea snake, *Hydrophis macdowelli*	EMBA	Species MAY occur in EMBA

4.5.6 Marine Mammals

A search of the EPBC Act Protected Matters Database, revealed 23 species of marine mammal as having a potential presence within the OA, with five additional species also having a potential presence within the EMBA. These species are listed in **Table 20** along with the 'presence ranking' (as assigned by the Protected Matters Database for both the OA and EMBA), their threat category and migratory status under the EPBC Act and their WA listing as 'threatened or priority fauna' under the Biodiversity Conservation Act 2016 (WA) (**BCA**). Given the pelagic nature of the OA and parts of the EMBA, several of these species are migratory and are characterised by having large oceanic distributions that are influenced by spatial and temporal variances between feeding and breeding grounds.

Table 20 Marine Mammal Species potentially occurring in the OA and EMBA

Scientific name	Common name	Presence ranking in OA	Presence ranking in EMBA	EPBC Act Threatened category	EPBC Act Migratory status	WA Listing - BCA
Balaenoptera musculus	Blue Whale	Known	Known	Endangered	Migratory	EN
Balaenoptera physalus	Fin Whale	Likely	Likely	Vulnerable	Migratory	EN
Balaenoptera borealis	Sei Whale	Likely	Likely	Vulnerable	Migratory	EN
Balaenoptera edeni	Bryde's Whale	May	Likely	-	Migratory	
Megaptera novaeangliae	Humpback Whale	Likely	Known	-	Migratory	CD
Physeter macrocephalus	Sperm Whale	May	May	-	Migratory	VU
Mesoplodon densirostris	Blainville's Beaked Whale, Dense-beaked Whale	-	May	-	-	-
Ziphius cavirostris	Cuvier's Beaked Whale, Goose-beaked Whale	May	May	-	-	-
Orcinus orca	Killer Whale, Orca	May	May	-	Migratory	-
Pseudorca crassidens	False Killer Whale	Likely	Likely	-	-	-
Feresa attenuata	Pygmy Killer Whale	May	May	-	-	-
Globicephala macrorhynchus	Short-finned Pilot Whale	May	May	-	-	-
Peponocephala electra	Melon-headed Whale	May	May	-	-	-
Kogia breviceps	Pygmy Sperm Whale	May	May	-	-	-
Kogia sima	Dwarf Sperm Whale	May	May	-	-	-
Grampus griseus	Risso's Dolphin, Grampus	May	May	-	-	-

Scientific name	Common name	Presence ranking in OA	Presence ranking in EMBA	EPBC Act Threatened category	EPBC Act Migratory status	WA Listing - BCA
Tursiops truncatus s. str.	Bottlenose Dolphin	May	May	-	-	-
Tursiops aduncus	Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin	May	Likely	-	-	-
Tursiops aduncus (Arafura/Timor Sea populations)	Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	May	Known	-	Migratory	-
Stenella longirostris	Long-snouted Spinner Dolphin	May	May	-	-	P4
Stenella coeruleoalba	Striped Dolphin, Euphrosyne Dolphin	May	May	-	-	-
Stenella attenuata	Spotted Dolphin, Pantropical Spotted Dolphin	May	May	-	-	-
Steno bredanensis	Rough-toothed Dolphin	May	May	-	-	-
Delphinus delphis	Common Dolphin, Short-beaked Common Dolphin	May	May	-	-	-
Lagenodelphis hosei	Fraser's Dolphin, Sarawak Dolphin	-	May	-	-	-
Orcaella heinsohni	Australian Snubfin Dolphin	-	Known	-	Migratory	P4
Sousa sahulensis	Australian Humpback Dolphin	-	Known	-	Migratory	P4
Dugong dugon	Dugong	-	Known	-	Migratory	OS

Key: EN = Endangered species, VU = Vulnerable species, CD = Species of special conservation interest (conservation dependent fauna), P4 = Priority 4: Rare, Near Threatened and other species in need of monitoring, OS = Other specially protected fauna.

Ecological summaries for the species ‘known’ or ‘likely’ to be present in and around the OA and EMBA are provided in the following subsections. In addition, while Omura’s whale (*Balaenoptera omurai*) is not identified as having a potential presence in the OA or the EMBA by the EPBC Protected Matters Database, occurrence of this small baleen whale has been noted in the vicinity of the OA and EMBA (Cerchio *et al*., 2019 and references therein). Hence this EP assumes that this species could also be present. Omura’s whales were only recently described by Wada *et al* (2003), and a paucity of information currently prohibits detailed conclusions about potential habitat use by this species within the OA and EMBA. However, McPherson *et al*. (2016) conducted acoustic monitoring at the Barossa Field in 2014/15 (300 km north of Darwin, and over 450 km northeast of the OA) and recorded calls which were attributed to this species in all months of the year, except for the period from 1 Nov to 23 Dec. For the Barossa Field, a consistent presence (as characterised by high call rates) was noted from Apr to Sep with a peak in Jun/Jul, particularly in at the deepest monitoring station (c. 240 m). Whales appeared to arrive and depart the Barossa Field from the southwest, indicating that they most likely have a year-round presence in the Timor Sea. Strandings and sightings of this species have been recorded in Western Australia, with observations of this species feeding over deep shoals and reefs with newborn calves present (marine mammalscience.org as cited in McPherson *et al*. 2016).

Likewise, dwarf minke whale (*Balaenoptera acutorostrata* ssp.) calls were commonly detected by McCauley (2011) around Scott Reef from May to September, so a possible presence of this species in the OA and EMBA have been assumed over this period.

No pinniped species are identified by the EPBC Protected Matters Database as having a potential presence within the OA or the EMBA. Although Australian sea lions and New Zealand fur seals do occur in WA their distribution is restricted to the southwest coast (south of Shark Bay and Kalbarri respectively).

There are several BIAs for marine mammals in the vicinity of the OA and EMBA (**Figure 22** and **Figure 23)**, including:

- Australian snubfin dolphin – although the OA does not overlap with any BIAs for this species, the EMBA overlaps with breeding/calving/resting and foraging BIAs in the vicinity of Kalumburu and Scambridge Gulf. The nearest BIA is located approximately 129 km south of the OA.
- Dugong – the EMBA overlaps with the dugong foraging (including high density) and breeding/calving/nursing BIAs located around Ashmore Reef, approximately 155 km west of the OA.
- Humpback whale – while there is no overlap between the humpback whale BIA and the OA or EMBA, a breeding and calving BIA occurs approximately 210 km to the south of the OA.
- Australian humpback dolphin (listed as Indo-Pacific humpback dolphin) – although the OA does not overlap with any BIAs for this species, the EMBA overlaps with foraging (including high density) and significant habitat BIAs in the vicinity of Kalumburu and breeding and foraging BIAs are also located near Darwin Harbour.
- Indian Ocean bottlenose dolphin/spotted bottlenose dolphin (listed as Indo-Pacific/ spotted bottlenose dolphin) – although no overlap occurs with either the OA or EMBA, breeding/calving and foraging BIAs for this species are located in the vicinity of Augustus Island (285 km south of the OA). A breeding BIA for the species is also located near Darwin Harbour.
- Blue whale migration and known distribution BIAs which overlap with the OA. The nearest blue whale feeding BIA is located 294 km southwest of the OA.

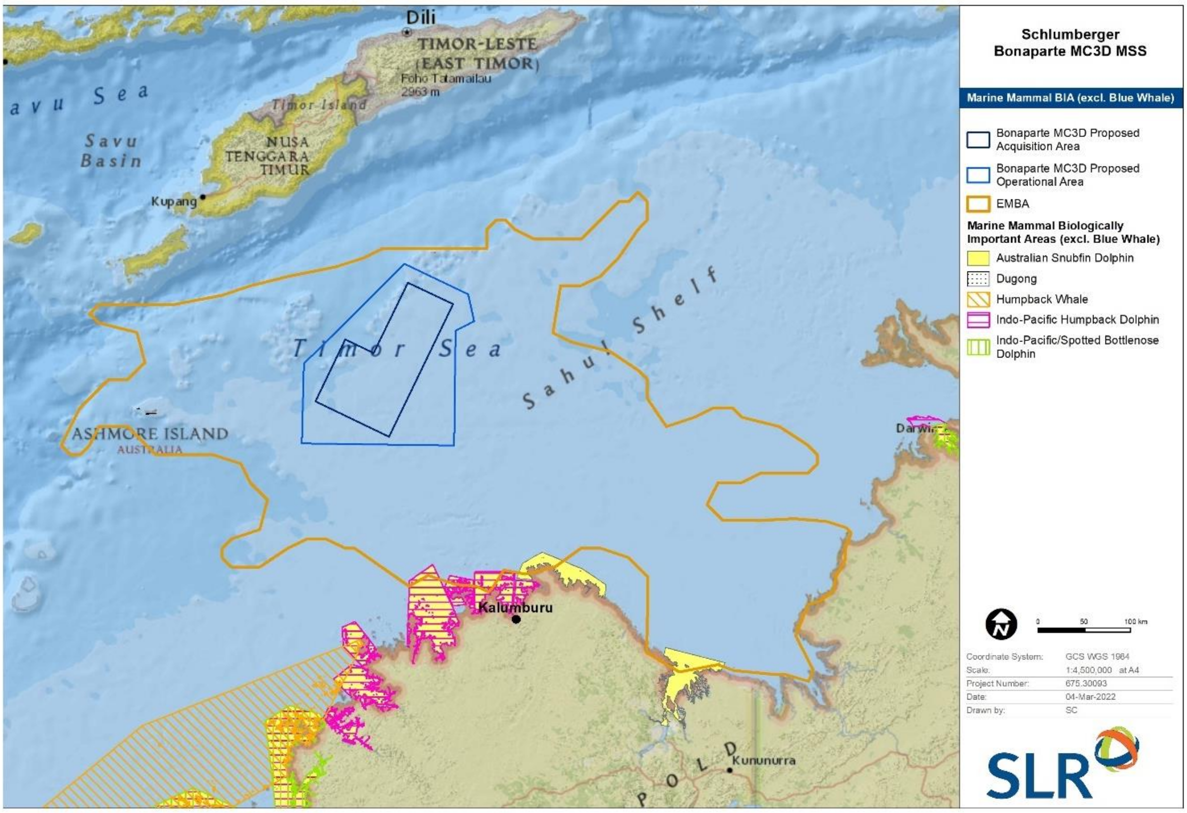


Figure 22 Marine Mammal BIAs in the vicinity of the OA and EMBA (excluding blue whales)

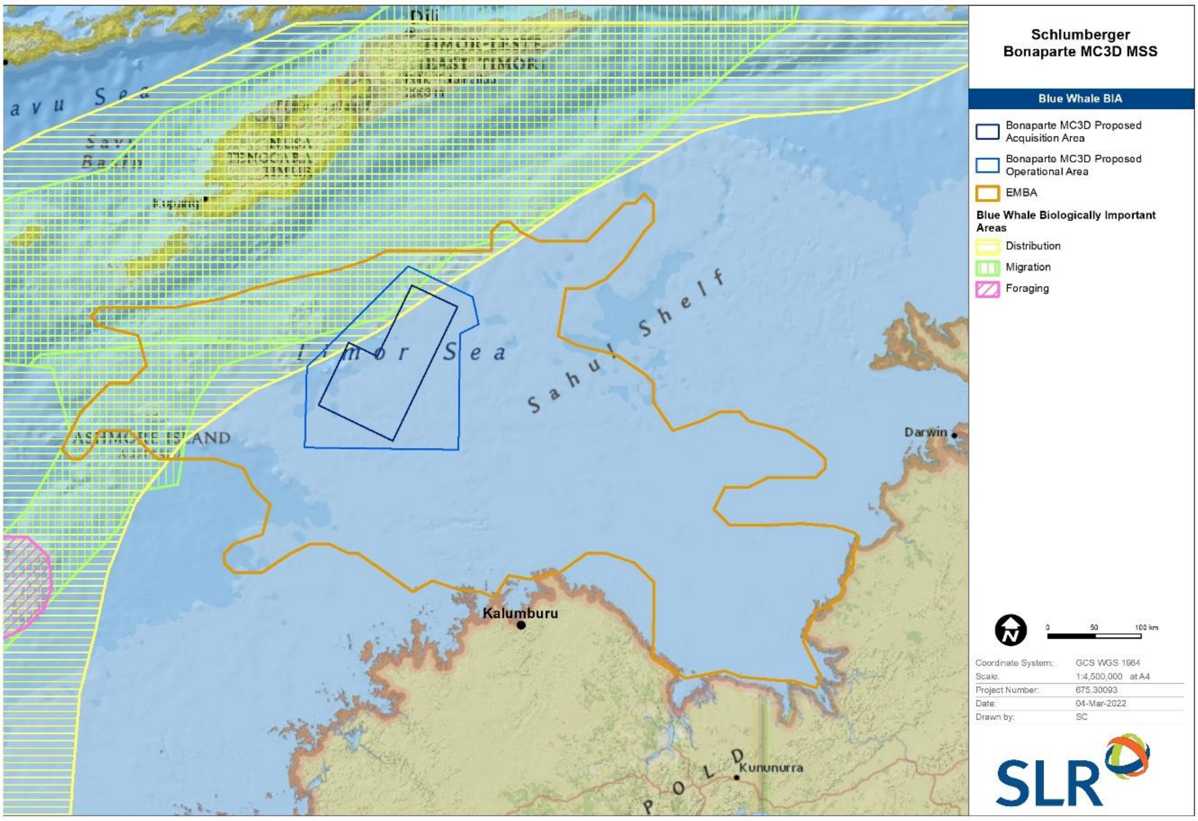


Figure 23 Blue whale BIAs in the vicinity of the OA and EMBA

4.5.6.1 Humpback whales

Humpback whales are currently listed by the IUCN as 'least concern' and this species has recently been removed from the Australian Federal Government's list of threatened species on account of the strong recovery trends for this species in Australian waters since full protection was afforded to them in 1965 (Australian Government, 2022). Within WA, this species is listed as 'conservation dependant' under the BCA (Wildlife Conservation (Specially Protected Fauna) Notice 2018, schedule 6).

Humpback whales undertake the longest migration of any mammal (Jackson *et al.*, 2014). They are seasonal migrants that move between low latitude winter breeding grounds and mid- to high-latitude productive summer feeding grounds (Pomilla and Rosenbaum, 2005; Robbins *et al*., 2011). Although humpbacks may utilise deep oceanic waters during migrations, they are typically a coastal species when breeding and feeding (Smith *et al.,* 2012).

The population of humpback whales that can be found in WA is referred to by the International Whaling Commission as Breeding Stock D (from here on referred to as humpback whales) and migrates annually from Antarctic feeding grounds in summer to winter breeding and calving grounds. Most breeding activity occurs on the east coast of Australia, but calving takes place in the coastal Kimberley Region from Camden Sound in the north to Broome in the south (15-18°S) (210 km south of the OA); however, the presence of neonates further south indicates that calving does occur as far south as North West Cape (Irvine *et al*., 2017). Low densities of whales were found north of Camden Sound which is thought to represent the northern distributional limit of humpback whales during the breeding season (Thums *et al*., 2018). The breeding season is relatively well defined for the Kimberley region and extends from late Jun to early Oct (How *et al.*, 2020). Peak numbers occur in early Aug (How *et al*., 2020) to mid Aug (Thums *et al*., 2018).

Northbound whales leave Antarctica in Mar/Apr and migrate along the WA coastline between Jun and Aug and southbound whales occur along the NW WA coast from Aug to Nov (MMPATF, 2022). The migration corridor along NW WA is typically coastal with whales staying mostly in waters less than 200 m deep; however, some deviation into deeper water is occasionally observed by southbound whales off the Ningaloo coast (e.g. Gales *et al*., 2010). Abundance for this population was thought to be more than 30,000 individuals in 2008 and was in a phase of exponential increase (Salgado-Kent *et al*., 2012).

Both male and female humpbacks produce communication calls, but only males emit the long, loud, and complex 'songs' associated with breeding activities. Dunlop *et al*. (2007) recorded social vocalisations of migrating east Australian humpbacks and recorded frequencies ranging from <30 Hz to 2.5 kHz over 34 different vocalisation types. The source level of singing humpback whales ranges from 123 – 183 dB re 1 µPa @ 1 m (Dunlop *et al.,* 2013). Surface-generated social sounds (e.g. breaches, pectoral slaps, and tail slaps) are also generated by humpback whales and are thought to have a communicative function (Dunlop *et al.,* 2010). These surface-generated sounds have been reported to be in the range of 133 – 171 dB re 1 µPa @1 m (Dunlop *et al.,* 2013).

The EPBC Act Protected Matters Database considers that humpback whales are known to occur in the EMBA and are likely to occur in the OA. There is no overlap between the humpback whale BIA and the OA or EMBA as the nearest BIA occurs approximately 210 km south of OA.

4.5.6.2 Blue whales

There are two subspecies of blue whale recognised in the Southern Hemisphere; the pygmy blue whale (*B. musculus brevicauda*) and the Antarctic blue whale (*B. musculus intermedia*). These two subspecies are difficult to distinguish without the use of genetic techniques, but differ in morphology, distribution, and vocal behaviour. Following an analysis of acoustic detections, and stranding, sighting and historical catch records, Branch *et al*., (2007) concluded that the majority of blue whales in the Australian region are probably pygmy blue whales, but that a few Antarctic blue whales may migrate to Australia in the austral winter, but Antarctic blue whales tend to have a more southern distribution than pygmy blue whales (Commonwealth of Australia, 2015).

Pygmy blue whales are currently listed by both the IUCN and the EPBC Act as Endangered. In WA they are listed as 'fauna that is rare or is likely to become extinct' in the Wildlife Conservation (Specifically Protected Fauna) Notice 2010, and under state policy they are ranked as endangered based on the IUCN criteria. The Southeast Indian Ocean pygmy blue whale population (also known as Indo-Australian pygmy blue whale population) inhabits waters from Indonesia along the coast of WA, and beyond into South Australia and the Southern Ocean (from here on referred to as pygmy blue whales). As with most baleen whales they undertake an annual migration from higher latitude feeding grounds to lower latitude breeding grounds. Pygmy blue whales feed on krill and depend on areas of high krill density to meet their high calorific requirements. Generally speaking, pygmy blue whales are present at feeding grounds from November to May (Commonwealth of Australia, 2015); however, a finer scale analysis of migration timing is provided later in this subsection.

Using data from both satellite tagging studies (2009-2021, a total of 22 tagged whales) and acoustic monitoring studies (2006-2019), the three most important feeding grounds in WA for this population have recently been confirmed by Thums *et al*. (2021) as being 1) the Perth Canyon and vicinity, 2) the shelf edge off Geraldton, and 3) the shelf edge from Ningaloo Reef to Rowley Shoals. This population also utilises feeding grounds at the Bonney Upwelling and other upwelling features off SA, Vic and Tas (Gill, 2002; McCauley *et al*., 2018; Möller *et al*., 2020) and south of Australian waters along the subtropical convergence zone (Garcia-Rojas *et al*., 2018). Acoustic detections from Scott Reef (c. 300 km southwest of the OA) have been consistently made (McCauley, 2011) and it has been suggested that this, coupled with high krill densities (Sutton *et al*., 2019), could indicate that some feeding may also occur here. While feeding at Scott Reef cannot be dismissed, Thums *et al*. (2021) suggests that this site (if indeed it does support feeding) is of lower relative importance. Despite this, Scott Reef potentially represents the nearest feeding location of pygmy blue whales to the OA. It is also noteworthy that foraging does occur along the migratory route, Double *et al*. (2014) and Möller *et al*. (2020) also suggest that foraging could also occur at the Indonesian breeding grounds as productive upwellings occur here from July to September each year which coincides with pygmy blue whale presence (Double *et al*., 2014).

While a total population abundance estimate is unavailable for the Southeast Indian Ocean pygmy blue whale, photo-identification mark-recapture estimates of the number of whales using the Perth Canyon foraging habitat are between 532 and 1,754 individuals (Jenner *et al*., 2008), and similar estimates of 662 to 1,559 were made following an acoustic assessment of southbound migrating blue whales off Exmouth (McCauley and Jenner, 2010). The total population size is assumed to be much higher though as these assessments only account for one of the known important feeding locations.

Sexual maturity of pygmy blue whales is reached at approximately 10 years of age, and adult females calve every two to three years (Commonwealth of Australia, 2015). Evidence suggests that the breeding ground for this population occurs in Indonesian waters, including Banda Sea, Molucca Sea, Timor Sea and Savu Sea (Gales *et al*., 2010; Thums *et al*., 2021).

Understanding migration timing and migration route is central to understanding temporal and spatial effects of anthropogenic activities on pygmy blue whales. It is noteworthy that there is substantial individual variation in both (Thums *et al*., 2021). For this reason, it is difficult to provide absolute time periods during which whales will certainly pass through or nearby the OA, but **Table 21** summarises multiple lines of evidence to suggest the months when whales could be in the vicinity of the OA.

Table 21 Migration timing of Pygmy Blue Whales in the vicinity of the OA

Month	**Northwest WA** - Between 12.4°S and 23.6°S - Satellite tag data - 13 whales (N), 2 whales (S) - Source: Thums *et al*. (2021)	**Indonesia** - North of 12.4°S, limit of EEZ - Satellite tag data - 6 whales (N), 2 whales (S) - Source: Thums *et al*. (2021)	**Scott Reef** - Between 13.45°S to 14.25°S - Acoustic monitoring data - 12 noise loggers - Source: McCauley, 2011	**Assumed Presence of Pygmy Blue Whales in OA** - See text for more context
Apr (start of northward migration period)	Migrating north, earliest date 12 Apr		Calls detected from early-Apr	Presence of northbound whales from late Apr
May	Migrating north	Migrating north, earliest date 15 May	Calls detected	Presence of northbound whales
Jun	Migrating north	Migrating north	Calls detected	Presence of northbound whales
Jul	Migrating north, latest date 12 Jul	Migrating north	Calls detected	Presence of northbound whales
Aug		Migrating north	Calls detected until mid-Aug	Presence of northbound whales
Sep (start of southward migration period)	Migrating south, earliest date 23 Sep	Migrating south		Presence of southbound whales from late Sep
Oct	Migrating south	Migrating south, latest date 11 Oct	Calls detected from early Oct	Presence of southbound whales
Nov	Migrating south, latest date 3 Nov		Calls detected	Presence of southbound whales
Dec			Calls detected	Presence of southbound whales
Jan			Calls detected until mid-Jan	Presence of southbound whales
Feb				
Mar				

For the northbound migration, the conclusions presented in column 5 of are underpinned by the data presented by Thums *et al*. (2021) regarding the occupancy rates of whales during migration where the time whales spent in northwest WA (12.4°S to 23.6°S) was: 19 ± 6 days on the northern migration (n = 13). On this basis, theoretically:

- Individual whales embarking on their northern migration early in the season, for example say 12 April, could be expected to pass into Indonesian waters (12.4°S, i.e. close to the OA), anytime from c. 25 April to 7 May; and
- Individual whales embarking on their northern migration late in the season, for example say 12 July, could be expected to pass into Indonesian waters (12.4°S, i.e. close to the OA), anytime from c. 25 July to 6 August.

Satellite tagging data and acoustic data (see **Table 21**) align well with regard to the extent of the northbound migration period; indicating that in the vicinity of the OA whales will be passing in a northbound direction from April to August.

There is however some uncertainty about the extent of the southbound migration period as tagging data suggests that, in the vicinity of the OA, whales will be travelling south from September to November, but acoustic data collected by McCauley (2011) from Scott Reef suggests that the southern migration period may extend until January. Of note here is that only two of the tagged whales documented by Thums *et al*. (2021) continued to transmit data during the southbound migration, so the sample size here is highly restrictive, and as highlighted by the authors, further research is needed regarding the southbound migration. For this reason, this EP takes a precautionary approach and assumes that southbound whales could be present in and around the OA until January.

There is considerable variability in the characteristics of the northward migratory corridor with latitude, where along the southern part of WA as far north as North-West Cape – Rowley Shoals, the corridor occurs relatively close to the Australian coast (100 ± 1.7 km) (Double *et al*., 2014) and is relatively narrow (Thums *et al*., 2021). North of Rowley Shoals, the migratory corridor widens substantially and becomes highly dispersed over an area of up to c. 700 km (Thums *et al*., 2021). In general, the migratory route of pygmy blue whales off WA makes extensive use of continental slope habitat (as opposed to shelf habitat which is more typical of pygmy blue whale movements off SA) (Thums *et al*., 2021). This highly dispersed nature of the migratory corridor in the vicinity of the OA means that whale density at this latitude is low, and although tag durations reported by Thums *et al*. (2021), were insufficient to document all tagged whales through to the Banda Sea breeding ground, it appears that at least half of the tagged whales were on a trajectory to pass along the west coast of Timor (see Figure 2 of Thums *et al*., 2021) before their tags stopped transmitting. Further to this, McCauley *et al*. (2011) reported that only 6-40% of the whales that pass Exmouth also pass Scott Reef (c. 300 km southwest of the OA) and no tagged whales travelled inshore of Scott Reef (Thums *et al*., 2021). This provides further evidence that a high proportion of northbound whales disperse widely as they progress north and therefore, whale density within the OA is expected to be low.

Some evidence of foraging or breeding or resting (characterised by lower rates of directional movement) was detected by Thums *et al*. (2021) along the east coast of Timor, but in general, this area is more commonly characterised by migratory behaviours. The most important migratory path at this latitude is however along the west coast of Timor (Thums *et al*., 2021) through the Savu Sea.

Thums *et al*., (2021) provide an assessment that compares the placement and extent of the existing pygmy blue whale BIAs (see **Figure 23**) with the locational data from tagged whales and acoustic detections. They concluded that there is generally good alignment between the migration BIA and the collected data. They did note that the migration BIA encompasses not only migratory behaviours, but also the presumed feeding/breeding/resting area in the Banda Sea, stating that further research is required to quantify the extent of area used by whales for different behaviours in Indonesian waters.

Blue whales vocalise at a low frequency (average of 0.01 – 0.110 kHz) (McDonald *et al.*, 2001; Miller *et al.*, 2014), meaning that their calls travel hundreds of kilometres underwater. Vocalisations of pygmy blue whales off Cape Leeuwin (WA) have been characterised as songs of either two or three repeating tonal sounds with harmonics (Gavrilov *et al.,* 2011). The most intense tonal sounds were recorded to have a source level of 179 ±2 dB re 1 µPa @ 1 m. Weaker short-duration calls of impulsive down-swept sounds were estimated to have source levels of 168 – 179 dB re 1 µPa @ 1 m (Gavrilov *et al.,* 2011).

The EPBC Act protected Matters Database considers that blue whales are known to occur in the OA and EMBA, and both the OA and EMBA overlap with distribution and migration BIAs for this species. The closest foraging BIA is located around Scott Reef to the southwest of the OA and EMBA (**Figure 23**).

4.5.6.3 Fin whale

Fin whales are currently listed by the IUCN and the EPBC Act as ‘vulnerable’. Within WA, this species is listed as ‘endangered’ under the BCA. In general, fin whales are found in offshore waters throughout the world (NOAA, 2018). Like other baleen whales, they head to high latitudes (between 50°S and 65°S) to feed over the summer months (Miyashita *et al*., 1995) and move to warmer lower latitude waters during winter to breed. Their migration paths are oceanic, and do not obviously follow coastlines (Bannister *et al.,* 1996). The migratory distribution of fin whales around Australia was investigated by Aulich *et al*. (2019) using passive acoustic monitoring and the results of this study for WA are summarised below.

Five monitoring stations were located along the WA coast at (from north to south) Scott Reef, Dampier, Montebello Islands, Onslow, Perth Canyon and Cape Leeuwin. Despite a three-year monitoring period at Scott Reef (the closest monitoring station to the OA), no fin whale vocalisations were detected at this location, neither were there any recorded off Onslow (two-year deployment). Calls were however detected from the Dampier, Perth Canyon and Cape Leeuwin stations. Perth Canyon represented the WA site with the greatest number of detections with a total of c. 177,000 fin whale pulses detected between 2009-2016. Across years, whales had a seasonal presence here from May to October. Fin whales were only recorded in two of the four survey years at Dampier where detections were made from August to October. The authors hypothesised that the lower rate of detection for Dampier could indicate either that whales at this latitude are spread across a wider offshore area; hence density and therefore detection rates are substantially lower or that most whales do not reach waters this far north. The lower detection rates for the Montebello Island and Onslow sites were more likely to reflect a smaller detection range based on shallower deployment sites.

Despite fin whales being listed as ‘likely’ to occur in the OA on the EPBC Protected Matters Database, the lack of acoustic detections north of Dampier suggest that if they do occur further north they will be at very low densities.

Fin whale communication vocalisations have been described as short (<1 second) down-swept tones, between 28 and 15 Hz at source levels of 189 ± 4 dB re 1 µPa @1 m (Širović *et al*., 2007).

The EPBC Act Protected Matters Database considers that fin whales are likely to occur in the OA and EMBA.

4.5.6.4 False killer whale

False killer whales are currently listed by the IUCN as 'near threatened' on account of their low natural densities, declining population trends and widespread impacts from fisheries bycatch. False killer whales are not listed as a threatened or migratory species by the EPBC Act, and within WA, this species is not listed as 'threatened or priority fauna' under the BCA.

Distributional information for this species at sea occurrence is scant for Australian waters, but strandings data suggests that false killer whales are widely distributed (Bannister *et al*., 1996; Chatto and Warneke 2000; Nicol 1987). Seasonal latitudinal changes and inshore/offshore movements may occur in response to the presence of warm oceanic currents and prey availability, such movements have been described for this species in western North Pacific and the northeastern Pacific (Culik, 2005; Ross, 2006).

Satellite tracking of four false killer whales was undertaken in the Arafura and Timor Seas in 2014 and indicated that although tagged individuals travelled large distances (over 7,500 km in c 100 days), the median distance from land was 24 km (range 100 m to 188 km) and water depth range was 0.3 to 118 m (Palmer *et al*., 2017). Locational positions from tracked whales extended from northwest of Darwin to Cape Wessel (Palmer *et al*., 2017). It is unknown if Australia waters support separate inshore and offshore populations as has been documented for other locations (e.g. in Hawaii: Baird *et al*., 2008), but this possibility may explain why the apparent distribution of tagged animals off the NT coast did not conform to the typical habitat preference for this species which is for deep oceanic waters (Stacey and Baird, 1991).

Despite false killer whales being listed as 'likely' to occur in the OA on the EPBC Protected Matters Database, this species typically occurs at low natural densities (Baird, 2018).

4.5.6.5 Sei whale

Sei whales are currently listed by the IUCN as 'endangered' and as 'vulnerable' by the EPBC Act. Within WA, this species is listed as 'endangered' under the BCA. Sei whales are thought to undertake a similar annual migration as other great whale species, although the timing of the sei whale migration is possibly later than the other species (Commonwealth Government, 2005).

Sei whales tend to prefer warmer water temperatures than other baleen whales (Mizroch *et al.*, 1984); their preferred water temperature is between 8 and 18°C (Horwood, 2009). In the south Indian Ocean the summer distribution (Jan-Feb) is thought to occur mostly between 40-55°S (Miyashita *et al*., 1995), but winter distributions at lower latitudes are not well understood. Sei whale occurrence and distribution in Australian waters has been complicated by the appearance similarities between sei and Bryde's whales; with many early records of sei whales not thought to be Bryde's whales which are more common in warmer waters (DoE, 2022g). In general this species is infrequently sighted in Australian waters, but records from WA do exist (Commonwealth, 2005).

Sei whale vocalisations have been recorded as low-frequency down-sweep calls that sweep from 82 to 34 Hz over 1.4 seconds, most often produced as a single call but occasionally as pairs or triplicates (Baumgartner *et al*., 2008). As well as low-frequency tonal and swept calls, McDonald (2006) also recorded broadband sounds described as 'growls' or 'wooshes'. The maximum source level of tonal calls recorded by McDonald (2006) was 156 ±3.6 dB re 1 µPa @ 1 m.

The EPBC Act Protected Matters Database considers that sei whales are likely to occur in the OA and EMBA.

4.5.6.6 Bryde's whale

Bryde's whales are currently listed by the IUCN as of 'least concern' and as 'migratory' by the EPBC Act. Within WA, this species is not listed as threatened or priority fauna under the BCA.

Year-round acoustic detections of Bryde's whales near Scott Reef were detected by McCauley (2011). This report also noted that Bryde's whale calls have also been detected from locations north of Darwin to off Exmouth with no apparent seasonality. In general, the distribution of Bryde's whales is typically restricted to tropical and warm temperate waters with a latitudinal range of between 40°N and 40°S (Kato, 2002). A point of difference between Bryde's whales and other baleen whales is that they do not migrate (Kato, 2002).

Oleson *et al*. (2003) analysed Bryde's whale calls from the Eastern Tropical Pacific, the Caribbean, and the Northwest Pacific. Whilst they concluded that regional variations in calls were present, Bryde's whales typically produce low frequency 'tonal' and 'swept' calls that are not dissimilar to other baleen whales. Virtually all calls analysed had a fundamental frequency below 60 Hz and were produced in extended sequences (Oleson *et al.*, 2003).

The EPBC Act Protected Matters Database considers that Bryde's whales may occur in the OA and are likely to occur in the EMBA.

4.5.6.7 Indian Ocean Bottlenose Dolphin and Spotted Bottlenose Dolphin

The Indian Ocean bottlenose dolphin is currently listed by the IUCN as 'near threatened' but is not listed by the EPBC Act or the BCA; however, DoE (2022h) recognises that the taxonomic and conservation status of many populations is unknown. The spotted bottlenose dolphin population of the Arafura and Timor Seas is currently considered to be a regional population of the broader taxonomic unit that is referred to as the Indian Ocean bottlenose dolphin (CMS, 2016).

Indian Ocean bottlenose dolphins are restricted to coastal waters of the Indo-Pacific, Indian and Western Pacific Oceans, where they are most commonly found in water depths less than 100 m (Wang, 2018). Within Australian waters, this species is distributed contiguously around the Australian mainland, where they have been confirmed to occur in bays and estuaries, nearshore waters, open coast environments, and shallow offshore waters off eastern, western, and northern Australia (Hale *et al.,* 2000; Möller and Beheregaray, 2001).

The vocalisations of Indian Ocean bottlenose dolphins are likely to be similar to those of common bottlenose dolphins which include echolocation clicks in the frequency range of 0.1 to 300 kHz (source levels of 125 to 173 dB re 1 µPa at 1 m), and communication whistles from 0.8 to 24 kHz (source levels of 218-228 dB re 1 µPa at 1 m) (Au *et al*., 1974; Evans, 1987; Richardson *et al*., 1995).

The EPBC Act Protected Matters Database considers that the Indian Ocean bottlenose dolphin may occur in the OA and is likely to occur in the EMBA, and that the regional spotted dolphin population from the Arafura and Timor Seas may occur in the OA and is known to occur in the EMBA. Although no overlap occurs with either the OA or EMBA, breeding/calving and foraging BIAs for this species (*Tursiops aduncus*), listed as Indo-Pacific/Spotted bottlenose dolphins, are located in the vicinity of Augustus Island. A breeding BIA for the species is also located near Darwin Harbour.

4.5.6.8 Australian Snubfin Dolphin

Australian snubfin dolphins are currently listed by the IUCN as 'vulnerable' and as 'migratory' by the EPBC Act. Within WA, this species is listed as 'Priority 4' under the BCA which relates to 'rare, near threatened and other species in need of monitoring'.

The distribution of this species is primarily shallow coastal waters (< 20 m deep) around the northern half of Australia between Broome and Brisbane River (Parra *et al*., 2002). Occurrence tends to be particularly associated with estuaries, river mouths and seagrass beds, but records of this species have been made out to 23 km offshore and along the northern Sahul Shelf (Parra, 2006; Parra and Corkeron, 2001; Parra *et al*., 2002; DoE 2022i). It is possible that Australian snubfin dolphins use shallow waters of the Sahul Shelf to transit between Australian coastal waters and eastern Indonesia and Papua New Guinea (DoE, 2022i), indeed a record of this species exists from Papua New Guinea (Beasley *et al*., 2002).

In WA, important areas for this species occur at Beagle and Pender Bays on the Dampier Peninsula, and Yampi Sound, and between Kuri Bay and Cape Londonderry (DEWHA, 2008b), although detailed population assessments for this species in WA have not been conducted to date. Evidence from this species in Queensland suggest that alongshore home-ranges for this species are large (Parra, 2006) and that average pod size is 5 individuals range 1-15) (Parra, 2005).

The EPBC Act Protected Matters Database considers that Australian snubfin dolphins are known to occur in the EMBA. Although the OA does not overlap with any BIAs for this species, the EMBA overlaps with breeding/calving/resting and foraging BIAs in the vicinity of Kalumburu and Scambridge Gulf.

4.5.6.9 Australian Humpback Dolphin

Australian humpback dolphins are currently listed by the IUCN as 'vulnerable' and as 'migratory' by the EPBC Act. Within WA, this species is listed as 'Priority 4' under the BCA which relates to 'rare, near threatened and other species in need of monitoring'.

This species occurs in tropical and subtropical waters along the northern Australian coast, including across the Sahul Shelf where they range between Australian waters and waters around the island of New Guinea (Jefferson and Rosenbaum, 2014), however uncertainties about the distribution around New Guinea and throughout the Arafura Sea remain due to lack of surveys in this area (Parra and Cagnazzi, 2016). While some movement between jurisdictions may occur, the majority of sightings data in Australian waters indicates that this species occupies coastal waters (< 20 km from shore) or sheltered offshore locations (close to islands or reefs) most of the time (Parra and Cagnazzi, 2016). Indeed, sightings in WA occurred in both clear water and turbid water habitats within 5 km of the coast, from 1 – 40 m water depth (see Parra and Cagnazzi, 2016). This species typically occurs in small groups and low levels of dispersal between populations has been hypothesised based on genetic studies (Parra and Cagnazzi, 2016).

The EPBC Act Protected Matters database considers that Australian humpback dolphins are known to occur in the EMBA. Although the OA does not overlap with any BIAs for this species, the EMBA overlaps with foraging BIAs in the vicinity of Kalumburu and breeding and foraging BIAs for Australian humpback dolphins (*Sousa sahulensis*), listed as Indo-Pacific humpback dolphins, are also located near Darwin Harbour (**Figure 22**).

4.5.6.10 Dugong

Dugongs are currently listed by the IUCN as ‘vulnerable’ and as ‘migratory’ by the EPBC Act. Within WA, this species is listed as ‘other specially protected fauna’ under the BCA which relates to ‘fauna otherwise in need of special protection to ensure their conservation’. Dugongs have a patchy, but large distribution across the South Pacific, occurring in Papua New Guinea, Solomon Islands, Vanuatu, New Caledonia, Palau and Australia (Gillespie, 2005). Given their reliance on seagrass habitats for food, their distribution is closely linked to the presence of seagrass meadows in tropical and subtropical waters. The highest densities of dugongs occur in large shallow bays, wide mangrove channels or in the lee of nearshore islands (Marsh *et al*., 2011), although they also use some offshore habitat over shallow, protected areas of the continental shelf (DoE, 2022j). In WA, several areas support dugong populations; however, the Kimberley Coast, including Roebuck Bay (Brown *et al*., 2014) and Ashmore Reef are of relevance to the EMBA. In general dugongs spend most of their time in water depths of less than 3 m (Chilvers *et al*., 2004).

Patchy seagrass habitat means that individual dugongs move between significant seagrass meadows (Sheppard *et al*., 2006), but the movement pattern and extent of individuals tends to vary substantially. The largest distance that an individual has been recorded travelling (between foraging habitats) is 560 km (Sheppard *et al*., 2006). Dugongs are a long-lived slow breeding species that are subject to a wide range of threats across their distribution (Woinarski *et al*., 2014).

The EPBC Act Protected Matters Database considers that dugongs are known to occur (including breeding) in the EMBA. The EMBA overlaps with the dugong foraging and breeding/calving/nursing BIAs located around Ashmore Reef. The dugong population at Ashmore Reef is estimated at c. 100 individuals (all age classes represented) and is possibly genetically distinct from other Australian populations (Whiting and Guinea, 2005). Habitat used by these dugongs here is considered unusual in its oceanic nature compared to populations around the Australian mainland, and a dugong sighting 130 km east of Ashmore Reef suggests that dugongs may also utilise other shallow areas of the Sahul Shelf (Whiting and Guinea, 2005). There is no overlap between the dugong BIAs and the OA.

4.5.7 Seabirds and Migratory Shorebirds

There are over 100 species of seabirds that occur naturally or regularly visit Australia during the course of their lifecycle. Australia's coastal and oceanic habitats, particularly offshore islands and surrounding waters are critically important areas for seabirds during the breeding and non-breeding season as places to breed, rest and feed. For long-distance migratory species, these habitats also provide resources so birds can build enough energy reserves to travel the long distance to complete their annual migration.

The DoEE has prepared a draft of a wildlife conservation plan for seabirds (DoEE, 2019). The Plan aims to provide a strategic national framework for the research and management of listed marine and migratory seabirds and to outline national activities to support the conservation of 76 seabird species and their habitat in Australia and beyond.

Many migratory shorebirds and seabird species are known to occur in the NWMR and NMR and 34 bird species are considered to be ecologically significant for the marine parks; that is, they are either endemic to the region, have a high number of interactions with the region (nesting, foraging, roosting or migrating) or have life history characteristics that make them vulnerable.

A number of seabirds and BIAs have been identified as potentially present within the OA and/or EMBA. A description of the distribution, migration movements, preferred habitat and life stages of the identified marine bird species is provided in **Appendix D**. The offshore distribution of seabirds is patchy, with birds congregating in areas where food is abundant (Reid *et al*., 2002). A number of the seabirds identified as potentially present do not breed in close proximity to the OA, as there are no islands within the OA to support breeding colonies, and seabirds breeding season will also determine the presence of seabirds. Therefore, not all the species identified in the tables below may be present during the Seismic Survey and, where possible, an indication of seasonality has been provided.

The closest known breeding sites occur at Ashmore Island and along the coast, east of the OA, see **Figure 24**, which support seabird and shorebird colonies of 10,000–15,000 birds. Extensive areas of shorebird and waterbird feeding habitat are associated with the mangroves and mudflats in this region (DEWHA, 2008b). Additionally, the Cartier Island and Ashmore Reef, within the EMBA, support breeding colonies of seabirds and migratory shorebirds. Given coastal habitats support large migratory populations, seabirds may fly over the OA during migrations.

Results from the EPBC Act Protected Matters Database (3 March 2022) revealed that there are one threatened, three threatened and migratory, and eight migratory seabird species that may be present within the OA, in addition to nine threatened, three threatened and migratory, and 29 migratory seabird species within the wider EMBA.

Within the EMBA another eight seabirds, that is not listed as threatened or migratory, has been registered: Black Noddy (*Anous minutus*), Rainbow Bee-eater (*Merops ornatus*), White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Black-eared Cuckoo (*Chalcites osculans*), Cattle Egret (*Bubulcus ibis*), Silver Gull (*Chroicocephalus novaehollandiae*), Lesser Crested Tern (*Thalasseus bengalensis*) and Magpie Goose (*Anseranas semipalmata*).

The following BIAs for marine bird species are located adjacent to the OA, within or close to the EMBA (**Figure** 24):

- Lesser crested tern breeding BIAs with the nearest located approximately 87 km southeast of the OA;
- Greater crested tern breeding BIA, located 87 km southeast of the OA;
- Roseate tern breeding BIAs, with the nearest located approximately 125 km southeast of the OA;

- Lesser frigatebird breeding and foraging BIAs, with the nearest located approximately 17 km south of the OA;
- Greater frigatebird breeding and foraging BIAs, with the nearest located 50 km west of the OA;
- Wedge-tailed shearwater breeding BIAs, with the nearest located 56 km of the OA;
- White-tailed tropicbird breeding BIA, located 60 km west of the OA;
- Red-footed booby breeding and foraging BIA, located 50 km west of the OA;
- Brown booby breeding and foraging BIA, located 114 km west of the OA;
- Little tern breeding BIAs, with the nearest located approximately 156 km south of the OA; and
- Little tern resting BIA (Ashmore Reef) located approximately 146 km west of the OA.

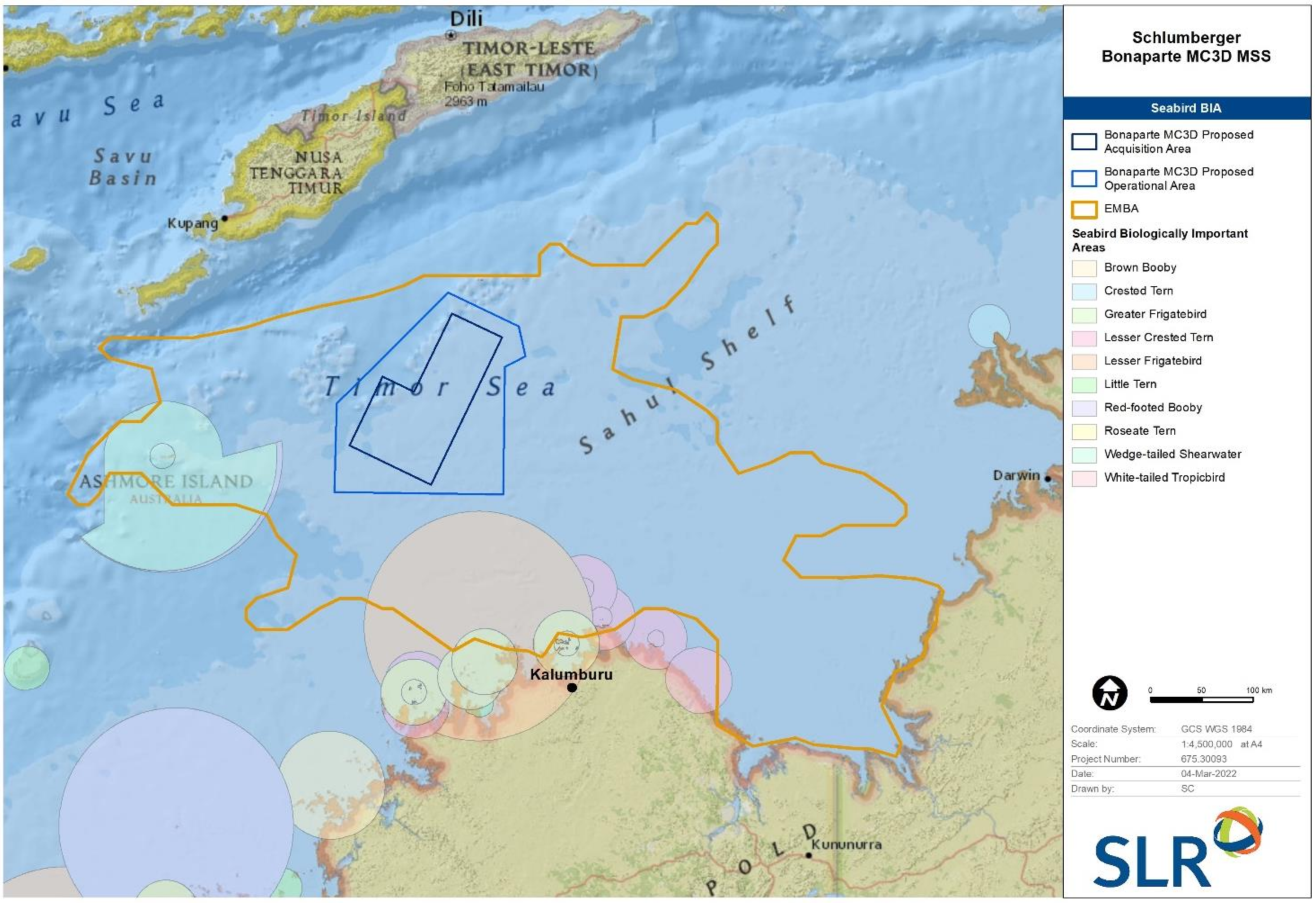


Figure 24 Biologically Important Areas for Seabirds and Migratory Shorebirds in the EMBA

4.5.8 Conservation Management Plans

Based on the characterisation of the biological environment provided in **Section 4.5**, a summary of the EPBC Act Conservation Management Plans, Recovery Plans and Conservation Advice that relate to species with the potential to occur within the OA are described in **Table 22**, below. In addition, any relevant measure contained within the conservation advice and recovery plans has been considered as part of the assessment of impacts and risks that may occur as a result of the Seismic Survey (**Section 7 – Section 9**).

Table 22 EPBC Act Conservation Management Plans, Recovery Plans and Conservation Advice relevant to the Seismic Survey

Species	Relevant Plan/Conservation Advice	Key threats within Plan/Advice of relevance to MSS	Plan/Advice actions relevant to this EP
Fish, Sharks and Rays			
Whale shark	Conservation Advice adopted 1 October 2015	Boat strike	Minimise transit time of large vessels in areas close to marine features likely to correlate with whale shark aggregations (Note these areas are not expected within OA).
Marine Reptiles			
Flatback Turtle	2017 Recovery Plan for Marine Turtles in Australia	Marine debris – Entanglement and Ingestion	Support the implementation of the EPBC Act in accordance with the *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life* (Commonwealth of Australia 2018).
		Chemical (e.g., from vessels) and terrestrial discharge	Ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to 'slow to recover habitats', (e.g., nesting habitat, seagrass meadows or coral reefs).
		Light pollution	No management actions of relevance to the Seismic Survey due to lack of habitat *critical* to marine turtles and turtle nesting are located in the vicinity of the OA. However, in accordance with the National Light Pollution Guidelines for Wildlife (Commonwealth of Australia 2020), *important* internesting habitat for listed species was identified within the OA and important foraging habitat was reported within 20 km of the OA. Subsequently, the potential impacts of artificial light generated throughout the Seismic Survey on marine turtles is further assessed in **Section 7.5.2.3**.
		Vessel disturbance	No management actions specific to vessel disturbance identified in Recovery Plan.
		Noise disturbance	No management actions specific to vessel disturbance identified in Recovery Plan.
Hawksbill Turtle	2017 Recovery Plan for Marine Turtles in Australia	See above for threats	See above for relevant actions.
Olive Ridley Turtle	2017 Recovery Plan for Marine Turtles in Australia	See above for threats	See above for relevant actions.

Species	Relevant Plan/Conservation Advice	Key threats within Plan/Advice of relevance to MSS	Plan/Advice actions relevant to this EP
Green Turtle	2017 Recovery Plan for Marine Turtles in Australia	Marine debris – Entanglement and Ingestion	Support the implementation of the EPBC Act in accordance with the *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life* (Commonwealth of Australia 2018).
		Chemical (e.g., from vessels) and terrestrial discharge	Ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to 'slow to recover habitats', (e.g. nesting habitat, seagrass meadows or coral reefs).
		Light pollution	No management actions of relevance to the Seismic Survey were identified due to lack of habitat *critical* to marine turtles and turtle nesting present in the vicinity of the OA. Further, no *important* habitat was reported within 20 km of OA. Nevertheless, a precautionary approach was taken and the potential impacts of artificial light, generated throughout the Seismic Survey, on marine turtles is further assessed in **Section 7.5.2.3.**
		Vessel disturbance	No management actions specific to vessel disturbance identified in Recovery Plan.
		Noise disturbance	No management actions specific to vessel disturbance identified in Recovery Plan.
Hawksbill Turtle	2017 Recovery Plan for Marine Turtles in Australia.	See above for threats	See above for relevant actions.
Leaf-scaled Sea Snake	Conservation Advice approved 15 February 2011	Not delineated	Not delineated. More research is required to fully understand the threats and ecological requirements for the species in order to determine the most appropriate management strategies. Thereafter, a Recovery Plan will be considered.
Short-nose Sea Snake	Conservation Advice approved 15 February 2011	Not delineated	Not delineated. More research is required to fully understand the threats and ecological requirements for the species in order to determine the most appropriate management strategies. Thereafter, a Recovery Plan will be considered.

Species	Relevant Plan/Conservation Advice	Key threats within Plan/Advice of relevance to MSS	Plan/Advice actions relevant to this EP
Marine Mammals			
Humpback whale	Conservation Advice approved 1 October 2015	Noise interference	All seismic surveys must be undertaken consistently with the EPBC Act Policy Statement 2.1 – Interactions between offshore seismic exploration and whales. Should a survey be undertaken in or near a calving, resting, foraging area, or a confined migratory pathway then Part B – additional management procedures must also be applied; For actions involving acoustic impacts (e.g. pile driving, explosives) on humpback whale calving, resting, feeding areas, or confined migratory pathways site specific acoustic modelling should be undertaken (including cumulative noise impacts); Should acoustic impacts on humpback calving, resting, foraging areas, or confined migratory pathways be identified a noise management plan should be developed. This can include: • The use of Shut-down and Caution Zones; • Pre and post activity observations; • The use of MFOs/MMOs and/or PAM; and • Implementation of an adaptive management program following verification of the noise levels produced from the action (i.e. if the noise levels created exceeded original expectations).
		Vessel disturbance and strike	• Ensure all vessel strike incidents are reported in the National Vessel Strike Database; and • Ensure the risk of vessel strike on humpback whales is considered when assessing actions that increase vessel traffic in areas where humpback whales occur and, if required appropriate mitigation measures are implemented to reduce the risk of vessel strike

Species	Relevant Plan/Conservation Advice	Key threats within Plan/Advice of relevance to MSS	Plan/Advice actions relevant to this EP
Blue whale	2015 – 2025 Conservation Management Plan for the Blue Whale	Noise interference – seismic and shipping	• Assess the effect of anthropogenic noise on blue whale behaviour; • Anthropogenic noise in BIAs will be managed such that any blue whale continues to utilise the area without injury, and is not displaced from a foraging area; and • EPBC Act Policy Statement 2.1. – Interaction between offshore seismic exploration and whales is applied to all seismic surveys.
		Vessel disturbance – vessel collisions	• Ensure all vessel strike incidents are reported in the National Ship Strike Database; and • Ensure the risk of vessel strikes on blue whales is considered when assessing actions that increase vessel traffic in areas where blue whales occur and, if required, appropriate mitigation measures are implemented.
		Marine debris	No management actions specific to marine debris have been identified within the blue whale Conservation Management Plan.
Fin whale	Conservation Advice approved 1 October 2015	Anthropogenic noise and acoustic disturbance	• Once the spatial and temporal distribution (including BIAs) of fin whales if further defined, an assessment of the impacts of increasing anthropogenic noise should be undertaken on fin whales; and • If required, additional management measures should be developed and implemented to ensure the ongoing recovery of fin whales.
		Vessel strike	Ensure all vessel strike incidents are reported in the National Vessel Strike Database.
Sei whale	Conservation Advice approved 1 October 2015	Vessel disturbance and strike	• Ensure all vessel strike incidents are reported in the National Vessel Strike Database; and • Ensure the risk of vessel strike on humpback whales is considered when assessing actions that increase vessel traffic in areas where humpback whales occur and, if required appropriate mitigation measures are implemented to reduce the risk of vessel strike.

Species	Relevant Plan/Conservation Advice	Key threats within Plan/Advice of relevance to MSS	Plan/Advice actions relevant to this EP
		Vessel strike	Ensure all vessel strike incidents are reported in the National Vessel Strike Database.
Seabirds and Migratory Shorebirds			
Seabirds (*general*)[6]	Draft Wildlife Conservation Plan for Seabirds 2019	Prey depletion	No management actions specific to prey depletion identified in the Conservation Plan.
		Anthropogenic disturbance	• Identify important habitats for all seabirds during critical life stages; and • Manage the effects of anthropogenic disturbance to seabird breeding and roosting areas.
		Transport	Identify important habitats for all seabirds during critical life stages
		Pollution – marine debris, light pollution, acute pollution, heavy metals	• Enhance contingency plans to prevent and/or respond to environmental emergencies that have an impact on seabirds and their habitats; and • Identify important habitats for all seabirds during critical life stages.

[6] Species covered under the wildlife conservation plan include those listed within Table 1 of the '*Draft Wildlife Conservation Plan for Seabirds'* (Commonwealth of Australia 2019), including but not limited to White-tailed tropicbird (*Phaethon lepturus*), Wedge-tailed shearwater (*Ardenna pacifica*), Lesser Frigatebird (*Fregata ariel*), Greater Frigatebird (*Fregata minor*), Brown Booby (*Sula leucogaster*), Red-footed booby (*Sula sula*), Little Tern (*Sternula albifrons*), Roseate Tern (*Sterna dougallii*), Crested Tern (*Thalasseus bergii*) and Lesser Crested Tern (*Thalasseus bengalensis*). As this document is still in draft and not in effect, it has been used as a guideline only.

4.6 Cultural and Heritage Values

In the NWMR and NMR, which comprise the OA and EMBA, identifying features such as sites of aboriginal significance and built European heritage is important to ensure cultural and heritage values are protected and preserved. Reliable information about the occurrence and extent of such features is limited or often not readily accessible. However, existing information and databases indicate they are predominantly terrestrial or constrained to the shoreline and coastal margins and fall within the State's jurisdiction.

The cultural and heritage properties of the OA and surrounding EMBA are considered below.

4.6.1 Aboriginal Heritage

Indigenous Australian people have a strong continuing connection with Land and Sea Country that extends back at least 65,000 years (Clarkson, *et al.* 2017). Across Australia, Indigenous people have been sustainably using and managing their sea Country throughout this period. Smith and Isherwood (2016) describe Sea Country as the collective of all estuaries, beaches, bays and marine areas within a traditional estate. Sea country is valued for Indigenous cultural identity, health and wellbeing. The connection between Indigenous people and the sea, which is in many ways similar, or possible identical, to that between Indigenous people and land, is encompassed by complex cultural, spiritual, ceremonial, territorial and economic factors (Parks Australia, 2004). Sea country, as on land, contains evidence of the ancient mystical events be which all geographic features, animals, plants and people were created (Smyth and Isherwood, 2016). The sea, like the land, is integral to the identity of each clan, and clan members have a kin relationship to the important marine animals, plants, tides and currents.

The nature of the relationships between Indigenous people and sea country, and the extent of uses of this sea country, vary from area to area, based on differences in culture and differences in environments (Smyth, 2007). Key values identified in the north-west region include (WGAC, 2018; TLC, 2021):

- Culture – law and culture are unique to each group and is strong when indigenous people are living on Country and able to teach future generations languages, stories and how to look after the Country. It is important for visitors to respect Country and culture;
- People – the connection between people and Country is unbroken and if the Country is healthy, people are healthy. Ensuring livelihoods and opportunities are available for current and future generations is important, in addition to passing on knowledge to young people;
- Hunting and gathering – customary practices for collecting and harvesting fish and other seafoods from different areas such as reefs and mangroves;
- Environmental diversity – intertidal and subtidal habitats are diverse including mangroves, reefs, shoals and rocky platforms. Further offshore marine mammals and reptiles are abundant and important, including for cultural foods and cultural gatherings;
- Cultural places – there are many important places in sea country of significant cultural and spiritual importance that need to be safeguarded.

An assessment of Native Title determinations which may exist within the EMBA has been undertaken as described within **Section 4.6.1.1**. An assessment of Indigenous values which may exist within the EMBA and traditional use of the associated marine resources has been undertaken as described in **Section 4.6.1.2**.

4.6.1.1 Native Title

Native Title is the recognition that Aboriginal and Torres Strait Islander people have rights and interested to land and waters according to their traditional law and customs, as set out in Australian Law, Native title is governed by the *Native Title Act 1993* (Cth). In accordance with the *Native Title Act 1993 ,* non-exclusive Native Title can exist offshore within the limits of Australia's territorial sea (12 NM), meaning that native titleholders will not have the right to exclude others from accessing the sea or seabed in the waters where native title exists.

A search of the National Native Title Tribunal Register did not identify any Native Title areas or any pending titles within the OA. However, two Native Title determinations have been made over (coastal) sea country within the southern portion of EMBA, south of the OA, including the Uunguu Part A (Wanjina-Wunggurr (Native Title) Aboriginal Corporation RNTBC on behalf of the members of the Wanjina Wunggurr community), and Balanggarra (Combined) (Balanggarra Aboriginal Corporation RNTBC on behalf of the members of the Balanggarra community) (**Figure 25**). These determinations, recognised in law, are non-exclusive, however, preserve continuing rights to access sea country to hunt, fish, gather and use the resources of the waters for personal, domestic, communal, cultural and spiritual needs.

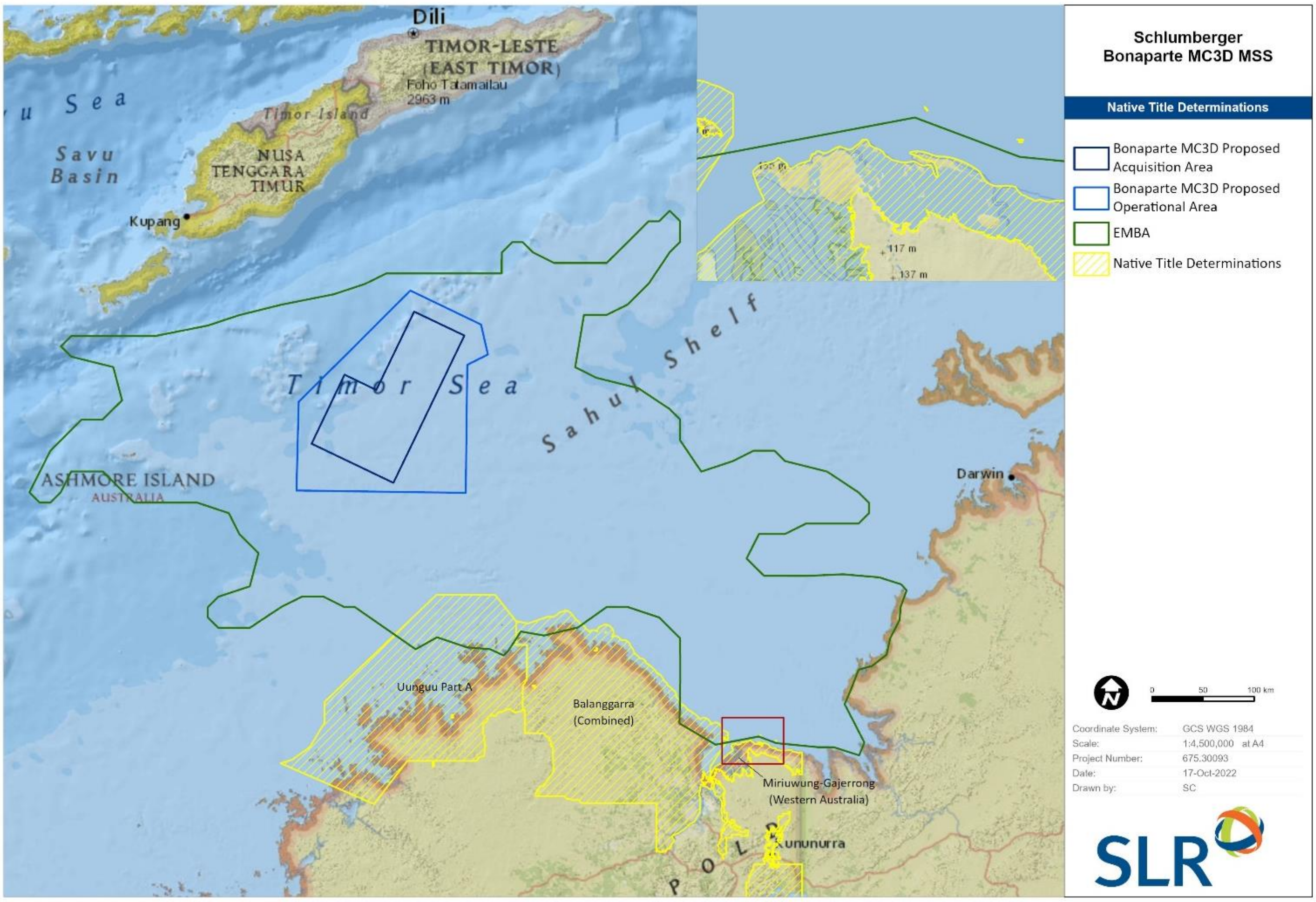


Figure 25 Cultural Heritage

4.6.1.2 Traditional Values and Use in the NWMR

Traditional Use of nearshore and marine waters in the vicinity of the OA and EMBA typically constitutes fishing, hunting and trade activity (DSEWPC, 2012a). The Ashmore Islands are thought to have been visited by Indonesian fishers from the islands of Rote, Sulawesi, and Ceram since the early eighteenth century, evidence of this is found at gravesites within the Ashmore Reef Marine Park (DSEWPC, 2012a). The Ashmore Islands were used both for fishing and as a staging point for voyages to the southern reefs off Australia's coast. Visits from traditional Indonesian fisherman continue today under the MoU 74 (see **Section 4.4.1.2**), with the MoU box shown in **Figure 29**. Therefore, Indonesian traditional fishers may be present within the EMBA, but are not expected to be present within the OA (further described in **Section 4.7.3**).

Australian Indigenous peoples use and actively manage the coastal and marine environments of the region as a resource and to maintain cultural identity, health and wellbeing, including within conservation areas such as Commonwealth, Australian and State Marine Parks. It is recognised that spiritual corridors extend from terrestrial areas into nearshore and offshore waters, that a number of marine animals are totems for Indigenous people, and that songlines pass through marine parks (DSEWPC, 2012a). Fishing, hunting, trade and the maintenance of culture and heritage through ritual, stories and traditional knowledge continue to be important uses of land and sea country (DSEWPC, 2012a).

The North Kimberley Marine Park located approximately 101 km south of the OA (**Figure 14**), contains many places of cultural and spiritual importance to traditional owners. Hunting, subsistence fishing and shell collecting are recognised as occurring in the Kimberley region (DNP, 2018a; DPAW, 2016b; Smyth, 2007).

As identified in **Section 4.6.1.1**, the land and sea country of the Wanjina Wunggurr people extends from the Bonaparte Archipelago to Kalumburu. The Wanjina Wunggurr people are strongly connected to sea country within this area, undertaking pearling, fishing and trade with Makassan. Many of the offshore warrurru (reefs) were visited by the Wanjina Wunggurr using rafts and canoes to take traditional sea voyages using travel routes extending from Lammarck Island to East Holothuria Reef (Wunambal Gaambera Aboriginal Corporation, 2016). The continuing importance of traditional use within region is reflected in the establishment of the Uunguu Indigenous Protected Area (Commonwealth of Australia, 2021).

The land and sea country of the Balanggarra people extends from Napier-Broome Bay to Cambridge Gulf and Wyndham in the JBG. In the past, the Balanggarra people speared fish along the rocky shoreline and in shallow waters. Saltwater fish, turtles, dugong, mud crabs and cockles continue to be important food sources for the Balanggarra people today (DPAW, 2016b). Fishing and hunting are still practiced today (DPAW, 2016b). As with the Wunambal Gaambera people, the Balanggarra Traditional Owners declared the Balanggarra Indigenous Protected Area in 2013 to manage, maintain and enhance its high diversity values for the future.

The largest settlement is the Aboriginal community of Kalumburu (DPAW, 2016b). Kalumburu is located on the western side of Cape Londonderry, 200 km southwest from the OA. There are no settlements on the western coast of the JBG until the Cambridge Gulf where the Oombulgurri community is located, approximately 130 km southeast of the OA.

The Traditional Owners of the Thamarrurr region have established the first stage of the Marri-Jabin Indigenous Protected Area located on the eastern side of the JBG (Commonwealth of Australia, 2021). The Thamarrurr Rangers work closely with the Traditional Owners and community members to actively manage the Marri-Jabin Indigenous Protected Area to protect their spiritual, cultural, social, economic and environmental connections with their country (Tharrmurr Development Corporation, 2022).

4.6.2 European and Marine Heritage

Historic shipwrecks, sunken aircraft and associated relics are recognised and protected under the *Underwater Cultural Heritage Act 2019*. Under the act, all wrecks and sunken aircraft more than 75 years old are protected, together with their associated relics regardless of whether their actual locations are known. The Commonwealth minister responsible for the environment can also make a declaration to protect any historically significant wrecks or articles and relics that are less than 75 years old.

A search of the Australasian Underwater Cultural Heritage Database confirms that there are no protected shipwrecks or sunken aircraft located within the OA. However, the Ann Millicent shipwreck (with shipwreck ID 3670), a sailing vessel wrecked in year 1888, is located immediately beyond the OA, 109 km to the west (**Figure 26**). Water depths at the wreck site are less than 80 m.

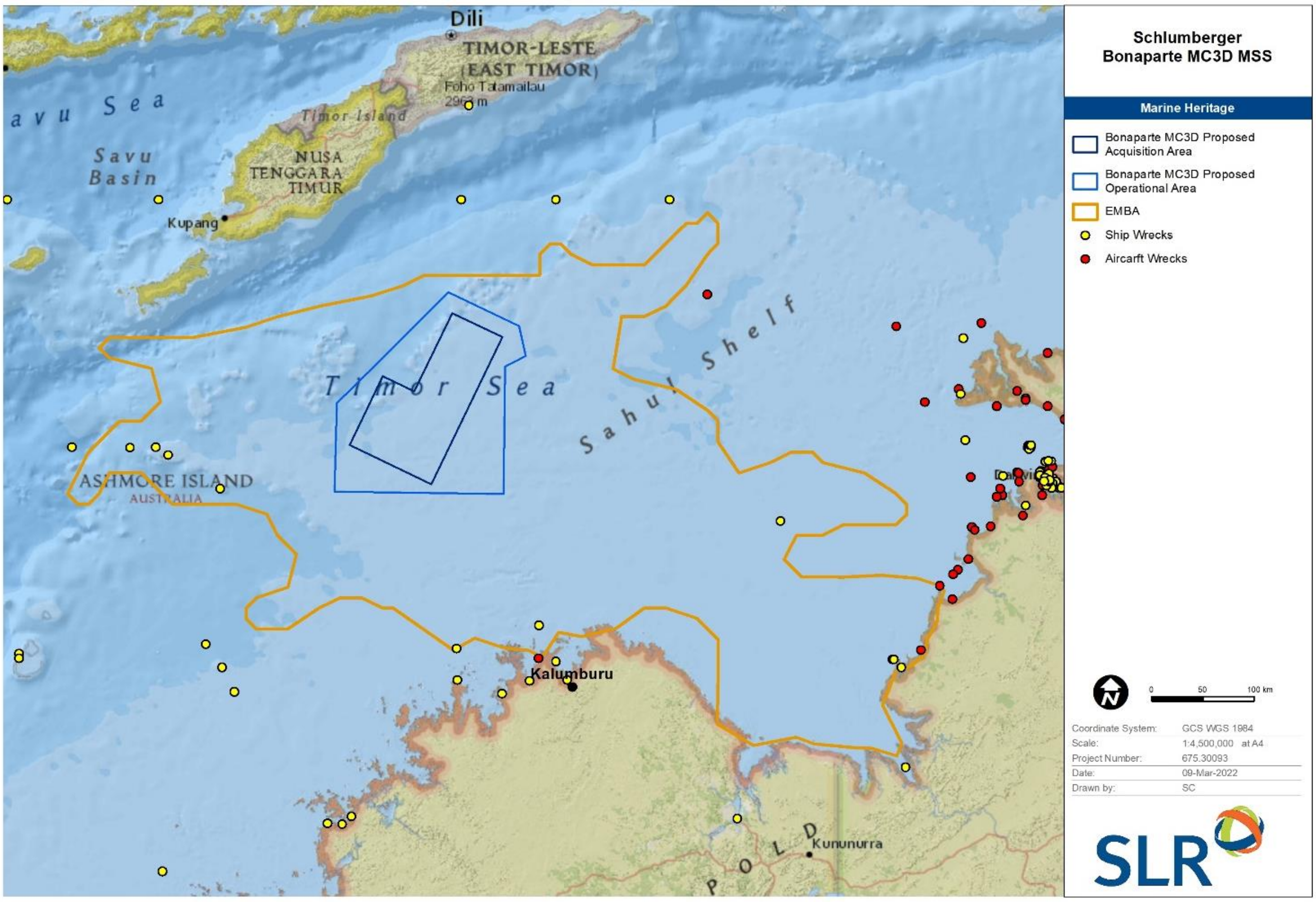


Figure 26 Places of Marine Heritage including Shipwrecks and Aircraft wrecks

4.7 Socio-Economic Environment

4.7.1 Coastal Settlements

Coastal settlements only occur along the southeastern extent of the EMBA, from Port Warrender across northwest WA to Wadeye within the Northern Territory extent of the JBG. Overall, these coastal areas are sparsely developed with population centres ranging from smaller indigenous community settlements of less than 50 people to small towns such as Kununurra comprising a population of 5,308 (Australian Bureau of Statistics, 2016).

Kununurra has an important horticultural industry, reflected in the high employment rates associated with the Agriculture, Forestry and Fishing industry. It's role as a transport hub in northern Australia is also evident, with Transport and Services identified as an important economic base for the region (Clifton *et al*., 2007). Outside of this, government administration and government supported industries such as education, defence and health are important employment sectors.

The following list includes those settlements adjacent to the EMBA which have a direct association with the marine environment through commercial and/or recreational activities and their corresponding population values[7]:

- Kalumburu (population; 412);
- Kununurra (population; 5,308);
- Wyndham (population; 780);
- Wadeye (population; 2,280);
- Thamarrurr (population; 3,764); and
- Baines (population; 249).

Where limited information was available on the extent, population, and socio-economic environment for community settlements, including indigenous community settlements, the precautionary principle has been applied and assumed a direct association with the marine environment. To this end, potential impacts to these coastal settlements has been evaluated and managed through consultation with the nominated State Government and the Representative Aboriginal Torres Strait Islander Body, in this case the Kimberley Land Council and the Northern Land Council (see **Section 5**).

[7] As denoted in the Australian Bureau of Statistics 2016 Census data, in lieu of 2021 Census data (to be released July 2022).

4.7.2 Tourism and Recreation

4.7.2.1 Whale Watching

Migrating humpback whales attract visitors to the Kimberley coastline from approximately July to September. The coastline encompassing Roebuck Bay, Broome, and the adjacent coastal waters are the staging point for departing whale watching cruise vessels and Australian Snubfin Dolphin viewing. Of note, is that Broome represents the most northerly location along the WA coastline where whale watching tourism providers operate, with most whale watching activity concentrated within the southwest region. Therefore, no commercial or tourism-based whale watching activity is known or expected to occur within the OA or the EMBA.

No whale watching tourism services appear to occur centric to pygmy blue whales.

This is consistent with what is known about humpback and pygmy blue whale distribution, migration and habitat use which show that humpback whale's activity is largely constrained to the coastal waters extending from the south up to the Bonaparte Archipelago and pygmy blue whale activity which appears to migrate to the offshore waters immediately beyond the Dampier Archipelago on route to the warmer waters of Indonesia and Timor Leste.

Due to these limitations, it is also considered unlikely that recreational whale watching activity is occurring within the OA or the EMBA.

4.7.2.2 Cruise, Sailing and Boating Activity

Similar to that described for recreational diving and snorkelling activity, vessel-based tourism within the NWMR is predominantly concentrated around natural features such as reefs, islands and cay, particularly, Rowley Shoals, Adele Island, Scott Reef and Ashmore Reef. Activities are characterised by luxury, multi-day cruises originating from Broome, travelling north, and incorporating a range of marine and terrestrial based activities undertaken at key staging points. Tourism in the region typically peaks during the dry season, from May to October. However, cruises are scheduled year-round.

No key staging or stop-over points were identified within the OA. However, a review of current itineraries for Cruise Operators such as Coral Expeditions and Diversity Charters indicated they routinely visit West Island at Ashmore Reef, a small Recreational Use Zone (IUCN IV) within the broader AMP which otherwise comprises Sanctuary Zone (IUCN Ia). Consequently, vessels may transit through the OA between key activity locations.

Having regard to the potential overlap in vessel tracks for tourism vessels and the proposed Seismic Survey Vessel, SLB has consulted with industry representative bodies including Marine Tourism WA and Kimberley Marine Tourism Association. The outcome of the relevant persons consultation programme is described in **Section 5.**

A number of luxury cruise operators have previously been identified as accessing the Kimberley coastal waters comprising the EMBA, including Kimberley Quest, Silversea and True North which operate from late throughout February to November to avoid the wet season (Santos, 2021). Some Kimberley cruises extend to the coastal waters of the JBG, situated over 350 km from the OA and located within the EMBA. Here, activities are predominantly land-based or take place in rivers, estuaries or within a few kilometres from the coast. As described above, cruise itineraries do not include the offshore waters of the OA, although operators may occasionally transit through the OA between key activity locations (Santos, 2021).

No sailing or other recreational boating activity was identified to occur within the OA, with the exception of recreational fishing activity. Recreational fishing activity is described in **Section 4.7.2.4.**

4.7.2.3 Diving, snorkelling and wildlife watching

Recreational diving and/or snorkelling within the northwest marine region of the OA generally occurs in water depths less than 30 m, concentrating around natural features such as reefs, islands and cay, particularly around Rowley Shoals, Adele Island, Scott Reef, Ashmore Reef, and around structures such as shipwrecks (DNP, 2018a; WA DPIRD, 2021).

Given its relative proximity to higher value recreational dive sites, such as Ashmore Reef, and the prevailing water depths (approximately 95% of that OA consists of water depths greater than 60 m), recreational diving and/or snorkelling is not anticipated to occur within the OA. However, it is a permitted activity within the adjacent Oceanic Shoals Marine Park, the marine waters where the Ann Millicent shipwreck is grounded (see **Section 4.6.2**) and on the West Island of Ashmore Reef, all of which are located within the EMBA.

In all cases, dive sites within the EMBA are typically only accessible via boat. A search of mainstream dive and charter tour offerings within the broader region identified two itineraries which included diving and snorkelling activity at West Island, Ashmore Reef. Based on the information available, tours ranged from September to December which is distinct from the peak cruise season ranging from May to October each year.

Bird watching activity is also known to occur at Ashmore Reef concurrent with the cruise and dive itinerates identified above (Kimberley Bird Watching, 2018). Whilst historical itineraries indicate specific trips occurred throughout the key seabird and shorebird breeding period from October through to March, no proposed voyages were identified across this time period.

4.7.2.4 Recreational Fishing

Recreational fishing is a popular activity in Western Australia, providing important social and economic benefits to the State's population. The participation rate of Western Australian residents is generally above the national average, with an estimated 25.4% of the population aged 15 years or older participating in fishing in the 2017/2018 monitoring period, which constitutes the most recent, published Statewide survey of boat-based recreational fishing in Western Australia (Ryan et al., 2019). Recreational Boat Fishing Licenses (**RBFL**) are lodged through the WA Department of Transport (**WA DoT**) and issued/regulated through WA DPIRD. There are four Fishing Bioregions, including the South Coast, West Coast, Gascoyne, and the North Coast. For the purposes of assessment, each bioregion can be further characterised into zones, whereby the Nort Coast bioregion comprises the Kimberley and Pilbara zones. The OA is located within the North Coast bioregion, which extends from Longitude 114 50 East to the WA – NT border and overlaps the Kimberley zone. The Kimberley zone extends from Pardoo, in the south, to the WA-NT border.

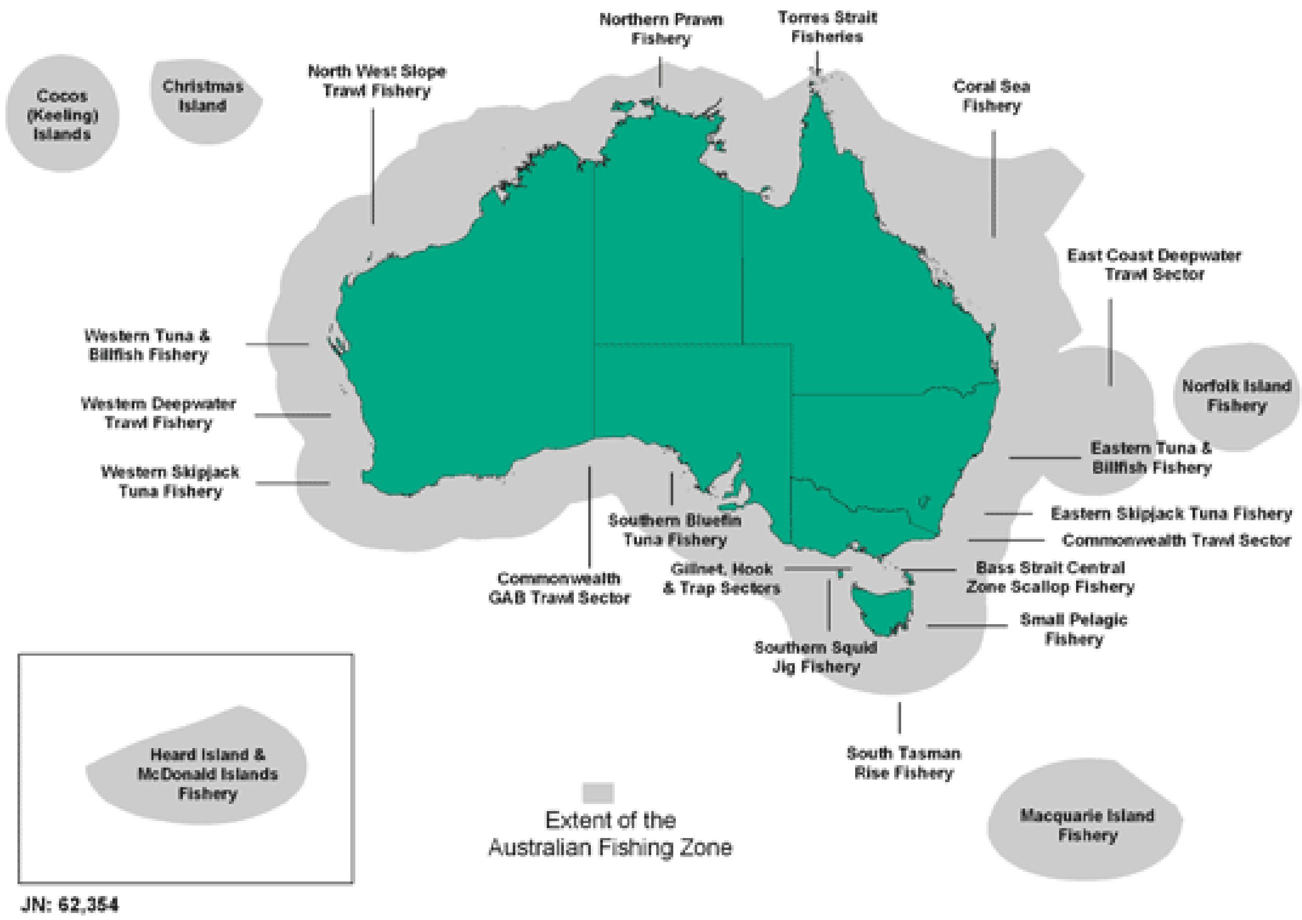
Within the Kimberley portion of the Nort Coast Bioregion, 55% of recreational license holders fished 15 days or more with 93% of activity reported to occur within the North Coast. Of the fishing effort recorded within the North Coast, activity occurred predominantly in nearshore habitat (47%), followed by inshore demersal (33%), estuary (11%), pelagic (4%), offshore demersal (2%) and freshwater (2%) (Ryan et al., 2019).

Twenty species accounted for 75% of the total catch (by numbers) of finfish and invertebrate in the Kimberley zone within 2017/2018. The top finfish species caught (kept and released) were Stripey Snapper (11% of the zone total catch), Grass Emporer (10%), Barramundi (7%) and Saddletail Snapper (5%). A further 14 species were caught at rates between 2 and 5%. The most common invertebrate species were Mud Crab (6%) and Blue Swimmer Crab (2%)(Ryan et al., 2019).

Given only 6% of the of all recreational fishing activity within the Nort Coast is reported to occur within the pelagic or offshore demersal environment, little to no recreational fishing activity is anticipated within the OA. However, recreational fishing is known to occur within the nearshore, inshore and estuarine environments comprising the EMBA.

4.7.3 Commercial Fisheries

Australia's fisheries are those that occur within the Australian EEZ (waters out to 200 NM from coastal baselines). Boundaries within Australia's fisheries have been established in order to simplify jurisdiction (Department of Agriculture and Water Resources (**DoAWR**), 2002). Inshore waters out to 3 NM represent State waters, with jurisdiction of these waters vested in the adjacent State or Territory (Geoscience Australia, 2018b). The Commonwealth has jurisdiction over fisheries occurring in Commonwealth waters; those between 3 NM and 200 NM from the coastline (DoAWR, 2002). Commonwealth waters are covered by the Australian Fishing Zone (**Figure 27**) (DoAWR, 2018) and are managed through the Australian Fisheries Management Authority (**AFMA**). Where a fishery falls within multiple jurisdictions, an Offshore Constitutional Settlement arrangement is generally developed, whereby sole responsibility is passed to one jurisdiction. Alternatively, a Joint Authority may be formed, allowing for the co-management of the fishery through the legislation of one jurisdiction (DoAWR, 2002).



Source: DoAWR, 2018

Figure 27 Australian Fishing Zone and Location of Commonwealth Fisheries

The offshore waters of WA and the NT are rich in marine resources and include the fishing grounds of a variety of commercial fisheries. The OA encompasses some Commonwealth, WA, and NT managed commercial fisheries and these are discussed in the following sections.

4.7.3.1 Commonwealth Managed Fisheries – The Regulator

AFMA is the Government agency responsible for the management and sustainable use of Australia's Commonwealth fisheries (those from 3 NM out to the extent of the Australian Fishing Zone). AFMA was established under the Fisheries Administration Act 1991, and it is under this Act, as well as the Fisheries Management Act 1991, that AFMA is invested with its objectives, functions and powers.

AFMA looks after Commonwealth fisheries through:

- Research and science which provides the information to manage fisheries, such as the setting of quota levels;
- Management and regulation that develops and makes the rules for fisheries (e.g. quota and gear restrictions, and issuing of permits); and
- Monitoring and enforcement of rules and regulations.

The aim of AFMA is to keep fish species, and the marine environment as a whole, in good health for the future. In order to achieve this, they work together with Australian State agencies, international counterparts, industry, scientists, and recreational and environmental fishery stakeholders (AFMA, 2018b).

AFMA ensures that impacts on commercial fisheries from petroleum activities, including MSSs, are considered by providing comment directly to the Department of Industry, Innovation and Science on annual acreage releases, and by providing comment to petroleum companies on proposals that may have significant impacts on fisheries. AFMA recommends petroleum operators to consult directly with fishing operators about proposed petroleum activities. Note that in some fisheries there are no associations (AFMA, 2018c).

Consultation with commercial fishers that may be affected by the Seismic Survey has been guided by AFMA recommendations and expectations. See **Section 5** and **Appendix F** for details on consultation with AFMA and the commercial fishing sector.

Commonwealth-managed fisheries with management boundaries that overlap with the OA and EMBA include:

- Northern Prawn Fishery (**NPF**);
- North West Slope Trawl Fishery (**NWSTF**);
- Western Tuna and Billfish Fishery (**WTBF**);
- Southern Bluefin Tuna Fishery (**SBTF**); and
- Western Skipjack Tuna Fishery (**WSTF**).

These fisheries are further described below.

4.7.3.1.1 Northern Prawn Fishery

The NPF extends from JBG across the top end to the Gulf of Carpentaria (**Figure 28**) with banana prawns and tiger prawns being the main targeted species.

White banana prawn (*Penaeus merguiensis*) is mainly caught during the day on the eastern side of the Gulf of Carpentaria, whereas redleg banana prawn (*P. indicus*) is caught during both day and night, mainly in JBG. Tiger prawns (*P. esculentus and P. semisulcatus*) are primarily taken at night (daytime trawling has been prohibited during the tiger prawn season). Most catches come from the southern and western Gulf of Carpentaria, and along the Arnhem Land coast (ABARES, 2021).

The NPF uses otter trawl gear to target a range of tropical prawn species. Most vessels have transitioned from using two trawl nets to using four trawl nets, a configuration that is considered more efficient (ABARES, 2021). Fishing effort and participation were reduced from a peak in 1980 to the current levels of around 8,000 days of effort and 52 vessels. Total catch in 2020 was 4,767 t, comprising 4,653 t of prawns and 114 t of byproduct species (predominantly squid, bugs and scampi). Annual catches tend to be quite variable from year to year, mostly because of natural variability associated with the target species, especially banana prawns (ABARES, 2021).

The fishery has two seasons: a predominantly banana prawn season that runs from 1 April to 15 June and a longer tiger prawn season that runs from 1 August to 30 November.

Figure 28 shows the main areas of fishing activity in the within the NPF between 2015-2020, based on fishing intensity data provided by the Australian Bureau of Agriculture and Resource Economics and Sciences (**ABARES**). No fishing occurs within the OA as it is located outside the NPF boundaries, however the eastern part of the EMBA extends into the JBG part of the NPF; however, the level of effort in this area is relatively minor compared to other parts of the NPF.

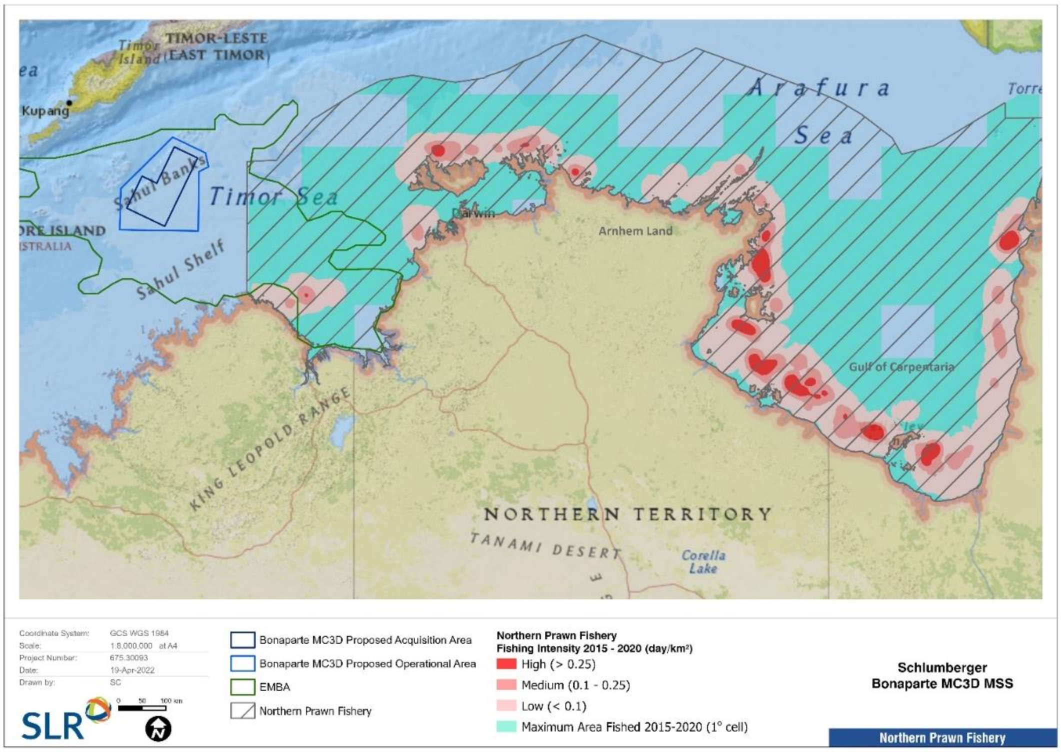


Figure 28 Fishing Effort within the Northern Prawn Fishery (2015-2020)

4.7.3.1.2 North West Slope Trawl Fishery

The NWSTF operates off north-western Australia from 114°E to 125°E, roughly between the 200 m isobath and the outer boundary of the Australian Fishing Zone. A large area of the Australia–Indonesia MOU box (an area off north-western Western Australia where Indonesian fishers may operate using only traditional methods) falls within the NWSTF (ABARES, 2021).

The NWSTF is divided into two regions, the western Pilbara and eastern Kimberly as shown in **Figure 29**. Since the late 1990s, the NWSTF has predominantly been a scampi fishery using demersal trawl gear, however a quantity of prawns is harvested each season, and squids are becoming an increasingly significant component of the catch (ABARES, 2021).

Fishing effort in the NWSTF is often linked to fishing in the NPF (discussed in **Section 4.7.3.1.1**) in that when boats cease to operate in the NPF, some move to the NWSTF (ABARES, 2021).

Figure 29 shows the areas of fishing activity in the within the NWSTF during 2019-20, based on fishing intensity data provided by the ABARES. No fishing occurs within the OA as it is located outside the NWSTF boundaries, however the western part of the EMBA extends part of the NWSTF, however no fishing occurred within the EMBA during 2019-20 as most of the fishing occurred further south (offshore from Broome).

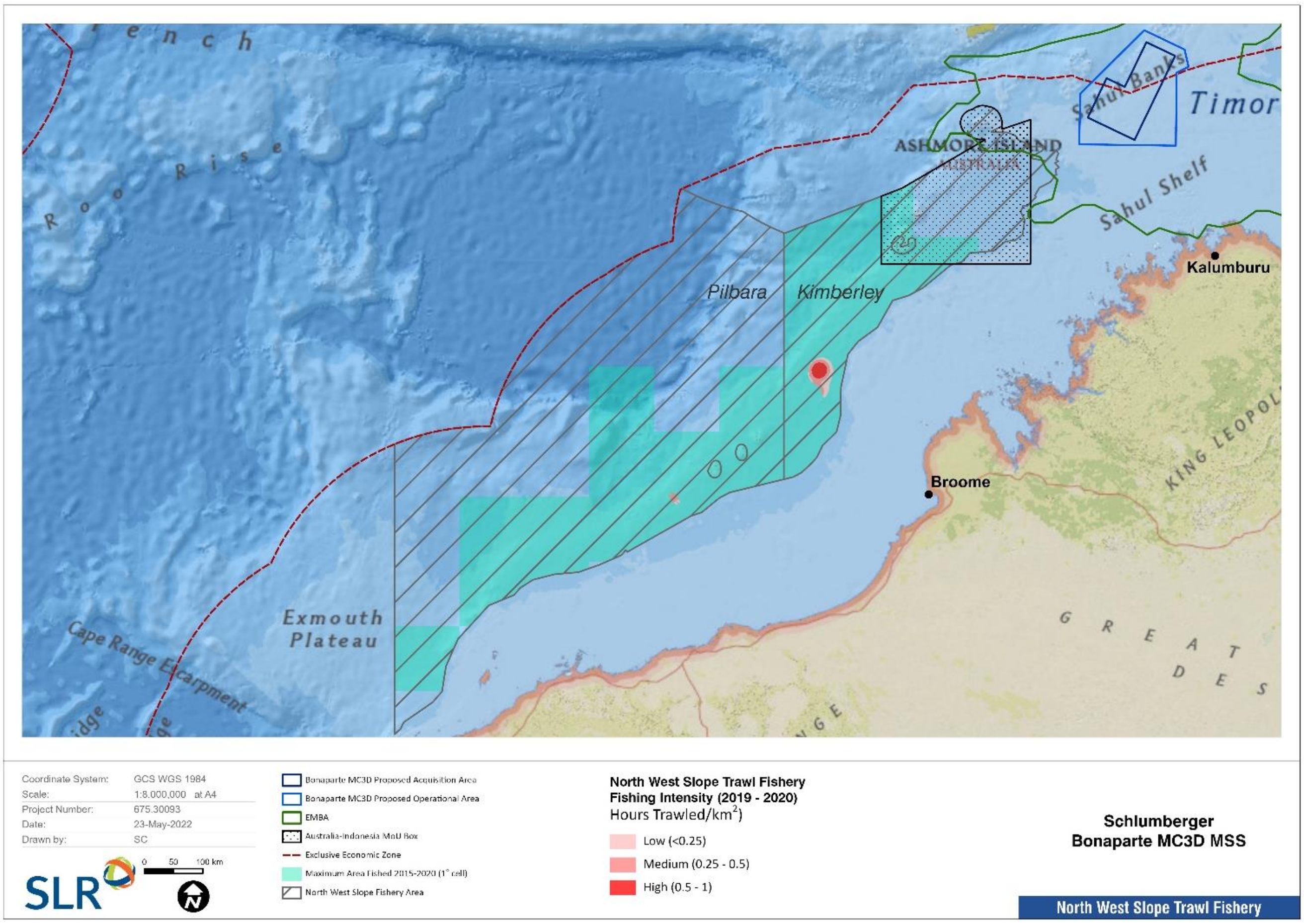


Figure 29 Fishing Effort within the North West Slope Trawl Fishery (2019-2020)

4.7.3.1.3 Western Tuna and Billfish Fishery

The WTBF operates in Australia's Exclusive Economic Zone and high seas of the Indian Ocean. In recent years, fishing effort has concentrated off south-west Western Australia (over 2,000 km from the OA), with occasional activity off South Australia (ABARES, 2021), meaning there is no overlap of either the OA or EMBA with recent fishing effort within the WTBF.

4.7.3.1.4 Western Skipjack Tuna Fishery

Two stocks of skipjack tuna (*Katsuwonus pelamis*) are thought to exist in Australian waters: one on the east coast that is part of a broader stock in the Pacific Ocean and one on the west coast that is part of a larger stock in the Indian Ocean. The two stocks are targeted by separate fisheries: the Eastern Skipjack Tuna Fishery and the WSTF. These are collectively termed the Skipjack Tuna Fishery, but the two stocks are assessed separately (ABARES, 2021).

Globally, catch of skipjack tuna increased steadily since the 1970s, and skipjack tuna has become one of the most commercially important tuna species in both the Indian and Pacific oceans. Catch in the Skipjack Tuna Fishery increased for a short period from 2005 to 2008, peaking at 817 t in 2007–08. The catch was supplied almost exclusively to the cannery in Port Lincoln. However, the cannery closed in 2010, and there has been no catch in the Skipjack Tuna Fishery since the 2008–09 fishing season (ABARES, 2021).

4.7.3.1.5 Southern Bluefin Tuna Fishery

The SBTF spans the Australian Fishing Zone. Southern bluefin tuna (*Thunnus maccoyii*) is targeted by fishing fleets within the Australia's EEZ. Young fish (1–4 years of age) move from the spawning ground in the north-east Indian Ocean into the Australian EEZ and southwards along the Western Australian coast (ABARES, 2021).

Since 1992, most of the Australian catch has been taken by purse seine, targeting juvenile southern bluefin tuna (2–5 years of age) in the Great Australian Bight with no fishing effort within the OA or EMBA. This catch is transferred to aquaculture farming operations off the coast of Port Lincoln in South Australia, where the fish are grown to a larger size to achieve higher market prices. Australian domestic longliners operating along the east coast also catch southern bluefin tuna, and there is some recreational fishing for the species (ABARES, 2021).

There is no overlap with fishing effort within the SBTF and the OA or EMBA.

4.7.3.2 Western Australian Managed Fisheries

WA State commercial fisheries are managed by the Western Australian Department of Primary Industries and Regional Development (**DPIRD**) under the Fish Resources Management Act 1994, Fisheries Resources Management Regulations 1995, relevant gazetted notices and licence conditions and applicable Fishery Management Plans.

The following WA managed fisheries have management boundaries that overlap with the OA and EMBA:

- Northern Demersal Scalefish Managed Fishery (**NDSMF**);
- Mackerel Managed Fishery (**MMF**);
- Specimen Shell Managed Fishery;
- Western Australia Joint Authority Northern Shark Fishery;
- Western Australian Sea Cucumber Fishery (**SCF**);

- Marine Aquarium Fish Managed Fishery (**MAFMF**);
- Abalone Managed Fishery;
- Kimberly Prawn Managed Fishery (**KPMF**);
- Kimberly Gillnet and Barramundi Managed Fishery (**KGBMF**);
- West Coast Deep Sea Crustacean Managed Fishery;
- Pearl Oyster Managed Fishery; and
- Kimberly Crab Managed Fishery (**KCMF**).

Schlumberger requested fish catch and effort data from WA DPIRD (FishCube data) for the above fisheries. Data were assessed for 60 x 60 NM and for 10 x 10 NM Catch and Effort System (**CAES**) blocks for the most recent six years (2015 to 2020). DPIRD does not release catch and effort data for CAES blocks where less than three vessels fished during the period of interest (i.e. less than three vessels per year or less than three vessels over the complete 6-year period). Where this applies, the Vessel Count is marked 'Less than 3', while Weight and Fishing Day Count are marked as 'N/A'. CAES blocks where the results are provided in this way confirm that fishing effort did occur within the block during that period, but the associated catch and effort values are not available.

Of the above fisheries, those which had any records of fishing effort within the OA were the NDSMF and MMF and the KPMF had more than three fishing day counts recorded fishing effort within the EMBA (but outside the OA). These three fisheries are discussed in greater detail in the following sections. In addition, fishing charters operate close to and offshore of the Kimberley Coast and this activity is also discussed in the following sections.

The four other fisheries, namely the SCF, KCMF, MAFMF, and KGBMF, had very minor fishing effort[8] recorded in the past five years within the southern part of the EMBA (adjacent to the Kimberley Coast) and are therefore not discussed further.

4.7.3.2.1 Northern Demersal Scalefish Management Fishery

The NDSMF is divided into two subregions, namely the Pilbara and Kimberly subregions. The Kimberley subregion of the NDSMF is relevant to this EP and operates off the WA coast east of 120° E longitude and is divided into two areas, Area 1 being the inshore sector and Area 2 being the offshore sector, the latter being split into three zones (Zones A, B, and C). The permitted methods in Area 2 of the NDSMF include handline, dropline, and fish traps, but since 2002 it has essentially been a trap-based fishery which uses gear time access and spatial zones as the primary management measures (Newman *et al.*, 2020). The main species landed by this fishery in the Kimberley subregion are goldband snapper, saddletail snapper, and red emperor.

Since 2008, annual catches within the Kimberley subregion of the NDSMF have exceeded 1,000 t (Newman *et al.*, 2020). The 2019 catch of 1,507 t was the largest reported catch across the whole fishery. The total catch within the Kimberly subregion of the NDSMF in 2019 constituted 34% of the total catch within the entire NDSMF (the remaining 64% being caught in the Pilbara subregion).

[8] The SCF had three 10x10 NM boxes, all with <3 vessel counts; the KCMF had on 60x60 NM box with a <3 vessel count; the KGBMF had four 60x60 NM boxes, three of which with <3 vessel counts and one with an unknown vessel count; and the MAFMF had four 10x10 NM boxes, all with <3 vessel counts.

Analysis of FishCube data shows that the area of fishing effort within the Kimberley subregion of the NDSMF is 127,613 km^2 for the period between 2015 and 2020 (refer **Figure 30**). The OA overlaps with 14,526 km^2 (11 %) of this fished area and the AA overlaps 6,290 km^2 (5%) as shown in **Figure 30**. Between 2015 and 2020 peak fishing intensity within the OA has been recorded between October and March (**Figure 31**).

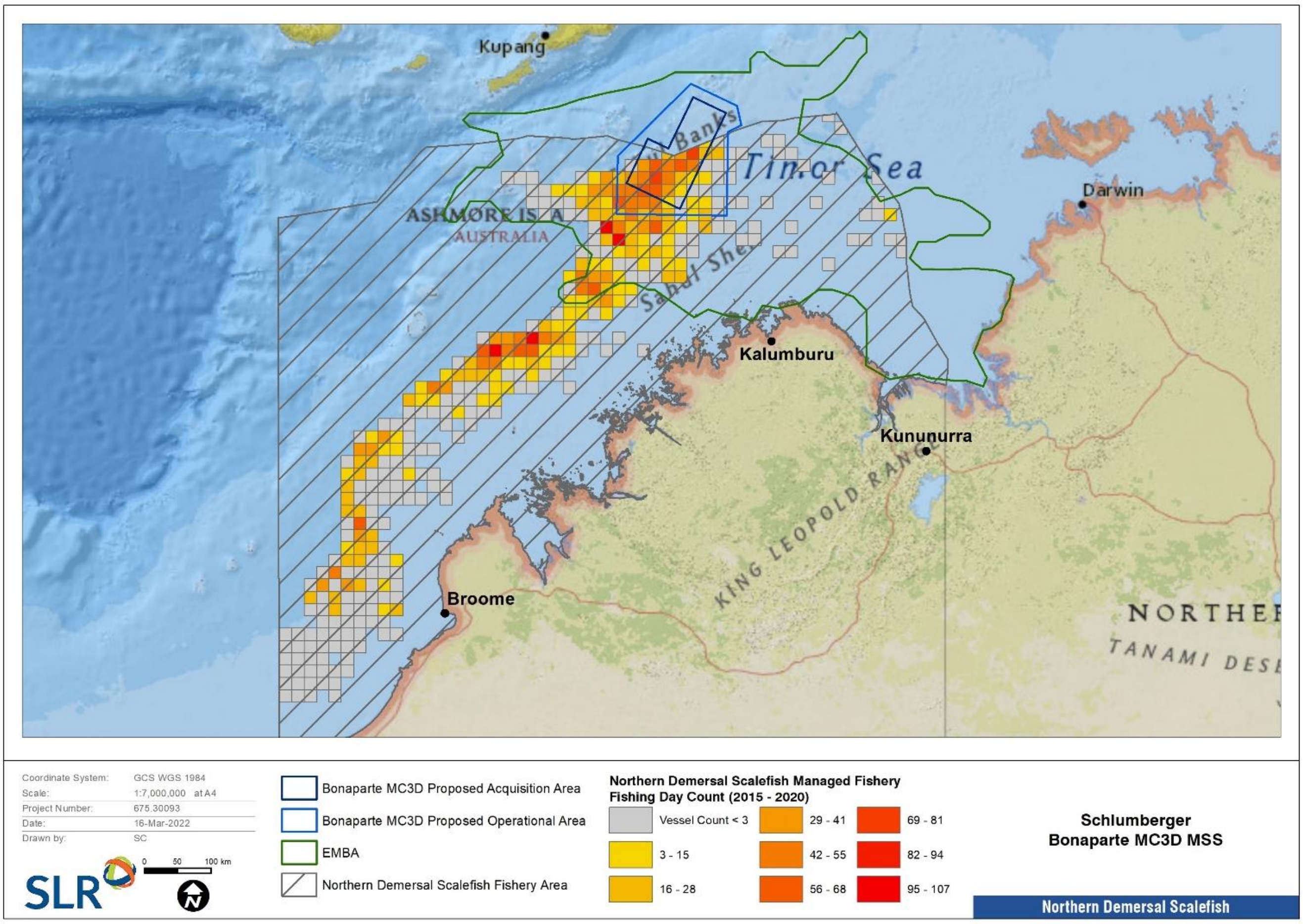


Figure 30 Fishing Effort within the Northern Demersal Scalefish Managed Fishery (2015-2020)

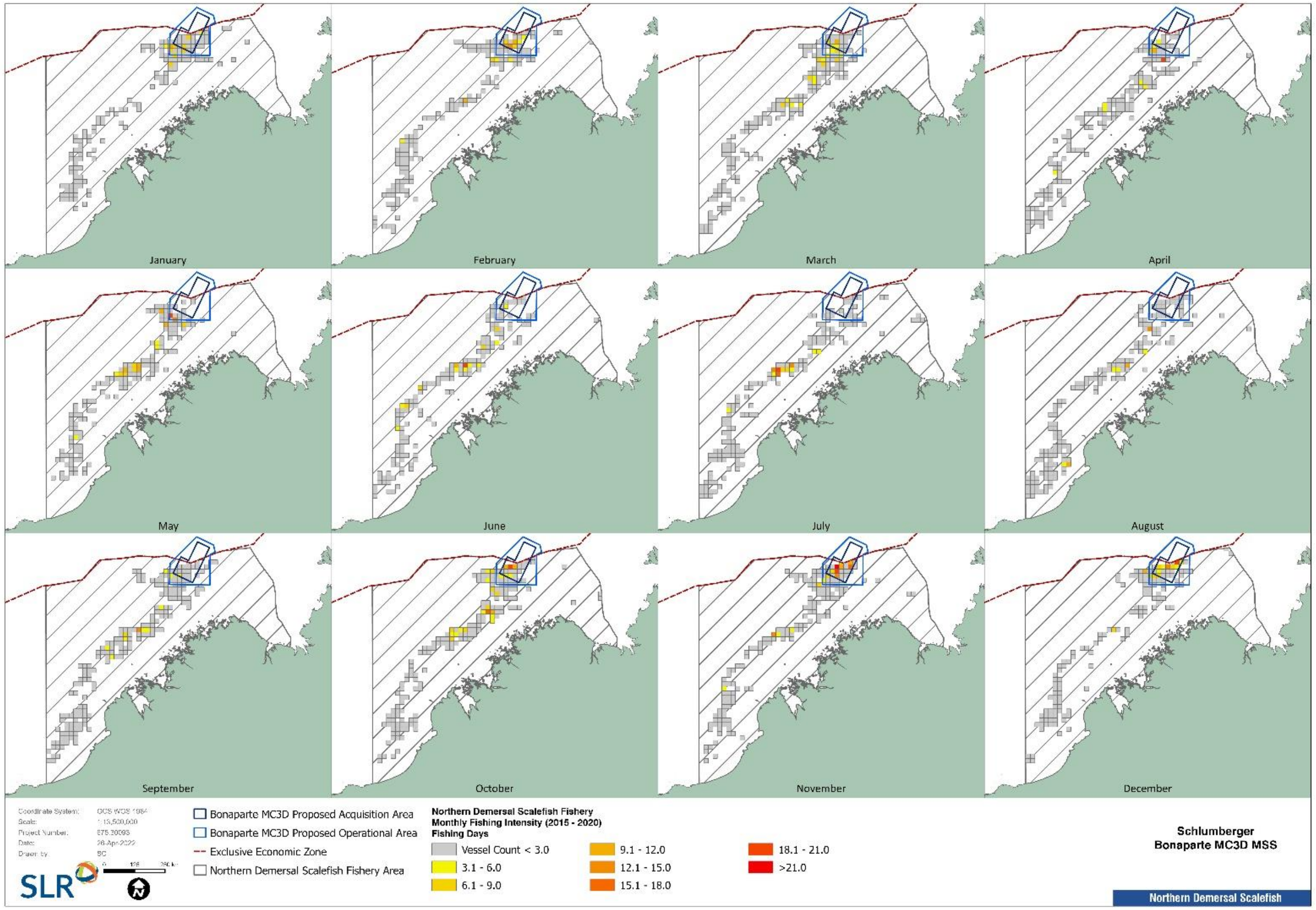


Figure 31 Northern Demersal Scalefish Managed Fishery Monthly Fishing Intensity (fishing days) between 2015 and 2020 within and proximal to the EMBA

4.7.3.2.2 Mackerel Managed Fishery

The MMF is divided into three areas with the OA being located within Area 1 – Kimberley (121°E to WA – NT border). The primary target species of the MMF is Spanish mackerel (*Scomberomorus commerson*), which is fished commercially between Geraldton and the NT border.

Licence holders may only fish for mackerel by trolling or handline. There are currently only 14 licences in the Kimberley management area. A total of 15 vessels operated across the entire MMF during the 2019/20 season (Lewis *et al*., 2021).

Analysis of FishCube data shows that the area of fishing effort within the Kimberley subregion of the NDSMF is 44,010 km^2 for the period between 2016 and 2020 (refer **Figure 32**). The OA overlaps with 538 km^2 (1 %) of this fished area as shown in **Figure 32** and no fishing occurred within the Acquisition Area.

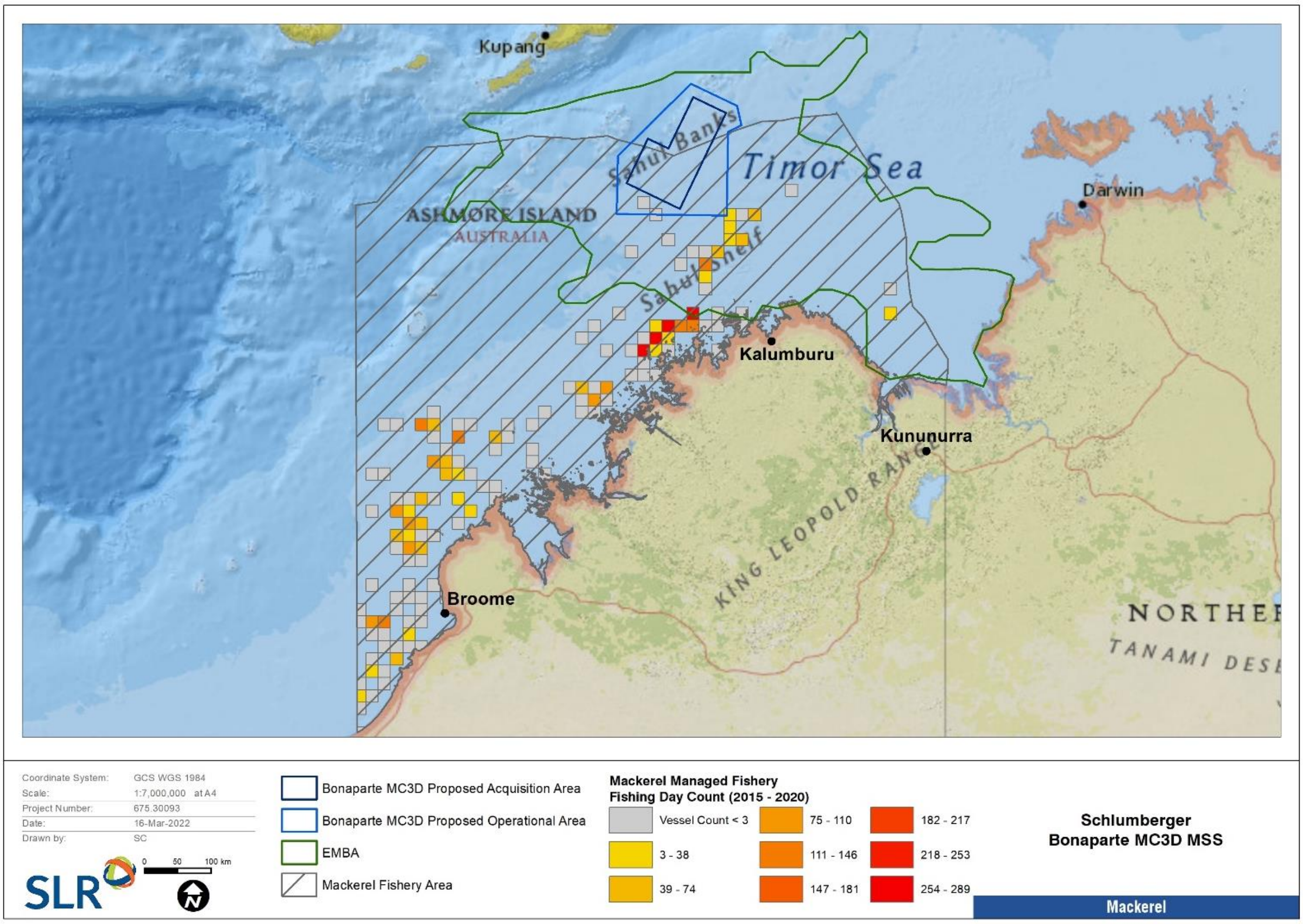


Figure 32 Fishing Effort within the Mackerel Managed Fishery (2015-2020)

4.7.3.2.3 Kimberley Prawn Managed Fishery

The KPMF is one of four managed prawn fisheries managed by the WA government and extends from Collier Bay in the west to Napier Broome Bay. The total prawn landings in 2019 for the KPMF were 100 t which was the lowest catch on record. The catch was primarily banana prawns (97 t), with 2 t of brown tiger prawns and 1 t of blue endeavour prawns also taken. There are two fishing periods for the season (April to mid-June, then from August to the end of November) with around 90% of the total landings taken in the first fishing period.

Analysis of FishCube data shows that the area of fishing effort within KPMF is concentrated close to the coast, however some fishing occurs within the EMBA, but none within the OA or AA (refer **Figure 33**).

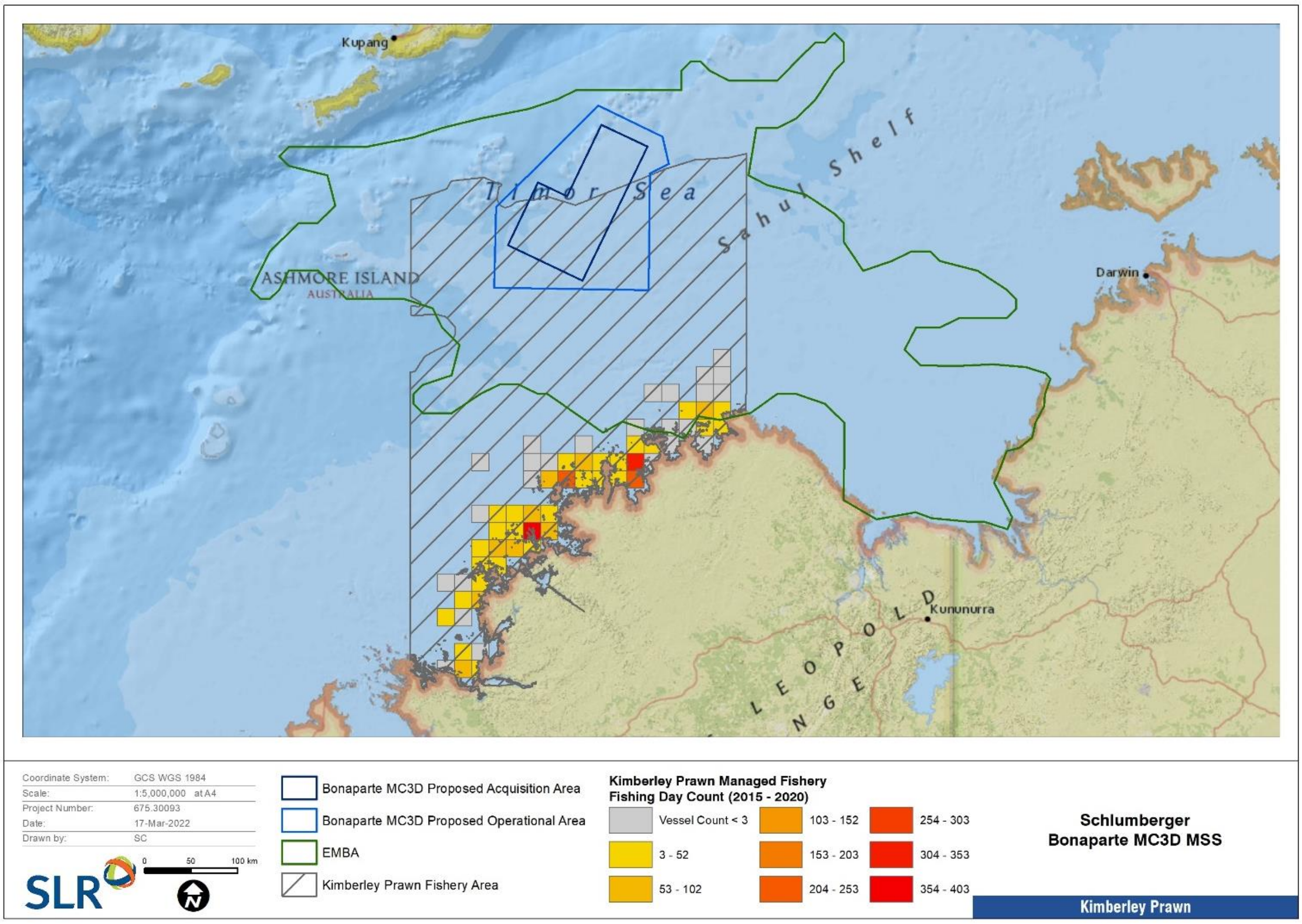


Figure 33 Fishing Effort within the Kimberley Prawn Managed Fishery (2015-2020)

4.7.3.2.4 Charter Fishing

The fishing charter industry in WA offers boat-based fishing tours of half day, full day and extended live aboard charters of two to 10 days duration (Howard *et al*., 2021). The industry operates tours along most of the WA coast, including the tours in the metropolitan area, regional tourist areas and a range of tours to very remote locations. Tours are offered all year round from a range of ports. The fishing charter industry in WA is regulated by the DPIRD. To operate as a Fishing Charter business, an operator is required to have a Fishing Tour Operator Licence covering the specific zone in which they operate tours. There are four Fishing Bioregions or zones, namely the South Coast, the West Coast, Gascoyne Coast and the North Coast (Pilbara/Kimberley). Each zone has different fishing regulations for possession limits per person. The charter fleet primarily consists primarily of vessels between five and 25 metres. The OA is located within the North Coast zone, which extends from Longitude 114 50 East to the WA – NT border.

The top species caught /kept In the North Coast zone in 2019 with shares of total take are Golden Snapper (14%), Rankin Cod (11%), Spangled Emperor (7%) and Mangrove Jack (6%), however there are a variety of fish caught/kept in with seven species rating 3-5% (Howard *et al*., 2021).

Figure 34 presents the charter fishing trip counts between 2016 and 2020. Most of the trips are close to the Kimberley Coast, however there are occasional trips further offshore. There are no recorded trips within the OA or Acquisition Area; however, some occur with the EMBA.

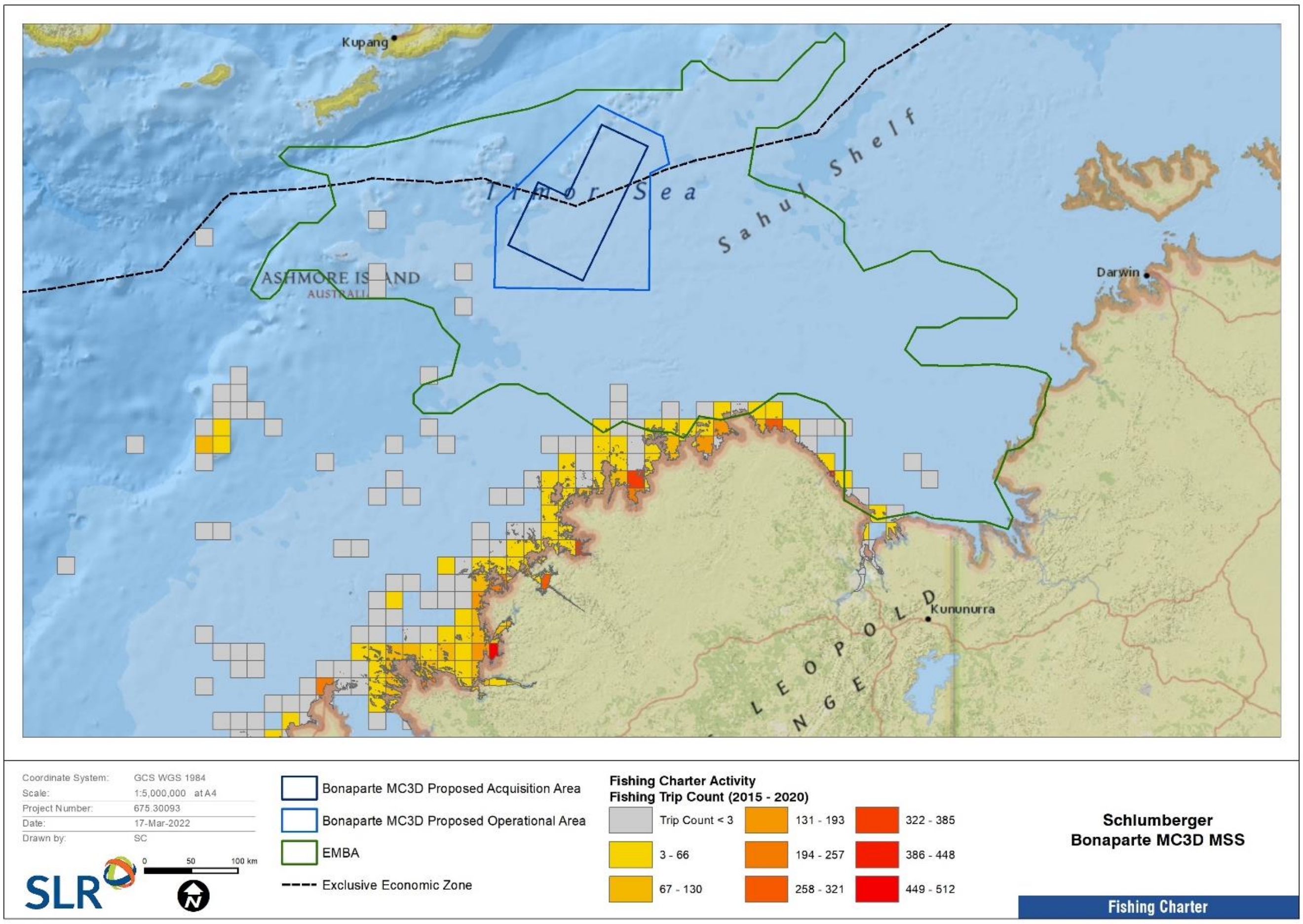


Figure 34 Western Australia Charter Fishing Trip Counts (2015-2020)

4.7.3.3 Northern Territory Managed Fisheries

NT State commercial fisheries are managed by the Northern Territory Department of Industry, Tourism and Trade (**DITT**), formerly known as the Department of Primary Industry and Resources (**DPIR**). Wild harvest fisheries are managed under the Fisheries Act 1988 and the Fisheries Regulations 1992.

Schlumberger requested fish catch and effort data from NT DITT for the fisheries it manages. Data were available in 60 x 60 NM CAES blocks for the most recent six years (2015 to 2020).

None of the NT managed fisheries overlap with the OA as it is not located within NT waters, however the following NT managed fisheries had some fishing effort between 2015-2020 within the southeast of the EMBA (as shown in **Figure 35**):

- Timor Reef Fishery;
- Small Pelagic Development Fishery (West Segment);
- Jigging Fishery;
- Demersal Fishery;
- Spanish Mackerel Fishery;
- Offshore Net and Line Fishery;
- Barramundi Fishery;
- Coast Line Fishery;
- Mud Crab Fishery;
- Special Permit Fishery;
- Aquarium Fishery;
- Pearl Oyster Managed Fishery; and
- Fishing Tour Operator.

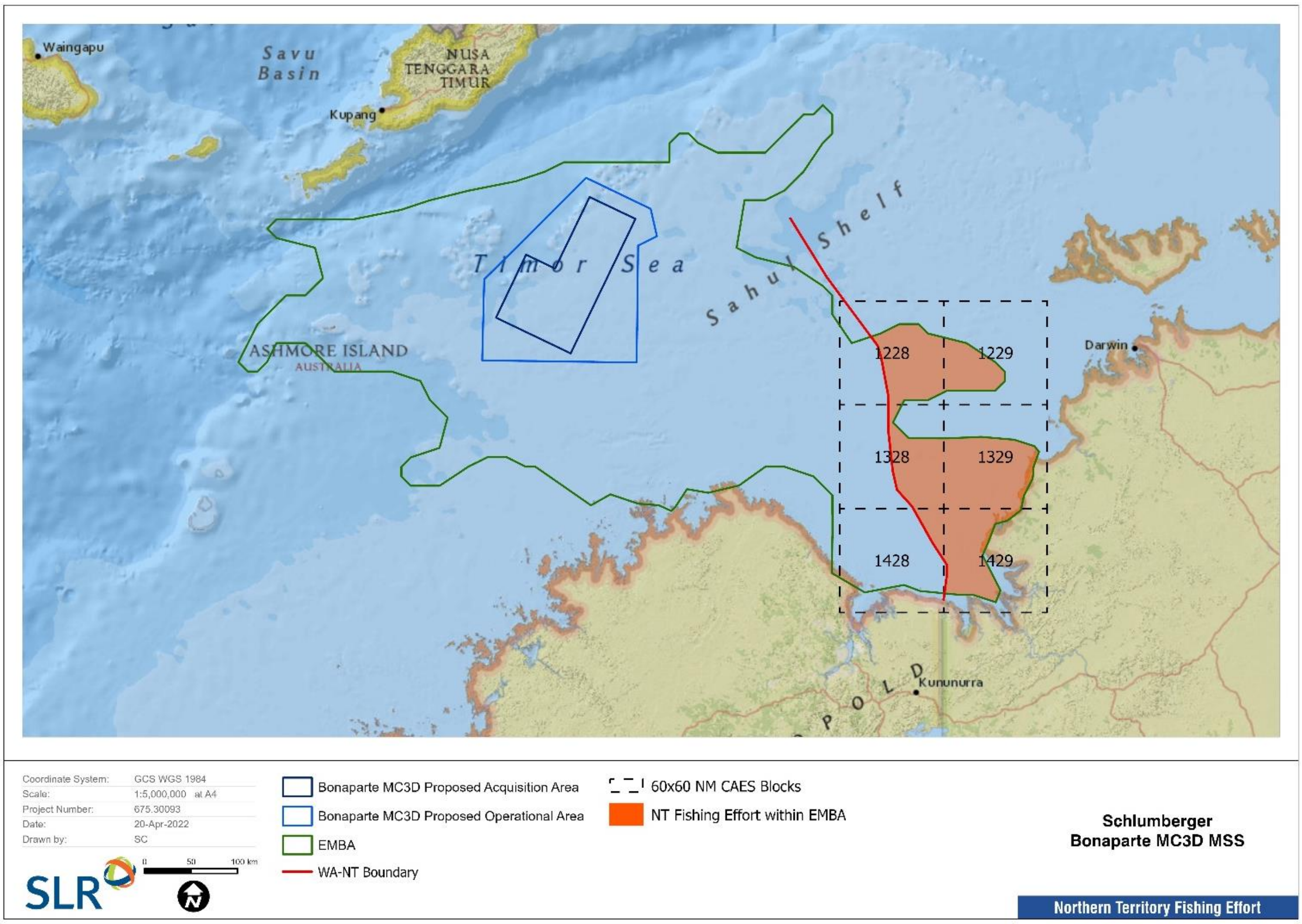


Figure 35 Northern Territory Fishing Effort within the EMBA

Catch information was unable to be provided by DITT for those blocks which had less than five licenses operating in them due to confidentiality reasons, however effort data was provided which gives an indication of the relative importance of any particular 60 x 60 NM CAES block to the fishery. **Table 23** presents a summary of the fishing effort within the six CAES blocks shown in **Figure 35** between 2015-2020 within the NT managed fisheries. It should be noted that some of this effort may not actually have taken place within the EMBA area because the 60 x 60 NM CAES blocks extend beyond the EMBA boundary (as shown in **Figure 35**). The greatest effort and catch totals within the EMBA were for the Demersal Fishery, Spanish Mackerel Fishery, Offshore Net and Line Fishery, and Barramundi Fishery. In addition, fishing tour operators fished extensively within the EMBA.

Table 23 Northern Territory Fisheries Fishing Effort within the EMBA (2015-2020)

Fishery	Fishing Effort	Total Catch*
Demersal Fishery	5,314 hours	>3,569,409 kg
Spanish Mackerel Fishery	15,822 hours	>427,536 kg
Offshore Net and Line Fishery	3,784 hours	>772,806 kg
Barramundi Fishery	1,131 days	382,792 kg
Mud Crab Fishery	638 days	>11,406 kg
Coastal Line Fishery	573 hours	>8,222 kg
Fishing Tour Operators	58,918 hours over 86,263 days	N/A

Fishery	Fishing Effort	Total Catch*
Aquarium Fish	277 hours	Confidential
Small Pelagic Development Fishery	108 hours	Confidential
Special Permit	70 hours	Confidential
Timor Reef Fishery	15 hours	Confidential
Jigging Fishery	6 hours	Confidential
Pearl Oyster Fishery	0.6 hours	Confidential

* Where ">" is stated it means that some catch data was not available for a particular CAES block but fishing occurred in that block, meaning the total catch will be greater than that stated.

4.7.3.4 Indonesian Commercial Fisheries

As described within **Section 3.2**, the proposed Seismic Survey is to be undertaken in an area with a complex jurisdictional setting in which Australia exercises seabed jurisdiction including the exploration for petroleum, and Indonesia exercises water column jurisdiction including fishing rights within parts of the OA. As such, it is possible that Indonesian commercial fishing vessels may be encountered within a portion of the Acquisition Area.

Indonesian regulations require vessels that exceed 30 gross registered tonnage to utilise a Vessel Monitoring System. As part of a partnership with Global Fishing Watch reached in June 2017, the Republic of Indonesia delivers VMS data for all Indonesian flagged fishing vessels to be made available on Global Fishing Watch's website. An analysis of this data has been undertaken in respect of the proposed Seismic Survey (see **Figure 36**), identifying all Indonesian flagged fishing vessels in the region over the six-year period of 2016 to 2021 to align with the fishing information obtained from DPIRD (**Section 4.7.3.2**)[9].

As can be seen in **Figure 36**, fishing effort occurs within the northern portion of the Acquisition Area; however, this is comparatively light to other fishing effort to the west and northeast of the Operational Area. As part of Global Fishing Watch's data analysis, the apparent fishing effort is reported in variable sized cells, with those in **Figure 36** showing the apparent fishing effort in hours/31km^2. An analysis of this information shows that approximately 1,800 hours of apparent fishing effort occurred within the AA between 2016 and 2021. This fishing effort was spread relatively evenly during the year, with an increase during the spring months.

[9] Available at: https://globalfishingwatch.org/map

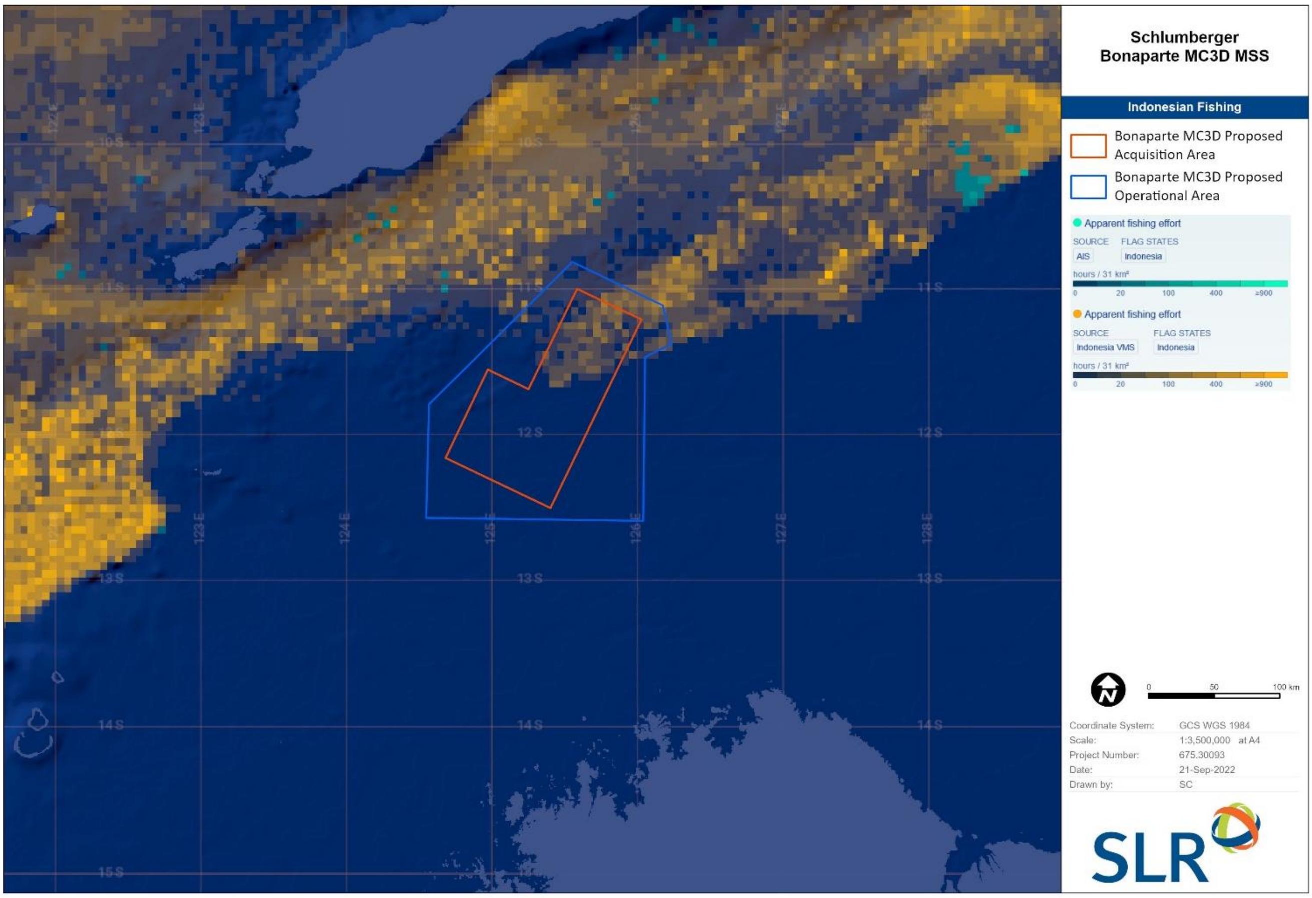


Figure 36 Indonesian Commercial Fishing Effort (2016 – 2021)

The VMS data delineates between vessel classes, with the primary use of the AA being by fishing vessels utilising four types of gear, that being:

- Basic longline
- Handline
- Handline tuna; and
- Purse seine (small pelagics).

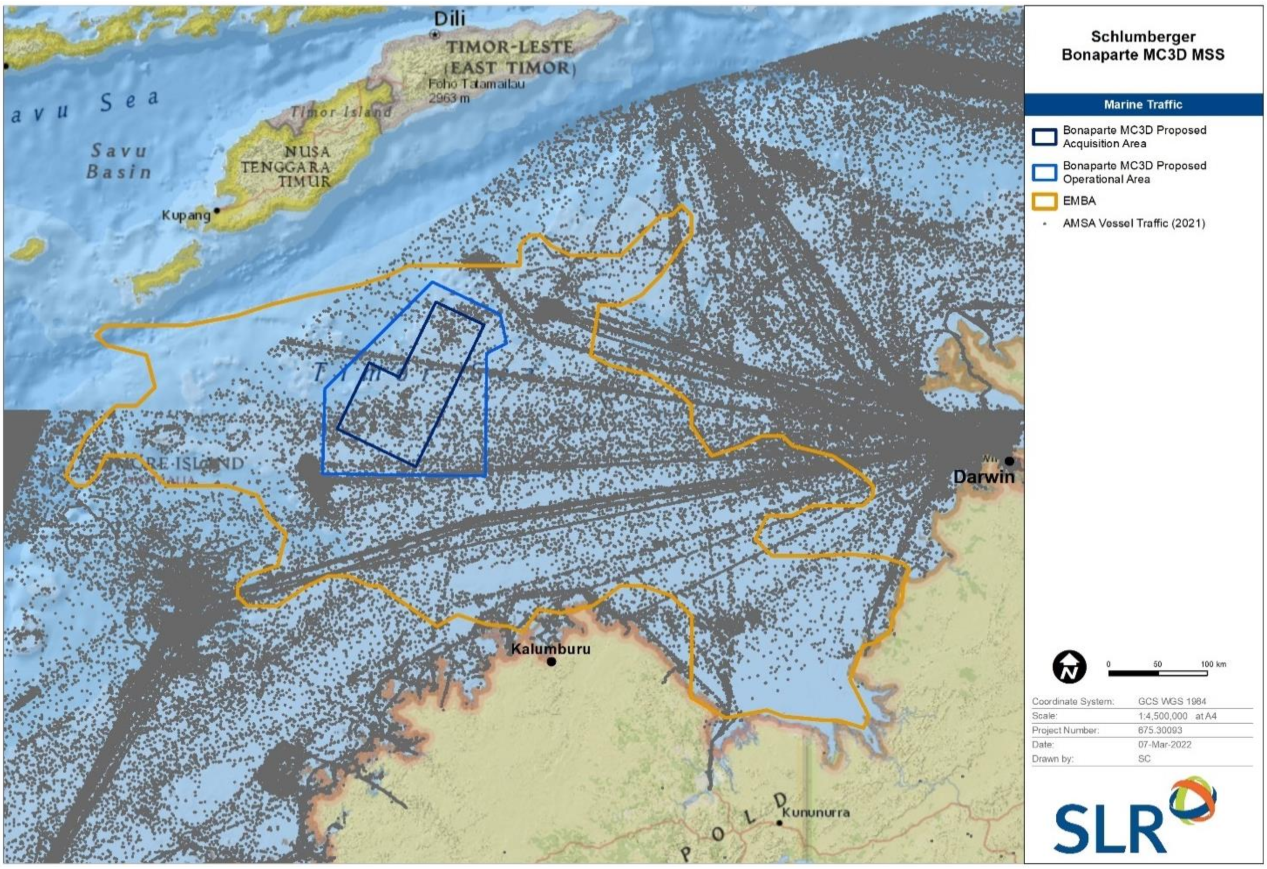
It should be noted that Indonesian fishing vessels that are less than 30 gross registered tonnage are not required to be equipped with VMS and may also operate in the area. In addition, the Arafura and Timor Seas are a recognised global hotspot for illegal, unreported and unregulated (IUU) fishing (Edyvane, 2017). While there has been significant progress in tackling IUU, the waters of Timor-Leste are still subject to IUU by large-scale, industrial foreign trawling operations (Edyvane, 2017).

4.7.4 Shipping

The North-west offshore region facilitates high shipping activity associated mining and oil and gas activities. The closest major port to the OA is Darwin Port, located over 650 km east of the OA. Kimberley Ports Authority operates two ports within the broader region, the Port of Derby to the southwest and the Port of Wyndham to the southeast. The Port of Wyndham is situated inland of the EMBA, on the West Arm of the Cambridge Gulf. Shipping activities within the region include:

- International bulk freighters/tankers, including mineral ore, hydrocarbons (LNG, liquefied petroleum gas, condensate) and salt carriers;
- General cargo ships;
- Domestic support/supply vessels servicing offshore facilitates;
- Construction vessels/barges/dredges;
- Offshore survey vessels; and
- Cruise ships

Vessel traffic in waters overlapping and in the vicinity of the OA between January 2021 and December 2021 is presented in **Figure 37** (AMSA, 2021). The data provides a conservative prediction of the likely traffic volumes that may be expected during the proposed Seismic Survey indicating the southern boundary of OA overlaps with high traffic shipping route.



Note: The above map only shows the vessel tracks from the vessels that have AIS onboard, vessels which don't have AIS will not be shown.

Figure 37 Marine Traffic Density in 2021

4.7.5 Oil and Gas Activities

4.7.5.1 Petroleum Titles and Production

The Bonaparte Basin is an established hydrocarbon province with a number of commercial operations identified within the OA and the EMBA. Petroleum titleholders with titles within the OA are listed in **Table 24** and shown in **Figure 38**.

Table 24 Offshore Petroleum Titles Details

Title Number	Title Type	Title Holder
AC/P66	Exploration Permit	INPEX Browse E&P Pty Limited
AC/RL12	Retention Lease	PTTEP Australasia (Ashmore Cartier) Pty Limited
AC/P61	Exploration Permit	Finder No 1 Pty Limited, Fugro Exploration Pty Limited
AC/P69	Exploration Permit	Neptune Energy Bonaparte Pty Limited, Santos Offshore Pty Limited, SapuraOMV Upstream (Western Australia) Pty Limited
AC/RL10	Retention Lease	Bengal Energy Limited, PTTEP Australia Timor Sea Pty Limited
AC/RL7	Retention Lease	PTTEP Australasia (Ashmore Cartier) Pty Limited
AC/RL4	Retention Lease	PTTEP Australia Timor Sea Pty Limited
AC/P63	Exploration Permit	Carnarvon Energy Limited
AC/P67	Exploration Permit	Neptune Energy Bonaparte Pty Limited, Santos Offshore Pty Limited, SapuraOMV Upstream (Western Australia) Pty Limited

In addition to those permits listed above, there are three production operations in close vicinity to the OA, those being the Montara Venture, Liberdade and the Northern Endeavour (**Figure 38**). These operations either utilise Floating Production, Storage and Offloading vessels, or transport the produced hydrocarbons in subsea pipelines to Darwin for processing onshore.

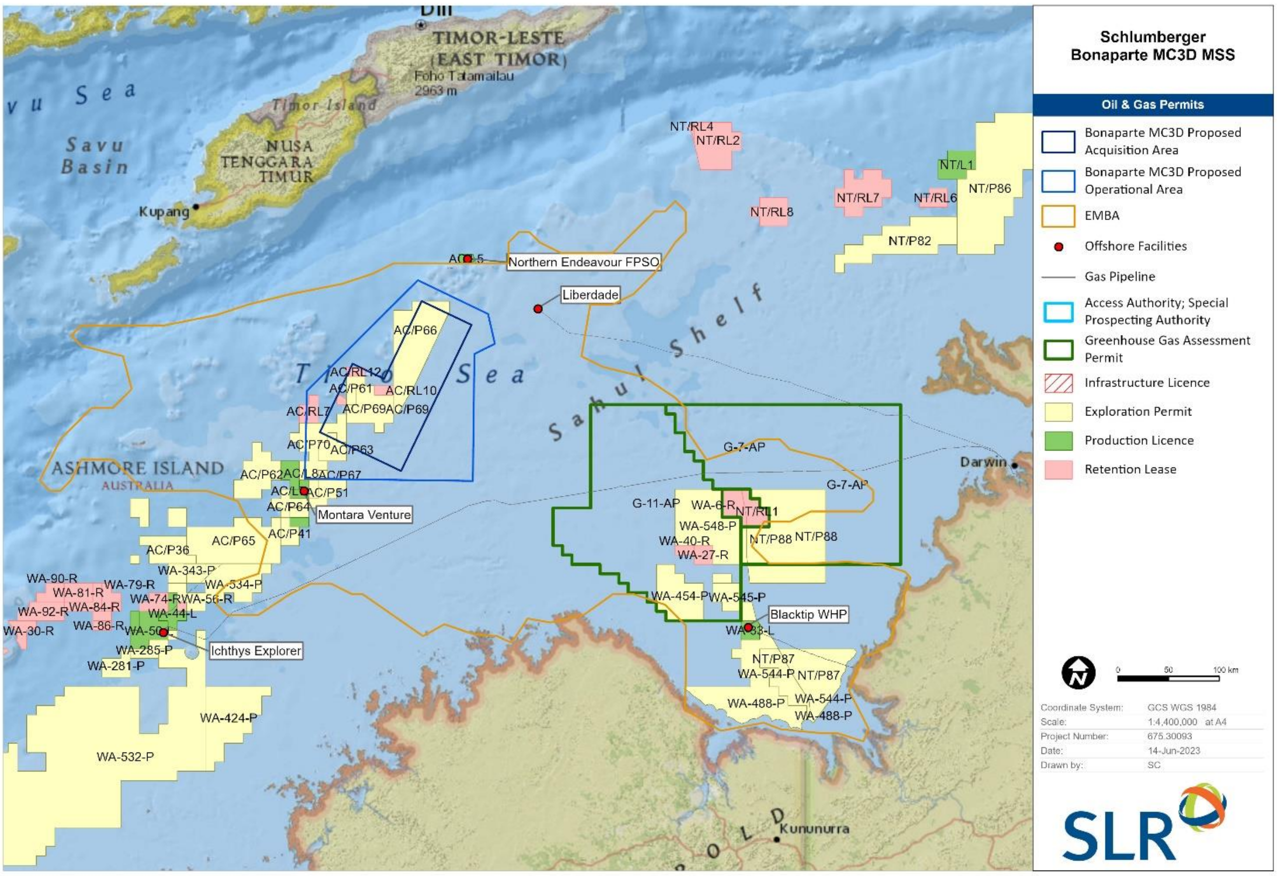


Figure 38 Offshore Petroleum Titles in the vicinity of the OA

4.7.5.2 Commercial Diving Operations for Petroleum Industries

Through consultation, relevant persons planning to undertake commercial diving operations were identified. Petrofac, who are decommissioning the Northern Endeavour FPSO located ~56 km north of the Acquisition Area, may be required to undertake commercial diving operations to the support their program.

4.7.6 Submarine Cables

The OA overlaps with two submarine cables, the North-West Cable System (**NWCS**) and a decommissioned submarine cable as seen in **Figure 39**.

The NWCS is a submarine fibre cable system designed to serve Australia's onshore and offshore resources industry and is part of Vocus Communications network (Vocus, 2023). The NWCS provides connectivity to the resources industry in Australia's northern and western regions, including offshore oil and gas facilities in the Browse, Bonaparte and Carnarvon Basins to onshore locations.

According to Seamap Australia, a decommissioned maritime cable also extends through the OA and AA, travelling from Darwin to Banyuwangi in Indonesia.

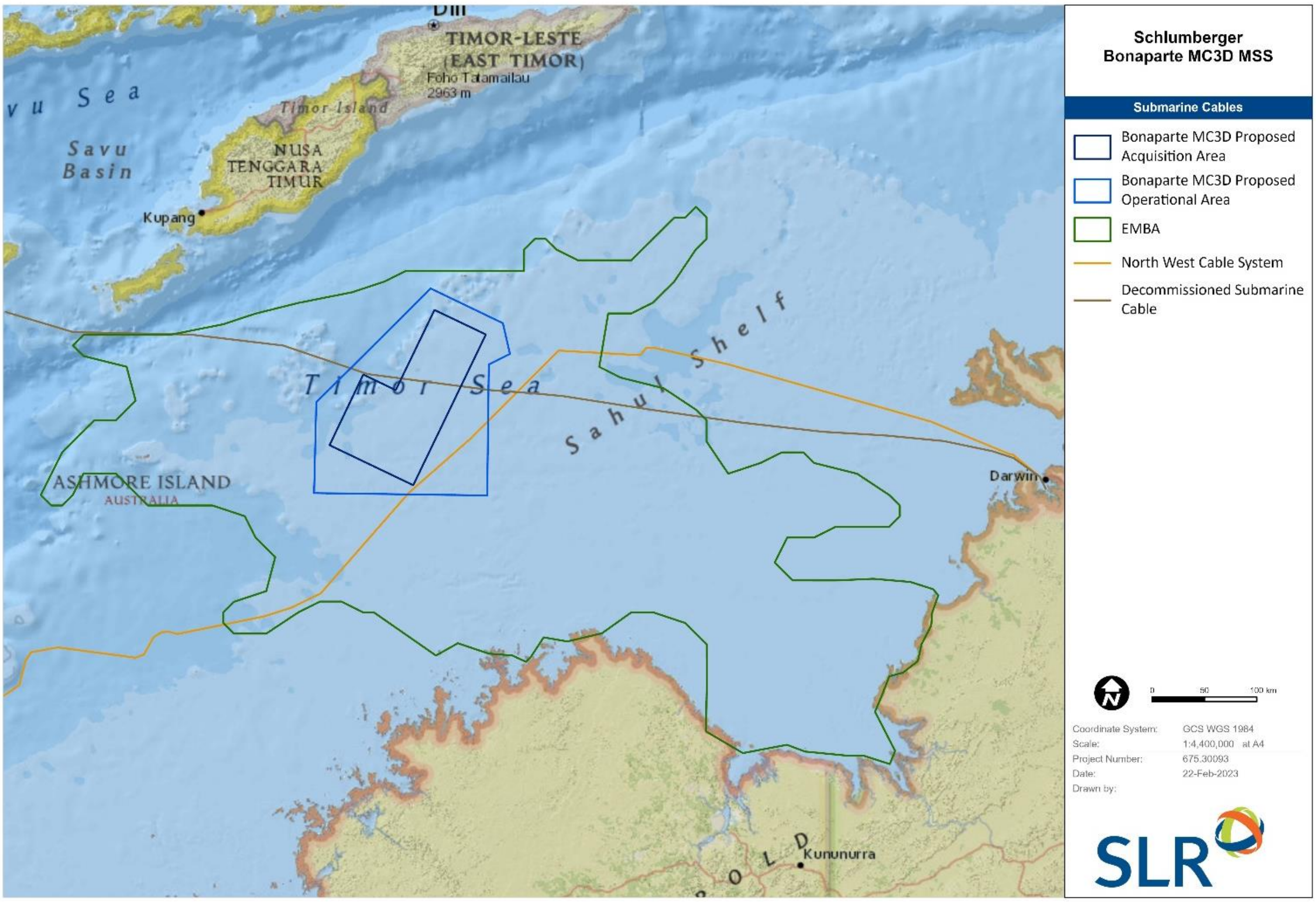


Figure 39 Submarine Cables in Vicinity of the OA and EMBA

4.7.7 Defence Activities

A search of the Department of Defence's unexploded ordinance register (**UXO**) map confirmed UXO are not known to occur within the OA (DoD, 2022). However, three offshore sites characterised as having potential to contain UXO were identified in proximity to the EMBA, with the closest site located 160 km west of Ashmore Reef (**Figure 40**). In each case, sites represent an area where Depth Charges were deployed in World War II including some which failed to function and release. Further detail is contained in Notice to Mariners NTM/12/Aus 315 and NTM/12/Aus 318.

The closest defence training area to the OA is the North Australian Exercise Area, approximately 215 km to the east of the OA and within the footprint of the EMBA (**Figure 40**). The North Australian Exercise Area is a maritime military zone administered by the Australian defence Force, as well as restricted airspace. The North Australian Exercise Area is used by the Royal Australian Air Force and the Roya Australian Navy for military operations including live weapons and missile firings.

A search of the Department of Defence website and WA Department of Transport Notice to Mariners did not identify any planned Defence activity within the OA or EMBA. However, a precautionary approach was adopted and the Department of Defence will be engaged and notified of the proposed Seismic Survey.

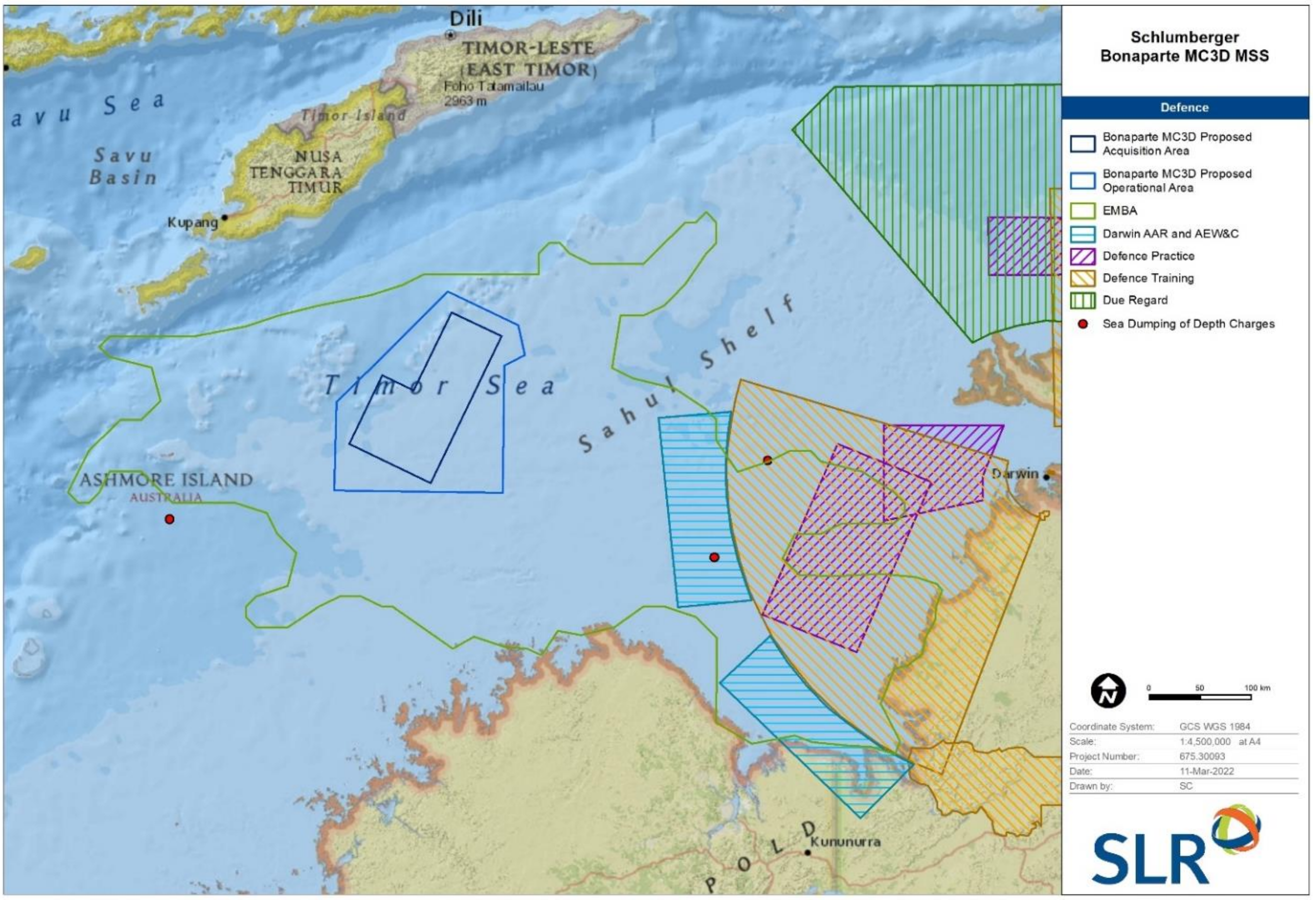


Figure 40 Defence Activities in the Vicinity of the OA and EMBA

4.8 Periods of Peak Sensitivity or Activity within the OA

A summary of distribution, activities and peak periods for significant species and other relevant activities that may occur annually within or close to the OA is provided in **Table 25** below.

Table 25 Timing of Key Activities Relevant to the OA and the Surrounding Area

Activity/Sensitivity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Source
Seismic Survey													
Planned timeframe													
Environmental Receptors and Activities													
Marine mammals													
Pygmy Blue Whale BIA (northern migration)													Thums *et al.*, 2021
Pygmy Blue Whale BIA (southern migration)													Thums *et al.*, 2021; McCauley, 2011
Fish/sharks													
Whale Shark BIA													Reynolds *et al.*, 2017; Sleeman *et al.*, 2010
Marine reptiles (closest site adopted for each species)													
Flatback turtle foraging BIA													Donovan *et al.*, 2008
Loggerhead turtle foraging BIA													Donovan *et al.*, 2008
Olive Ridley turtle foraging BIA													Donovan *et al.*, 2008
Green turtle nesting BIAs													Dethmers *et al.*, 2006; DEH, 2005
Hawksbill turtle nesting BIAs													DSEWPC, 2012; Limpus, 1995
Seabirds and migratory shorebirds (BIAs close to OA, and species that are likely to be present within OA)													
Greater Frigatebird, breeding, foraging BIA													DoEE, 2022
Lesser Frigatebird, breeding, foraging BIA													Birdlife, 2022
Lesser Crested Tern, breeding BIA													DSEWPC, 2012c
Greater Crested Tern, breeding													Chatto, 2001; DSEWPC, 2012c

Activity/Sensitivity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Source
Wedge-tailed shearwater, breeding BIA													DoEE, 2022
Streaked shearwater													DoEE, 2022; Marchant and Higgins 1990
Red-footed Booby, breeding, foraging BIA													DoEE, 2022; Clarke, 2010
White-tailed tropicbird, breeding													DoEE, 2022; Clarke, 2010
Wedge-tailed shearwater, breeding BIA													DoEE, 2022
Streaked shearwater													DoEE, 2022; Marchant and Higgins 1990
Red-footed Booby, breeding, foraging BIA													DoEE, 2022; Clarke, 2010
White-tailed tropicbird, breeding BIA													DoEE, 2022; Clarke, 2010
Commercial indicator species spawning/aggregation													
Spanish mackerel													Lewis, 2020
Goldband snapper													Newman *et al.*, 2008
Saddletail snapper													Newman *et al.*, 2008
Red emperor													Newman *et al.*, 2008
Banana prawns													AFMA, 2022
Brown tiger prawns													AFMA, 2022
Blue endeavour prawns													AFMA, 2022
Commercial fishing													
Northern demersal scalefish fishery													DPIRD, 2022
Marine traffic													
Commercial shipping													AMSA, 2021

Activity/Sensitivity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Source
Tourism – cruise vessels													Santos, 2021
Tourism – diving, snorkelling, wildlife watching													DNP, 2018a; WA DPIRD, 2021
Key	Distribution/activity occurs:												
	Peak period:												

5 Relevant Persons Consultation

Consultation with relevant persons is an integral component of the project development and planning phase of any potentially impacting activity, and SLB acknowledges that undertaking an effective consultation programme that extends for the duration of the EP is critical to the success of the Seismic Survey. SLB is aware of and understands the requirements regarding appropriate consultation, as defined under the Environment Regulations and has developed an inclusive and ongoing relevant persons consultation process that will extend beyond the completion of the Seismic Survey for the duration of the EP.

This section demonstrates that SLB has undertaken an extensive consultation programme in accordance with Regulation 10A(g) of the Environment Regulations and that the measures) SLB has adopted, or propose to adopt, because of the consultation process, are appropriate. SLB is also committed to the ongoing consultation throughout the acquisition of the Seismic Survey and will consult with relevant persons for the duration of the EP.

To assist with developing an effective consultation programme that informs, provides sufficient information and builds capacity in relevant persons, to the extent that they understand the potential risks and impacts associated with the proposed Seismic Survey on their functions, interests and activities, SLB has been guided by Division 2.2A of the Environment Regulations, NOPSEMA Guidance Document N-04750-GL2086 A900179 (Consultation in the course of preparing an environment plan, NOPSEMA 2023) (**the Guidance Document**), and the instructive reasons given by the Full Federal Court of Australia, in its appeal decision Santos NA Barossa Pty Ltd v Tipakalippa [2022] FCAFC 193 on 2 December 2022. In addition, the general principles for public participation regarded as underpinning good practice (IAP2, 2016), as well as the WA DMIRS Stakeholder and Community Engagement[10] frameworks have been consulted

5.1 Regulatory Requirements and Guidelines

In accordance with sub regulation 11A(2) of the Environment Regulations, SLB are required to consult with 'relevant persons' who may be affected by the Seismic Survey and provide sufficient information to allow the relevant person to make an informed assessment of the possible consequences that may arise from the proposed activities on the functions, interests or activities of the relevant person. In addition, SLB must provide a reasonable period of time to assess the activity being proposed (i.e. the Seismic Survey) and respond accordingly to raise any objections or claims they may have. Issues and concerns raised may relate to environmental, social, economic and other factors. It is expected that any such objections or claims raised are considered by SLB and, wherever practicable, incorporated into the management and control measures of the proposed Seismic Survey as a component of this EP. SLB will extend this further through ongoing consultation where any claims raised even during the acquisition of the Seismic Survey would be assessed and if any change to management or control measures is required, would be done so through the management of change process.

The parties considered as 'relevant persons' and who have been engaged with as part of the consultation programme are defined within **Section 5.3** and a full list of all persons consulted is provided in **Appendix E**. For the purpose of this EP, the definition of a relevant persons followed the direction and intent of the Guidance Document and relevant paragraphs cited by the Appeal Decision. This ensured that relevant persons were identified on the basis of their functions, interests and activities in relation to the Seismic Survey.

[10] https://www.dmp.wa.gov.au/Stakeholder-and-community-22456.aspx

In developing this EP and the corresponding relevant persons consultation, SLB has considered the requirements of the following:

Relevant case law:

- Tipakalippa v National Offshore Petroleum Safety and Environmental Management Authority (No 2) [2022] FCA 1121 (**the Primary Decision**); and
- Santos NA Barossa Pty Ltd v Tipakalippa [2022] FCAFC 193 (**the Appeal Decision**).

NOPSEMA:

- Guideline N-04750-GL2086 Consultation in the Course of Preparing an Environment Plan, May 2023;
- Guidance Note N-04750-GN1847 A662607 Responding to Public Comment on Environment Plans (July 2022);
- Guideline N-04750-GL1887 A705589 Consultation with Commonwealth agencies with responsibilities in the marine area (January 2023); and
- The publication produced by NOPSEMA titled "Requirements for Consultation and Public Comment on Petroleum Activities in Commonwealth Waters" 2018.

Australian Fisheries Management Authority:

- Petroleum industry consultation with the commercial fishing industry (https://www.afma.gov.au/sustainability-environment/petroleum-industry-consultation), accessed December 2021.

Commonwealth Department of Foreign Affairs and Trade:

- Engage with DFAT (https://www.dfat.gov.au/trade/engage-with-dfat), accessed December 2021.

Government of Western Australia, Department of Fisheries:

- Guidance statement for oil and gas industry consultation with the Department of Fisheries 2013.

Government of Western Australia, Department of Transport:

- Offshore Petroleum Industry Guidance Note, Marine Oil Pollution: Response and Consultation Arrangements 2020.

5.2 Relevant Persons Consultation Objectives

SLB has identified a set of key objectives for the relevant persons consultation programme. These objectives were developed with the intention to inform and build capacity in relevant persons, to the extent that they understand the potential risks and impacts associated with the proposed Seismic Survey on their specific functions, activities and interests, and to make available the opportunity to raise any concerns, objections or claims they may have. In addition, this consultation will ensure SLB understands the concerns the relevant persons may have and hear suggestions on how these concerns can be mitigated through appropriate controls in the EP. Finally, to ensure that wherever practicable concerns raised are incorporated into the management of the proposed Seismic Survey as a component of this EP.

The key objectives for the relevant persons consultation programme included:

- Undertake the consultation process in accordance with the key principles of effective consultation (Section 7 Guidance Document);

- Identify all relevant persons in accordance with the Guidance Document and the Appeal Decision;
- Initiate and ensure ongoing transparent, open and honest communication with all relevant persons;
- Provide relevant persons with sufficient information to allow them to make an informed assessment of the possible consequences of the activity on their functions, activities, values or sensitivities;
- Provide adequate opportunity (i.e. reasonable period) for relevant persons to consider and query the information and provide feedback;
- Provide a mechanism for assessing the merit of any objections or claims received;
- Where applicable, demonstrate where control measures have been incorporated as a result of relevant persons consultation feedback;
- Support ongoing relevant persons identification and consultation throughout the project; and
- Demonstrate to NOPSEMA that completed and ongoing consultation with relevant persons is consistent with the requirements of the Environmental Regulations.

5.3 Requirements for Identification of Relevant Persons

Regulation 11A of the Environment Regulations holds that the titleholder (in this case SLB) must consult each of the following (a 'relevant person'):

(a) 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;

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

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

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

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

On 21 September 2022, Justice Bromberg handed down his judgement in the Primary Decision . One of the issues covered in the judgement was how titleholders should identify the "universe of relevant persons" that may fall within section 11A(1) of the Environment Regulations. The process of identifying relevant person(s) is the first step in fulfilling the requirements of section 11A of the Environment Regulations.

As stated by Justice Bromberg in the Primary Decision, determining who falls within the description of (a), (b), (c) and (e) is a "relatively straightforward exercise" (para. 136 of the Primary Decision). However, the description of a relevant person in (d) can raise "substantial complexity" (para. 137 of the Primary Decision) as:

- The number of persons falling within the description may be very large and in numerous categories;
- The words "functions, interests or activities" must be construed with their intended meaning; and
- The nature and extent of any potential effect upon the "functions, interests or activities" or particular persons or the categories of particular persons may be difficult to assess.

Further to the above, the Appeal Decision (and subsequently the Guidance Document) provides guidance on the phrase "*functions, interests or activities*". Based on these two documents, the phrase "*functions, interests or activities*" should be constructed broadly as it best promotes the objects of the Environment Regulations, including that activities are carried out in a manner consistent with the principles of ESD. The phrase is a composite one, each part of which has work to do in identifying relevant persons. The meaning of each part of the phrase is defined in the Guidance Document as follows:

- Functions – refers to "a power or duty to do something" (para. 60 of the Appeal Decision);
- Interests – to be construed as conforming with the accepted concept of "interest" in other areas of public administrative law. Includes "*any interests possessed by an individual whether or not the interest amounts to a legal right or is a proprietary or financial interest or relates to reputation*" (para. 63 & 65 of the Appeal Decisions); and
- Activities – to be read broadly and is broader than the definition of 'activity' in regulation 4 of the Environment Regulations and is likely directed to what the relevant person is already doing (para. 51, 58 and 59 of the Appeal Decision).

A methodology has been developed to accurately and transparently determine the relevant person(s) associated with the Seismic Survey, including those whose functions, interests or activities as per (d) of 11A(1) above may be affected by the activities proposed. This methodology also includes an identification of those relevant person(s) that fall under (a), (b), (c) and (e) of 11A(1) above.

For the purpose of this EP, and in accordance with Section 6 of the Guidance Document, the process of identifying relevant persons under Section 11A(1)(d) has encompassed the concept of 'Decisional Choice' of which individuals/organisations may have functions, interests or activities in the activities proposed to be undertaken as part of this EP.

5.4 Method for Identification of Relevant Persons

In accordance with the Guidance Document, this section sets out the process by which relevant persons were identified and continue to be identified throughout the duration of the Seismic Survey. The process followed by SLB is outlined below:

1. Scope out the proposed activity to ensure it is properly understood by the titleholder;
2. Determine the potential impacts and risks associated with the activity;
3. Determine the extent of the EMBA by the activity;
4. Characterise the environment within the EMBA by developing a broad understanding of the values and sensitivities in the EMBA; and
5. Identify relevant persons by determining potential functions, interests or activities of persons or categories of persons that may intersect with the EMBA. As part of this process, each relevant person(s) will be assigned into consultation categories to enable appropriate consultation based on their potential functions, interests or activities within the EMBA.

Each of these five steps in SLBs methodology for identifying relevant persons are discussed in further detail in the following sections. This process ensures that relevant persons are identified not only in terms of the spatial boundary of the EMBA but were also identified in regard to their functions, interests or activities bound by the values and sensitivities of the EMBA.

The consultation undertaken with these relevant persons is outlined further in **Section 5.5**.

5.4.1 Scope the Activity

The first important step of any consultation methodology is to ensure that the proposed activity is properly understood by the titleholder, including the potential impacts and risks associated with that activity to enable identification of relevant person(s).

A detailed description of the proposed Seismic Survey is included within **Section 3**, and outlines the Seismic Survey location, the timing and duration of the Seismic Survey and the specifications of the Seismic Survey including source configuration, streamer configuration, sail lines and the project related vessels.

5.4.2 Determine the Impacts and Risks

A detailed discussion on the potential impacts and risks associated with the activity is included within **Section 6.1** of this EP, which resulted in the identification of the following activities which may result in impacts or risks to the functions, interests or activities of potentially relevant person(s):

- Planned activities:
    - Physical presence of the Seismic Vessel and towed equipment (**Section 7.1**);
    - Acoustic disturbance to the marine environment (**Section 7.2**);
    - Routine permissible waste discharges (**Section 7.3**);
    - Atmospheric emissions (**Section 7.4**); and
    - Artificial light emissions (**Section 7.5**).
- Unplanned activities:
    - Establishment of invasive marine species (**Section 8.1**);
    - Streamer loss (**Section 8.2**);
    - Vessel collision or sinking, and any potential fuel spill from ruptured fuel tanks, if any (**Section 8.3**);
    - Hydrocarbon spill response (**Section 8.4**); and
    - Accidental release of hazardous and non-hazardous materials (**Section 8.5**).

5.4.3 Determine the Extent of the EMBA

To identify potentially relevant person(s), the EMBA needs to be considered in order to determine the potential exposure to impacts for those relevant person(s). As discussed within **Section 4.1**, most activities (either planned or unplanned) associated with the Seismic Survey may affect the environment up to a few kilometres from the source location which is constantly moving through the AA. A significant unplanned event, such as a vessel fuel oil spill, has the potential to impact the existing environment over a substantially larger area than that affected by planned activities, and minor unplanned events. Therefore, an EMBA was derived using stochastic fuel oil dispersion and fate modelling. This modelling simulated the occurrence of 100 realistic spill events of 1,000 m^3 of MGO from three locations within the OA, randomly distributed over the previous decade. An output of this modelling was the maximum extent at which various environmental thresholds were reached, including for floating, entrained, dissolved and shoreline accumulations of hydrocarbons.

The extent of the EMBA was based on a combination of the maximum extent of the fuel oil spill trajectory at which entrained hydrocarbons were above the low threshold from each of the three modelled release locations. Utilising the maximum extent from all three spill locations results in a worst-case scenario for the spatial extent of impacts from the Seismic Survey

5.4.4 Characterise the Environment within the EMBA

The EMBA is an important tool to assist SLB with determining the extent to which the values and sensitivities need to be considered in relation to the Seismic Survey. Once the environment within this EMBA has been characterised, it is then possible to determine the person(s) which fall within (a) to (e), listed in **Section 5.4.1** above, that may be impacted.

Section 4 provides a detailed characterisation of the values and sensitivities of the environment within the EMBA, including details on the physical environment, marine protected areas and sensitive areas, the biological environment, cultural and heritage values, and the socio-economic environment. The values and sensitivities associated with the EMBA have been guided by various databases and search tools, including the Protected Matters Search Tool from the DoCCEEW, the National Native Title Register search tool, the Australasian Underwater Cultural Heritage database, the National Electronic Approvals Tracking System and commercial fisheries data using the CAES blocks. From this guidance, further details on specific values and sensitivities have been established from published literature, bioregional planning documents, EPBC Act Conservation Management Plans, Recovery Plans and Conservation Advice, organisation strategic plans and annual reports, along with details provided by relevant persons where provided. Utilising this detailed information, it is then possible to accurately determine the functions, interests or activities that relevant persons may have with any aspect of the existing environment.

5.4.5 Identification and Categorisation of Relevant Persons for Informing Consultation Effort

As stated in Section 7 of the Guidance Document, the consultation process should be appropriate for the category of relevant person, and the type of function, interest or activity; where interests are held communally, the method of consultation will need reasonably to reflect the characteristics of the interests affected by the proposed activity.

The identification of relevant person(s) is a key step in the preparation of an EP due to the requirement of regulation 11A in that a titleholder must consult with each relevant person. Regulation 11A(2) and (3) requires the titleholder to 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 and allow the relevant person a reasonable period for the consultation.

It is considered that not all relevant persons require the same amount of information or period for consultation based on the various different functions, interests or activities of the relevant person and the manner in which they may be impacted by the Seismic Survey. As such, a tiered system has been developed as outlined in **Section 5.4.5.1** as a starting point for consulting with relevant persons. Where relevant persons identified the need for additional information or additional time to adequately assess the potential impacts from the Seismic Survey on their functions, interests or activities then this was worked through with them on a case-by-case basis to ensure a bespoke consultation process was followed were required.

5.4.5.1 Consultation Categories

As outlined above, relevant persons have different functions, interests or activities associated with the EMBA and as such, warrant different levels of effort of consultation. To enable this to occur in a structured, concise and transparent manner, three categories (A, B, C) of relevant persons have been developed to use as an initial tool to guide the appropriate type of consultation to be undertaken, the amount of sufficient information to be presented and determination of sufficient timeframes to respond (**Section 5.4.5**).

A consultation categorisation matrix (**Table 26**) sets out this initial approach to categorise each relevant person on the basis of the following two elements:

1. Area of function, interest or activity — the area across which the relevant persons functions, interests or activities overlap with sensitivities in the EMBA or OA, noting that the OA and EMBA areas are defined terms in this EP; and
2. Influence – is the level of influence of the relevant person (high, medium, low) which is determined by their functions, interests, or activities. Examples of the three levels of influence are as follows:
    - A relevant person with a 'high' influence would be governmental agencies that have legislated mandates to manage particular environmental receptors (e.g. AMPs) or traditional owners that have registered native title that could be impacted by the proposed activities;
    - A relevant person with a 'medium' influence would be one that operates commercially in the project area (e.g. commercial fishers) and could be impacted by the proposed activities; and
    - A relevant person with a 'low' influence would be private users of the area (e.g. recreational users) or those associated with general special interest groups.

In accordance with the Guidance Document, the methodology here has considered various published guidance related to good practice consultation. The term 'influence' is an example of terminology commonly applied across a range of good practice consultation methods. SLB fully recognise that the term 'influence' is not a regulatory term associated with the Environment Regulations, but the use of this terminology is based on a common methodology of categorising participants in communications with stakeholders (i.e. relevant persons in this case).

An example of the use of this terminology in the Australian governmental context can be seen in the Stakeholder Identification Tool developed by the WA Department of Mines, Industry Regulation and Safety which specifically applies interest versus influence to rank stakeholders.

It is also noted here that where a relevant person has specifically requested bespoke consultation requirements, SLB have fully accommodated those requirements. Thus, where a relevant person has been initially assessed as requiring a Category B or C level of consultation, if that relevant person has indicated they require a Category A level of consultation, this is accommodated into the consultation framework as required.

Table 26 Relevant Person Categorisation Matrix

		Area of Function, Interest or Activity	
		OA	EMBA
Influence	High	Category A	Category A
	Medium	Category A	Category B
	Low	Category A	Category C

5.4.5.2 Relevant Person Identification

5.4.5.2.1 Relevant Person Identification under Regulation 11A(1)(a), (b), (c) and (e)

As stated by Justice Bromberg in the Primary Decision, determining who falls within the description of regulation 11A(1)(a), (b), (c) and (e) is a relatively straightforward exercise. Due to the prescribed nature of the requirements of regulation 11A(1)(a), (b), (c) and (e) the methods for identifying relevant persons under these parts relies on industry and expert knowledge and experience (including previous work history) and the use of other EPs associated with seismic surveys which have similar risks and impacts as the proposed Seismic Survey. In addition to this, searches of publicly available information, including, but not limited to, government databases and registers, web searches for background information on functions, interests or activities were conducted.

Based on the above, SLB have utilised previous operational experience in Australia and expert knowledge of the impacts and risks of the Seismic Survey, along with assessing recently approved EPs for seismic surveys to identify a list of relevant persons under regulation 11A(1)(a), (b), (c) and (e). **Table 27** provides an outline of those person(s) who are considered relevant under (a), (b), (c) and (e) along with a justification as to why they are considered relevant under the Environment Regulations.

Table 27 Regulation 11A(1)(a), (b), (c) and (e) Relevant Person Identification

Relevant Person	Justification
Regulation 11A(1)(a): 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	
Australian Communications and Media Authority (ACMA)	The ACMA is the statutory body responsible for regulating communications and media services in Australia, including the submarine cable regime. A previously consulted relevant person suggested ACMA as a relevant person for the proposed survey, as there may be submarine cable systems managed by ACMA in the vicinity of the Seismic Survey.
Australian Fisheries Management Authority.	The Australian Fisheries Management Authority are responsible for the efficient management and sustainable use of Commonwealth fish resources. As the Seismic Survey has the potential to impact Commonwealth managed fisheries, the Australian Fisheries Management Authority is considered relevant, including those specific fisheries that operate in the North West Shelf. Specific details of managed fisheries (including specific representatives of Northern Prawn Fishery, North West Slope Trawl Fishery, Western Tuna and Billfish Fishery and Southern Bluefin Tuna) under Australian Fisheries Management Authority is included within the assessment under 11A(1)(d), contained within **Table 28**.
Australian Hydrographic Office	The Australian Hydrographic Office is responsible for the publication and distribution of nautical products and other information required for the safety of ships navigating in Australian waters. The Seismic Survey will pose a potential risk to the safety of other ships navigating in the area, therefore the Australian Hydrographic Office is considered to be a relevant person. In addition, the Seismic Survey is required to be notified to the Australian Hydrographic Office by SLB a minimum of three weeks prior to the commencement of activities.
Australian Institute of Marine Science	The Australian Institute of Marine Science provides the research and knowledge of Australia's tropical marine estate required to support growth in its sustainable use, effective environmental management, and protection of its unique ecosystems. It is considered that the Australian Institute of Marine Science is a relevant person due to the interest in the marine environment in northern Australian waters which potentially intersects with the Seismic Survey.
Australian Maritime Safety Authority	The Australian Maritime Safety Authority is Australia's national regulatory body promoting the safety and protection of the marine environment and combating ship-sourced pollution and provides for the infrastructure and safety of navigation in Australian waters. Based on this, it is considered Australian Maritime Safety Authority is a relevant person under regulation 11A(1)(a).
Department of Climate Change, Energy, the Environment and Water	The DoCCEEW protects Australia's natural environment and heritage sites, helps respond to climate change and carefully manages water and energy resources. The DoCCEEW is considered a relevant person due to the overarching directive in managing the natural environment and due to the potential impacts and risks associated with the Seismic Survey. It is worth noting that the DoCCEEW was, up until 30 June 2022, the Department of Agriculture, Water and the Environment with which SLB also consulted (see **Appendix I**).

Relevant Person	Justification
Department of Agriculture, Fisheries and Forestry (**DAFF**)	The DAFF operates across a range of regulations across agriculture, forestry, and fisheries. Relevant to this EP, the DAFF enforces laws related to biosecurity controls of pest and disease risks of vessels arriving in Australia and as such are considered a relevant person. It is worth noting that the DAFF was, up until 30 June 2022, the Department of Agriculture, Water and the Environment with which SLB also consulted (see **Appendix I**).
Department of Defence	The Department of Defence manages Royal Australian Navy training activities at sea. Their Maritime Activities Environmental Management Plan recognises that some key training areas are locations where a number of differing activities may be conducted simultaneously. Peacetime activities include maritime surveillance and response within Australia's offshore maritime zones, hydrographic, oceanographic and meteorological support operations. These maritime activities relate directly to the proposed Seismic Survey, and as such as considered a relevant person.
Department of Foreign Affairs and Trade	The Department of Foreign Affairs and Trade (**DFAT**) promotes and protects Australia's international interests. Due to the complex jurisdictional boundaries within the OA the DFAT were considered to be relevant persons.
Department of Infrastructure, Transport, Regional Development, Communications and the Arts	One aspect of the Department of Infrastructure, Transport, Regional Development, Communications and the Arts relates to supporting an efficient, safe and environmentally friendly maritime transport system, including an effective regulatory framework for shipping and environmental and safety regulations. Based on this, and the fact that the Seismic Survey may impact maritime transport due to the physical presence of the vessels, the Department of Infrastructure, Transport, Regional Development, Communications and the Arts are considered a relevant person.
GeoScience Australia	GeoScience Australia is Australia's pre-eminent public sector geoscience organisation and are involved in describing and understanding the earth for Australia's benefit. Due to this, and the fundamental idea behind a Seismic Survey (i.e. to identify accumulations of hydrocarbons) it is considered that GeoScience Australia will have an interest in the Seismic Survey.
National Offshore Petroleum Titles Administrator (**NOPTA**)	NOPTA administers titles and data management for petroleum and greenhouse gas titles in Australian Commonwealth waters in support of the effective regulation and management of offshore petroleum resources consistent with good oil field practice and optimum recovery. Seismic surveys are an integral aspect of developing Australia's offshore petroleum resources. Due to their administrative role in offshore petroleum resources, NOPTA is considered a relevant person, and as such has been consulted with. In addition, notification requirements to NOPTA are provided in **Section 10.6.1**.
Parks Australia The Director of National Parks (**DNP**)	Parks Australia and the DNP are responsible for the six national parks, 60 marine parks and the Australian National Botanic Gardens. The EMBA associated with the Seismic Survey intersects with AMPs, and as such the requirements for managing potential risks and impacts on those AMPs from the Seismic Survey results in Parks Australia and the DNP being considered relevant persons.

Relevant Person	Justification
Regulation 11A(1)(b): Each Department or agency of a State or the Northern Territory to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant	
NT Department of Infrastructure, Planning and Logistics	NOPSEMA recommended the Northern Territory Department of Transport as a relevant person for the Seismic Survey as they may have functions, interests or activities (e.g. marine transport and safety) within the OA and/or EMBA that may be impacted by the proposed operations. The Northern Territory Department of Transport merged with several departments in 2016 to form the Department of Infrastructure, Planning and Logistics, and based on the recommendations of NOPSEMA, the Department of Infrastructure, Planning and Logistics is considered to be a relevant person.
NT Department of Industry, Tourism and Trade	The Northern Territory Department of Industry, Tourism and Trade is the coordinating agency for economic and industry development. A primary responsibility of the Northern Territory Department of Industry, Tourism and Trade is to manage the sustainable use of aquatic resources in the Northern Territory. Due to the potential overlap with the EMBA from an unplanned activity, and the associated risks and impacts on the aquatic resources in NT State Waters, it is considered that the Northern Territory Department of Industry, Tourism and Trade are a relevant person.
WA Department of Biodiversity, Conservation and Attractions	The Department of Biodiversity, Conservation and Attractions is responsible for protecting the natural and cultural values of Western Australia. In terms of the Seismic Survey, the state marine parks that intersect with the EMBA result in Department of Biodiversity, Conservation and Attractions being considered a relevant person.
WA Department of Primary Industries and Regional Development	The Department of Primary Industries and Regional Development works to develop and protect Western Australia's agriculture and food section and aquatic resources. Due to the potential overlap with impacts and risks on the aquatic resources in state waters based on the EMBA, it is considered that Department of Primary Industries and Regional Development are a relevant person.
WA Department of Primary Industries and Regional Development - Fisheries	A primary responsibility of the Department of Primary Industries and Regional Development (Fisheries) is to conserve, sustainably develop and share the use of Western Australia's aquatic resources and their ecosystems for the benefit of present and future generations. Due to the potential impacts and risks on commercial fishing interests (i.e. from an unplanned activity) it is considered that the Western Australia Department of Primary Industries and Regional Development – Fisheries is a relevant person.
WA Department of Mines, Industry Regulation and Safety	The WA Department of Mines, Industry Regulation and Safety supports the safe, fair and responsible future for the Western Australian community, industry, energy and resources sector. Due to this, and the fundamental idea behind a Seismic Survey (i.e. to identify accumulations of hydrocarbons) it is considered that WA Department of Mines, Industry Regulation and Safety will have an interest in the Seismic Survey.
WA Department of Parks and Wildlife	The WA Department of Parks and Wildlife service delivers on ground operations in relation to conservation and ecosystem management, parks and visitor services and regional and fire management services. As the WA Department of Parks and Wildlife oversees and participates in programs in relation to ecosystem management, and the overlap of the EMBA with state waters, it is considered that WA Department of Parks and Wildlife are a relevant person.

Relevant Person	Justification
WA Department of Transport	The WA Department of Transport integrates and enhances coordination of the State's transport operations, including in relation to boating facility management and marine safety regulation and education. As the Seismic Survey introduces a potential impact in the form of the physical presence of the vessels on maritime transport, it is considered that the WA Department of Transport is a relevant person.
WA Marine Science Institution	Government consortium of state, government and academic organisations working collaboratively for promotion of science research. Based on the potential impacts and risks on the marine environment from the Seismic Survey, it is considered that the WA Marine Science Institution is a relevant person.
Kimberly Port Authority	The Port Authorities Act 1999 (WA) outlines a number of roles and responsibilities of the Kimberley Port Authority, which includes to be responsible for the safe and efficient operation of the port and to protect the environment in which the port operates. Due to potential overlaps between the Seismic Survey and the operations of the Ports in Western Australia (such as through provisioning of the Seismic Vessel or through potential interactions between the vessels and those using the Ports) it is considered that the Kimberly Port Authority is a relevant person.
Shire of Wyndham-East Kimberley	The Shire of Wyndham East Kimberley is one of the four local government areas in the Kimberley region of northern Western Australia. The Shire covers an area of 121,000 square kilometres and is one of four local governments that make up the Kimberley region. The Shire includes the towns of Kununurra and Wyndham and there are also a number of Aboriginal Communities; the largest being Kalumburu, which is situated in the northern part of the Shire.
Victoria Daly Regional Council	The Victoria Daly Regional Council is a local government area in the Northern Territory of Australia. The shire covers an area of 153,287 square kilometres and had a population of 3,138 in June 2018. The Council aims toward ensuring all communities are strong, safe and healthy; abundant with respect for culture and heritage. The Council aspires to provide good governance, leadership and advocacy and work towards building a strong regional economy by promoting local employment and high-quality services within financial resources. The Council is also striving towards maintaining and developing Council assets, natural resources and country.
West Daly Regional Council	The West Daly Regional Council is a local government area of the Northern Territory, Australia. The shire covers an area of 14,070 square kilometres and had a population of 3,649 in June 2018, with over 90% identifying as Aboriginal.
Regulation 11A(1)(c): The Department of the responsible State Minister, or the responsible Northern Territory Minister	
Not applicable as the Seismic Survey is not within State waters.	
Regulation 11A(1)(e): Any other person or organisation that the titleholder considers relevant	
Indonesian Government (and associated agencies)	As outlined in **Section 3.2** the OA is located in a complex jurisdictional area with the southern half of the OA is located within the Australian EEZ and the northern half is located within the Indonesian EEZ. Due to this, the Indonesian Government has been considered a relevant person.
Ministry of Agriculture and Fisheries of Timor Leste	The Ministry of Agriculture and Fisheries of Timor Leste was recommended by Australian regulators as a focal point for trying to identify and provide information to Indonesian fishers.

Relevant Person	Justification
Indonesian Ministry for Marine Affairs and Fisheries (Directorate of Surveillance of Marine and Fisheries Resources)	Consultation with DFAT has identified the Indonesian Ministry for Marine Affairs and Fisheries (in particular the Directorate of Surveillance of Marine and Fisheries Resources) as a potentially relevant person in relation to the fisheries that may occur within the MoU Box that overlaps slightly with the EMBA.
Indonesian Ministry for Maritime Affairs and Investment (Directorate of Border Delimitation)	Consultation with DFAT has identified the Indonesian Ministry for Maritime Affairs and Investment (in particular the Directorate of Border Delimitation) as a potentially relevant person in relation to the fisheries that may occur within the OA.

Since the above persons are governmental entities with high influence that have interests in both the OA and the EMBA, they are considered Category A relevant persons based on the matrix in **Table 26**.

5.4.5.2.2 Relevant Person Identification under Regulation 11A(1)(d)

As stated by Justice Bromberg in the Primary Decision, the description of a relevant person given by (d) can raise substantial complexity. To address this complexity, this identification process has relied on the comprehensive identification of values and sensitivities within the EMBA (Section 4) and conducting an evaluation to discover possible intersections with the functions, interests and activities of people or organisations. In accordance with Section 6 of the Guidance Document, SLB has used a range of "*processes for identification of relevant persons*" that provides for "*sufficiently broad capture of ascertainable persons and organisations who may have their functions, interests or activities affected or that may be affected by the activity*".

SLB adopted the following processes when identifying relevant persons, which are consistent with the expectations set out in the Guidance Document. These are considered appropriate for the purpose of identifying the universe of relevant persons whose functions, interests or activities are associated with the environmental values and sensitivities in the EMBA:

- Publication in appropriate media formats to facilitate the process of self-identification of relevant person(s) (discussed further below);
- Searches of publicly available information, including, but not limited to, government databases and registers, web searches for background information on functions, interests or activities;
- Industry and expert knowledge and experience (including previous work history, professional networks);
- The use of other EPs associated with seismic surveys which have similar risks and impacts as the proposed Seismic Survey; and
- Utilisation of advice from relevant persons who may know of other persons or organisations that may be considered relevant, including through discussions with organisations representing traditional owner groups and workshops with nearby traditional owner groups.

After developing a comprehensive list of relevant persons using the above processes, the categorisation of these relevant person(s) (as detailed in **Section 5.4.5.1**) was undertaken to ascertain the starting point of consultation requirements.

As outlined above, the consultation programme has provided for self-identification of relevant person(s) through public notification processes. The primary method for this was via the publication of the EP on NOPSEMA's website, SLB's website, national, state-wide and regional newspapers (see **Section 5.6** for further details).

Following the self-identification of a relevant person through this publication process, SLB undertook an assessment using the information provided by the potentially relevant person of their functions, interests and activities, and assessed how those may or may not be associated with the OA or EMBA. If this assessment showed that this person(s) was considered relevant for the purpose of this EP, then consultation was conducted with them at their earliest convenience to ascertain the potential impacts and/or risks to their function, interest or activity, and the development of control measures to address these concerns.

An example of such a process occurring is in relation to Petrofac (listed in **Table 28**). Despite their main functions, activities and interests occurring outside the spatially defined EMBA, they have self-identified and been assessed as a relevant person for the purpose of this EP. Thus, consultation will continue with Petrofac throughout the duration of the Seismic Survey to meet their specific requirements as a relevant person.

Following the matrix in **Table 26**, and applying the descriptions detailed in **Section 5.4.5.1**, **Table 28** lists the relevant persons described by regulation 11A(1)(d). The 'Justification' column of **Table 28** provides details on the functions, interests or activities of the relevant person in either the OA or EMBA, and details on what SLB consider to be their level of influence in order to categorise each of the relevant persons for the purpose of specifying the consultation efforts. The methods used to identify these relevant persons are listed above, and to avoid unnecessary duplication the methods used for each relevant person is not included in **Table 28**. A full report on the consultation undertaken with the relevant persons is included within **Appendix I**, as per the requirements of Regulation 16(b).

5.4.5.2.2.1 Approach to Identifying Commercial Fishers

The commercial fishing industry are the primary relevant persons with a commercial interest in the maintenance of access to and the condition of the marine environment (e.g., conservation of aquatic resources) within the EMBA. There are multiple licence holders that undertake fishing activities within the OA and who have the potential to be directly impacted by the proposed Seismic Survey. Licence holders that undertake fishing activity within the EMBA have the potential to be impacted in the unlikely event of a fuel spill.

The approach to identifying relevant persons within the commercial fishing industry sector who may be potentially impacted by the proposed Seismic Survey, and specific application of methods outlined within **Section 5.4.5.2.1** and **Section 5.4.5.2.2**, is as follows:

- Publication in National, State and Territory and regional newspapers to facilitate the process of self-identification of relevant person(s) within the commercial fishing industry;
- To characterise the environment within the EMBA, undertake a detailed assessment of fisheries boundaries and fishing activity intercepting the OA and EMBA, using data extracted from FishCube within ABARES[11], DPIRD[12], NT DITT[13] and Global Fishing Watch[14], as detailed within **Sections 4.7.3.1** to **4.7.3.4**;
- Consult Commonwealth, State and Territory departments who coordinate the authorisation of commercial fisheries licenses, fisheries management and surveillance/enforcement programs within the Australian Fishing Zone and State Coastal Waters, as described in **Section 5.4.5.2.1**;

[11] Denotes data source used to assess fishing activity within Commonwealth Fisheries
[12] Denotes data source used to assess fishing activity within WA State Managed Fisheries
[13] Denotes data source used to assess fishing activity within NT State Managed Fisheries
[14] Denotes data source used to assess fishing activity by International Flagged Vessels

- Provide an Information Pack to peak industry associations and representative bodies (peak representative bodies) determined to represent Commonwealth Fisheries, as determined by AFMA. Requested feedback and provide the opportunity to raise any concerns in relation to the proposed Seismic Survey. Further, provided the opportunity to receive 48 hour look aheads. Attempted to ascertain the nature of peak representative bodies delegations to consult with SLB on behalf of their members, as required;
- Provide an Information Pack with key information that was requested such as the coordinates of the Operational Area in WGS84 latitude and longitude within an excel spreadsheet along with results from fishery assessments to peak representative bodies determined to represent State and Territory Fisheries, as determined in published in *Supporting cooperative coexistence of seismic surveys and commercial fisheries in Australia's Commonwealth Marine Area Guidance Framework* (Commonwealth of Australia 2022). Requested feedback and provide the opportunity to raise any concerns in relation to the proposed Seismic Survey. Further, provided the opportunity to receive 48 hour look aheads. Attempted to ascertain the nature of peak representative bodies delegations to consult with SLB on behalf of their members, as required;
- Provide an Information Pack with key information that was requested such as the coordinates of the Operational Area in WGS84 latitude and longitude within an excel spreadsheet along with results from fishery assessments directly to commercial fisheries license holders who undertake or may have entitlements to undertake fishing within the EMBA, as directed by the Commonwealth, State and Territory industry departments or the peak representative body, or in lieu of a suitably placed peak representative body known to the titleholder. Requested feedback and provide the opportunity to raise any concerns in relation to the proposed Seismic Survey. Further, provided the opportunity to receive 48 hour look aheads;
- Utilise advice from relevant persons, contact as described above, who may know of other relevant persons or organisations that may be considered relevant as described in **Section 5.4.5.2.2**;
- Use of other EPs associated with seismic surveys which have similar risks and impacts as the proposed Seismic Survey, as they relate to the commercial fishing industry.

5.4.5.2.2.2 Approach to Identifying Traditional Owners

The approach to identifying **traditional owners that may be relevant persons** potentially impacted by the proposed Seismic Survey, and specific application of methods outlined within **Section 5.4.5.2.1** and **Section 5.4.5.2.2**, is as follows**:**

- Publication in National, State and Territory and regional newspapers to facilitate the process of self-identification of traditional owners that may be relevant person(s);
- Undertook an assessment of Aboriginal cultural values, Aboriginal heritage and Native Title which may exist within the OA and EMBA through searches of publicly available Government databases and registers and web searches, to characterise the environment within the EMBA as detailed within **Section 4.6.1**;
- Undertook searches of publicly available Government databases and registers and web searches to identify relevant Aboriginal Land Council's, Traditional Owner Groups and Native Title holders whose functions, interests and activities within the EMBA may be affected by the planned and unplanned activities and which may not be formerly documented;
- Consult Regional Councils who represent local government areas and their constituents, many of which identify as Aboriginal, as described in **Section 5.4.5.2.1**;

- Provided an Information Pack to Land Councils determined to be relevant via a search of publicly available resources. Requested feedback and provided the opportunity to raise any concerns in relation to the proposed Seismic Survey. Asked whether they were aware of any additional relevant persons that may be of relevance and which SLB may consult with. Requested specific contacts and details of any other relevant persons that SLB were recommended to consult with, or where suitable, requested that they pass SLBs contact details on to any relevant persons they consider should have further information on the proposed Seismic Survey;
- Following consultation with relevant Land Councils, provided an Information Pack to Traditional Owner Groups. Requested feedback and provided the opportunity to raise any concerns in relation to the proposed Seismic Survey. Asked whether they were aware of any additional relevant persons that may be of relevance and which SLB may consult with. Where most suitable, requested that they pass SLBs contact details on to any relevant persons;
- In collaboration with Land Councils and Traditional Owner Groups, scheduled online workshops to present and discuss the Seismic Survey with broader network of team members (e.g., within the Land Councils and Traditional Owner Groups) and with traditional owners from community, to facilitate the process of self-identification and further identification of other relevant persons;
- Utilise advice from relevant persons, contact as described above, who may know of other relevant persons or organisations that may be considered relevant as described in **Section 5.4.5.2.2**; and
- Use of other EPs associated with seismic surveys which have similar risks and impacts as the proposed Seismic Survey, as they relate to the Aboriginal heritage and traditional owner values.

Table 28 Regulation 11A(1)(d) Relevant Person Identification

Relevant Person	Justification	Area of Function, Interest or Activity	Influence	Category
Conservation Council of Western Australia	The Conservation Council of Western Australia has an interest in a variety of the biological environment receptors in the wider EMBA which may be impacted in the unlikely event of a fuel oil spill. Western Australia not-for-profit, non-government conservation and environment organisation. Representative of over 100 conservation groups and a large member database. Due to this large member base and groups that associate with the Conservation Council of Western Australia, the public notice consultation discussed in **Section 5.6**) was considered the best method of disseminating information to them and requesting information on potential claims or objections. It is considered that the influence of this relevant person is low as they represent a general special interest group.	EMBA	Low	Category C
Centre for Whale Research	Non-government organisation promoting cetacean related research. The Centre of Whale Research has an interest in the marine mammals associated with the EMBA (and wider) which may be impacted by the Seismic Survey as discussed in **Section 7** and **Section 8**. It is considered that the influence of this relevant person is low.	EMBA	Low	Category C
The Wilderness Society	Non-government organisation advocating conservation and may have functions, interests and activities in the EMBA associated with the biological environment. The Wilderness Society is an Income Tax Exempt Charity across all states/territories in Australia. The Wilderness Society has an interest in a variety of the biological environment receptors in the wider EMBA which may be impacted in the unlikely event of a fuel oil spill. It is considered that the influence of this relevant person is low.	EMBA	Low	Category C

Relevant Person	Justification	Area of Function, Interest or Activity	Influence	Category
Kimberley Land Council	Refer to **Section 4.6.1.1**; three Native Title determinations (Balanggarra, Uunguu Part A and Miriuwung and Garerrong) have been made over (coastal) sea country within the southern portion of EMBA, which is located to the south of the OA. Areas located in the EMBA are likely to include places of cultural and spiritual importance to traditional owners groups the KLC work with, and this area is likely to be used as a resource for maintaining cultural identity, health and wellbeing. KLC are considered to have a high influence on the project by way of assisting with engaging traditional owner groups to understand the interests, functions and activities that may be affected by the project.	EMBA	High	Category A
Balanggarra Aboriginal Corporation RNTBC	These three registered native title body corporates represent the three Native Title Determinations that have been identified within the EMBA. A search of the National Native Title website, utilising the spatial files for the EMBA, found that three determinations overlap the EMBA. Based on this it is considered that these three body corporates have an interest in the area which may be impacted in the unlikely event of a fuel oil spill. It is considered that the influence level of these three body corporates is high based on the indigenous rights associated with the Native Titles. Through consultation with KLC, these native title body corporates were identified, and contact details provided by KLC. SLB started consultation with all of these groups and will continue to do so throughout the duration of the EP to ascertain how the project may affect their functions, interests or activities and identify how effects can be avoided or minimised. Communications that have taken place between SLB and these native title body corporates are provided in **Appendix F** and **Appendix I**.	EMBA	High	Category A
Wanjina-Wunggurr (Native Title) Aboriginal Corporation RNTBC. This is the body corporate of Uunguu Part A.		EMBA	High	Category A
Miriuwung and Gajerrong #1 (Native Title Prescribed Body Corporate) Aboriginal Corporation RNTBC		EMBA	High	Category A

Relevant Person	Justification	Area of Function, Interest or Activity	Influence	Category
Northern Land Council	Refer to **Section 4.6.1.2**; waters southeast of the OA across the North Kimberly Marine Park are places of cultural and spiritual importance to traditional owners, and used as a resource for maintaining cultural identity, health and wellbeing. NLC are considered to have a high influence on the project by way of assisting with engaging traditional owner groups to understand the interests, functions and activities that may be affected by the project.	EMBA	High	Category A
Commonwealth Fisheries Association (CFA)	The CFA is non-profit organisation and is the peak body representing the collective rights, responsibilities and interests of a diverse commercial fishing industry in Commonwealth-regulated fisheries. CFA and the fisheries they represent have the potential to be impacted by various activities associated with the Seismic Survey. Therefore, the CFA is considered to have a medium level of influence due to the various commercial fishing organisations they represent.	EMBA	Medium	Category B
Northern Prawn Fishery – including concession holders	As outlined within **Section 4.7.3.1.1**, the NPF extends from the JBG across the top end to the Gulf of Carpentaria. No fishing occurs within the OA as it is located outside the NPF boundaries, however the eastern part of the EMBA extends into the JBG part of the NPF; however, the level of effort in this area is relatively minor compared to other parts of the NPF. Based on this level of fishing, and the areas which may be impacted from the Seismic Survey, the NPF is considered to be a Category B relevant person.	EMBA	Medium	Category B
North West Slope Trawl Fishery – including concession holders	As discussed in **Section 4.7.3.1.2**, the NWSTF is located in deep water from the coast of the Prince Regent National Park to Exmouth between the 200 m depth contour and the outer limit of the Australian Fishing Zone. No fishing occurs within the OA as it is located outside the NWSTF boundaries, however the western part of the EMBA extends into part of the NWSTF. Therefore, as there is potential for the Seismic Survey to impact the fishing zone, the NWSTF is considered a Category B relevant person.	EMBA	Medium	Category B

Relevant Person	Justification	Area of Function, Interest or Activity	Influence	Category
Western Tuna and Billfish Fishery	The WTBF operates within both the Australian Fishing Zone (between Tip of Cape York Queensland, west and south to the border between South Australia and Victoria) and the adjacent high seas (refer to **Section 4.7.3.1.3**). Recent fishing effort has concentrated off south-west Western Australia and South Australia and has not overlapped either the OA or EMBA. However, license holders may have entitlements to undertaken fishing within the EMBA and, therefore, there is still potential for the Seismic Survey to impact the WTBF. Hence, WTBF is considered a Category B relevant person.	EMBA	Medium	Category B
Southern Bluefin Tuna Fishery	The SBTF covers the entire sea area around Australia, out to 200 NM from the coast. Recent fishing effort has targeted juvenile SBT in the Great Australia Bight with no fishing effort within or near either the OA or the EMBA (refer to **Section 4.7.3.1.5**). ASBTIA considered they were not a relevant person through the consultation process due to no fishing in the area or breeding of SBT in the area; however, license holders may have entitlements to undertake fishing within the EMBA and, therefore is considered a Category B relevant person.	EMBA	Medium	Category B
Northern Territory Guided Fishery Industry Association	The Northern Territory Guided Fishery Industry Association is the peak body responsible for promoting, developing and maintaining the guided fishing industry in the Northern Territory. They represent professional fishing guides and operators and also provides advice on legislative, management and practical issues to government and decision makers. The Northern Territory Guided Fishery Industry Association has been considered a relevant person due to the EMBA extending into Northern Territory waters.	EMBA	Medium	Category B
Western Skipjack Tuna Fishery – including concession holders	The Skipjack Tuna Fishery covers the entire sea area around Australia, out to 200 NM from the coast. The WSTF operates between the Tip of Cape York Queensland, west and south to the border between South Australia and Victoria. There has been no catch in the Skipjack Tuna Fishery since the 2008-09 fishing season (refer to **Section 4.7.3.1.4**). However, license holders may have entitlements to undertake fishing within the EMBA and, therefore, the WSTF is considered a Category B relevant person.	EMBA	Medium	Category B

Relevant Person	Justification	Area of Function, Interest or Activity	Influence	Category
Western Australian Fishing Industry Council	WAFIC is the main industry body representing professional fishing in Western Australia and are the key contact for the various commercial fishery organisations operating within the OA and EMBA. WAFIC and the organisations they represent have the potential to be impacted by various activities associated with the Seismic Survey and are considered to have a medium level of influence due to the various commercial fishing organisations they represent. WAFIC are considered a key relevant person who facilitating the consultation process between SLB and fishers, including all individual licence holders that may be impacted by the Seismic Survey (refer Mackerel Managed Fishery and Northern Demersal Scalefish Managed Fishery discussed in the following rows). WAFIC were able to provide relevant information to the licence holders, for whom they hold the contact details.	OA/EMBA	Medium	Category A
Northern Territory Seafood Council	Through consultation with other relevant persons, the NTSC were recommended as a relevant person because they represent the Northern Territory seafood industry's interests. Although potentially impacted by the survey, the Northern Territory fishery effort is located outside of the project OA. However, key commercial fishing may occur within the EMBA. The NTSC is considered to have a medium level of influence due to the various seafood organisations they represent.	EMBA	Medium	Category B
Mackerel Managed Fishery - all license holders	Commercial fishery organisations that operate within the OA based on the assessment found within **Section 4.7.3**.	OA	Medium	Category A

Relevant Person	Justification	Area of Function, Interest or Activity	Influence	Category
Northern Demersal Scalefish Managed Fishery – all license holders	Note that the consultation with those licence holders under these two managed fisheries were consulted with by WAFIC, details of each of the licence holders managed by these two fisheries can be found in **Appendix I** These two parties may be directly impacted by the Seismic Survey within the OA, either through the physical presence of the vessels, or from the acoustic disturbance from the seismic source. These parties are considered to have a medium influence as they operate commercially within the OA. These two parties may be directly impacted by the Seismic Survey within the OA, either through the physical presence of the vessels, or from the acoustic disturbance from the seismic source. These parties are considered to have a medium influence as they operate commercially within the OA.			
Specimen Shell Managed Fishery	Commercial fishery organisations that operate within the EMBA based on the assessment found within **Section 4.7.3**. Contact with the licence holders under these managed fisheries is being managed by WAFIC as per the discussion in (**Section 5.5.6.1**). Fishing effort is reported to occur outside of the project OA, but within EMBA. Commercial fishers operating within the EMBA may be impacted in the unlikely event of a fuel oil spill. Following guidance from WAFIC during the consultation process, WAFIC have a preferred approach for consultation over unplanned events which may impact licence holders within the EMBA (Consultation Approach for Unplanned Events - WAFIC[15]). Should a fuel spill occur, WAFIC would then contact these fishers immediately and considered they did not need any further information at this stage as WAFIC are representing their interest. These parties are considered to have a medium influence as they operate commercially within the EMBA.	EMBA	Medium	Category B
Western Australia Sea Cucumber Fishery				
Marine Aquarium Fishery				
Kimberley Prawn Managed Fishery				

[15] https://www.wafic.org.au/what-we-do/access-sustainability/oil-gas/consultation-approach-for-unplanned-events/

Relevant Person	Justification	Area of Function, Interest or Activity	Influence	Category
Kimberley Gillnet and Barramundi Managed Fishery				
Kimberley Crab Managed Fishery				
Demersal Fishery				
Spanish Mackerel Fishery				
Offshore Net and Line Fishery				
Barramundi Fishery				
Mud Crab Fishery				
Coastal Line Fishery				
Fishing Tour Operators				
Aquarium Fish				
Small Pelagic Development Fishery				
Special Permit Fishery				
Timor Reef Fishery				
Jigging Fishery				
Pearl Oyster Fishery				

Relevant Person	Justification	Area of Function, Interest or Activity	Influence	Category
Joint Authority Northern Shark Fishery Abalone Fishery license holders West Coast Deep Sea Crustacean Managed Fishery Pearl Oyster Managed Fishery	Commercial fishery organisations which are entitled to operate within the EMBA, but for which there was no relevant fishing activity reported based on the assessment within **Section 4.7.3**. Contact with the licence holders under these managed fisheries is being managed by WAFIC as per the discussion in (**Section 5.5.6.1**). Based on the findings of the assessment within **Section 4.7.3,** no fishing effort is reported to occur within the OA or EMBA and, therefore, commercial fishers with entitlements to operate within the EMBA are not expected to be impacted. These parties are considered to have a medium influence as they have entitlements to operate commercially within the EMBA.	EMBA	Medium	Category B
Western Australian Game Fishing Association	The Western Australian Game Fishing Association coordinates the activities of game fishing throughout Western Australia and includes a variety of fishing club members. Their interests lie in the EMBA (and wider) which may have potential impacts from an unlikely fuel oil spill. As the Western Australian Game Fishing Association has commercial interests in the area it is considered they have a medium level of influence.	EMBA	Medium	Category B
Australian Southern Bluefin Tuna Industry Association	Commercial fishery organisation intersecting with the EMBA as discussed within **Section 4.7.3.1**. Due to the commercial nature of their interests, it is considered that the Australian Southern Bluefin Tuna Industry Association has a medium level of influence.	EMBA	Medium	Category B
Tuna Australia	Commercial fishery organisation intersecting with the EMBA as discussed within **Section 4.7.3.1**. Due to the commercial nature of their interests, it is considered that the Tuna Australia has a medium level of influence.	EMBA	Medium	Category B
Northern Prawn Fishery Industry Association Pty Ltd	Commercial fishery organisation which represents the interests of Northern Prawn Fishery operators. It is considered that their interests in the EMBA may be impacted, in the unlikely event of a fuel oil spill. Due to the commercial nature of their interests, it is considered that the Northern Prawn Fishery Industry Association Pty Ltd has a medium level of influence (discussed in **Section 5.6**).	EMBA	Medium	Category B

Relevant Person	Justification	Area of Function, Interest or Activity	Influence	Category
Australia Fisheries Trade Association	Australia Fisheries Trade Association advocates for policies that increase participation in the recreational fishing industry; recreational/volunteer organisation. It is considered that their interests in the EMBA may be impacted by a fuel oil spill and as they represent general users of the area (i.e. recreational fishers) their level of influence is considered to be low. As this relevant person represents general users in the area it is not possible to list all persons here; however, the consultation with this larger group of relevant persons was undertaken through the public notices put out by SLB (discussed in **Section 5.6**).	EMBA	Low	Category C
Recfishwest	Recreational/volunteer organisation promoting the interests of recreational fishers. Individual members may on occasion use the waters within/proximate to the EMBA which may be impacted in the unlikely event of a fuel oil spill and as they represent general users of the area (i.e. recreational fishers) their level of influence is considered to be low. As this relevant person represents general users in the area it is not possible to list all persons here; however, the consultation with this larger group of relevant persons was undertaken through the public notices put out by SLB (discussed in **Section 5.6**).	EMBA	Low	Category C
Coral Expeditions	Commercial tourism organisation intersecting with the EMBA which may be impacted in the unlikely event of a fuel oil spill and as they represent commercial users of the EMBA their level of influence is considered to be medium. The charter fishing boats fall under this classification of tourism for WA and NT.	EMBA	Medium	Category B
Marine Tourism WA				
Kimberley Marine Tourism Association				
BKB Holidays Travel Agency				
Carnarvon Energy - AC/P63 (Exploration permits)	Industry organisation that has two tenures within the OA and EMBA (refer to **Figure 38**) and potentially operates commercially within the survey area. Consequently, Carnarvon Energy is considered a Category A relevant person.	OA, EMBA	Medium	Category A

Relevant Person	Justification	Area of Function, Interest or Activity	Influence	Category
Inpex Browse - AC/P66 (Exploration permit and retention lease)	Industry organisation that has one tenure within the survey area (refer to **Figure 38**). Although AC/RL4 is located outside of the AA, OA and EMBA, AC/PC66 is within the OA and EMBA and potentially operates commercially within the survey area. Consequently, Inpex Browse is considered a Category A relevant person.	OA, EMBA	Medium	Category A
Finder Energy – AC/P61 (Exploration permit)	Industry organisation that has tenure within the OA and EMBA (refer to **Figure 38**) and potentially operates commercially within the survey area. Consequently, Finder Energy is considered a Category A relevant person.	OA, EMBA	Medium	Category A
Santos Ltd - AC/P69, AC/P67 (Exploration permits)	Industry organisation that has multiple tenure within or near the OA and EMBA (refer to **Figure 38**) and potentially operates commercially within the survey area. Consequently, Santos Ltd is considered a Category A relevant person.	OA, EMBA	Medium	Category A
PTTEP Australasia - AC/RL12, AC/RL7 (Exploration permit, production licence and retention leases)	Industry organisation that has multiple tenure (including a production licence) within the OA and EMBA (refer to **Figure 38**) and potentially operates commercially within the survey area. Consequently, PTTEP Australasia is considered a Category A relevant person.	OA, EMBA	Medium	Category A
Petrofac	Self-identified as a relevant person through the public notice period. Although their activity is outside of the EMBA, they will be part of the ongoing consultation and communication/notification programmes due to their close proximity to the EMBA, their effort to engage and as a level of courtesy to keep them informed. Petrofac will receive the four-week pre-start notification, as well as the 48-hour look-ahead reports that will be distributed every 24 hours advising of where the survey vessel will be operating.	EMBA	Medium	Category A
Melbana Energy Ltd – AC/P70	Industry organisation that has tenure within the OA and EMBA (refer to **Figure 38**) and potentially operates commercially within the survey area. Consequently, Melbana Energy Ltd is considered a Category A relevant person.	OA, EMBA	Medium	Category A

Relevant Person	Justification	Area of Function, Interest or Activity	Influence	Category
Tiwi Land Council (TLC)	Native title holder located east of the EMBA. Although Tiwi Islands are situated more than 103 km northwest of the EMBA at the closest point, SLB is uncertain how far their sea country extends and therefore has contacted TLC to confirm whether they should be considered a relevant person for this project. The TLC's initial response was that given the project was offshore Bonaparte then consultation should be with the Northern Land Council (NLC). However, TLC has asked for more information and would share with their representatives to confirm whether they have any interest. As such, TLC will be part of the ongoing consultation and communication/notification programmes, until SLB receives confirmation they would not be considered a relevant person. Communications that have taken place between SLB and TLC are provided in **Appendix F** and **Appendix I**.	EMBA	Low	Category C
Submarine cabling companies: BW Digital Inligo Network Vocus Group	These submarine cabling companies own, manage and maintain various submarine cable systems around Australia. A previously consulted relevant person (ACMA) suggested DW Digital, Inligo Networks and Vocus Group as relevant organisations for the proposed survey, as there may be submarine cable systems managed by these companies in the vicinity of the Seismic Survey.	OA	Medium	Category A
Bengal Energy Ltd AC/RL10 (Retention Lease)	Industry organisation that has multiple tenure within or near the OA and EMBA (refer to **Figure 38**) and potentially operates commercially within the survey area. Consequently, Bengal Energy Ltd is considered a Category A relevant person.	OA, EMBA	Medium	Category A

5.5 Relevant Persons Consultation Programme

5.5.1 Overview

The consultation programme has been designed in accordance with the Object of Regulation 3 of the Environment Regulations, which is to ensure that any petroleum activity or greenhouse gas activities carried out in an offshore area is:

a) Carried out in a manner consistent with the principles of ESD as set out in section 3A of the EPBC Act; and

b) Carried out in a manner by which the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable; and

c) Carried out in a manner by which the environmental impacts and risks of the activity will be of an acceptable level.

As noted in the Guidance Document, the process of preparing an Environment Plan is an iterative one. The design of the consultation programme specifically recognises and accommodates this iterative process, whereby additional information may be received that may require further consultation processes to be undertaken, including with additional relevant person(s). The relevant person consultation programme led by SLB is ongoing for the duration of the EP. The consultation programme has and continues to provide a mechanism for information and knowledge exchange between SLB and relevant persons regarding the proposed Seismic Survey as well as understand the values and sensitivities of each relevant person. SLB have provided the opportunity for relevant persons to ask specific questions, provide feedback, have meetings and have transparent, open and honest communications as set out in **Appendix I**.

Consultation for the Seismic Survey identified 64 relevant persons which included government agencies, ports, non-government agencies, fisheries, recreational groups, traditional owner groups, native title holders and petroleum and exploration companies. In addition to the 64 relevant persons identified, individual licence holders within the Mackerel Managed Fishery and Northern Demersal Scalefish Fishery were consulted with via WAFIC. The summary list of relevant persons that have been contacted as a component of the relevant persons consultation programme for the Seismic Survey are provided in **Appendix E**. As described in **Section 5.4.5.2**, these relevant persons have been characterised using the definitions prescribed under Environment Regulation 11A.

SLB are required to ensure full transparency is maintained during the relevant persons consultation process. This is to allow NOPSEMA to determine whether consultation has been undertaken appropriately and in accordance with the requirements of the Environment Regulations. To this end, a copy of the Information Packs developed by SLB and disseminated to all relevant persons, is included in **Appendix H.** It is noted that there were three different Information packs distributed as part of the consultation programme, and these are included within **Appendix H**. This included the general information pack, a commercial fishers information pack and a native titleholder information pack. Specific information packs depending on the relevant person was developed to provide the correct information in relation to their interest in the area.

Environmental Regulations 16(b)(iv) requires SLB to include a copy of the full text of any response that has been submitted by a relevant person, within the final EP. The regulations also require inclusion of the written response by SLB, and any written correspondence received from any other relevant person during the relevant person consultation programme. The unedited versions of all correspondence with relevant persons that formed part of the relevant person consultation process is provided in **Appendix F**.

In addition to this, where verbal communications between SLB and relevant persons have occurred, meeting minutes or memos were generated to document the consultation. This documentation of the consultation is consistent with the requirements of the 2011 Explanatory Statement to the Environment Regulations, which states that the summaries included from relevant person consultation should promote transparency of all levels of consultation undertaken. Where they exist, these minutes and memos have been included within **Appendix G**.

The details of completed and projected consultation with relevant persons are further described in the following sections.

5.5.1.1 Providing Sufficient Information to make an Informed Assessment

As detailed within the Guidance Document, information provided to relevant persons must be sufficient to allow an informed assessment of the possible consequences of the activity on the functions, interests or activities of the relevant person. The level of this information is likely to vary for different relevant persons and may depend on the degree to which a relevant person is affected.

As noted above, the consultation programme as a whole is an iterative process. Central to this, and as noted in the Guidance Document, the provision of information to relevant persons is also an iterative process. In turn, the iterative process serves to inform the 'decisional choice' that SLB have applied to consultation with relevant persons. This means that the decisional choice for each iteration provides relevant person(s) with finer detail and precision on a case-by-case basis, such that relevant persons consulted have the most appropriate information about the Seismic Survey as it relates to their own functions, interests or activities, and relevant person(s) are given the best opportunity to outline what information needs they have and have the ability and opportunity to request that from SLB.

For each iteration of the consultation program, where there has been no change in the level of decisional choice following each iteration (i.e. no change in the finer detail or precision of information requested by the relevant person(s)), no further iterations to case-by-case consultation has been deemed necessary, and SLB have considered that for that relevant person(s), sufficient information has been provided.

The initial consultation process that was followed as part of this EP included disseminating information packs to those persons considered relevant to the Seismic Survey, and the advertisement of the EP in newspapers and on SLBs and NOPSEMAs websites. This initial consultation was intended to be generic and provide a high-level overview for the relevant person to decide whether they required more information to assess the possible consequences of the activity on their functions, interests or activities. At the time of original lodgement of the EP, this type of initial consultation was considered in accordance with the requirements and precedent at the time.

Following this consultation process, SLB provided specific information/details for each of the relevant persons that requested such information; this was primarily in relation to those with commercial interests in the OA (such as commercial fishers), and those with cultural values associated with the EMBA. Allowing the relevant person to specify the information that they consider necessary to assess the possible consequences of the activity ensures that they are actively involved in developing a tailored consultation process. If it was identified that insufficient information was provided in the initial round of consultation, revised and targeted information was developed and provided where required following the Appeal Decision and Guidance Document being released.

This process will also add to the understanding of what level of information specific groups of relevant persons need for future applications, resulting in increased industry knowledge.

5.5.1.2 Providing a Reasonable Period to make an Informed Assessment

Regulation 11A(3) states titleholders must provide a ”reasonable period” for the relevant person to make an informed assessment of the possible consequences of the proposed activity on their functions, interests or activities so they are able to respond with any concerns (para. 56 of the Appeal Decision). However, no discernible definition as to what is considered a ‘reasonable period‘ to support adequate relevant person feedback is provided in the Environmental Regulations, and it is acknowledged that this is assessed on a case-by-case basis, depending on the functions, interests or activities of relevant persons, (see **Section 5.4.5.1**) , and corresponding requirements for more detailed (or not) further information and consultation efforts. Thus the provision of a ”reasonable period” is inherently linked to the iterative process described above for providing sufficient information, and is accommodated into the overall consultation programme on a case-by-case basis.

All relevant person were engaged, at a minimum, on two separate occasions. As noted throughout this section, where relevant persons have requested further consultation, this has been accommodated on a case-by-case basis. In most cases, approximately three calendar weeks passed between the initial and follow-up communications. It is considered that multiple attempts to engage and the provision of subsequent updates regarding the survey details and any changes/revisions is characterised as a ”reasonable period” to support relevant person feedback. Where no response has been received following the passing of a ”reasonable period”, this has been reflected within the communications database (**Appendix F**).

As outlined within **Section 5.4.5**, a tiered system has been developed as a starting point for consulting with relevant persons. Where relevant persons identified the need for additional time to adequately assess the potential impacts from the Seismic Survey on their functions, interests or activities, this was then worked through with them on a case-by-case basis to ensure a bespoke consultation process was accommodated. Although this was undertaken as part of initial consultation, a follow-up with each relevant person (no matter what category) was undertaken to provide further updates to the project and provide the relevant person(s) with a further option to engage with SLB about how their functions, interests or activities may be impacted by the Seismic Survey. By reaching out on multiple occasions this accounts for potential availability or accessibility issues that the relevant person may have.

As part of the initial round of consultation SLB requested responses back within two-weeks. However, this was a starting point, and if and when relevant persons required further time, or information, this was provided to them. It is also worth noting that even though a two-week period was requested, in the initial round of consultation this included an email on 17 January 2022, requesting contact back by 7 February, the subsequently following this another email was sent on 8 February 2022 requesting contact back by 28 February, equating to approximately 6 weeks of initial consultation. Some of the relevant persons engaged in consultation with SLB during and following this period, and over the past 22 months (January 2022 to November 2023) multiple periods were included, resulting in substantially larger time frames for those relevant persons to assess the application.

SLB also notes feedback from the Regulator and peak industry representative bodies regarding the possible impact of ‘fatigue’ on the amount of consultation. Given the number and frequency of similar projects proposed and occurring within the broader NWMR, it is understood from relevant persons consulted as part of preparing this EP that many relevant persons have received a high volume of communications from titleholders, resulting in decreased capacity and willingness to consult. With respect to this constraint, SLB will continue to make available the opportunity for relevant persons to communicate with SLB, and likewise relevant persons are able to receive communications (i.e. 48 hour look-aheads) from SLB throughout the life of the project. Other offers to assist with consultation fatigue was provided by SLB, including targeted, concise and fit-for-audience information in order to make communication/understanding easier, and in order to develop relationships and build trust and reliability for this Seismic Survey, and future applications. Additional time was provided where requested in order to account for the consultation fatigue felt by some of the relevant persons.

5.5.2 Approach

Identified relevant person(s) have been prescribed a level of consultation based on the categories in which they have been assigned. These levels of consultation include either 'involve', 'consult' or 'inform' based on the anticipated area of interest and levels of influence and align with Category A, Category B and Category C outlined in **Section 5.4.5.1**.

- Consultation with Category A relevant persons(s) is described as active 'involvement', whereby SLB works directly with relevant person(s) throughout the consultation process to ensure that concerns and queries by relevant person(s) are consistently understood and considered. This consultation was targeted based on the relevant persons high level of influence and their specific areas associated with their functions, interest and activities, and where required the relevant persons were involved in the development of control measures. The intention of this consultation is to seek direct feedback on the proposed Seismic Survey with a focus on understanding the values and sensitivities of each relevant person and ensuring potential impacts to those values and sensitivities are mitigated through control measures and commitments made in the EP;
- Consultation with Category B relevant person(s) is described as routine 'consult and seek feedback' level of consultation, whereby SLB seeks to gather feedback from Category B relevant person(s) to understand values and sensitivities should the relevant person(s) consider they are impacted by the Seismic Survey. The intention of this consultation is to seek direct feedback on the proposed Seismic Survey with a focus on understanding the values and sensitivities of each relevant person and ensuring potential impacts to those values and sensitivities are mitigated through control measures and commitments made in the EP; or
- Consultation with Category C relevant persons is described as an 'inform and seek feedback' level of consultation, whereby SLB provides Category C relevant person(s) with balanced and objective information to assist them in understating the activity, impacts and controls. Opportunity to provide feedback, or ask for further information that may be relevant to their functions, interests or activities, is provided through SLB communication channels. The intention of this consultation is to seek direct feedback on the proposed Seismic Survey from those persons that are not actively known at the time and provides an opportunity for relevant persons who have not been identified to self-identify and provide information on any values and sensitivities they may have. If any feedback is received, SLB will review with the intention of ensuring those values and sensitivities that have been raised are mitigated through control measures and commitments made in the EP. Public notification through newspaper advertisements is the most likely way this will take place and will be ongoing through the EP process as part of the ongoing consultation process.

Table 29 sets out the key activities, tool, information provided, and justifications for each Category of relevant persons. It is noted here, that depending on individual requirements Category A or B relevant persons information packages and follow up consultation are combinations of tools/activities and have been based on the whether the relevant persons needed/wished to continue the consultation (i.e. additional activities/tools were not used if the relevant person did not identify the Seismic Survey as a concern to them).

Table 29 Consultation Activities and Tools across Category A, B C Relevant Persons

Relevant Persons Category	Activity / Tool	Information provided	Timeframes and Justification*
Category A: *Involved* level of consultation	• Direct consultation • 'Face to face' meetings or via video conferencing • Organised phone calls • Follow up calls/video conferencing • Ongoing email exchanges	• Targeted and specific Information packs • EP publication notification (national, state regional) • Individual email /email follow ups • Meeting minutes • Memorandum	Multiple communication attempts (minimum 2, and more as required), including pre-activity, and post activity notification processes. Timeframes are to be ongoing if required on a case-by-case basis.
Category B: *Consult and seek feedback* level of consultation	• Email exchanges as required or requested by Category B relevant persons • Phone calls or video meetings as requested by relevant persons	• Information pack • EP publication notification (national, state regional) • Email exchanges/email summaries	Multiple communication attempts (minimum 2, and more as required), including pre-activity, and post activity notification processes. Timeframes may be extended if requested.
Category C: *Inform and seek feedback* level of consultation	• Notification via public media outlets (i.e. newspaper notices with request for feedback to the SLB email address included within notice.	• Information pack • EP publication notification (national, state regional)	Minimum two separate occasions, with around three calendar weeks between initial and follow up communication

*All Relevant Persons are provided, at a minimum, two separate notifications, with around a three-week period in between the two initial consultation periods. All efforts that have been undertaken as part of the consultation process is included within Appendix F and Appendix I. these appendices note the attempts that have been made despite no response in some instances.

For Category A and B relevant persons, sufficient information is considered to be defined as the provision of information as requested by the relevant person(s), to their satisfaction that concerns and queries have been addressed in good faith, and in a timely fashion to facilitate further discussion and enable relevant persons to disseminate information to their own stakeholder groups. This is further considered as information that provides enough detail and information to enable the relevant persons to understand the proposed activity and determine whether the proposed activities (both planned and unplanned) may impact any of their values, sensitivities or commercial activities.

Given the broad requirements across Category A and B relevant persons, sufficient information may require personalised and targeted communications, with multiple (more than two) follow up consultations. An example of targeted communications that SLB has provided to relevant persons is the provision of GPS coordinates of the OA in a Microsoft Excel spreadsheet to commercial fishers so they can copy the coordinates straight into the chart plotting software. This not only makes it easier for the fishers but also avoids any transcription errors.

Likewise, the information sheet included within the Native Titleholder information pack differs to the commercial fishers information sheet, so SLB has targeted the audience/relevant persons, and also sought feedback from key groups consulted as to whether the information provided was sufficient to meet the needs of informing relevant persons. Information within the correspondence undertaken and phone calls held provided further context of the proposed activities as well as the potential for an unplanned activity to occur (i.e. fuel oil release following the rupture of the vessels fuel tank(s)), and what area of the receiving environment may be impacted should an unplanned activity eventuate (i.e. the area covered by the EMBA).

No suggestions of additional information that should be included was provided by any of the relevant persons that were asked directly whether the information was appropriate. As a result, SLB considers that the information provided as part of the consultation process was sufficient to enable relevant persons to make an informed decision as to whether their values and sensitivities or commercial interests would be impacted from the Seismic Survey. Providing sufficient information allowed relevant persons to make an informed decision as to whether they wanted to provide feedback on the proposed activity or not. The different information sheets distributed to the relevant persons are provided in **Appendix H**.

For Category C relevant persons, the information provided was considered to be sufficient in accordance with the notification requirements, under the regulatory requirements and guidelines and SLBs commitment to providing sufficient information for relevant persons to make an informed decision on SLBs proposed activity (**Section 5.1**).

Consultation with Category A and B relevant persons was initiated early in the project by SLB to identify their level of interest in the project, and to begin developing control measures (if needed) to address their concerns with respect to the Seismic Survey. Consultation with these relevant persons remains ongoing through the EP evaluation process and will continue for the duration of the EP. Any feedback provided by a relevant person will be carefully considered and if a change is required, will be done so through the management of change process. Any communications and/or feedback received will be logged as part of the ongoing consultation register.

For Category C relevant persons, all notifications will be undertaken in accordance with statutory timeframes for public notification under the regulations (see **Section 5.1**). In addition, these notifications for Category C relevant persons will also be ongoing through the newspaper advertisements that will be placed in relevant newspapers that also informs those potentially relevant persons that were not known at the time of preparing the EP. Should any feedback be provided, it will still be considered and incorporated where relevant through the management of change process.

The consultation programme with relevant persons comprised of a number of different approaches and phases, including:

- General relevant persons consultation, consisting of:
- Developing an Information pack, including a Relevant Persons Factsheet providing an overview of the proposed activities and location details (see **Section 5.5.3**);
- First round of general relevant persons consultation;
- Second round of general relevant persons consultation, including follow-up;

- Specific relevant persons consultation;
- Pre-activity notification;
- Ongoing relevant persons consultation;
- and
- Post-activity notification.

At the outset, general consultation material was disseminated to all categories of relevant persons to initiate communications between the proponent and relevant persons, provide an opportunity to establish a meeting and to socialise the proposed Seismic Survey. Using the information gained during the relevant persons identification process and based on feedback received regarding the information pack, key relevant persons were identified for specific consultation. The nature of specific consultation is such that it's tailored to, and therefore highly variable amongst the range of specific relevant persons. Specific consultation may include increased frequency of communications or more detailed communications regarding the potential impacts to the relevant persons activities or a change in the mode of communications (e.g., phone vs email) utilising the general activities/tools identified in **Table 29**.

Of note, is that not all general consultation communications occurred concurrently. As the development of the EP progressed, new sensitivities, receptors and corresponding 'relevant persons' were subsequently identified. Where this occurred, additional relevant persons were contacted as soon as reasonably possible to notify them of the proposed Seismic Survey and, therefore, were communicated 'out of cycle' with the broader general relevant persons consultation programme.

Due to COVID driven constraints placed on face-to-face meetings and non-essential travel, consultation activities were limited to those undertaken using digital means of communications such as email, phone and teleconference. This mode of communication and consultation did not appear to hinder the consultation process as the world has quickly adapted to virtual meetings following the COVID pandemic.

A detailed description of the nature and timing of each consultation activity (such as emails, calls, teleconference meetings or postage of letters) are provided in the subsequent sections (**Sections 5.5.3** to **5.5.6**).

A summary of the information provided to all relevant persons is provided below, along with the dates of consultation and provision of information. As a result of the consultation programme and ongoing follow up with those that have not responded, SLB is confident that it has provided relevant persons with sufficient information to make an informed assessment, as well as providing a reasonable period for each relevant person to consider all of the information received and provide any feedback for SLB to assess any claims raised and implement any additional controls as required.

5.5.3 Information Pack

To support the first round of general consultation with relevant persons, an Information Pack was developed to describe the proposed Seismic Survey, location of the OA and introduce SLBs corporate and project level consultation and environmental commitments. The relevant persons identified were contacted via email and provided with the Information Pack in January 2022 (**Appendix F**). This information was subsequently made available to relevant persons as they were identified throughout the development of the EP and as a result of the wider consultation process with relevant persons.

The following information was provided to all relevant persons within the Information Pack:

- A high-level description of the proposed location of the Seismic Survey;

- Description of the proposed seismic activity;
- SLBs commitment to communication during the Seismic Survey;
- SLBs commitment to environmental performance;
- A request to all relevant persons for feedback on the Seismic Survey with full contact details of SLB representatives provided;
- Location map of proposed AA and survey lines within the OA; and
- Coordinates of OA boundary.

For the purposes of the consultation process, when the first round of information material was sent out to the identified relevant persons, the specific details of where the survey was likely to be acquired was not known; hence, a decision was made not to include the Acquisition Area, where the full acoustic source array will be active. However, the larger Operational Area where all activities related to the Seismic Survey would occur was included.

As the consultation and EP process progressed, two further information packs were developed so that the information provided was specific to the relevant person. An information pack was developed for commercial fishers and one for Native Titleholder Groups. These examples can be found In Appendix H.

5.5.4 First Round of General Relevant Persons Consultation

After the relevant persons were identified, the consultation process commenced. This process sought to determine what environmental and social values, sensitivities, access rights, commercial interests, risks and impacts were of most concern to relevant persons in relation to the Seismic Survey and to establish a precedent for mutual sharing of information between all parties.

The first round of consultation with relevant persons was undertaken in January 2022 and consisted of an introductory email and appended Information Pack. All relevant persons were encouraged to engage, ask questions and invited to provide comment or request additional information if they required it.

The initiation of general consultation with relevant persons occurred intermittently throughout the course of preparing this EP, as new relevant persons were progressively identified in accordance with the methods outlines in **Section 5.4**

A record of all feedback received from relevant persons and the responses provided by SLB is summarised in **Appendix I**.

Feedback from this first round of consultation with relevant persons was incorporated into the survey planning and design phase, as well as the control measures.

The feedback received from relevant persons was relatively sparse and focussed on advising on further notification requirements prior to the survey commencing. For example, with respect to surrounding Oil and Gas operators this included implementing a 48-hour operational look ahead plan. For selected groups this included recommendations to contact all additional relevant persons regarding the Seismic Survey.

Parks Australia provided a list of recommendations to be considered as part of the EP process in their reply, focussing on consideration of the potential impact to protected receptors such as the Oceanic Shoals Marine Park located adjacent to the OA, vulnerable species, BIAs, KEFs and areas of significant cultural value. In addition, the DNP requested that they be made aware of any oil/gas pollution incidences as soon as possible.

The initiation of general consultation with relevant persons occurred intermittently throughout the course of preparing this EP, as new relevant persons were identified in accordance with the methods outlines in Section 5.4.

5.5.5 Second Round of General Relevant Persons Consultation

The second round of consultation with relevant persons was undertaken in February/March 2022. This primarily consisted of disseminating a standardised follow-up email to the relevant persons that had not yet responded. However, a customised email response was also sent to the relevant persons who expressed interest in the proposed Seismic Survey during the first round of consultation, including further high-level information relating to their potentially impacted activities where required.

The second round of consultation occurred in accordance with the initial consultation with relevant persons. Hence, it also occurred throughout the course of preparing this EP, as new relevant persons were progressively identified.

Similar to the first round of consultation, there were a high proportion of relevant persons who did not respond to communications.

WAFIC replied to the second round of general stakeholder communications in February/March 2022, as described in **Section 5.5.6**, and further details provided in **Appendix I**.

5.5.6 Specific Relevant Persons Consultation – Commercial Fishing Industry

The commercial fishing industry are the primary relevant persons with a commercial interest in the maintenance of access to and the condition of the marine environment (e.g., conservation of aquatic resources) within the EMBA. There are multiple licence holders that undertake fishing activity within the OA and who have the potential to be directly impacted by the proposed Seismic Survey. Licence holders that undertake fishing activity within the EMBA have the potential to be impacted in the unlikely event of a fuel oil spill.

Relevant persons within the commercial fishing industry were identified in accordance with the approach described in **Section 5.4.5.2.2.1**. A summary of relevant persons which may have entitlements to fish within the EMBA, associated jurisdiction of operations (e.g., Commonwealth, State or Territory) and spatial extent of contemporary fishing effort within the last five years is provided in **Table 30.** Overall, there is a minor overlap between the fished areas of the Mackerel Managed Fishery, the Northern Demersal Scalefish Managed Fishery and the proposed Acquisition Area, where the acoustic source will operate under full power. Further details on the overlap are provided in **Section 4.7.3.2**.

Subsequent consultation with relevant persons occurred through a combination of communication modes (e.g., phone, email and hard copy letters sent via mail) to effectively circulate sufficient information, including tailored material, to relevant persons. Consultation with the commercial fishing industry commonly occurred as specific consultation, as appropriate. The level of specific consultation undertaken was proportionate to the level of interest and influence of relevant persons, as well as guidance from relevant persons who act as peak representative bodies (i.e. WAFIC).

Further information on SLBs consultation process with the commercial fishing industry is provided in **Section 5.5.6.1** through to **Section 5.5.6.12**.

SLB consider that the information provided to licence holders was sufficient to make an assessment of the proposed Seismic Survey on their activities. SLB provided the commercial fishing industry with data and data visualisations derived from the detailed fisheries assessment (see **Sections 4.7.3.1** to **4.7.3.4)**. Further, based on feedback received from WAFIC regarding the suitability of consultation materials, SLB revised the tailored information provided to the commercial fishing industry through including GPS coordinates of the Operational Area and reduction in explanatory text regarding legislative requirements. It was highlighted that a Microsoft Excel spreadsheet with the GPS coordinates would allow fishers to copy and paste directly into their chart plotting computer systems so that they have a better idea on where the operations will occur in relation to their fishing areas.

SLB consider that sufficient opportunities and timeframe were provided for the relevant Commonwealth, State and Territory department, peak representative bodies and licence holders to raise any concerns held regarding the survey and to undertake further consultation as required.

Responses from representatives of Commonwealth, State and Territory departments, peak representative bodies and commercial fishing license holders were used to further characterise the environment within the EMBA and, consequently, re-assess the potential impacts of the Seismic Survey. Though, there was no changes to the assessment of impacts within **Section 7.1.3.1** and **Section 7.2.3** or control measures outlined within **Section 7.1.5** and **Section 7.2.6** as a result. All objections and claims raised were managed in accordance with the processes outlined in **Section 5.5.11**.

Table 30 Commercial and State Fisheries Boundaries which overlap with the EMBA and Estimated Fishing Activity

Jurisdiction	Fishery – Subsector	Estimated fishing activity in OA	Estimated fishing activity in EMBA
Commonwealth Fisheries	Western Skipjack Fishery	No recent effort reported	No recent effort reported
Commonwealth Fisheries	Southern Bluefin Tuna Fishery	No recent effort reported	No recent effort reported
Commonwealth Fisheries	Western Tuna and Billfish Fishery	No recent effort reported	No recent effort reported
Commonwealth Fisheries	Northern Prawn Fishery	No recent effort reported	Considerable effort in area
Commonwealth Fisheries	North-West Slope Trawl Fishery	No recent effort reported	No recent effort reported
State Managed Fisheries	Mackerel Managed Fishery	Limited effort in area	Limited effort in area
State Managed Fisheries	Northern Demersal Scalefish Fishery	Considerable effort in area	Considerable effort in area
State Managed Fisheries	Joint Authority Northern Shark Fishery	No recent effort reported	No recent effort reported
State Managed Fisheries	Western Australian Sea Cucumber Fishery	No recent effort reported	Limited effort in area
State Managed Fisheries	Specimen Shell Managed Fishery	No recent effort reported	Limited effort in area

Jurisdiction	Fishery – Subsector	Estimated fishing activity in OA	Estimated fishing activity in EMBA
State Managed Fisheries	Marine Aquarium Fish Managed Fishery	No recent effort reported	Limited effort in area
State Managed Fisheries	Abalone Managed Fishery	No recent effort reported	Limited effort in area
State Managed Fisheries	Kimberley Prawn Managed Fishery	No recent effort reported	Limited effort in area
State Managed Fisheries	Kimberley Gillnet and Barramundi Managed Fishery	No recent effort reported	No recent effort reported
State Managed Fisheries	West Coast Deep Sea Crustacean Managed Fishery	No recent effort reported	Limited effort in area
State Managed Fisheries	Pearl Oyster Managed Fishery	No recent effort reported	Limited effort in area
State Managed Fisheries	Charter Fishery	No recent effort reported	Limited effort in area
State Managed Fisheries	Kimberley Crab Managed Fishery	No recent effort reported	Limited effort in area
Territory Managed Fisheries	Demersal Fishery	No recent effort reported, OA outside of jurisdiction	Considerable effort in area
Territory Managed Fisheries	Spanish Mackerel Fishery	No recent effort reported, OA outside of jurisdiction	Considerable effort in area
Territory Managed Fisheries	Offshore Net and Line Fishery	No recent effort reported, OA outside of jurisdiction	Considerable effort in area
Territory Managed Fisheries	Barramundi Fishery	No recent effort reported, OA outside of jurisdiction	Considerable effort in area
Territory Managed Fisheries	Mud Crab Fishery	No recent effort reported, OA outside of jurisdiction	Limited effort in area
Territory Managed Fisheries	Coastal Line Fishery	No recent effort reported, OA outside of jurisdiction	Limited effort in area
Territory Managed Fisheries	Fishing Tour Operators	No recent effort reported, OA outside of jurisdiction	Considerable effort in area
Territory Managed Fisheries	Aquarium Fish	No recent effort reported, OA outside of jurisdiction	Limited effort in area
Territory Managed Fisheries	Small Pelagic Development Fishery	No recent effort reported, OA outside of jurisdiction	Limited effort in area
Territory Managed Fisheries	Special Permit	No recent effort reported, OA outside of jurisdiction	Limited effort in area
Territory Managed Fisheries	Timor Reef Fishery	No recent effort reported, OA outside of jurisdiction	Limited effort in area
Territory Managed Fisheries	Jigging Fishery	No recent effort reported, OA outside of jurisdiction	Limited effort in area
Territory Managed Fisheries	Pearl Oyster Fishery	No recent effort reported, OA outside of jurisdiction	Limited effort in area

5.5.6.1 Northern Territory Department of Industry, Tourism and Trade

The Northern Territory Department of Industry, Tourism and Trade (**NT DITT**) were identified as a relevant person by NOPSEMA.

The NT DITT are the managing department for Territory fisheries who coordinate the authorisation of commercial fisheries licenses, fisheries management and surveillance/enforcement programs within Territory Coastal Waters. Consultation with all other Commonwealth and State departments occurred in accordance with the methods described in **Section 5.4.5.2.1**, as no further requests for information were received requiring more detailed communications regarding the potential impacts to the relevant persons activities.

SLB electronically distributed a tailored Information Sheet and cover email to NT DITT on 6 April 2023, to the email contact provided via their website. The information summarised a high-level description of the proposed Seismic Survey, location of the OA, oil spill modelling and fisheries assessments undertaken to date, SLBs commitments to communication throughout the project and environmental performance. The information included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area. Relevant personnel and contact details were included within the information. Additionally, SLB queried who the peak industry body for consultation with NT commercial fisheries license holders would be, noting that they currently understood Northern Territory Seafood Council held these delegations.

A representative from the NT DITT (NT Fisheries) responded via email on 13 April 2023. The respondent confirmed that the operational area is contained wholly within WA waters and consequently there are no Northern Territory commercial fisheries operating within the area. Nonetheless, it was noted that the stock structure of many commercially and recreationally important fish species is not well understood and any potential impact on aquatic life within the operational area, as a result of the proposal, could potentially negatively impact on fish stocks or those shared stocks that straddle the WA/NT border.

Amongst other statements, the respondent requested that any seismic work undertaken, does not occur within the warmer months of the year, which generally coincide with many tropical fish species spawning seasons. The spawning season for many tropical fish species usually occurs from about September until the end of March. The respondent noted that the best option from NT Fisheries point of view would be to conduct seismic work soon after the wet season ends, as conducting the survey later in the year would potentially lead to negative impacts on fish stocks just prior to a spawning event.

The respondent confirmed that Northern Territory Seafood Council would be the appropriate body to contact regarding consultation with NT commercial fisheries that operate within the EMBA.

SLB sent a follow-up email on 14 April 2023 with the objective of providing further information which may assist NT Fisheries in determining the potential impacts to their interests, being aquatic (fisheries) resources. SLB provided a series of excerpts from the EP which specifically address NT Fisheries concerns regarding impacts to fish, fish larvae and eggs. SLB also confirmed that the impacts to fish, fish larvae and eggs have been assessed within the EP by a fish and fisheries specialist.

SLB noted NT Fisheries statement regarding sensitive seasonal windows, such as the warmer months, which generally coincide with many tropical species spawning seasons and confirmed that, in the course of developing the EP, consideration has been given to all sensitivities, seasonality and receptors that could be influenced by the activity and the temporal windows in which these sensitivities may be most vulnerable.

SLB confirmed that an appropriate management measure had been developed with specific regard to the conservation of fish populations (i.e. avoidance of shallow areas) and provided excerpts from the EP detailing this measure. SLB also confirmed that commercial fisheries protocol would be in place to compensate fishers for loss of catch, where a claim is determined to have merit, should any unanticipated impacts to fish arise as a result of the seismic survey.

SLB asked that NT Fisheries review the information provided and confirm whether it had assisted in further determining whether there may be any impacts to their interests. At this time of this report, no feedback has been received from NT Fisheries.

Based on the discussion above around the specific consultation undertaken with NT Fisheries, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for the NT Fisheries to determine the potential impacts and/or risks to their functions, interests and activities, and that the EP review process can advance. Importantly, through the consultation undertaken to date SLB has obtained an understanding of the NT Fisheries interests and the mechanism through which NT Fisheries perceive their interests, spawning activity of commercially important species, may be impacted. Notably, the assessment undertaken within **Section 7.2** indicates that the risk of negative impact to commercial fishery catches due to exposure to seismic emissions associated with the MSS has been assessed as low. Similarly, the impact and risk acceptability assessment undertaken within **Section 7.2.7** determined the predicted level of impact from acoustic emissions do not exceed the defined acceptable level.

Notwithstanding, as a direct result of consultation with NT DITT, SLB completed further desktop assessment to comprehensively characterise fish spawning activity within the EMBA (refer to **Section 4.5.1.2**). Consequently, the potential impacts of the Seismic Survey were re-assessed. Though, there was no changes to the assessment of impacts within **Section 7.2.2.2.3.2** and **Section 7.2.3.1** or control measures outlines within **Section 7.2.6**. Hence, there were no changes to the impact and risk acceptability assessment undertaken within **Section 7.2.7.** All objections and claims raised were managed in accordance with the processes outlined in **Section 5.5.13**.

SLB commits to continuing their consultation efforts with NT Fisheries through ongoing consultation as per the discussion in **Section 5.5.14**, including provision of the pre-activity notification and post activity notification (refer to **Section 5.5.14** through to **Section 5.5.16**).

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.6.2 Commonwealth Fisheries Australia

In accordance with the guidance framework *Supporting cooperative coexistence of seismic surveys and commercial fisheries in Australia's Commonwealth marine area* (Commonwealth of Australia, 2022), Commonwealth Fisheries Australia (**CFA**) are the peak industry body representing the interests of fishers operating in Commonwealth managed fisheries.

CFA replied in the second-round of general consultation with relevant persons. CFA directed this information to three alternate peak industry bodies, including WAFIC, ASBTIA and Tuna Australia. SLB confirmed that they are consulting with all relevant commercial fishers and thanked CFA for providing further suggestions. Whilst WAFIC and ASBTIA had already been identified as relevant persons, CFA's recommendation to contact Tuna Australia was adopted to ensure 'broad capture' of relevant persons as defined in **Section 5.4.5.2.2**.

Based on updated guidance from NOPSEMA, SLB contacted CFA via phone on 12 May 2023. There was no response to the call, however, SLB left a message requesting CFA return the call to discuss the license holders which CFA represents and any boundaries which may exist around this representation.

Based on the discussion above around the specific consultation undertaken with CFA, and the unedited correspondence in **Appendix F** including CFAs statement that they will leave it with the relevant commercial fishers based in WA, SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for the CFA to determine the potential impacts and/or risks to their functions, interests and activities, and that the EP review process can advance. SLB commits to continuing their consultation efforts with CFA as per the discussion in **Section 5.5.14**, including, including through provision of the pre-activity and post-activity notification (refer to **Section 5.5.15** and **Section 5.5.16**)

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.6.3 Australian Southern Bluefin Tuna Industry Association

The Australian Southern Bluefin Tuna Industry Association (ASBTIA) were identified as a relevant person through the methods defined in **Section 5.4.** Further, ASBTIA were identified as a relevant person through consultation with CFA (refer to **Section 5.5.6.1**) and Tuna Australia (refer to **Section 5.5.6.7**). Hence, consultation with ASBTIA is summarised herein.

As stated by ASBTIA via their website:

> *'…The Australian Southern Bluefin Tuna Industry Association (ASBTIA) represents the Australian SBT industry…Over 90% of Australia's quota is caught by ASBTIA's 7 member companies…'*

ASBTIA replied in the first round of general consultation with relevant persons. ASBTIA confirmed they:

> *'…do not actively fish in that area, nor is the area within what we believe to be the spawning area for our SBT stocks. You do not need to keep us informed of this activity…'*

No further consultation with ASBTIA or license holders of the SBTF were conducted.

Based on the discussion above around the specific consultation undertaken with ASBTIA, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for the ASBTIA to determine the potential impacts and/or risks to their functions, interests and activities, and that the EP review process can advance. SLB will preclude ASBTIA from ongoing consultation based on the statements from ASBTIA outlined above.

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.6.4 Northern Prawn Fishing Industry Pty Ltd

The Northern Prawn Fishing Industry Pty Ltd (**NPFI**) were identified as a relevant person through consultation with the nominated AFMA Fishery Manager for the Northern Prawn Fishery. In accordance with guidance provided by the nominated AFMA Fishery Manager, SLB consulted with '*license holders within the Northern Prawn Fishery (NPF) as well as the NPF's industry association, the Northern Prawn Fishery Industry Association (**NPFI**)*'.

As stated by NPFI via their website:

> *'…The Northern Prawn Fishing Industry is a collective of trawler operators, processors and marketers acting together as a voice for the industry in the Northern Prawn Industry, which spans the pristine waters from Cape York to The Kimberley's. The company was formed in 2007 to represent the interests of Northern Prawn Fishery operators and to promote the on-going sustainable development of the fishery….'*

SLB electronically distributed a tailored Information Sheet and cover email to the NPFI on 8 February 2022, to the email contact provided by the nominated AFMA Fishery Manager and as is listed on the NPFI website. The information summarised a high-level description of the proposed Seismic Survey, location of the OA, SLBs commitments to communication throughout the project and environmental performance. The information included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area. Relevant personnel and contact details were included within the information. No response from the recipient or license holders were received.

SLB distributed a revised information sheet, including a summary of the relevant fisheries assessments undertaken to date, and spreadsheet of GPS coordinates on 6 April 2023. Again, the Information Sheet and cover email requested for license holders to make contact or provide any feedback in regard to the Seismic Survey. At the time of this report, there was still no response received from NPFI or associated license holders.

Based on the discussion above around the specific consultation undertaken with NPFI, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for the NPFI to determine the potential impacts and/or risks to their functions, interests and activities, and that and the EP review process can advance. SLB commits to continuing their consultation efforts with NPFI as per the discussion in **Section 5.5.14**, including through provision of the pre-activity and post-activity notification (refer to **Section 5.5.15** and **Section 5.5.16**).

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.6.5 Northern Prawn Fishery License Holders

Northern Prawn Fishery license holders were identified as a relevant person through consultation with the nominated AFMA Fishery Manager for the Northern Prawn Fishery. In accordance with guidance provided by the nominated AFMA Fishery Manager, SLB consulted with '*license holders within the Northern Prawn Fishery (NPF) as well as the NPF's industry association, the Northern Prawn Fishery Industry Association (**NPFI**)*'.

SLB obtained the relevant license holders contact details from AFMA under the terms of a Deed of Confidentiality. Contact details including the relevant postal address, email address and phone number were provided.

SLB electronically distributed a tailored Information Sheet and cover email to each of the listed license holders of the Northern Prawn Fishery on 22 May 2023. The information summarised a high-level description of the proposed Seismic Survey, location of the OA, fisheries assessments undertaken to date, SLBs commitments to communication throughout the project and environmental performance. The information included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area. Relevant personnel and contact details were included within the information. No response from the license holders were received.

SLB contacted license holders via phone throughout the 1 June 2023 and 2 June 2023 and received a range of responses, including confirmation that license holders had no concerns and/or would like to be removed from further consultation or notification that they would review the information, though many did not respond to the call. Where recipients answered the call and hadn't reviewed the information, SLB provided a high-level description of the proposed Seismic Survey, location of the OA, fisheries assessments undertaken to date and control measures relevant to commercial fishers. SLB asked whether they had any further questions based on the information provided, or whether the information provided was sufficient. Where there was no response to the call, SLB left a message requesting a return call or response to the email sent on 22 May 2023.

SLB sent a follow-up email on the 6 June 2023, including an attached Information Sheet and spreadsheet of GPS coordinates. At the time of this report, there was still no response received from Northern Prawn Fishery license holders.

Based on the discussion above around the specific consultation undertaken with NPFI, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled (refer to refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for the NPFI to determine the potential impacts and/or risks to their functions, interests and activities, and that the EP review process can advance. SLB commits to continuing their consultation efforts with Northern Prawn Fishery License Holders as per the discussion in **Section 5.5.14**, including through provision of the pre-activity and post-activity notification (refer to **Section 5.5.15** and **Section 5.5.16**).

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.6.6 North West Slope Trawl Fishery License Holders

Northern West Slope Trawl Fishery license holders were identified as a relevant person, in lieu of a relevant representative body to consult with.

SLB obtained the relevant license holders contact details from AFMA under the terms of a Deed of Confidentiality. Contact details including the relevant postal address, email address and phone number were provided.

SLB electronically distributed a tailored Information Sheet and cover email to each of the listed license holders of the North West Slope Trawl Fishery on 22 May 2023. The information summarised a high-level description of the proposed Seismic Survey, location of the OA, fisheries assessments undertaken to date, SLBs commitments to communication throughout the project and environmental performance. The information included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area. Relevant personnel and contact details were included within the information. No response from the license holders were received.

SLB contacted license holders via phone on 2 June 2023, though did not receive any response. Subsequently, SLB left a message requesting a return call or response to the email sent on 22 May 2023.

SLB sent a follow-up email on the 6 June 2023, including an attached Information Sheet and spreadsheet of GPS coordinates. At the time of this report, there was still no response received from North West Slope Trawl license holders.

Based on the discussion above around the specific consultation undertaken with NPFI, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for the NPFI to determine the potential impacts and/or risks to their functions, interests and activities, and that the EP review process can advance. SLB commits to continuing their consultation efforts with North West Slope Trawl Fishery license holders as per the discussion in **Section 5.5.14**, including through provision of the pre-activity and post-activity notification (refer to **Section 5.5.15** and **Section 5.5.16**).

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.6.7 Tuna Australia

Tuna Australia were identified as a relevant person through consultation with the Commonwealth Fisheries Association.

SLB electronically distributed a tailored Information Sheet and cover email to Tuna Australia on 8 February 2022, to the email contact provided via the AMFA website. The information summarised a high-level description of the proposed Seismic Survey, location of the OA, fisheries assessments undertaken to date, SLBs commitments to communication throughout the project and environmental performance. The information included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area. Relevant personnel and contact details were included within the information.

Tuna Australia responded on 12 April 2023, indicating the proposed 3D seismic survey area is unlikely to have an impact based on their understanding of the Western and Eastern Tuna and Billfish Fisheries. Notwithstanding this, Tuna Australia offered to facilitate consultation with Western Tuna Billfish Fisheries concession holders on SLBs behalf and provided an associated Position Statement and agreement of services.

In accordance with guidance provided by AFMA during consultation, SLB continued to consult with fishers who may have entitlements to fish within the proposed area. As directed by AFMA, this can be done through the relevant fishing industry associations or directly with fishers who hold entitlements in the area.

Within their Position Statement, Tuna Australia states:

> *"…Tuna Australia is the industry association representing statutory fishing right holders, fishing companies, fish processors and sellers and associate members of the Eastern and Western Tuna and Billfish fisheries in Australia…Tuna Australia is considered the peak body for the longline fishing sector by the Australian Government. Therefore, Tuna Australia is considered a 'relevant person' consistent with a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environmental plan…"*

In May 2023, SLB contacted Tuna Australia to progress the service agreement provided by Tuna Australia for consultation with all their members in regard to the Western Tuna and Billfish Fishery, Southern Bluefin Tuna Fishery and Australian Skipjack Fishery.

The consultation process that Tuna Australia commenced on 24 May 2023 and involved an initial email campaign which provided the project specific information sheet and GPS coordinates out to all concession holders inviting comment on the survey. Tuna Australia requested that their members provide all comments on the proposed survey by 2 June 2023. Between 4-8 June, Tuna Australia made a number of phone calls to members in order to seek clarity on information provided as well as to have discussions with concession holders whilst in port. Tuna Australia also had face to face discussions with a number of members who hold SBT and skip jack concessions. Tuna Australia also consulted with the AFMA SBT Manager regarding current science on migration and distribution of SBT.

There was approximately 61% active engagement from the Tuna Australia members with the consultation method (i.e. clicked on links, opened attachments) with the documents provided being opened multiple times, which Tuna Australia suggested there was repeat engagement with the material provided. The consultation report that Tuna Australia incorporates feedback provided from 40-50 members, advice from Tuna Australia directors and discussions with external sources.

Having reviewed the Position Statement and commentary supplied by Tuna Australia regarding the likelihood of impacts, along with the consultation feedback, SLB consider they have ascertained Tuna Australia's and their members interests and activities that may be affected by the survey. The detailed fisheries assessment of catch and effort over the previous four reporting years indicated no pelagic fishing activity has occurred within the EMBA which is also confirmed within the Tuna Australia summary of the active tuna fisheries in Australia; however, there is potential for tuna fishing activity within the EMBA at the end of 2023. Tuna Australia's consultation summary is provided in **Appendix I**. The concerns raised within the consultation summary regarding the proposed survey have been assessed for their merits and responded to throughout this EP within **Section 7.2**.

As a result of the consultation process that SLB has undertaken with Tuna Australia on behalf of its members, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled in relation to the pelagic fishing interests of Tuna Australia and its members (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for the Tuna Australia to determine the potential impacts and/or risks to their functions, interests and activities.

SLB commits to continuing their consultation efforts with Tuna Australia and the license holders they represent within ongoing consultation as per the discussion in **Section 5.5.14**, including the provision of the pre-activity and post-activity notifications, 48-hour lookaheads and communications as and when required (**Section**s **5.5.14** to **5.5.15**).

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.6.8 Western Skipjack Tuna Fishery License Holders

Western Skipjack Fishery license holders were identified as a relevant person, in lieu of a relevant representative body to consult with.

SLB obtained the relevant license holders contact details from AFMA under the terms of a Deed of Confidentiality. Contact details including the relevant postal address, email address and phone number were provided.

SLB electronically distributed a tailored Information Sheet and cover email to each of the listed license holders of the Western Skipjack Tuna Fishery on 22 May 2023. The information summarised a high-level description of the proposed Seismic Survey, location of the OA, fisheries assessments undertaken to date, SLBs commitments to communication throughout the project and environmental performance. The information included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area. Relevant personnel and contact details were included within the information.

SLB received one response on 23 May 2023 from a license holder requesting they be removed from the mailing list and direct all correspondence through Tuna Australia. On this basis, SLB confirmed with Tuna Australia that Western Skipjack Tuna Fishery license holders would be incorporated within their consultation program, previously thought to capture only the Eastern and Western Billfish Tuna Fishery license holders. Tuna Australia confirmed that their program did capture Western Skipjack Tuna Fishery license holders. Therefore, to avoid duplication and consequent confusion, further consultation with Western Skipjack Tuna Fishery license holders occurred in accordance with Tuna Australia's processes.

Based on the discussion above around the specific consultation undertaken with Western Skipjack Fishery license holders, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for the Western Skipjack Fishery license holders to determine the potential impacts and/or risks to their functions, interests and activities, and that the EP review process can advance. SLB commits to continuing their consultation efforts with Western Skipjack Fisherylicense holders through ongoing consultation with Tuna Australia as per the discussion in **Section 5.5.14**, including through provision of the pre-activity and post-activity notification (refer to **Section 5.5.15** and **Section 5.5.16**).

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.6.9 Western Australian Fishing Industry Council Consultation

As nominated by the WA Government, the Western Australian Fishing Industry Council (**WAFIC**) are the peak industry body representing commercial fishing, pearling, and aquaculture enterprises as well as processors and exporters in WA. WAFIC was created by the industry more than 50 years ago to work in partnership with government and set directions for the management of WA's commercial fisheries. SLB has been communicating with the WAFIC since the commencement of the consultation programme to effectively engage with license holders actively operating within the OA. As stated by WAFIC (see unedited correspondence in **Appendix F**):

> *"The comments provided as part of this consultation are WAFIC comments in relation to us representing the interest of the broader commercial fishing aimed at minimising impacts to our industry. The individual licensed commercial fishers were also given the opportunity to provide feedback on the proposed activities, and as you are aware no feedback was received. WAFIC has assisted in the engagement process with fishers by distributing the fact sheet developed of the Bonaparte Basin 3D seismic survey".*

WAFIC replied in the second-round of consultation with relevant persons. WAFIC requested further information regarding the proposed air gun array volume (in^3) and queries regarding the assessment of the peak fishing periods, key spawning times for aquatic species during the survey period and the possibility of an adjustment protocol to compensate fishers if they are displaced from their fishing grounds during the Seismic Survey.

SLB provided the fishery assessment results that were carried out across the OA to WAFIC as well as all of the additional information that WAFIC had requested. The fisheries assessment identified two fisheries as either fishing in or close to the OA and they are discussed in **Sections 5.5.6.10** and **5.5.6.11**. Following the annual summaries of catch data over a five-year period, WAFIC recommended monthly breakdown in catch effort, which was requested from DPIRD and provided to WAFIC once the additional assessment was complete. No further questions were received from WAFIC over the fisheries assessment.

WAFIC made it clear that consultation with fishers has changed recently, whereby in the past, operators went to WAFIC, who then engaged with their members on the proposed offshore activity. However, this was taking up a lot of WAFIC's time due to extensive levels of consultation and made a call to no longer facilitate consultation with licence holders. As a result, it was now up to the applicant to complete the consultation with licence holders. Due to confidentiality reasons, WAFIC are not able to pass on contact details of licence holders which made it very difficult in contacting the licence holders directly.

SLB requested contact details from DPIRD for the licence holders within the two fisheries identified as either fishing in or close to the OA; however, only postage details were provided, as summarised in **Section 5.5.6** and **Section 5.5.6.11**.

SLB met with WAFIC on 6 September 2022 to provide an update on the EP process and discuss further consultation with relevant persons given there was still no responses from any licence holder, even after the EP was publicly notified for a period of 30 days. The intention of the meeting was to discuss with WAFIC the difficulties in consulting directly with licence holders when full contact details are not available, and no responses had been received to the mail out of information in April 2022. SLB had already sent out another round of letters which included the Information Sheet providing details of the Seismic Survey to all licence holders within the two identified fisheries on 5 September 2022.

WAFIC acknowledged the difficulty titleholders are having engaging with licence holders when no contact details are provided other than postal addresses. As a result, WAFIC has restarted facilitating the consultation process between titleholders and fishers, following a fee for service-based approach, which SLB agreed to.

In order to provide sufficient and relevant information to the licence holders, WAFIC recommended that the information sheet should be short, succinct and include specific details such as survey commencement and duration, along with a summary of control measures relevant to the licence holders and their activities. WAFIC also suggested that a Microsoft excel spreadsheet be included within the information distributed that has the GPS coordinates of the OA in WGS84 projection, so they can be easily copied into chart plotting systems to determine whether their specific fishing activities will be impacted or not.

Following these recommendations, SLB modified the Information Sheet, which is provided in **Appendix H**. SLB considers that following two rounds of letters and the revised information sheet and GPS coordinates that WAFIC distributed, that the licence holders have been provided with sufficient information to allow an informed assessment of whether their activities will be impacted by the proposed Seismic Survey. The minutes of this meeting are provided in **Appendix G**.

WAFIC suggested that two-weeks was sufficient time for licence holders to make an informed decision as to whether the Seismic Survey will have any impact on their activities, and also sufficient time for the licence holders to provide any feedback or ask any further questions. As a result, SLB considers that the information provided to the relevant persons and the time period allowed for them to make an informed assessment, is in accordance with the requirements of the Environment Regulations 11A.

After the licence holders were provided a two-week period to consider the information distributed, WAFIC confirmed there were no responses received from any licence holders. There was also no feedback received from the letters and information sheet that SLB distributed to all licence holders within the NDSMF and MMF.

After the RFFWI by NOPSEMA, SLB undertook further consultation with WAFIC, more in terms of the commercial fishers operating in the wider EMBA that could be impacted if the hull of the Seismic Survey vessel was ruptured and the fuel tanks were also ruptured, releasing fuel oil into the marine environment. SLB met with WAFIC to discuss this and WAFIC's preferred approach and recommendation to SLB was to have two separate consultation strategies for direct operational impacts (i.e. physical presence of survey vessel and towed array) and unplanned events (i.e. fuel oil spill).

WAFIC suggested that in the unlikely chance an unplanned event occurred such as fuel oil spill, SLB would notify WAFIC immediately of the spill, and WAFIC would immediately notify and consult with the affected stakeholders (i.e. fishers) on behalf of the titleholder, directly when that event occurs (refer to **Section 5.7.2**). WAFIC noted that this approach is appropriate for consultation when the likelihood of an oil spill occurring like modelled is extremely low.

In January 2023, further discussions were held with WAFIC to confirm their expectations of SLB should a fuel oil spill occur (refer to meeting minutes in **Appendix G**). SLB has demonstrated their awareness and understanding of their obligations to WAFIC including:

- providing a comprehensive overview of SLB's arrangements for responding to a spill event within the Oil Pollution Emergency Plan (OPEP) **Section 10.10**;
- detailing the notification requirements to the relevant State or Commonwealth agencies referred to in the OPEP (**Table 128** of **Section 10.10.6.1.3**) and noting here that WAFIC has been incorporated into the notifications procedures set out in **Table 128**. This process enables WAFIC to initiate the fishery closure process if required;
- referencing the Operational and Scientific Monitoring Program (OSMP) in Appendix L which outlines the scientific monitoring to be undertaken in the event of a spill. The monitoring response, if triggered, is specific to the spatial and temporal requirements, and sensitivities identified (in accordance with the NEBA process) across the modelled trajectory. The process set out in the OSMP (permit requirements, suite of monitoring plans to be triggered, and reporting processes) ensures that information can assist with traceability of affected catch and impacted areas, which can be used to inform processing facilities and ultimately provide consumers and industry confidence about returning to impacted areas; and
- developing a financial compensation protocol that addresses damaged or lost equipment, fish catch loss and costs associated with relocation and a temporary reduction in catch due to displacement.

During February 2023, SLB consulted with WAFIC regarding the requirements to be included in the protocol. Following further consultation during November to December 2023, SLB agreed to adopt the WAFIC endorsed National Energy Resources Australia Commercial Fishing Industry Adjustment Protocol (NERA, 2021). The requirements of this protocol are fortified within the EP as control measures, which must be met and implemented and will be compliance-monitored.

Based on the detailed discussion above around the extensive consultation undertaken with WAFIC, and the unedited correspondence in **Appendix F**, and given SLB has ascertained WAFICs interests and activities that may be affected by the survey and incorporated measures within the EP to address their concerns, SLB has fulfilled their consultation obligations (refer to **Section 5.5.13**) in order for the EP review process to advance. As WAFIC is considered a Category A relevant person with an 'involved' level of consultation (**Table 29**), SLB will continue to directly consult with WAFIC throughout the duration of the EP as per the discussion in **Section 5.5.14**, this will encompass the finalization of the review process of the compensation protocol.

Further details of consultation with WAFIC are provided in **Appendix F**.

5.5.6.10 Northern Demersal Scalefish Managed Fishery Consultation

SLB has been communicating with the NDSMF since the commencement of the relevant persons consultation programme to effectively engage with the license holders actively operating within the OA. A fishery assessment was undertaken to further understand the potential for conflict with NDSMF licence holders (**Section 4.7.3.2.1**). The NDSMF assessment extracted information from FishCube over the period 2015-2020 and identified that the OA overlapped with 11% of the fished area and the AA overlapped with 5% of the fished area.

As described above, general consultation communications were sent to both DPIRD and WAFIC in January 2022 and February/March 2022 as the Government regulator of State Fisheries and the peak industry representative for corresponding license holders, respectively.

SLB were advised that WAFIC are the relevant fisheries representative with regard to proposed oil and gas activities. The nature and timing of communications with WAFIC are described in **Section 5.5.6.9**. Due to consultation fatigue and resourcing, WAFIC changed their stance on how they engage with industry and licence holders and as a result, stopped facilitating consultation with relevant persons or distributing relevant information to licence holders. WAFIC recommended SLB submit a request to DPIRD for the contact information of licence holders active in the northern demersal scalefish fishery.

SLB subsequently submitted a request and obtained the details of the relevant licence holders in the northern demersal scalefish fishery; however, only postage details were provided. Several attempts were made to find phone numbers or emails for the licence holders but that did not prove successful despite many attempts.

As a result, a hard copy letter and accompanying Information Pack was sent directly to individual NDSMF license holders on 22 April 2022. The letter summarised a high-level description of the proposed Seismic Survey, location of the OA, fisheries assessments undertaken to date, SLB's commitments to communication throughout the project. The cover letter sent to licence holders requested the licence holders to make contact and provide their electronic or phone details to commence further consultation.

Unfortunately, WAFIC could not facilitate any further consultation with the licence holders or provision of contact details. No responses from license holders were received nor were any contact details such as email or telephone number provided to follow up again. It is considered that licence holders were provided sufficient information and given sufficient time to assess the information that they were provided, and to make an informed decision as to whether the proposed Seismic Survey would have any impact on their fishing activities. SLB are still awaiting a response to these letters, and it is considered that sufficient information was provided to the licence holders, an adequate time period was provided to receive any feedback, along with a request from SLB for the licence holders to provide further contact details so more direct consultation could take place. Based on this, and despite all the efforts to consult with the licence holders, the assessment undertaken within **Section 7.1.3.1** and the control measures implemented have been based on industry best practice and SLBs previous experience working with fishers, given no direct feedback was received from any licence holders to incorporate into this process. Notwithstanding this, SLB are willing to commence consultation at any time and provide further information or 48-hour lookaheads at any point with these licence holders, should they make contact for such a request.

Following the 30-day public notification period of the EP, and still no responses received from licence holders, another round of hard copy letters was distributed on 5 September 2022. Again, the cover letter requested for the licence holders to make contact or provide any feedback in regard to the Seismic Survey. After four weeks there was still no response received from licence holders following this mail out.

As discussed in **Section 5.5.6.9**, WAFIC facilitated consultation between SLB and the NDSMF licence holders by electronically distributing a revised information sheet and spreadsheet of GPS coordinates on 12 September 2022. WAFIC provided licence holders with a two-week period for any feedback or concerns to be raised by licence holders. As of 28 September, no feedback had been received by any NDSMF licence holder.

Based on the discussion above around the consultation undertaken with NDSMF licence holder, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**). The multiple attempts at reaching out, both by SLB and WAFIC, is considered to constitute the provision of sufficient information and the extended period of time in which NSDMF had to respond is considered to correspond to a reasonable period of time for NDSMF licence holder to determine the potential impacts and/or risks to their functions, interests and activities. SLB commits to continuing their consultation efforts with NDSMF licence holder as per the discussion in **Section 5.5.14**, including through provision of the pre-activity and post-activity notification (refer to **Section 5.5.15** and **Section 5.5.16**).

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.6.11 Mackerel Managed Fishery (MMF) Consultation

The MMF is the other fishery identified as having activities in close proximity to the OA. A fishery assessment was undertaken to further understand the potential for conflict with NDSMF licence holders (**Section 4.7.3.2.2**). The MMF assessment extracted information from FishCube over the period 2015-2020 and identified that the OA overlapped with 1% of the fished area and there were no fishing activities in the Acquisition Area. The nature and status of consultation with the MMF licence holders is consistent with those described for NDSMF, in terms of two rounds of hard copy letters being sent out to licence holders (22 April 2022 and 5 September 2022) and WAFIC providing relevant information to the MMF licence holders. The cover letter that SLB distributed requested for the licence holders to make contact or provide any feedback in regard to the Seismic Survey to undertake further consultation. After four weeks from the letters being distributed, there was still no response received from licence holders following the second mail out of information.

WAFIC facilitated consultation between SLB and the MMF licence holders by distributing a revised information sheet and spreadsheet of GPS coordinates on 12 September 2022. WAFIC provided licence holders with a two-week period for any feedback or concerns to be raised by licence holders. As of 28 September, no feedback had been received by any MMF licence holder.

Based on the discussion above around the consultation undertaken with MMF licence holders, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**). The multiple attempts at reaching out, both by SLB and WAFIC, is considered to constitute the provision of sufficient information and the extended period of time in which MMF had to respond is considered to correspond to a reasonable period of time for MMF licence holders to determine the potential impacts and/or risks to their functions, interests and activities. SLB commits to continuing their consultation efforts with MMF licence holders as per the discussion in **Section 5.5.14**, including through provision of the pre-activity and post-activity notification (refer to **Section 5.5.15** and **Section 5.5.16**).

5.5.6.12 Northern Territory Seafood Council

The Northern Territory Seafood Council were identified as a relevant person through consultation with WAFIC. Following the ruling by Justice Bromberg on 14 October 2022, SLB met with WAFIC to understand how to best navigate the requirement to consult with relevant persons which may have functions, activities or interests within the EMBA. Acknowledging that the EMBA overlapped both WA and NT State Waters, the WAFIC representative indicated that Northern Territory Seafood Council were the NT equivalent peak industry association responsible for facilitating engagement with license holders.

In accordance with the guidance framework *Supporting cooperative coexistence of seismic surveys and commercial fisheries in Australia's Commonwealth marine area* (Australian Government, 2022), Northern Territory Seafood Council (**NTSC**) are the peak industry body representing the interests of commercial fishers operating in NT State managed fisheries.

SLB electronically distributed a tailored Information Sheet and cover email to NTSC on 27 October 2022, to the email contact provided via their website along with a request to meet and discuss the survey further. The information summarised a high-level description of the proposed Seismic Survey, location of the OA, fisheries assessments undertaken to date, SLBs commitments to communication throughout the project and environmental performance. The information included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area. Relevant personnel and contact details were included within the information. The information also included an example of consultation approaches determined in collaboration with WAFIC, such as 48 hour look aheads, for consideration.

SLB sent a follow-up email on the 18 January 2023 with another request to meet and discuss the details of the project and any potential conflict with fishers further.

SLB contacted the NTSC switchboard on 18 April 2023 and were provided with an additional internal email address through which to consult. During this phone call, the NTSC representative indicated that notification of proposed at-sea activities were typically included within an internal weekly newsletter issued via email to NT license holders and that, therefore, NT license holders may have already been made aware of the Seismic Survey. SLB sent a follow-up email on 18 April 2023, with the previous email correspondence and supporting information attached, summarising their phone call and requesting NTSC review the information provided and clarify whether this information has already been circulated to NT license holders.

SLB sent another follow-up email on 1 May 2023 requesting feedback on the request for clarification provided on the 18 April 2023. SLB requested NTSC contact them if any additional information or assistance was required to progress this query.

A representative from NTSC responded via email on 15 May 2023. The respondent confirmed that the, as discussed, the area is located in WA and is not in NT waters and that the activity had not been communicated to the broader membership. NTSC noted that those which have dual licenses in NT and WA would presumably be aware of the activity from WAFIC.

SLB contacted NTSC via phone on 30 May 2023. SLB thanked NTSC for their email response and confirmed that the purpose of this follow-up phone call was to attempt to clarify SLBs interpretation of NTSCs role as it relates to consultation with titleholders on behalf of license holders. SLB confirmed that they understood NTSC's role, amongst other things, was to act as an incorporated association which represented NT seafood industry's interests when consulting with other industries. NTSC confirmed that this query was best placed through liaison with an alternate team member. NTSC provided an additional internal email address through which to place this query. SLB and NTSC determined that the best course of action would be to meet to discuss this matter, and re-provide information previously supplied regarding the activity within the meeting request.

SLB electronically re-distributed the materials previously supplied to the additional NTSC email address provided on 31 May 2023. Within the email, SLB requested NTSC advise a suitable meeting time prior to 7 June 2023. SLB noted that it would be good to discuss whether NTSC have any questions or concerns over what is being proposed, whether they are satisfied with the information SLB have provided and also to confirm the delegations for consultation with NT commercial fisheries license holders. SLB clarified that they are eager to confirm their interpretation of NTSC role as it relates to consultation with titleholders and license holders. At the time of this report, there was still no response received from NTSC or associated license holders.

Based on the discussion above around the consultation undertaken with NTSC, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for the NTSC or associated license holders to determine the potential impacts and/or risks to their functions, interests and activities, and that the EP review process can advance. SLB commits to continuing their consultation efforts with NTSC as per the discussion in **Section 5.5.14**, including through provision of the pre-activity and post-activity and post-activity notification **Section 5.5.15** and **Section 5.5.16**.

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.6.13 Northern Territory Guided Fishing Industry Association

The Northern Territory Guided Fishing Industry Association (**NT GFIA**) were identified as a relevant person through the methods defined in **Section 5.4.**

As stated by NT GFIA on their website:

> *'…NT GFIA is the peak body responsible for promoting, developing, and maintain the guided fishing industry in the Territory. From wild coastal rivers and estuaries to the rich open waters of the Timor And Arafura Seas…The NT GFIA represents professional fishing guides and operators of the Northern Territory…The NTFGIA also provides advice on legislative, management and practical issues to government and decision makers…'*

SLB contacted NT GFIA via phone on 19 May 2023 to provide a high-level summary of the Seismic Survey and ascertain NT GFIA's delegations with regard to consultation. NT GFIA confirmed that they do represent guided and charter fishing license holders and they notify them and consult with the about other activities such as this, as needed. Consequently, SLB confirmed they would provide an information sheet NT GFIA which described the proposed survey area in relation to NT GFIA potential activities, the management measures and processes for communications.

SLB electronically distributed a tailored Information Sheet and cover email to NT GFIA on 22 May 2023, to the email contact provided on their website and confirmed via phone call. The information summarised a high-level description of the proposed Seismic Survey, location of the OA, oil spill modelling and fisheries assessments undertaken to date, SLBs commitments to communication throughout the project and environmental performance. The information included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area. Relevant personnel and contact details were included within the information.

SLB contacted NT GFIA via phone on 2 June 2023, though did not receive any response. Subsequently, SLB left a message requesting a return call or response to the email sent on 22 May 2023.

SLB sent a follow-up email on the 11 June 2023 including an attached Information Sheet and spreadsheet of GPS coordinates. The email included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area and queried whether the information provide was sufficient. At the time of this report, there was still no response received from NT GFIA.

Based on the discussion above around the consultation undertaken with NT GFIA, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for the NT GFIA to determine the potential impacts and/or risks to their functions, interests and activities, and that the EP review process can advance. SLB commits to continuing their consultation efforts with NT GFIA as per the discussion in **Section 5.5.14**, including through provision of the pre-activity and post-activity notification (refer to **Section 5.5.15** and **Section 5.5.16**).

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.7 Specific Relevant Persons Consultation – Submarine Cable Providers

Submarine cable providers were identified in accordance with the approach described in **Section 5.4**. Submarine cable providers who own and operate commercial assets within and surrounding the OA and could be impacted by the proposed activities are relevant persons. There are two submarine cables, the North-West Cable System and a decommissioned submarine cable which have been identified within the OA (**Section 4.7.6** and **Figure 39**). The Australian Hydrographic Office (**AHO**) was identified as a relevant person from the outset due to their function as the custodian of nautical products and other information required for safety of ships navigating in Australian waters. Further, the AHO were identified as a relevant person through consultation with the Australian Communications and Media Authority (**ACMA**).

Subsequent consultation with relevant persons occurred through a combination of communication modes (e.g., website contact/enquiry platforms, phone and email) to effectively circulate sufficient information, including tailored material, to relevant persons. Consultation with the submarine cable providers and the AHO commonly occurred as specific consultation, as appropriate. The level of specific consultation undertaken was proportionate to the level of interest and influence of relevant persons.

Further information on SLBs consultation process with the commercial fishing industry is provided in **Section 5.5.7.1** to **Section 5.5.7.5**.

SLB consider that the information provided to submarine cable providers and AHO was sufficient to make an assessment of the proposed Seismic Survey on their functions, activities or interests. SLB provided submarine cable providers and AHO with data visualisations depicting the inferred location of known submarine cables (refer to **Section 4.7.6**). Further, all recipients were asked whether further information was required, or, whether the information provided was sufficient. A response was obtained from all submarine cable providers, ultimately confirming that they did not have any objections or claims though selected providers would like to remain included in ongoing consultation to remain abreast of the survey details. The AHO confirmed that the submarine cables identified by SLB are the only submarine cables known to AHO.

Based on the discussion around consultation discussed above, SLB consider that sufficient information and a reasonable period of time were provided, as reflected in the receipt of response by all relevant persons (confirming that they did not have any objections or claims).

The information obtained during the course of consultation has informed this EP.

5.5.7.1 Australian Communications and Media Authority

The Australian Communications and Media Authority (**ACMA**) were identified as a relevant person after two submarine cables were determined to intercept the OA and EMBA. In accordance with SLBs objective to 'support ongoing relevant person identification and consultation throughout the project', SLB distributed an information sheet, tailored supporting material, and cover email to the relevant ACMA email address as listed on the ACMA website on 16 February 2023. The information summarised a high-level description of the proposed Seismic Survey, location of the OA, SLBs commitments to communication throughout the project and environmental performance. The information included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area. Relevant personnel and contact details were included within the information. Tailored supporting material consisted of a figure depicting the inferred location of the North-West Cable System and a decommissioned submarine cable, with respect to the OA and EMBA.

The ACMA responded on 21 February 2023 to confirm the request had been received and was under consideration. SLB received a subsequent response from the ACMA on 22 February 2023 detailing the regulatory functions of the ACMA with regard to submarine cables, including the authority to impose restrictions or prohibitions on certain activities that pose a risk to submarine cables of national significance. The ACMA confirmed the proposed survey area did not appear to be in the vicinity of a protection zone associated with a submarine cable of national significance. Notwithstanding, the ACMA advised SLB to contact the owners of any submarine cables in the survey area. The ACMA identified Vocus as the owner of the North-West Cable System and BW Digital and Inligo Networks as owners of forthcoming submarine cable projects. The ACMA also recommended SLB contact the AHO, who maintain records of the geospatial coordinates of all active and out-of-service submarine cables including those which ACMA may not be able to provide comment on.

SLB conducted further consultation based on ACMAs recommendations (as detailed in the subsections below) and is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for the ACMA to determine the potential impacts and/or risks to their functions, interests and activities and that the EP review process can advance. SLB commits to continuing their consultation efforts with ACMA as per the discussion in **Section 5.5.14**, including through provision of the pre-activity and post activity notification (refer to **Section 5.5.15** and **Section 5.5.16**).

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.7.2 Inligo Networks

SLB raised a general enquiry with Inligo Networks via their website on 23 February 2023. On Wednesday 5 April 2023, SLB called the Inligo Networks switchboard via the (Melbourne) number listed on their website. The switchboard operator provided a direct email address for personnel responsible for these queries. SLR electronically distributed an Information Sheet and cover email to the Inligo Networks email contact provided on 5 April 2023. The information summarised a high-level description of the proposed Seismic Survey, location of the OA, SLBs commitments to communication throughout the project and environmental performance. The information included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area. Relevant personnel and contact details were included within the information. Tailored supporting material consisted of a map depicting the inferred location of the North-West Cable System and a decommissioned submarine cable, with respect to the OA and EMBA.

Inligo Networks responded on 11 April 2023, confirming that they had reviewed the material supplied and that the works described will not have any impact on the cable planned by Inligo Networks. The respondent confirmed that the planned cable did not intercept the EMBA. Additionally, that marine survey works planned for 2024 would be constrained to, or close to, the expected cable path. The respondent requested Inligo Networks be advised if delays or changes to the works timetable require any part of the works to push into 2025.

SLB responded on 11 April 2023 and confirmed the detailed response had been received and committed to keep Inligo Networks updated on the programme going forward, including any extension to the proposed activities.

SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for Inligo Networks to determine the potential impacts and/or risks to their functions, interests and activities and that the EP review process can advance. SLB commits to continuing their consultation efforts with Inligo Networks as per the discussion in **Section 5.5.14**, including through provision of the pre-activity and post activity notification (refer to **Section 5.5.15** and **Section 5.5.16**).

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.7.3 BW Digital

SLB raised a general enquiry with BW Digital via their website on 23 February 2023. The query summarised a high-level description of the proposed Seismic Survey and location of the OA. The information included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area. SLB also queried whether any further information was required, or, whether BW Digital were satisfied with the information provided.

BW Digital responded on 23 February 2023 confirming that they had no additional questions at this stage. BW Digital asked to received look ahead notifications and be provided with any maps of the survey area along with general information on timing of the wider survey program to incorporate this into their proposed operations and identify any areas that may require further discussion.

SLB sent a follow-up email on 24 February to address the request for further information revied from BW Digital. SLB confirmed that BW Digital would be added to the 48 hour look aheads which will be distributed every 24 hours. The attachments (Information Sheet and figure) provided were consistent with those previously described for correspondence with Inligo Networks on 5 April 2023. The cover email provided an estimate survey commencement of March April, pending regulatory approval; however, it is noted that final notification on timing would be provided to BW Digital as part of the pre-survey notifications in accordance with the Implementation Strategy.

SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for BW Digital to determine the potential impacts and/or risks to their functions, interests and activities and the EP review process can advance. SLB commits to continuing their consultation efforts with BW Digital as per the discussion in **Section 5.5.14**, including through provision of the pre-activity and post activity notification as well as incorporating BW Digital as a recipient for look ahead notifications (refer to **Section 5.5.15** and **Section 5.5.16**)

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.7.4 Vocus

SLB raised a general enquiry with Vocus via their website on 23 February 2023. On Wednesday 5 April 2023, SLB called the Vocus Networks switchboard via the general number listed on their website. The switchboard operator provided a group email address for personnel responsible for the protection of assets. SLR electronically distributed an Information Sheet and cover email to the Vocus Networks email contact provided on 5 April 2023. The information summarised a high-level description of the proposed Seismic Survey, location of the OA, SLBs commitments to communication throughout the project and environmental performance. The information included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area. Relevant personnel and contact details were included within the information. Tailored supporting material consisted of a map depicting the inferred location of the North-West Cable System and a decommissioned submarine cable, with respect to the OA and EMBA.

Vocus responded on 18 April 2023, having forwarded the information internally to their National Field Operations Manager. The National Operations Manager requested confirmation of the coordinates and coordinate projection. SLR responded on 18 April 2023, confirming the coordinate projection and attaching shapefiles of the Operational Area and Acquisition Area. In parallel with issuing this email, SLR called Vocus to discuss the coordinates for the survey area on 18 April 2023.

SLB summarised the phone call within an email, issued on the following day. The email queried whether the coordinates provided were sufficient to determine where the survey is planned in relation to Vocus' activities and extended the offer to provide further information including 48 hour look aheads of the activities, nominally distributed every 24 hours.

Vocus responded on 20 April 2023 to confirm they have received the information and will respond shortly.

SLB sent a follow-up email on 1 May 2023 to see if Vocus had overlaid the coordinates provided and whether they had any concerns regarding the survey Acquisition Area.

Vocus responded on 3 May 2023, indicating that the Operational Area overlapped with one of Vocus' signal repeaters. Vocus referenced the ICPC requirements for best practice and recommendations when operating submarine cables. Vocus indicated that there may be a need to adjust grid patterns or signal strengths nearer to active equipment. Vocus requested estimated pressure at the seabed for this survey. Vocus also requested to receive the look ahead plans and, depending on the information provided, shorter notification of the vessels activities may be required when operating around the active equipment for network monitoring and assurance.

SLB compiled further detailed information regarding the location of the survey, including shapefiles and coordinates for the Acquisition Area. SLB provided further information regarding the nature and location of activities in which the acoustic source is active. A copy of the UAM report (Connell *et al*., 2022) was also provided with the appropriate limitations around the objective of this study. SLB requested coordinates for the repeaters for incorporation into the Environment Plan. SLB queried whether the asset owner had previous experience regarding suitable distance or exclusion thresholds from the receivers, with regard to commercial seismic surveys. SLB confirmed that they can ensure Vocus receives the 48 hour look ahead notifications which are distributed every 24 hours throughout the survey duration. SLB confirmed more frequent notifications during operations around the North West Cable System were possible if required following receipt of the further information. Having regard for this request, SLB requested Vocus advise of suitable notification requirements so that they may consider these for incorporation into operations.

SLB sent a follow-up email on 19 May 2023 to see if Vocus had any further concerns about the survey or whether they are comfortable, based on the spatial separation of the survey lines to their assets, that there will be no impact from the proposed survey.

Vocus responded on 19 May 2023 confirming that they had reviewed the information provided. Vocus confirmed that they are fine with the fact that there is no active equipment (i.e. signal repeaters) within the Acquisition Area and wished SLB well with the survey.

Based on the discussions above SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for Vocus to determine the potential impacts and/or risks to their functions, interests and activities and the EP review process can advance. SLB commits to continuing their consultation efforts with Vocus as per the discussion in **Section 5.5.14**, including through provision of the pre-activity and post activity notification as well as incorporating Vocus as a recipient for look ahead notifications (refer to **Section 5.5.15** and **Section 5.5.16**)

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.7.5 Australian Hydrographic Office

The Australian Hydrographic Office (**AHO**) were identified were identified as a relevant person through the methods defined in **Section 5.4.**

AHO provided an acknowledgment of receipt during the first-round of general consultation, though no feedback or specific commentary regarding the survey was provided.

The AHO was subsequently identified as a relevant person by ACMA in their remail response on 22 February 2023, where they suggested:

> *'…For further assistance identifying submarine cables in the vicinity of the survey area, including domestic submarine cables which the ACMA may not be able to provide comment on, we recommend SLB contact the AHO. AHO maintains records of the geospatial coordinates of all active and out-of-service submarine cables….'*

SLB distributed an information sheet, tailored supporting material, and cover email to the relevant AHO email address as listed on the AHO website (and as previously contacted) on 13 April 2023. The previous AHO respondents were also included as recipients on the email. The information summarised a high-level description of the proposed Seismic Survey, location of the OA, SLBs commitments to communication throughout the project and environmental performance. The information included a request for feedback and the offer to raise any concerns in relation to relevant persons activities in the area. Relevant personnel and contact details were included within the information. Tailored supporting material consisted of a map depicting the inferred location of the North-West Cable System and a decommissioned submarine cable, with respect to the OA and EMBA. The covering email provided contextual information as to why SLB was contacting AHO regarding the Seismic Survey, noting that ACMA had indicated they may be data custodians for geospatial data that details the location of all active and out-of-service submarine cables. SLB requested any such information was provided.

AHO provided an acknowledgment of receipt on 14 April 2023, though no feedback or specific commentary regarding the survey or the location of submarine cables was provided.

SLB sent a follow-up email on 18 April 2023 to query whether the relevant team members had received the previous email information and, if so, whether any further information regarding the location of submarine cables was available.

AHO responded on 2 May 2023 to confirm they have expedited this request. AHO subsequently confirmed, on the same day, that the cables shown on their charts on the figures supplied by SLB were consistent. AHO were not aware of any other cables.

SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for AHO to determine the potential impacts and/or risks to their functions, interests and activities and the EP review process can advance. SLB commits to continuing their consultation efforts with AHO through ongoing consultation as required for the maintenance of safe navigation, including through the provision of the pre-activity and post-activity notification (refer to **Section 5.5.15** and **Section 5.5.16**).

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.8 Specific Relevant Persons Consultation – Land Councils and Traditional Owner Groups

Indigenous Australian people have a strong continuing connection with Land and Sea Country that extends back some 50,000 years. Across Australia, Indigenous people have been sustainably using and managing their sea Country throughout this period. Sea country is valued for Indigenous cultural identity, health and wellbeing. First Nations peoples and communities have cultural responsibilities to care for Country and play an important role in the conservation and sustainable use of Australia’s environment and heritage. This unique relationship that First Nations peoples and communities have to care for the environment including land, sea, waterways, flora and fauna may constitute an interest under Regulation 11(1)(d).

Relevant persons who identify as traditional owners were identified in accordance with the approach described in **Section 5.4.5.2.2.2**. Land Councils and Traditional Owner Groups identified and determined to be relevant persons include:

- The Kimberley Land Council (**KLC**)
- Uunguu Part A – Wunambal Gaambera Aboriginal Corporation (also known as **WGAC**);
- Balangarra Aboriginal Corporation (combined) (also known as **BAC**);

- Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation (also known as **MG Corporation**);
- Northern Land Council (**NLC**); and
- Tiwi Land Council (**TLC**).

Subsequent consultation with relevant persons occurred through a combination of communication modes (e.g., phone, email, face-to-face meetings and virtual meetings/online workshops) to effectively circulate sufficient information, comprising tailored material, to relevant persons. Consultation with the traditional owners occurred consistently as specific consultation. The level of specific consultation undertaken was proportionate to the level of interest and influence of relevant persons.

Further information on SLBs consultation process with the Land Councils and Traditional Owner Groups is provided in **Section 5.5.8.1** through to **Section 5.5.8.3.**

SLB consider that the information provided to Land Councils and Traditional Owner Groups was sufficient to make an initial assessment of the proposed Seismic Survey on their activities. SLB provided all Land Councils and Traditional Owner Groups with data visualisations derived from the assessment of Aboriginal Heritage to assist in their assessment of impacts to their functions, interests and activities (see **Section 4.6.1**). Where further information was requested, or the opportunity to meet (either face-to-face or virtually) arose, SLB presented an introduction to marine seismic surveys, a description of the proposed Seismic Survey, SLBs understanding of the environmental characteristics and known cultural sites/values, the environmental impact and risk assessment methodology and the associated marine fauna control measures. SLB also generated tailored information, specific to values highlighted by relevant persons. For example, the TLC identified strong cultural and subsistence links to sea turtles during the course of consultation. As a result, SLB generated a detailed summary of their understanding of the OA and EMBA as it relates to marine turtle distribution, habitat usage and life history. Further SLB summarised the impact assessment undertaken and control measures in place to mitigate effects to marine turtles.

SLB consider that sufficient opportunities were provided for Land Councils, Traditional Owner Groups and traditional owners who self-identify as relevant persons to raise any concerns held regarding the survey and to undertake further consultation as required.

Responses and insights gained through consultation with Land Councils and Traditional Owner Groups provided detail used further characterise the environment within the EMBA and, consequently, the identification of control measures. In parallel with consultation with the Tiwi Land Council, SLB implemented adaptive management measures in the event that three or more marine turtle instigated shut downs occur within a 24 hour period (see **Section 7.2.6**).

Finally, all objections and claims raised were managed in accordance with the processes outlined in **Section 5.5.15.**

5.5.8.1 Kimberley Land Council

Kimberley Land Council (**KLC**) were identified as a relevant person from the outset of the consultation process as they are the peak indigenous body in the Kimberley region that work with Aboriginal people. It was considered that KLC were the conduit to provide sufficient information to so that they could determine whether the Seismic Survey would have any impact on the activities of Aboriginal people or native title holders.

KLC works with approximately 25 native title groups and were considered the appropriate body to distribute the information to the relevant native title groups, given they would be best placed to assess the proposed activities and determine whether they would have any impact on native title, or the functions, interests or activities of the Kimberley Aboriginal people.

SLB distributed the Information Sheet and cover email to KLC on 24 February 2022 and again on 31 August 2022 with a request to provide to relevant persons. No responses were received from this information provided. SLB considers sufficient information was provided to KLC in the cover letters and Information Sheet to make an informed decision and provide feedback as to whether the proposed activities will have any impact on the Kimberley Aboriginal people.

A follow up phone call with KLC was made on 14 September 2022 and minutes from this discussion are provided in **Appendix G**. The earlier emails were acknowledged as having been received by KLC and an overview of the Seismic Survey was provided to KLC on the proposed activities, survey location, control measures etc.

Based on the phone discussion and the information already provided (via the information sheet) and primarily due to the location of the OA offshore, KLC did not have any concerns about the proposed Seismic Survey. If KLC have any future concerns, they have advised that they have all the contact details and will provide any questions should they arise as part of ongoing consultation.

SLB continued consultation with KLC in October and November 2022 and provided an additional information sheet that was specifically developed for Native Titleholders to develop some feedback that could be incorporated into the EP.

Throughout all of the communications with KLC and the traditional owner groups, numerous offers and requests to meet was put forward by SLB with the intention to discussing the Seismic Survey in more detail, as well as some key questions that can be considered as part of the EP development, that being:

- Do you have any functions, interests or activities that may be affected by the proposed activities to be carried out under the environment plan?
- Do you have any sea country rights that may be affected by the proposed activities to be carried out under the environment plan?
- Do you want to meet with SLB to discuss the proposed activities to be carried out under the environment plan?

SLB sought guidance from KLC on what specific groups SLB need to consult with in regard to the proposed Seismic Survey based on the EMBA approach for identifying relevant persons which had been based on worst-case scenario as a result of a fuel oil spill during the survey.

KLC provided the names and contact details of the three Traditional Owner groups that overlap with the EMBA (as shown in **Figure 25**), which included:

- Uunguu Part A – Wunambal Gaambera Aboriginal Corporation (also known as WGAC);
- Balangarra Aboriginal Corporation (combined) (also known as BAC); and
- Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation (also known as MG Corporation).

It is SLBs understanding that Wanjina-Wunggurr (Native Title) Aboriginal Corporation is the prescribed body corporate for the Uunguu Part A.[16]

A number of communications have taken place between SLB, KLC and the traditional owner groups between October 2022 and February 2023 which are detailed within **Appendix G** and **Appendix I**.

SLB has made multiple attempts to engage with the traditional owner groups BAC and MG Corporation over the past months without receiving meaningful two-way engagement. Consequently, SLB has not been able to progress any further at identifying any activities or interests that may be affected by the proposed survey. SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) and the EP review process can advance. SLB commits to continuing their consultation efforts with BAC and MG Corporation to identify whether they have activities or interests that may be affected by the proposed survey and any pertinent information will be incorporated within the EP and survey operations, as required.

SLB met with the traditional owner group WGAC, including the GM of WGAC, on 22 December 2022. In their capacity of GM, SLB continued to engage with the GM as the main point of contact, as they are considered to hold authority to speak on behalf of the WGAC in their role as GM. The WGAC provided SLB with a cultural historical background of the land and sea users and their subsistence. SLB discussed the relevant persons consultation guidelines NOPSEMA recently released and advised they wish to hold a community meeting with their people to provide an opportunity to discuss the project and hear any potential concerns they may have. Both parties discussed the development of an ‘agreement of terms’ with what processes are to be followed in the unlikely event of an oil spill and how this will be put to affect. The intention is this agreement would be suitable for all groups within KLC. The WGAC advised they would be willing to take the lead and assist SLB in linking to other KLC groups. SLB would draft the agreement with assistance from the WGAC to provide key terms to be used.

The WGAC provided SLB with the key terms to be used within the agreement in late January 2023. The WGAC and SLB met 31 January 2023 to discuss the key terms provided by the WGAC, and SLB advised they would review and respond as soon as possible. SLB reviewed the key terms and responded with a letter of assurance addressing each of the terms raised by the WGAC, for the WGAC to consider. In the meantime, the parties set about arranging a workshop with their people and possibly extending to other groups within the KLC. SLB held a workshop in Perth on 16 February 2023 with the WGAC to discuss the survey, current status of the EP and letter of assurance that SLB had provided the WGAC. The WGAC requested more clarity and assurance around actions and responsibilities following a fuel spill. SLB informed the WGAC of the control measures provided within EP that will be employed during the survey that address their concerns. The meeting concluded with both parties agreeing to the WGAC drafting a revised mutual agreement between SLB and the WGAC to resolve the meeting discussion points.

Over the course of consultation following the February workshop, SLB continued to engage with WGAC on multiple occasions. A telephone meeting on 1 March between SLB and the GM of WGAC discussed the progress of the draft agreement. Specifically, SLB enquired with WGAC if it was the intention for the agreement to cover the other subgroups in KLC, and WGAC GM indicated that this was the intent. A further telephone meeting on 20 March was held with SLB and the GM of WGAC, indicating the draft agreement was ready for legal review. It was also during this meeting that a discussion covering the request for the oil spill modelling to be reviewed was addressed, and that SLB would provide a list of suitably qualified experts to WGAC for their review. This meeting also discussed a meeting that was to occur on 21st and 22nd of March with the Directors of WGAC; an invitation was subsequently provided to SLB to attend and present the information.

16 http://www.nntt.gov.au/searchRegApps/NativeTitleRegisters/Pages/NNTR_details.aspx?NNTT_Fileno=WCD2011%2F001

The invitation to the Director's meeting was accepted and resulted in SLB presenting to the Directors of WGAC on the 22nd of March. This presentation provided SLB with direct contact with the Directors and included the provision of information including a detailed description of the Seismic Survey including survey specifics and a description of the environment, values and sensitivities identified, and a discussion in detail on the management measures to be implemented within the EP for each identified sensitivity. A description of the UAM and associated potential impacts to fauna was discussed, along with the oil spill modelling undertaken for the Seismic Survey. A description of the management measures for these risks was detailed, including the nature of the Survey Vessel and its accompanying Support Vessels. Full details of what was discussed within this meeting is included within **Appendix G**. WGAC acknowledged that the controls in place to safeguard a spill occurring from the Seismic Vessel were apparent; however, concerns remained for a third-party vessel involved in a collision with the operation. This led onto further discussions being had regarding the review of the Oil Spill modelling, and the proposed agreement.

Numerous email correspondence between April to October 2023 (**Appendix F**) demonstrates the progression of the commissioning of the review of the oil spill model, as requested by WGAC.

In accordance with the draft agreement (see below), SLB facilitated and funded the engagement of a suitably qualified independent reviewer, as nominated by WGAC, to assess the fuel spill model. It is noted that both parties agreed on a suitable independent assessor with demonstrated experience completing fuel spill modelling for comparable activities. The authors of the fuel spill modelling, as well as the independent reviewers, presented the key findings to WGAC in an online presentation on 9 November 2023. As part of this presentation, and as requested by WGAC, modelled scenario data extracted for the months of February and March were presented and discussed (refer to **Appendix G** for full consultation records).

Minutes of the presentation, as well as the extracted modelled data were provided to WGAC, for the opportunity to provide further comments or questions. Further attempts to call the GM of WGAC were made on four occasions (refer to **Appendix G**) following the workshop, however all voice messages and requests for calls to be returned have not been forthcoming.

A further meeting occurred between SLB and the GM of WGAC on 30 November 2023 (meeting minutes for this are provided within **Appendix G**) to provide addition information to clarify further oil spill response roles and responsibilities, and to provide further information on financial assurance. It was confirmed in this meeting that the GM facilitates discussion between the WGAC Directors (including disseminating information and arranging meetings) with the Director's then subsequently socialising the information with the Traditional Owners. This meeting also confirmed that the information provided have previously been passed onto the WGAC Directors.

A further meeting with the WGAC Directors on 7 December 2023 allowed SLB to provide a presentation to the WGAC Directors around the oil spill modelling that was undertaken, and the review which occurred. This meeting was attended by SLB and the independent reviewer of the oil spill modelling to provide an explanation of the approach used for both the original oil spill modelling and the review, including how well the modelling had captured the risks for the WGAC area. As part of this meeting, a detailed discussion was had in relation to the control measures that are in place for the Seismic Survey, and the methods of response in the highly unlikely event of an oil spill. Detailed meeting minutes are included within **Appendix G**, and within the relevant person consultation log in **Appendix I**.

Consistent with the consultation objectives outlined in **Section 5.3**, the intent of developing a mutual agreement is to undertake the consultation process in accordance with the key principles of effective consultation, particularly transparency, collaboration and integrity. The mutual agreement is intended to outline the processes which are to be followed and insurances which will be in place should the unlikely event of a fuel oil spill from the Seismic Vessel occur and how this will be put into effect in terms of a response.

During the course of consultation, parts of the draft agreement have already been completed. These are summarised as the following:

- Provision of SLBs oil spill response arrangements, including prevention and remediation methods;
- Provision of financial assurances including evidence of currency of adequate insurances that SLB hold and the requirement for SLB to indemnify WGAC from effects on their rights and interests; and
- An independent assessment of the fuel spill modelling undertaken for the activity and upon which the EMBA has been defined.

The fuel spill modelling review has been undertaken by suitably qualified persons with demonstrated experience completing fuel spill modelling for comparable activities and the spill prevention, response and monitoring plans have subsequently been developed and described within the EP. Noting that the fuel spill modelling and response processes are described within the EP, the intention of developing a mutual agreement which distils this information with specific regard to the WGACs concerns is to support effective communication

To support the collaborative development of a draft mutual agreement and to facilitate final execution, SLB will continue to make available resources to communicate with WGAC and respond to queries and concerns as required, via previously used and successful channels (i.e., email, phone, video conference or face-to-face meeting), until such a time where the mutual agreement is executed, and all of the commitments made as part of the agreement are honoured.

In this respect, SLB have offered to attend and present information at the WGAC AGM (provisionally scheduled for 15 December 2023), but at the time of the EP submission have not received a confirmation of this from WGAC. SLB will continue to request to be invited to WGAC meetings, and have stated their willingness to attend and repeat the presentation delivered on the 9 November 2023, if requested by WGAC.

Having regard for their limited resources, SLB will pro-actively contact WGAC on a fortnightly basis to see whether they may provide any assistance in the development and implementation of the draft mutual agreement for the same period, using email and phone methods in the first instance. SLB will continue ongoing consultation in accordance with the process outlined in **Section 5.5.14** and assess the merit of any potential objections and claims in accordance with **Section 5.5.11.**In order to confirm that these concerns have been addressed, a control measure has been included within **Table 106**, and a consequential EPSs have been included within **Table 108**.

Summary of consultation with Wunambal Gaambera Aboriginal Corporation

SLB has continued to engage with the WGAC over the course of the consultation since early 2022. Key points are summarized as follows:

- SLB commenced consultation in January 2022, with tailored consultation with WGAC continuing since early 2023;
- SLB and WGAC achieved several milestone meetings during late 2022 and during 2023:
  - December 2022: Telephone meeting, with a key outcome being SLB and WGAC agreeing to developing an 'agreement of terms' with KLC, with WGAC offering to take the lead on behalf of KLC to develop the terms of the agreement;
  - January 2023: Initial in-person meeting with WGAC representatives, who outlined their concerns. The key terms of the agreement were outlined and WGAC offered to speak to other groups;
  - February 2023: A workshop was arranged with WGAC (with other TOs including KLC invited);

  - March 2023: Follow up online MS Teams meeting with WGAC GM, WGAC directors and other TO members.
  - November 2023: Meeting with the WGAC GM to provide addition information to clarify further oil spill response roles and responsibilities, and to provide further information on financial assurance.
  - December 2023: Meeting with the WGAC Director's to provide an explanation of the oil spill modelling undertaken, and the review conducted.
- SLB continued to disseminate information to WGAC:
  - Fact sheet and summary information issued directly to WGAC (issued October 2022);
  - Tailored fact sheet for Traditional Owners (issued November 2022);
  - Newspaper articles issued on two occasions (issued June 2022 and October 2022);
  - Public comment period (13 June – 13 July 2022);
- SLB continued to respond to further information requests from WGAC:
  - Fuel Spill response and mitigation measures presented and sent to WGAC (EP excerpts issued December 2022, with subsequent tailored workshop presented in November 2023);
  - Oil spill modelling was independently reviewed and presented to WGAC, including summer-specific scenario data extracted and presented to WGAC as requested (October and November 2023);
  - Copy of Financial Assurance sent to WGAC (issued February 2023);
  - Provision of letter detailing insurance arrangement and financial obligations (should a fuel spill occur) under the National Plan (Letter issued 23 November 2023, **Appendix F**).

Based on the detailed discussions above, and the information provided within **Appendix F** and **G**, SLB is confident and in no doubt that all relevant information to date has reached the WGAC Directors, which is subsequently disseminated to the Traditional Owners. Sufficient time has elapsed (effectively since March 2023) for determination on the potential impacts and/or risks to their functions, interests and activities and for feedback to be provided on this information. As such, SLB considers their obligations under regulation 11A have been discharged. Nevertheless, SLB commits to continuing their consultation efforts with the WGAC to identify any activities or interests that may be affected by the proposed survey and any pertinent information will be incorporated within the EP and survey operations, as required.

Further details of correspondence with KLC or any of the local traditional owner groups is provided in **Appendix F** and **Appendix I**.

5.5.8.2 Northern Land Council

Northern Land Council (**NLC**) were also identified as a relevant person from the start of the consultation process. NLC is an independent statutory authority of the Commonwealth responsible for assisting Aboriginal peoples in the Top End of the Northern Territory to acquire and manage their traditional lands and seas.

SLB distributed the Information Sheet and cover email to NLC on 24 February 2022 and 31 August 2022. No responses were received from this information provided. SLB considers sufficient information was provided to NLC in the cover letters and Information Sheet to make an informed decision and provide feedback as to whether the proposed activities will have any impact on the Aboriginal peoples in the Top End of the Northern Territory.

A follow up phone call with NLC was made on 14 September 2022 and minutes from this discussion is provided in **Appendix G**. The earlier emails were acknowledged as having been received and an overview of the Seismic Survey was provided to NLC on the proposed activities, survey location, control measures etc.

NLC were going to discuss further internally and would contact SLB if there were any further questions or issues arising. No further feedback has been received by NLC.

SLB has continued consulting with NLC with the additional time since the RFFWI and there has been numerous correspondence through October and November 2022 (**Appendix G** and **Appendix I**). As discussed above, SLB developed a specific information sheet for native titleholders to seek feedback and provided this to NLC to help facilitate discussions with members and ensure specific and focused information was provided to assist with the understanding of what is being proposed as well as helping to identify whether they have any values or sensitivities at risk as a result of the proposed survey.

It was made clear to NLC through information in the email and the provision of a map showing the EMBA, that a worst-case scenario had been incorporated into the EP and consultation process, where a fuel oil spill has been used to determine the extent of consultation with relevant persons and traditional owners.

NLC put SLB in contact with the NLC Sea Country team and provided their contact details. SLB contacted all three members of the NLC Sea Country team and provided the focused native title groups information sheet as well as a summary of what is proposed, the area for the proposed survey and the specific questions that are listed in **Section 5.5.8.1** to understand and seek feedback on the interests and rights of traditional owners that may be impacted as a result of the survey. SLB also extended an invite to meet with the NLC Sea Country team.

The NLC Sea Country team responded by providing the contact details of their legal team and suggested that SLB should contact the legal team directly for any further information. SLB contacted the legal team providing the native titleholder information sheet with some further context on the proposed Seismic Survey. An invite to meet to undertake further discussions was also offered; however, no response has been received at time of submission.

SLB met with NLC representatives from the Petroleum and Energy Group and their legal team on 13 January 2023 and minutes from this discussion are provided in **Appendix G**. The meeting focused around interpreting the relevant persons consultation guidelines NOPSEMA recently released. SLB and NLC discussed a condensed information sheet showing the location of the survey area and EMBA and community meetings to provide the Traditional Owners opportunity to understand and ask questions about the project.

Further correspondence with NLC confirmed a community meeting with Traditional Owners would be most beneficial and plans were made for a community meeting to be held on 17 February 2023 to present the survey and discuss any queries or concerns the Traditional Owners may have. Technical problems prevented the meeting from being held on 17 February 2023, however the meeting was rescheduled for 24 February 2023, once technical issues had been resolved later in the day. In the meantime, a NLC representative is going to meet with several families to explain seismic surveying, the proposed project and encourage them to attend the meeting on 24 February 2023. SLB arranged the community meeting with NLC for 24 February 2023, however, NLC failed to attend and SLB were forced to abandon the meeting later that morning. SLB contacted NLC to reschedule the community meeting for the following week and has been advised they are to re-direct their queries back to the NLC Petroleum and Energy Group and legal team with a formal request.

SLB has attempted to engage exhaustively with NLC over the past months without receiving meaningful two-way engagement. Consequently, SLB has not been able to progress any further at identifying any activities or interests that may be affected by the proposed survey. Based on the discussion above around the specific consultation undertaken with NLC, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**) with the provision of sufficient information and a reasonable period of time for the NLC to determine the potential impacts and/or risks to their functions, interests and activities and that the EP review process can advance. SLB commits to continuing their consultation efforts with NLC as per the discussion in **Section 5.5.14** to identify any activities or interests that may be affected by the proposed and any pertinent information will be incorporated within the EP and survey operations, as required. This consultation includes provision of the pre-activity notification and post activity notification (refer to **Section 5.5.14** through to **Section 5.5.16**), regardless of whether NLC respond or provide further comment or information.

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.8.3 Tiwi Land Council

SLB contacted the Tiwi Land Council (**TLC**) on 25 January 2023 to discuss who they should liaise with about the proposed survey to present the project and discuss any concerns their people may have. Their initial response was that given the project was offshore Bonaparte then consultation should be with the NLC. SLB advised TLC they were already liaising with NLC, however wanted to ensure Tiwi Islanders were also aware of the survey. TLC asked for more information to be provided to them. TLC advised SLB they would direct the information to the Tiwi Island representatives. SLB forwarded the information to TLC to share with their people on 25 January 2023. SLB followed up correspondence from January 2023 to determine if there were any queries or concerns, however, SLB was unsuccessful with a response from TLC.

SLB contacted TLC on 09 February 2023 and spoke to an alternative TLC representative whom advised the original representative had been ill and suggested they would liaise with their lead environmental specialist. Then TLC could confirm if further consultation is needed.

SLB followed up the previous TLC representative on 15 February 2023, but that representative was away and passed on contact details for another TLC representative, whom contacted SLB later that day. SLB discussed the survey with this TLC representative including the EMBA, conservative nature of oil spill modelling and the therefore low likelihood of any effect on the Tiwi Islands. TLC confirmed the EMBA does not reach the distance from their shore to where their sea connection ends. TLC also agreed with previous advice from another TLC representative that ongoing consultation with Native Title Owners would be more relevant with NLC. SLB provided an update on the recent consultation with NLC. However, SLB advised TLC that they wanted to be certain Tiwi Islanders had no concerns with the proposed survey and asked for written confirmation of their discussion to confirm this. The TLC representative advised they would discuss this internally and respond later that day. TLC responded advising SLB to contact previous TLC representative and reminded SLB that all involvement and consultation with the Tiwi Islands must go through all the formal documents, processes and permits within the TLC. SLB responded to TLC asking when the appropriate representative would be available given they had already spoken with them and emailed and not yet had a response from them.

SLB emailed the suggested TLC representative again on 20 February 2023 requesting some time to discuss the proposed survey and explained how SLB had attempted to speak to other TLC representatives but had been directed back to them. SLB advised they were hoping to they could speak with TLC as they are currently finalising their EP resubmission to NOPSEMA this week. SLB phoned TLC again on 21 February 2023 to discuss the proposed survey as they had not received a response to their previous email message (sent 20 February 2023). TLC re-confirmed their understanding that the survey was remote from Tiwi Islands and the EMBA did not reach the Tiwi Islands. SLB acknowledged this discussion and further added the conservative nature of the oil spill modelling that had been undertaken [to assist calculate the EMBA].

SLB asked TLC if there were any other concerns the Tiwi Islanders may have in relation to the project. TLC suggested the best way forward was to hold a presentation meeting online where SLB could present the project, the risks to the environment and the management of those risks. SLB agreed this would be good and asked if the TLC representative could help organise personnel to join an online meeting. TLC suggested holding a meeting on 22 February 2023 (next day) given the time SLB had been seeking to consult over the past several weeks. SLB appreciated this and confirmed they would send a meeting invite out for 22 February 2023. SLB concluded the phone call by thanking TLC for their time and advice related to setting up an online meeting with SLB and their team.

SLB and SLR met with TLC on 22 February 2023 and provided a presentation detailing the proposed survey, listened to feedback from TLC and discussed questions around any concerns that TLC had. TLC advised they were most concerned about mitigating the risk of a fuel spill from vessel collision and impacts to marine turtles and other marine life. SLB and SLR explained the extensive measures detailed in the EP that have been assessed and planned to minimise and mitigate the likelihood of risks and impacts. TLC advised SLB that TLC were electing a new council mid-March 2023 and the new members would value a similar presentation to upskill them in this type of operation, given the recent increase in seismic activity.

SLB provided comprehensive information to address TLC's meeting queries in an email to TLC on 23/02/2023 and asked whether further consultation would be required. This information included a description of marine turtle distribution, habitat usage and life history as they relate to the EMBA, coupled with a focused summary of the impact assessment undertaken and control measures in place to mitigate effects to marine turtles. TLC forwarded the information provided by SLB to the TLC environment officer for consideration. Following discussions with the TLC CEO, the TLC environment officer advised SLB they would be tabling SLB's project at the next council meeting proposed for mid-March 2023 and would respond following discussion with members at that meeting. SLB acknowledged TLC's response and advised TLC they were planning to re-submit their EP to NOPSEMA this week, however, will continue to engage with TLC as part of their commitment to ongoing consultation. SLB also advised they would be happy to present the seismic survey information at their mid-March meeting, otherwise will be in contact later in March.

Although there has been difficulty engaging with TLC, based on the discussion above around the specific consultation undertaken with TLC, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled (refer to **Section5.5.13**) with the provision of sufficient information and a reasonable period of time for the TLC to determine the potential impacts and/or risks to their functions, interests and activities and that the EP review process can advance. SLB commits to continuing their consultation efforts with TLC as per the discussion in **Section 5.5.14**, to identify any activities or interests that may be affected by the proposed survey through ongoing consultation. An example of this ongoing consultation since March 2023 has included contacting TLC in regards to the newly elected council members and the additional emails sent throughout 2023 to update TLC on the EP process. Any pertinent information will be incorporated within the EP and survey operations, as required. Ongoing consultation also includes the provision of the pre-activity notification and post activity notification (refer to **Section 5.5.14** through to **Section 5.5.16**), regardless of whether TLC respond or provide further comment or information.

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.9 Foreign Relevant Persons Consultation

As outlined within **Section 3.2**, the proposed Seismic Survey is to be undertaken in an area with a complex jurisdictional setting in which Australia exercises seabed jurisdiction including the exploration for petroleum, and Indonesia exercises water column jurisdiction including fishing rights within parts of the OA. In addition, the defined EMBA extends into the MoU Box (shown in **Figure 29**). Therefore, it is possible that Indonesian commercial fishing vessels may be encountered by the Seismic Vessel within a portion of the Acquisition Area and/or be operating within the area of overlap between the EMBA and the MoU Box. As such, both DFAT and the associated agencies within the Indonesian Government were identified within **Table 27** as relevant persons.

Consultation has been initiated with both DFAT and AFMA to ascertain the relevant departments within the Indonesian Government that should be consulted in relation to the Seismic Survey. This consultation has resulted in three additional relevant persons being identified, that being the Ministry of Agriculture and Fisheries of Timor Leste, the Ministry for Maritime Affairs and Investment (in particular the Directorate of Border Delimitation) and the Ministry for Marine Affairs and Fisheries (in particular the Directorate of Surveillance of Marine and Fisheries Resources). Consultation with these parties, which included the provision of a factsheet translated into Bahasa, has not been responded to; however, SLB will continue in its attempts to reach out to these parties so that any comments or concerns can be effectively addressed through the ongoing consultation process as per **Section 5.5.14**.

This consultation with DFAT and AFMA has highlighted the potential for both traditional and potentially illegal fishing occurring with the MoU Box and surrounding area by fishers that are from a wide geographical area. In this situation it is difficult for SLB to ascertain the individual Indonesian fishers that may have functions, interests or activities affected by the activity. Consultation with AFMA identified the best approach for consulting with these fishers would be disseminating information at the key fisheries port and local towns where those fishers often frequent on Rote Island prior to accessing the MoU Box. To this end, SLB has translated the factsheet that has been used for the Seismic Survey into Bahasa to be distributed at the local port facilities so that if there are Indonesian fishers who may potentially fish in the MoU Box can reach out to SLB.

In addition to the above factsheets being provided at port facilities, and due to the situation of individual (some being illegal) fishers operating in the offshore Bonaparte area, SLB have proposed control measures to manage potential direct interactions with Indonesian fishers. This includes the Seismic Vessel, Chase Vessel and Support Vessels having communication sheets in Bahasa and Tetum language detailing key information regarding the Seismic Survey being provided to any Indonesian fishers if they are encountered during the Seismic Survey.

At the time of EP submission, no further requests for time have been requested, and no further requests for further information or consultation has been received by SLB from Foreign Relevant Persons. Based on the discussion above around the specific consultation undertaken with DFAT and AFMA, as well as the Ministry of Agriculture and Fisheries of Timor Leste, the Ministry for Maritime Affairs and Investment, and the Ministry for Marine Affairs and Fisheries, and the unedited correspondence in **Appendix F**, SLB is satisfied their consultation obligations have been fulfilled (refer to **Section 5.5.13**). In this regard, SLB is satisfied with the provision of sufficient information and a reasonable period of time for Foreign Relevant Persons to determine the potential impacts and/or risks to their functions, interests and activities and the EP review process can advance.

Further details of these discussions are provided in **Appendix F** and **Appendix I**.

5.5.10 Public Notification

Publication in multiple media formats was undertaken to facilitate the process of self-identification of relevant persons(s).

SLB placed a notification on their website briefly summarising the location of the proposed survey and the status of the environmental plan. SLB confirmed NOPSEMA has completed their check of the EP and public comment is invited from 13 June – 13 July 2022. The web page provided an embedded link to NOPSEMA's online publication of the Bonaparte MC3D Marine Seismic Survey EP Summary and associated links and contact details. The web page also provided a link to share this information or contact SLB regarding the activity. This web page is still available via https://www.slb.com/resource-library/article/2022/bonaparte-mc3d-marine-seismic-survey.

SLB also published a web page update, broadly consistent with the information provided in the information pack, via KeyFacts Energy Ltd to notify those interested in oil and gas and renewable energy activity and who subscribe to these updates.

SLB placed notices in appropriate National, State and regional newspapers (June 2022 and October 2022), based on their previous experience and industry knowledge. The notice included a brief summary of the location of the proposed survey and the status of the environmental plan. SLB confirmed NOPSEMA has completed their check of the EP and public comment is welcome. The notice included a weblink to the Bonaparte MC3D Marine Seismic Survey EP Summary and SLB's web page for the activity. Notices were placed in The Australian, The West Australian Daily, the Broome Advertiser Daily, Kimberley Echo Daily and Northern Territory News Daily, to support broad capture of those who may have functions, interests or activities within the EMBA.

An excerpt of SLBs notice within the Northern Territory News Daily is included within **Appendix H**.

5.5.11 Management of Objections and Claims

If any objections or claims are raised during consultation, including during ongoing consultation, these will be substantiated utilising publicly available information, including scientific literature and/or fishing data where available. Where an objection or claim is substantiated, it will be assessed as per the risk assessment process outlined within **Section 6** and, depending on the outcome of this assessment, appropriate controls will be applied to manage the impacts and risks to **ALARP** and an **Acceptable Level**. Further to this, if the objection or claim triggers a revision of the EP, this will be managed in accordance with the Management of Change process outlined within **Section 10.4.7**. SLB will advise the relevant person that raised the objection or claim of the outcome of this process, including whether or not the objection or claim is substantiated, how it was assessed and what, if any, controls were put in place to manage the impact or risk to **ALARP** and an **Acceptable Level**.

A number of responses were received from relevant persons after they had considered the Information Pack provided. The nature of responses was varied; some included requests for further information, to be kept informed and some noted that the proposed survey was not relevant for their interest in the area. Where objections or claims were received, these were addressed as per the discussion above, with details on how these were addressed within the EP being outlined within **Appendix I**. These claims were considered to be adequately addressed through the development of this EP and associated control measures and operational procedures.

Likewise, in accordance with the Environment Regulations 16(b)(ii) all submissions have been considered in the assessment of risk and responses have been provided back to all submitters. All concerns raised have been considered within the development of this EP and control measures have been tailored where necessary to reduce the risks to **ALARP** and an **Acceptable Level**.

Control measures in **Section 7** and **8** that will be implemented throughout the Seismic Survey are considered adequate to reduce impacts of the Seismic Survey, and in particular the protection of the BIAs and their corresponding receptors to **ALARP** and an **Acceptable Level**. Where existing control measures did not adequately address any objections or claims made, additional control measures were identified and implemented.

In accordance with the Environment Regulations 16(b)(iii), the claims that have been made by relevant persons are summarised in **Appendix I**, with the response by SLB and the relevant section within the EP where those concerns are addressed. The full correspondence between the relevant persons and SLB is provided in **Appendix F**.

5.5.11.1 Self-Identification of Relevant Persons

Subsequent to the initial relevant person identification process, one submission was received during the 30-day public notification process. This submission was by Petrofac, who are decommissioning the Northern Endeavour FPSO, which may require diving operations. The Northern Endeavour FPSO is located ~56 km north of the AA and is shown in **Figure 38**.

An assessment has been undertaken in **Section 7.2.4** on commercial dive operations, along with control measures that would be implemented based on distance between activities. The risk assessment undertaken on diving operations as a result of the Seismic Survey was determined to be Low. In addition to this, SLB has committed to operating in accordance with Rev 2.1 of 'Safe Diving Distance from Seismic Survey Operations' that was released by the Diving Medical Advisory Committee in 2020.

Petrofac were not engaged with directly at the start of the process; however, Petrofac self-identified as a relevant person through the public notice period, and as such are considered to be a relevant person and will be part of the ongoing consultation and communication/notification programmes. Petrofac will receive the four-week pre-start notification, as well as the 48-hour look-aheads that will be distributed every 24 hours advising of where the survey vessel will be operating as detailed in **Section 5.5.12**.

5.5.12 Assessment of Provision of Sufficient Information and Time to Respond

Regulation 11A(2) of the Environment Regulations states that:

> *"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."*

As detailed within **Section 5.5.3** the initial consultation included the provision of an information pack to all relevant persons; consisting of an information sheet and a detailed email. This information pack outlined various aspects of the Seismic Survey including the location of the OA (with GPS coordinates of the corner boundaries), a description of the proposed seismic activity, approximate timing, the adherence of SLB to the relevant legislation. In addition, where further information was requested by a relevant person, this has been provided on a case-by-case basis.

Given the full scope of the Seismic Survey was provided, and further information provided upon request, it is considered that the information provided was sufficient for the relevant persons to make an informed decision on whether their activities would potentially be impacted by the Seismic Survey. This process also made available the opportunity for relevant persons to provide feedback, raise concerns, participate in further consultation and submit any objections to SLB.

An assessment of sufficient time and reasonable periods is described in **Section 5.5.1.** It is re-iterated, given the iterative consultation process, and that where further information and consultation has been requested, this is subsequently accommodated for in extending the period required for consultation.

There were no comments or concerns raised by relevant persons during the consultation programme that resulted in any additional control measures being implemented.

No relevant persons, either via email or phone correspondence stated that the information provided to them was insufficient to allow them to determine the potential impacts and risks associated with the proposed Seismic Survey with regard to their activities. In all cases, where further information was requested, it has been provided.

Despite an extensive consultation process, only a small proportion of the total relevant persons identified responded with comments or questions regarding the Information Pack, despite SLB making several of attempts to follow up with all relevant persons. As a result, it was considered that those relevant persons which did not respond, had no concerns over the Seismic Survey, and SLB focused consultation efforts on those parties which had concerns or comments regarding the proposal. An example of this is the ongoing consultation with the commercial fishing industry.

The consultation process with the commercial fishing industry and the industry representatives outlined in **Section 5.5.6** is an ongoing process and will continue for the duration of the Seismic Survey and beyond the life of the project. Engaging with these organisations (i.e., WAFIC and Tuna Australia) provided SLB with a greater understanding of the potential impacts the Seismic Survey may have on the licence holders and their activities. WAFIC also helped guide the scope of information provided to licence holders so that it was relevant based on their experience with what licence holders expect to receive from titleholders. Tuna Australia advised that a consortium of WTBF concession owns are currently planning to fish in key northwest grounds from late 2023 onwards. SLB will ensure ongoing consultation, pre-survey notification and provision of the 48-hour lookaheads will be implemented as part of the commitments made through the consultation process. Mitigation measures will be implemented to alleviate these concerns and to assist with minimising fishing gear in the water within the survey path through the incorporation of 48-hour look-aheads which will be transmitted to fishers that have requested to be included in the distribution of these plans every 24 hours during the survey. In addition, SLB has committed to implementing a compensation plan to offset any loss of equipment or catches by fishers that is directly associated to the Seismic Survey (**Section 7.2.3.1**), and the use of a Support Vessel and a Chase Vessel during the survey will provide additional support out on the water. There has been a number of attempts to engage with licence holders and there has been a lot of time since the information was provided and the EP was submitted. For the more recent consultation that WAFIC undertook on behalf of SLB, WAFIC provided a two-week period for the provision of any feedback or questions, as WAFIC considered this was sufficient time for a licence holder to make an assessment of the proposed Seismic Survey on their activities. Additionally, Tuna Australia consulted with all of their members utilising multiple means of communication and provision of survey specific information, which was acknowledged as being read through the notifications received when the recipients downloaded the information.

Based on the discussion and information provided above, SLB considers that the information provided to the relevant persons during the consultation process was sufficient and that relevant persons had sufficient time to consider the information and make an informed decision as to any potential impacts of the survey on their activities, in accordance with the Environment Regulations and relevant guidance.

5.5.13 Fulfilment of Consultation Obligations

As outlined within the Guidance Document, the obligation to consult must be discharged prior to submitting an EP to NOPSEMA. In order for the consultation to be considered fulfilled, the following matters need to be addressed:

- The provision of sufficient information as per **Sections 5.5.1.1**;
- A reasonable period of time to make an informed decision must have been demonstrated as per **5.5.1.2**; and
- If any objections and claims are raised during consultation, it is a requirement that these are adequately assessed and addressed, where valid, as per the discussion within **Section 5.5.9**.

An assessment of whether consultation with each relevant person has been fulfilled is included within the Relevant Person Consultation Report within **Appendix I**. This process assessed the consultation undertaken against the requirements outlined within **Section 5.5.12**. Given the iterative framework of the consultation process, where further information and consultation has been requested by relevant person(s), this was then accommodated for by extending the period required for that consultation.

As can be seen within the unedited correspondence in **Appendix F**, although a two-week period was requested for responding to the initial correspondence from SLB, further follow-ups provided those relevant persons additional time to provide a response. The original correspondence which included the information pack was sent to relevant persons on 17 January 2022 and asked for comments on the proposal and/or information requests by 4 February 2022. This was followed up by a further email on 8 February 2022, requesting responses by 28 February 2022. Over the course of NOPSEMA's processing of the EP, further notifications were sent to the relevant persons including updated details on the proposed Seismic Survey. Where relevant persons did not provide additional comments and/or request further information, it was determined that they had been provided with sufficient information to determine the potential impacts and risks to their functions, interests or activities in the area. Also, due to the extended period of time over the course of not only the initial 6 weeks in January/February 2022 that this consultation occurred, but also the follow-up notifications during the processing of the EP application, it was considered a reasonable period of time for those relevant persons to determine the potential impacts and/or risks to their functions, interests or activities in the area.

In addition to the multiple attempts to contact relevant persons prior to lodgement (and the further follow-ups during the processing of the EP) the relevant persons also had the opportunity to submit during the 30-day public notification period which included newspaper articles including links to the EP itself (as outlined within **Section 5.5.10**), thereby containing sufficient information.

For relevant persons who responded to SLB's consultation efforts, such as requesting further information or time to meet and discuss the proposed Seismic Survey, this occupied the bulk of the effort. This, however, did not preclude the consultation efforts directed at other relevant persons who did not respond or offered no comments or questions, as they were still provided with updates over the course of NOPSEMA assessment period. Where further discussion around the provision of sufficient information and a reasonable period of time to make an informed decision is required due to complexities in the consultation undertaken with specific relevant persons (primarily around commercial fishers, submarine cable providers and native title holders), this has been included within **Sections 5.5.6** to **5.5.8**. A more detailed assessment is required in these instances as some of the matters raised are complex in nature and can often be in relation to activities outside the scope of this EP or establishing ongoing relationships with the relevant person(s).

It is worth noting that although the fulfilment of consultation with relevant persons is a key aspect of the EP process, SLB will continue to undertake consultation with relevant persons in an ongoing manner as outlined within **Section 5.5.12**.

5.5.14 Ongoing Consultation with Relevant Persons

SLB will continue to engage with relevant persons for the duration of the Seismic Survey, in accordance with the Environment Regulations 14(9), to provide project updates and keep them informed as information becomes available. To achieve this, SLB set the following objective with regard to ongoing consultation, as part of the relevant person consultation programme (see **Section 5.2**), that being 'support ongoing relevant person identification and consultation throughout the project'.

The objective was underpinned by the following outcomes, each of which were considered necessary for successful ongoing consultation:

- Continual identification of relevant persons that may be affected by the survey;
- Provision of sufficient information to all relevant persons identified; and
- Continual identification and resolving of any issues that may arise as identified by relevant persons.

SLB acknowledges that new relevant persons can be introduced at any time throughout the duration of the EP, and a flexible and adaptive consultation methodology is required to accommodate such introductions. As such, ongoing consultation, as described in the relevant objective and outcomes above, is an important aspect of the consultation methodology, and will be achieved by implementing the following actions:

- At least six weeks prior to survey commencement, SLB will perform a desktop review to assess for any new relevant persons in the region. This assessment will include all relevant EP submissions and a review of relevant persons identified by other proponents of seismic operations in any newly accepted EPs;
- SLB will undertake monthly reviews of the currency of the list of relevant persons and may initiate an MoC process if new relevant persons are identified and/or new issues which have potential to increase the risk of interference with their functions, activities or interests are determined (detailed further in **Section 10.4.7**);
- A review of potentially new or previously unidentified relevant persons may also be initiated at any time, in the event that SLB is approached, contacted by, or made aware of a person/group/organisation (via self-identification or identified by other relevant persons) that had not previously been identified as a relevant person for the purpose of this EP;
- In the event that a new relevant person is identified by SLB, they will be contacted as soon as possible to provide them with sufficient information regarding the Seismic Survey. This will include a description of the identified impacts and associated control measures that are being implemented so that it is clear to see that the risks to this particular relevant person will be reduced to **ALARP** and **Acceptable Levels**; and
- SLB will distribute Information Sheets at selected locations that target recreational users who are transient to the OA. For example, at retailers that sell recreational fishing gear and local dive shops.

Where the above actions have not resulted in successful notification to relevant persons, SLB will lean on one Support Vessel and one Chase Vessel on the water during the Seismic Survey. These vessels will be in contact with other maritime users during the survey and will be able to identify any vessels on the water that are unaware of the survey operations and ensure that no vessels travel in close proximity to the Seismic Vessel or streamers towed behind the vessel.

In addition to this more generalised ongoing consultation process with relevant persons, some relevant persons will be consulted with in an ongoing manner where some of the matters raised during the initial consultation are complex in nature and often in relation to activities outside the scope of this EP, or these discussions involve establishing an ongoing relationship with the relevant person(s).

Should any relevant person raise any objections or claims or provide feedback during this ongoing consultation SLB will undertake an assessment of the merit of their claim as a relevant person as per the methodology provided in **Section 5.5.11**. This review will ensure that the impacts and risks of the Seismic Survey remain **ALARP** and at an **Acceptable Level**.

The following decision support resources would be applied to assess whether any potential change in impacts or risks was significant:

- Classifications of existing impacts and risks within the risk assessment matrix in this EP;
- Legislative requirements, guidelines, standards;
- Relevant literature;
- UAM results;
- Sound thresholds within the EPBC Act;
- The Temporary Threshold Shift (**TTS**) and Permanent Threshold Shift (**PTS**) for the relevant receptors identified within the OA (**Section 7.2**); and
- Professional Judgement.

Throughout the duration of the Seismic Survey, 'sub-audits' of the contents of the EP will be carried out, as detailed within **Section 10.4.4**. Sub-audits will focus on the particular sections of the EP relating to the sub-audit 'trigger', one of which is the identification of a person/group/organisation who has not previously been identified or considered as a relevant person and will be completed as per the details within **Table 126**. Findings and recommendations obtained through the auditing process will be distributed to the relevant parties in order to undertake the appropriate actions. If an audit relates to a topic that had previously been raised by a relevant person, an updated response will be prepared and provided to the relevant person.

5.5.15 Pre-activity Notification to Relevant Persons

Prior to commencing the Seismic Survey, SLB will provide specific details to all relevant persons in relation to confirmed project timing and location. A number of temporal and spatial driven mitigations have been implemented into the survey planning to reduce the impacts on blue whales within the BIA to **ALARP** and an **Acceptable Level**.

SLB has also committed to providing relevant persons with 48-hour look-ahead of where the survey vessels will be, so that they can then incorporate the survey plans into their operations. This look-ahead will be updated every 24 hours.

Navigational warnings and Notice to Mariners will also be issued on maritime radio and via email correspondence which provide information about the Seismic Vessel, including the Seismic Vessel being restricted in its ability to manoeuvre due to towing the streamer array.

A summary of the pre-activity notification process by SLB is provided in **Table 31**.

Table 31 Pre-Activity Notifications by SLB

Timing – prior to the Seismic Survey	Stakeholder	Information to be Provided
Approval of EP	DNP	That the EP has been approved by NOPSEMA via email to MarineParks@environment.gov.au
4 weeks	All relevant persons (including Petrofac)	• Summary of proposed activity • Summary of vessel and seismic gear • OA coordinates • Date of activity commencement • Duration of activity • SLB contact details
4 weeks	Australian Defence Force	• Operational area coordinates • Date of activity commencement
4 weeks	Australian Hydrographic Office (**AHO**)	Contact AHO at datacentre@hydro.gov.au with details relevant to the operations to promulgate the appropriate Notice to Mariners. Updates will be provided to AHO on progress and, importantly, any changes to the operations.
10 days prior	NOPSEMA	Written notification of the date of intention to commence the Seismic Survey that is included within this EP.
10 days prior	Department of Mines, Industry Regulation and Safety (**DMIRS**)	Provide a pre-start notification confirming the start date of the proposed activity to petroleum.environment@dmirs.wa.gov.au. Consultation with DMIRS resulted in this request, and although no timeframe was provided, a 10-day notification period has been utilised to align with NOPSEMA notification.
At least 24-48 hours prior to operations	AMSA's Joint Rescue Coordination Centre (**JRCC**)	Contact JRCC by email (rccaus@amsa.gov.au) for promulgation of radio-navigation warnings. The JRCC requires: • Vessel details (including name, callsign and Maritime Mobile Service Identity) • Satellite communication details (including INMARSAT-C and satellite telephone numbers) • Area of operation • Requested clearance from other vessels • Date of activity commencement • Duration of activity • SLB contact details • Any other information that may contribute to safety at sea Updates should be provided to JRCC on progress and, importantly, any changes to the operations.

5.5.16 Post-activity Notification to Relevant Persons

There are also some post-survey notification requirements that SLB are required to adhere to. These are provided in **Table 32**.

Table 32 Post-Activity Notification Requirements

Timing – post Seismic Survey	Stakeholder	Information to be Provided
Relevant time post-completion	All relevant persons	Notification that the survey is now complete, and the survey vessels are no longer in the area.
Relevant time post completion	AMSA	Summary of any significant or noteworthy interaction with commercial shipping during the Seismic Survey.
10 days post completion	DMIRS	Provide a cessation notification to petroleum.environment@dmirs.wa.gov.au. Consultation with DMIRS resulted in this request, and although no timeframe was provided, a 10-day notification period has been utilised to align with NOPSEMA notification.
10 days post completion	NOPSEMA	Written notification to NOPSEMA advising of the completion of the survey.
As soon as practicable	NOPSEMA	Written notification to NOPSEMA advising that all of the activities and obligations covered under the EP have been completed.

5.6 Public Comment

NOPSEMA published SLBs EP on their website in accordance with the Environment regulations 9(AB) and 11B for a period of 30 days. It was notified that the EP was available for public comment on NOPSEMAs website by the following means: SLBs website, a national newspaper (The Australian – National Daily), a state-wide newspaper (The West Australian Daily) and regional newspapers close to the OA (Broome Advertiser Daily, Kimberley Echo Daily, Northern Territory New Daily).

Only one submission was received during this 30-day public notification period, which was from Petrofac in relation to activities included within the decommissioning of the Northern Endeavour FPSO, which may require commercial diving operations. As summarised in **Section 5.5.1**, SLB consider Petrofac to be a relevant person and SLB will keep Petrofac fully informed through the entire Seismic Survey programme (i.e. 48 hour look-aheads), as well as providing all the pre-survey notifications prior to survey commencement.

5.7 Fuel Oil Spill Response Emergency Consultation Protocols

This section sets out the process SLB will follow in the event of an unplanned release of fuel oil to the marine receiving environment. There are two key components to the process: the role of the OPEP, and the communication with relevant persons. This section identifies the relationship between the two processes.

5.7.1 Oil Spill Emergency Plan

Section 10.10 sets out the OPEP – SLB's arrangements for responding to a fuel oil spill (Level 1 or Level 2) event during the Seismic Survey. The OPEP follows the framework and requirements set out in the National Plan for oil spill even response.

Table 128 lists the division of responsibilities between statutory authorities and the nominated Control Agency (**CA**) for a Level 1 or 2 spill. The role of the CA is to assume control, including decision making ability, to respond to any oil spill incident and respond in accordance with the National Plan.

Under the OPEP, notification processes are the responsibility of the Vessel Master. **Table 129** sets out the OPEP notification process and timeframes for both Level 1 and Level 2 responses. This includes responsible authority direct numbers, and key instruction for notification.

On this basis, the focus of the OPEP is on the CA's decision-making process, as guided by the National Plan to implement notification processes, instigate the Net Environmental Benefit Analysis (**NEBA**), and to instigate decisions as to the appropriate course of action (including response logistics, liaison with SLB's Project Manager to instigate the Operational and Scientific Monitoring Plan (**OSMP**)) under a Level 1 or Level 2 spill event.

5.7.2 Relationship of OPEP to Relevant Persons

Relevant person(s) are not formally included in the notification process described in **Section 10.10.6.1.3**. The roles of the agencies/personnel, under the direction of the CA, are focussed on the containment of the spill, and immediate (within hours to 48 h) need to provide information and updates of any event to Statutory Agencies (**Table 129**). The full list of relevant persons is provided within **Appendix E**. However, it is noted that under the MMF and NDSMF that have been consulted within on behalf by WAFIC or SLB has provided hard copy letters, there are many licence holders.

Although relevant person(s) formally sit outside the OPEP Notifications process, in the event of an oil spill, relevant persons will need to be notified to ensure they have timely and sufficient information to carry out their functions, inform their own stakeholder groups, manage their own decision making processes, and manage their (and their stakeholders) own risks accordingly. Procedures are in place with WAFIC that should a fuel oil spill release occur, SLB will notify WAFIC immediately and WAFIC will inform all licence holders that could potentially be impacted by a fuel oil spill. SLB would still undertake its own notifications, but the agreement with WAFIC will specifically target the licence holders that use the area identified in the wider EMBA.

The notification and emergency consultation with relevant persons, in the event of an oil spill, recognises:

- Emergency notification is undertaken in good faith and with transparent, accurate and timely information;
- Relevant persons may hold different values and interests in the affected area of the unplanned event; SLB are not making decisions or judgments about the values of the relevant persons and what may be of importance for managing actual or perceived risk management of the relevant person(s); and

- Relevant persons are best placed to inform SLB and the CA about the impact of the spill on their particular interest; information of specific interests, values and sensitivities of relevant persons can be incorporated into the NEBA where possible, which may be used to inform the logistical response process and requirements of any OSMP. The list of relevant persons that have been consulted with are included in **Appendix E**.

It is important to note for the Emergency response process, CA may also be relevant persons (depending on the jurisdiction, and where the governmental agency has an interest/value in the affected area), but relevant persons are not automatically a CA.

5.7.3 Consultation with Relevant Persons

The following section describes the general consultation process with relevant persons (Category A and Category B) that will be followed in the event of a Level 1 or Level 2 spill, shown schematically in **Figure 41**. It is intended that this process is strongly aligned with the OPEP (**Section 10.10**) as well as the OSMP (**Appendix L**) and is aimed at meeting the information requirements for any Category A or Category B relevant persons.

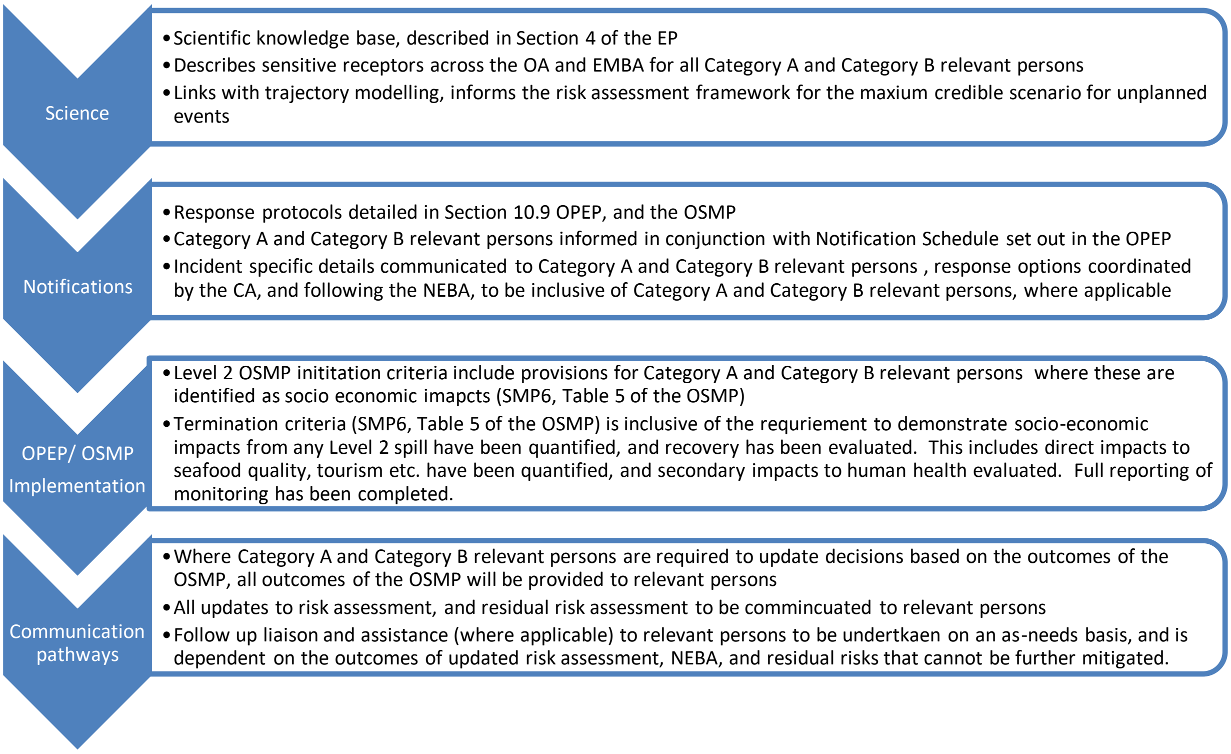


Figure 41 Information Pathways for Informing Category A and Category B Relevant Persons under Level 1 or Level 2 Spill Scenarios

5.7.3.1 Scientific Knowledge Base

Fundamental to understanding actual or perceived risks to sensitive receptors is a solid understanding of the aquatic biota and marine receiving environment in the vicinity of the Seismic Survey. The current state of scientific knowledge as it relates to aquatic biota and marine receptors within the OA and EMBA are detailed in **Section 4**. This knowledge directly serves to inform the NEBA (**Section 10.10**) under any real time trajectory modelling, in the unlikely event of a Level 2 Spill assessment.

Combines with the assessment of risks (**Section 8.4**), updates to actual or perceived risks to sensitive receptors can be benchmarked against the current state of knowledge.

5.7.3.2 Notifications

Section 10.10 sets out the notifications process to be adhered to in the event of a Level 1 or 2 Spill. Accordingly, Category A and Category B relevant persons, as identified by the location and nature of the spill, will be notified in conjunction with the statutory agencies as per the schedule in **Table 129**.

SLB are not in the position to impose decision making processes onto Category A and Category B relevant persons but will ensure that relevant persons are provided with the most up to date and relevant scientific knowledge in order that Category A and Category B relevant persons are in the position to develop fully informed decisions to manage their interest in the affected area. For example, decisions to close fisheries, or restrict contact recreation, fall outside the expertise and commercial knowledge of SLB, but SLB will ensure all up to date science-based information is communicated to Category A and Category B relevant persons so that they are in a position to coordinate managed responses, including the management of actual or perceived risks to their own stakeholder groups.

5.7.3.3 OPEP/OSMP Initiation and Implementation

Initiation of logistic response actions from a Level 1 or Level 2 spill are the responsibility of the CA. For a Level 2 spill, the response process follows the implementation process set out in Figure 3 of the OSMP. This process indicates the NEBA is undertaken early in the response, as well as following the monitoring and reporting requirements to ensure any spill is remedied and effects are mitigated.

The OSMP describes Type 1 and Type 2 (Scientific) criteria for both the initiation and termination of monitoring. Provision of socio-economic impact monitoring (inclusive of Category A and Category B relevant persons) is included as key criteria for any scientific monitoring programme. The process of OSMP initiation and termination also serves to inform the NEBA to ensure the appropriate course of response is being implemented, and to ensure all Category A and Category B relevant persons are provided with sufficient and timely scientific knowledge to manage stakeholder risks (actual and perceived).

5.7.3.4 Communication pathways

All outcomes of the OPEP and OSMP will be communicated to Category A and Category B relevant persons where decisions are required to inform any updated actions the relevant person have been required to undertake due to any Level 1 or 2 spill event during the Seismic Survey. Given the OSMP is specific to initiation criteria (see **Table 5** of the OSMP, **Appendix L**), and decisions pending the CA and updated NEBA, specific timeframes for communication processes to relevant persons cannot be defined at this stage. In the event of a Level 2 spill, and any OSMP implementation, communication/consultation with relevant persons (concerned with socio-economic impacts) is also included as part of the initiation criteria (see SMP6, **Table 5** of the OSMP, **Appendix L**).

Information provided may include:

- Outcomes of secondary NEBA, with focus on any sensitive receptors specific to Category A and Category B relevant persons if required;
- Updated risk assessments undertaken for sensitive receptors, informed by real time trajectory modelling and updated information about the spill characteristics; and

- Updated knowledge about any potential residual risks to sensitive receptors, following the implementation of mitigations and actions as directed by the CA during the implementation of the OPEP and OSMP response.

In the event that residual risks to sensitive receptors are unacceptable to Category A and Category B relevant persons, SLB will seek to engage to fully understand and assist where applicable the extent to which further actions under the OSMP and NEBA can be beneficial.

For Commercial Fishers, SLB has agreed to financially support the commercial fishing industry (as represented by WAFIC) in the unlikely event of an unplanned spill impacting the industry as per the SLB Loss Adjustment Protocol. SLB will consider any claims for compensation from licence holders on a case-by-case basis, and may be provided in the following circumstances:

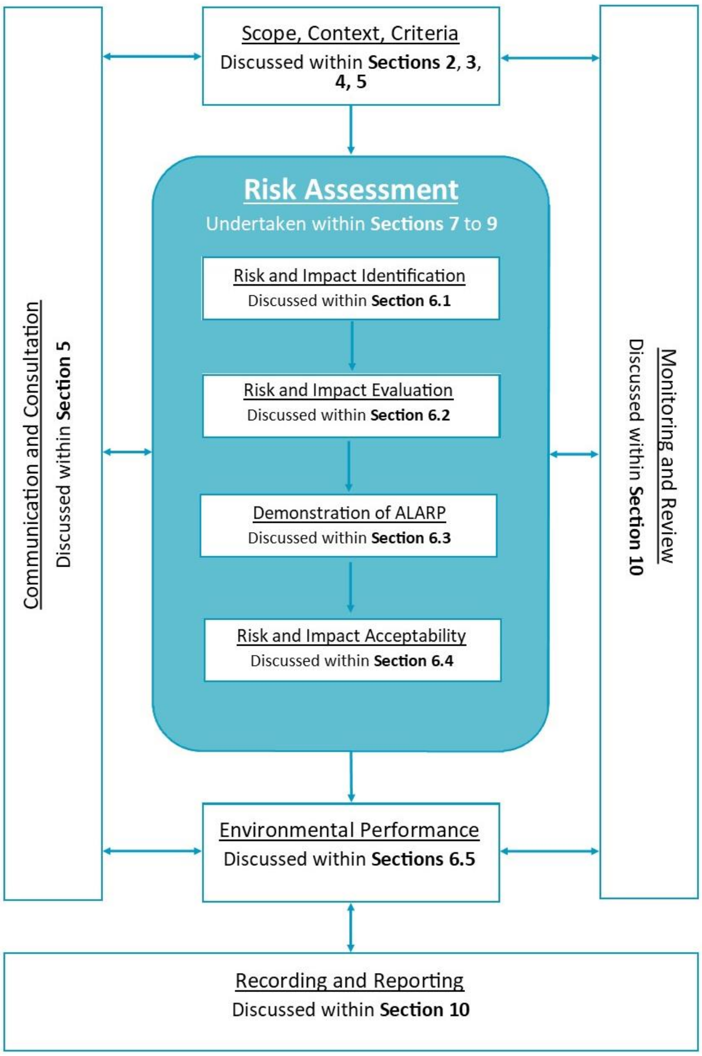
- Fishing equipment has been damaged as a direct result of a fuel oil spill from the Seismic Survey; and
- A licence holder experiences a reduction in historical average Catch Per Unit of Effort as a result from either perceived or actual impacts associated with a fuel oil spill from the Seismic Survey.

In order to receive compensation, a licence holder must be able to show that they would have received the revenue from the landed catch that is subject to the claim, incurred additional costs associated with perceived or actual impacts, or have incurred costs from lost or damaged fishing equipment.

6 Environmental Impact and Risk Assessment Methodology

Regulation 13(5) and 13(6) of the Environment Regulations requires SLB to include details of all environmental impacts and risks arising from or associated with the proposed activity, along with an evaluation of these impacts and risks. The assessment should give appropriate consideration to the nature and scale of each impact or risk, and whether these are likely to be realised as a result of planned and unplanned operations. Accordingly, this assessment must detail the control measures which will be utilised to reduce the impacts and risks of the activity to **ALARP** and an **Acceptable Level**.

The following impact and risk assessment methodology has utilised the joint Australian & New Zealand International Standard Risk Management – Guidelines, (**AS/NZS ISO 31000:2018**) (ISO, 2018). **Figure 42** shows a modified version of the AS/NZS ISO 31000:2018 risk management process diagram to provide a summary on the framework adopted in the development of this EP. To this end, the corresponding sections which address each aspect of the risk management process have also been highlighted.



Source: modified from ISO, 2018

Figure 42 Risk Management Process Adopted from AS/NZS ISO 31000:2018

Some useful definitions for terms which are used throughout the environmental impact and risk assessment are provided in **Table 33.** These terms have been adapted from the AS/NZS ISO 31000:2018 and associated Handbook on Environmental Risk Management – Principles and Process (HB 203:2006) (Standards Australia, 2006).

Table 33 Environmental Impact and Risk Assessment Terminology

Term	Synonymous Terms	Description
The activity[1]		An activity or activities which may occur as part of the Seismic Survey.
Acceptable Level[2]	Acceptable Impact	An 'acceptable level' is the specified amount of environmental impact and risk that an activity may have which is tolerable, is consistent with all relevant principles, and does not compromise the management/conservation/protection objectives of the environment.
As Low as Reasonably Practicable[3]		The operator has to show through reasoned and supported arguments that there are no other practicable options that could reasonably be adopted to reduce risks further. Practicable does not mean 'possible' as a decision on whether an option is practicable involves consideration of a number of factors, including the sensitivity of receiving environment to adverse effects; the financial implications of the option when compared with other options; and the current state of technical knowledge and the likelihood that the option can be successfully applied.
Control Measure[4]		A system, an item of equipment, a person or a procedure, that is used as a basis for managing environmental impacts and risks. Control measures maintain and/or modify risk
Cost[5]	Sacrifice	The sacrifice required for implementing a control measure, which includes an impost such as the money, time, and/or trouble required to implement a particular control measure. Environmental cost may also be a cost in some circumstances (e.g. dispersant use on an oil spill).
Consequence[2,5,6]		Magnitude/level of effect on the environment in the event that an adverse effect occurs as a result of an activity or incident. For example, loss, injury or concern. This may be expressed qualitatively or quantitatively.
Effectiveness (*re control measures)* [2]		A measure of how well the control performs the required function and is determined with consideration to aspects of reliability, functionality, survivability and availability
Environmental Performance Outcome[2]		A specified measurable level of environmental performance that titleholders are seeking to achieve for the life of the activity and which supports effective management of aspects of an activity to the extent that any associated environmental impacts and/or risks are of an Acceptable Level.
Environmental Performance Standard[2,4]		Parameters which control measures are assessed against to ensure they consistently perform to reduce the impact or risk to ALARP and to an Acceptable Level.
Practicability (*re control measures)* [2]		Practicability is a measure of the risk reduction (benefit) gained from applying the control measure compared to the cost.
Predicted Impact[2,7]	Impact	Actual or potential change to the environment, adverse or beneficial, that is predicted to occur by a proposed activity.

Term	Synonymous Terms	Description
Acceptable Impact[2]	Acceptable Level	An 'acceptable level' is the specified amount of environmental impact and risk that an activity may have which is tolerable, is consistent with all relevant principles, and does not compromise the management/conservation/protection objectives of the environment.
Incident[5]	Event	Any occurrence that can have an adverse impact on the environment. An incident releases the intrinsic potential of a hazard.
Inherent Risk[5]		The untreated risk level
Likelihood[6]	Probability	The probability that something (e.g. an adverse effect) will occur as a result of an activity. This may be expressed qualitatively or quantitatively.
Measurement Criteria[2]		Define how the environmental performance outcomes and standards will be measured to determine whether the outcomes have been met during the Seismic Survey
Receptor[2,5]		A physical, biological, chemical or social component of the environment which may be subject to an impact.
Risk[5,6]		The chance of something happening that will have an impact on the objectives. It is measured in terms of the consequence should an adverse effect occur and its likelihood of occurring.
Residual Risk[8]		The risk remaining when control measures are in place.
Source of Impact[5]	Stressor Hazard Environmental aspect	An activity or entity that induces an adverse response or impact.

Source of Definitions:

1. SLB
2. NOPSEMA Guidance Note N04750-GN1344 A524696 Environment plan content requirements. (NOPSEMA 2020)
3. NOPSEMA Guidance Note N-04300-GN0166 A138249 ALARP (NOPSEMA 2020g).
4. NOPSEMA Guidance Note N-04300-GN0271 A336398 Control measures and performance standards (NOPSEMA 2020e)
5. Handbook on Environmental Risk Management – Principles and Process (HB 203:2006) (Standards Australia, 2006).
6. Australian & New Zealand International Standard Risk Management – Guidelines, (AS/NZS ISO 31000:2018)
7. Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.
8. NOPSEMA Guideline N-04750-GL1721 A524696 Environment plan decision making (NOPSEMA 2020b).

6.1 Identification of Environmental Impacts or Risks

Regulation 13(5)(a) of the Environment Regulations requires an EP to include details of the environmental impacts and risks which may arise as a result of the activity, to establish a link between the proposed activity and the environment that may be affected.

On this basis, parts of the activity that interact with the environment and, by extension, those relevant persons/marine users who may use it, were identified with consideration to the following:

- The legislative requirements, guidelines and standards that apply to the Seismic Survey (**Section 2**);
- A comprehensive description of the activities that will occur during the Seismic Survey, including timing, and the equipment to be utilised (**Section 3**);
- A comprehensive description of the existing environment that may be affected by the activity, including key sensitivities such as species distributions, subsea habitat, and the location of biologically important areas, protected areas and socio-economic activities which may coincide with the Seismic Survey identified as part of the desktop studies (**Section 4**); and
- Feedback from relevant persons regarding the socio-economic activities which may coincide with the Seismic Survey (**Section 5**).

The proposed Seismic Survey activities have been split into two sub-categories, planned and unplanned activities. Planned activities are defined as those which constitute part of the MSSs approach and are known to occur, whereas unplanned activities are defined as those which have a risk of occurring but are not anticipated to be realised as part of normal operations. It's important to distinguish that planned activities can give rise to both known and potential environmental impacts, whereas unplanned activities can only be associated with potential environmental impacts. This is further described in **Section 6.2.**

The following activities have been considered within this assessment:

- Planned activities (Section 7), including:
- Physical presence of the Seismic Vessel and towed equipment (Section 7.1);
- Acoustic disturbance to the marine environment (**Section 7.2**);
- Routine permissible waste discharges (**Section 7.3**);
- Atmospheric emissions (Section 7.4); and
- Artificial light emissions (Section 7.5).
- Unplanned activities (Section 8), including:
- Establishment of invasive marine species (**Section 8**);
- Streamer loss (Section 8.2);
- Vessel collision or sinking, and its associated potential hydrocarbon spill (**Section 8.2**);
- Hydrocarbon spill response (Section 8.4); and
- Accidental release of hazardous and non-hazardous materials (**Section 8.5**).

In addition to the above sub-categories, the potential cumulative impacts and risks which may arise as a result of the Seismic Survey have been considered within **Section 9**.

6.2 Evaluation of Known and Potential Environmental Impacts and Risks

In accordance with Regulation 13(5)(b) of the Environment Regulations, an EP must include an evaluation of all potential impacts and risks which may arise as a result of the proposed activity, appropriate to the nature and scale of each impact or risk. The purpose of the evaluation is to document the analysis undertaken to establish the environmental impacts and risks in terms of their extent, duration, severity and certainty in order to demonstrate that the activity can be undertaken in such a way that the environmental impacts and risks will be managed to **ALARP** and an **Acceptable Level** (NOPSEMA, 2020).

To achieve this, the source of impact, pathway through which impacts may be realised and the potential receptors must first be defined. Receptors may include individuals, protected species, populations, habitats, ecosystem functions and socio-economic features or activities. This information forms the basis for which the relative consequence, likelihood and residual risks of impacts can be assessed, in broad accordance with the methods and principles described within the AS/NZS ISO 31000:2018 and HB 203:2006.

The evaluation of known and potential environmental impacts and risks is a systematic process comprising six broad steps, as described **Table 34**, and discussed further in the following sections.

Table 34 Summary of Impact and Risk Evaluation Steps

Section	Description
6.2.1	Assessment of Nature and Scale
6.2.2	Identification of Receptors
6.2.3	Identification of 'Good Practice' Control Measures
6.2.4	Determination of Consequence Rank
6.2.5	Determination of Likelihood Rank
6.2.6	Determination of Residual Risk

6.2.1 Assessment of Nature and Scale

When evaluating the potential impacts and risks which may arise as a result of the proposed activity, the nature and scale of each impact or risk is determined considering:

- The relative value of the receiving environmental (e.g. supporting nationally, regionally or locally important species including threatened species and ecological communities, key ecological features and role in ecosystem functioning);
- The resilience to change of the EMBA;
- The type and number of impact pathways;
- The spatial extent of impacts;
- The timing, duration and frequency of the impact, with consideration to environmental and ecological seasonal sensitivities (e.g., migratory periods for EPBC Act protected fauna, or high activity periods for commercial fisheries);
- The severity of impacts (e.g., individual effects, population-level effects, ecosystem effects);
- The reversibility of impacts;

- Potential cumulative impacts; and
- Uncertainty in the above information.

6.2.2 Identification of Receptors

Based on the descriptions provided in **Section 2** to **Section 5**, the receptors which have been determined as relevant to the Seismic Survey include:

- Marine environmental quality (water, sediment, air quality);
- Plankton;
- Benthic habitats (Banks, Shoals and Reef);
- Benthic invertebrates;
- Marine fauna ;
- EPBC Act listed marine fauna;
- Marine protected areas and sensitive areas;
- Cultural heritage values;
- Commercial fisheries;
- Commercial shipping;
- Tourism and recreation;
- Divers (commercial and recreational);
- Petroleum exploration and production activities;
- Defence activities; and
- Research activities.

6.2.3 Identification of Legislated and ‘Good Practice’ Control Measures

In accordance with the Risk Related Decision Making Framework described in the Oil & Gas UK Guidelines on Risk Related Decision Making (Oil & Gas UK, 2014), ‘Good Practice’ is considered to be the recognised risk management processes and measures which are implemented to manage well-understood impacts and risks generated by an activity. For the purpose of this EP, both legislative requirements and control measures considered to be ‘Good Practice’ were identified based on the guidance outlined in **Section 2** and with consideration to the Marine Bioregional Plan for the North-west Marine Region, the Australian IUCN Reserve Management Principles for Commonwealth Protected Areas, relevant Approved Conservation Advice and Recovery Plans, Management Plans and SLBs internal practices.

Where ‘Good Practice’ is reflected in Australian legislation or relevant Australian Government policies and guidance, these requirements will be applied. When identified in non-regulatory source material, relevant ‘Good Practice’ will be adopted when feasible and reasonably practicable to implement.

6.2.4 Determination of Consequence Rank

For each receptor predicted to be impacted by a planned or unplanned event, the consequence rank has been determined assuming the credible worst-case impact or risk which may arise if controls fail. The applicable consequence rank is then selected with consideration the scale and duration of effect as described in **Table 35**.

6.2.5 Determination of Likelihood Rank

For each receptor predicted to be impacted by a planned or unplanned event, the likelihood rank has been determined based on historical frequency of analogous events occurring within the industry. The applicable likelihood rank has been selected assuming effective implementation of 'Good Practice' control measures, using the criteria described in **Table 36**.

6.2.6 Determination of Residual Impact and Risk

The residual impact and risk assessment has been undertaken to determine the effect of 'Good Practice' control measures in mitigating the inherent risk levels, for each receptor predicted to be impacted by a planned and unplanned event. Accordingly, the residual impact and risk ranking reflects that risk or impact that remains when all adopted control measures are implemented. The residual impact and risk are determined using the matrix presented in **Table 37**. Corresponding descriptions for each impact and risk ranking, ranging from 'Negligible' to 'Very High', are provided in **Table 38.**

If the residual risk does not meet the requirements outlined in **Section 6.3** and **Section 6.4**, iterations of the assessment process continue until the residual impact and risk are reduced to an **Acceptable Level** and/or additional controls have been identified and/or rejected or accepted to demonstrate **ALARP.**

Table 35 Criteria for Assessing Potential Consequence Levels

Consequence level	Scale of Effect	Duration of Effect	Effect on Populations & Protected Species and Recovery Period	Effect on Socio-Economic Receptors	Effect on Habitat & Ecosystem Function
0 – Negligible	Highly localised effect (<1 km^2)	Short-term and intermittent/temporary	No predicted adverse effects to populations. Immediate recovery. No protected species impacted.	No disruptions to normal activities. No predicted effects on natural resources or local communities.	Undetectable, affecting <1% of original habitat area. Ecosystem function unaffected.
–1 - Minor	Localised effect (1 – 10 km^2)	Short-term, occurring frequently but ceases when activity ceases	No detectable adverse effect to populations. Rapid recovery would occur (weeks to months). Some individuals of protected species may be impacted.	Short term disruptions to normal activities (weeks to months). Possible minor adverse effects to natural resources and/or local communities.	Measurable but localised, affecting 1 – 5% of original habitat area. Minor changes to ecosystem function.
–2 - Moderate	Medium scale effect (10– - 20 km^2)	Medium-term but ceases when activity ceases	Detectable impacts to populations. Could affect seasonal recruitment but does not threaten long-term viability. Recovery probably measured in months to years. Some population level effects may become apparent for protected species.	Medium-term disruptions to normal activities (months). Moderate adverse effect to natural resource and/or local communities.	Potential impacts more widespread, affecting 5 – 20% of original habitat area. Moderate changes to ecosystem function.
–3 - Severe	Large scale effect (20 – 50 km^2)	Long-term but ceases when activity ceases	Impacts to populations are severe and may limit capacity for population increase. Recovery measured in multiple years. Population level impacts are detectable for protected species.	Long-term disruptions to normal activities (years). Severe adverse effect to natural resources and local communities.	Widespread impacts, affecting 20 – 60% of original habitat area. Severe changes to ecosystem function.
–4 - Major	Very large scale effect (50 – 100 km^2)	Long-term and continues after activity ceases	Long-term viability of populations is clearly affected. Local extinctions are a real possibility if activity continues. Recovery period of decades. Serious conservation concerns for protected species.	Extensive disruptions to normal activities (years to decades). Highly significant and major adverse effects to natural resources and potentially affecting national communities.	Activity may result in major changes to ecosystem or region, affecting 60 – 90% of original habitat area. Major changes to ecosystem function.
–5 - Catastrophic	Regional effect (>100 km^2)	Permanent	Local extinctions are expected in the short-term. Long-term recovery greater than decades and possibly never recovers. Very serious conservation concerns for protected species.	Very extensive disruptions to normal activities (decades). Catastrophic, widespread and potentially irreparable damage to natural resources. Massive negative and potentially irreversible effects on local and national communities, which may not be able to maintain pre-effect livelihood.	Activity will result in critical changes to ecosystem or region, affecting virtually all original habitat. Total collapse of ecosystem.

Table 36 Criteria for Assessing Likelihood of Consequence Occurring

Score/Level	Likelihood of exposure	Historical frequency
–1 - Remote	Highly unlikely but theoretically possible	Unheard of in the industry
–2 - Rare	May occur in exceptional circumstances	Has occurred once or twice in the industry
–3 - Unlikely	Uncommon, but has been known to occur elsewhere	Has occurred more than five times in the industry but not in the company
–4 - Possible	Occurred in a minority of similar studies or projects	Has occurred in the industry and in the company
–5 - Likely	Likely to occur and has generally occurred in similar projects	Has occurred once or twice in the company
–6 - Certain	Could be expected to occur more than once during project delivery	Has occurred frequently in the company

* Whereby 'likelihood' = the likelihood of a consequence occurring from the various activities

Table 37 Overall Residual Risk of Impacts Matrix

		Consequence Level					
		0 – Negligible	1 – Minor	2 – Moderate	3 – Severe	4 – Major	5 – Catastrophic
Likelihood of Consequence	1 – Remote	Negligible (0)	Low (1)	Low (2)	Low (3)	Low (4)	Low (5)
	2 – Rare	Negligible (0)	Low (2)	Low (4)	Moderate (6)	Moderate (8)	Moderate (10)
	3 – Unlikely	Negligible (0)	Low (3)	Moderate (6)	Moderate (9)	High (12)	High (15)
	4 – Possible	Negligible (0)	Low (4)	Moderate (8)	High (12)	High (16)	Very High (20)
	5 – Likely	Negligible (0)	Low (5)	Moderate (10)	High (15)	Very High (20)	Very High (25)
	6 – Certain	Negligible (0)	Moderate (6)	High (12)	Very High (18)	Very High (24)	Very High (30)

Table 38 Residual Risk Ranking and Impact Descriptions

Risk Ranking	Predicted Risk	Predicted Magnitude of Impact
Very High (18 – 30)	Very High Risk – Unacceptable for project to continue under existing circumstances. Requires immediate action. Works should not re-commence until the risk has been reduced to ALARP and an acceptable level. If it is not possible to reduce the risk, work has to remain prohibited.	Very high Impact - Unacceptable for project to continue under existing circumstances. Requires immediate action. Works should not re-commence until the predicted magnitude of impact has been reduced to ALARP and an acceptable level. If it is not possible to reduce the risk, work has to remain prohibited
High (12 – 16)	High Risk – The level of risk is not tolerable and additional control measures are required to reduce the impact/risk, where practicable, to ALARP and an acceptable level.	High Impact – The predicted magnitude of impact is not tolerable and additional control measures are required to reduce the impact/risk, where practicable, to ALARP and an acceptable level.
Moderate (6 – 10)	Moderate Risk – The level of risk is acceptable, providing all practicable controls have been implemented to reduce the impact/risk to ALARP. Requires continued tracking and recorded action plans.	Moderate Impact - The predicted magnitude of impact is acceptable, providing all practicable controls have been implemented to reduce the impact/risk to ALARP. Requires continued tracking and recorded action plans.
Low (1 – 5)	Low Risk – The level of risk is acceptable without further reduction measures being required. Control measures consistent with good industry practice have been applied or have been assumed in the design process. No further development of control measures is required if ALARP.	Low Impact - The predicted magnitude of impact is acceptable without further reduction measures being required. Control measures consistent with good industry practice have been applied or have been assumed in the design process. No further development of control measures is required if ALARP.
Negligible (0)	Negligible Risk – no intervention or further monitoring is required. No detectable environmental impact.	Negligible Impact - no intervention or further monitoring is required. No detectable environmental impact.

6.3 Demonstration of ALARP

In accordance with Regulation 10A(b) and 13(5)(c) of the Environment Regulations, the EP must demonstrate that the environmental impacts and risks of the activity will be reduced to **ALARP**. In practice, this means that all available and effective control measures must be implemented where the cost is not grossly disproportionate to the environmental benefit gained from implementing the control measure. Accordingly, risk treatment involves a cost benefit analysis of alternative, substitute and additional control measures that may further reduce impacts and risks which have not been demonstrated to be ALARP during the evaluation of environmental impacts or risk (**Section 6.2**)(NOPSEMA 2020f).

Ideally, the adopted control measures should reduce the residual impact and risk to a Low (or lower) ranking; however, if the impact or risk remains at a higher ranking, it is further assessed to determine whether it has been reduced to **ALARP.**

A systematic approach to demonstration of ALARP has been developed based on the requirements outlined in NOPSEMA Guidance Note ALARP N-04300-GN01660166 A138249 (NOPSEMA 2020g) and with consideration to the Risk Related Decision Making Framework described in the Oil & Gas UK Guidelines on Risk Related Decision Making (Oil & Gas UK, 2014).

The Risk Related Decision Making Framework provides for a continuum of 'decision contexts', which comprise a combination of influential factors and constraints within which the decision as to the risk or impact an activity generates is to be made. These factors are broadly summarised as informing a) the type of activity to be undertaken b) the risk and uncertainty and c) the influence of relevant persons. Once the decision context has been defined, the appropriate assessment techniques can be determined. The following assessment techniques may be used for different decision contexts to determine if the activity is being managed to ALARP:

- Good practice: Adherence with recognised guidelines, standards and control measures that are used to manage well-understood impacts and risks is demonstrated;
- Engineering (or Environmental) Impact and Risk assessment: Quantitative analysis is undertaken to increase understanding of the impacts/risks. This may include the application of a range of techniques such as underwater sound modelling or cost benefit analysis; and
- Precautionary approach: Uncertainty is counterbalanced through conservative assumptions which include the 'worst-case' scenario that can be realised. Accordingly, a control measure may be more likely to be adopted.

For the purpose of this assessment, and in accordance with the standard level of approach identified within the approved body of Eps, three 'decision contexts' have been adopted: Type A, B & C (**Figure 43**).

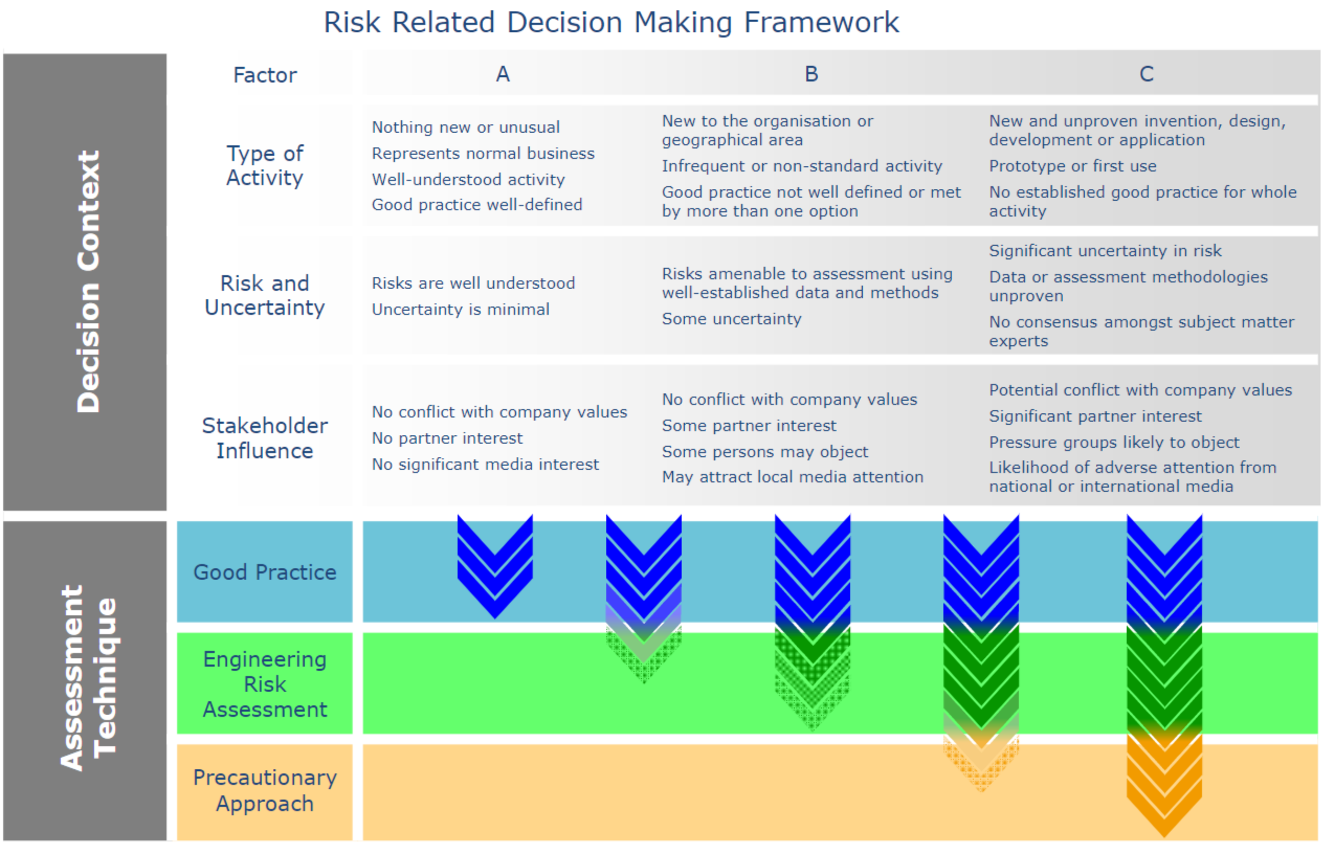


Figure 43 Risk Related Decision Making Framework, Oil & Gas UK (2014)

A description of each 'decision context' and the associated decision methodologies used to demonstrate achievement of ALARP is provided in **Section 6.3.1** to **Section 6.3.3.**

6.3.1 Type A

The decision context is determined to be Type A if the risks and impacts are relatively well understood, with minimal uncertainty and no considerable interest from relevant persons. In general, decision making will be guided by the application of recognised good practice which is well-defined in legislation, standards, and guidelines. Proactive and professional judgement, including utilising industry experience, are sufficient to identify effective control measures and assess adherence to legislative requirements and 'Good Practice'.

If the decision context is categorised as Type A, adherence to all relevant legislation, codes and environmental standards and 'Good Practice' techniques and controls is considered sufficient to demonstrate the impacts and risks are managed to ALARP. Further assessment, such as an engineering risk assessment, is not necessarily required to identify additional control measures.

6.3.2 Type B

The decision context is determined to be Type B if the risks and impacts involve some uncertainty and greater complexity and generate several concerns from relevant persons. These risks may be novel to the proponent or area, attributed to a non-standard activity and, therefore, good practice is not necessarily well defined. They are typically associated with areas of increased environmental sensitivity.

If the risk is categorised as Type B, an Engineering (or Environmental) Impact and Risk assessment is required. Additional quantitative analysis is performed, including through the use and interpretation of numerical analysis (e.g., analysis of commercial fisheries catch and effort data) or predictive modelling (e.g., UAM), to further define the risk or impact and cost benefit analysis for adopting further management. The cost benefit analysis is based on a weight of evidence approach to defining the possible environmental benefit gained from adopting alternate, substitute and additional controls measures, compared to the cost of implementing them.

For the purpose of this EP, the hierarchy of controls, which follows a tiered system of 'eliminate-substitute-reduce-mitigate', has been utilised to identify alternate, substitute and additional controls measures (**Table 39**) (NOPSEMA, 2020e).

Table 39 General Hierarchy of Controls

Control	Example	Effectiveness
Eliminate	Elimination of the risk or impact, such as eliminating the light source to remove impacts from artificial light emissions.	Most Effective
Substitute	Substitute the method of an activity in favour of a lower impact one, such as substituting Heavy Fuel Oil for MGO to reduce the amount of atmospheric emission.	
Reduce	Reduction of the risk or impact, such as reducing the oil content in discharged water to reduce the potential contamination of the sea.	
Mitigate	Mitigate the potential risk or impact of conducting an activity, such as maintaining separation distances from land when discharging wastes to mitigate the potential impacts on coastal environments	Least Effective

The outcome of the cost benefit analysis determined whether a control measure was considered effective and/or practicable to implement. A clear justification is provided for each determination. Based on this determination, control measures were adopted for implementation or dismissed. ALARP is demonstrated when all available and effective control measures have been considered and implemented, where the cost is not grossly disproportionate to the environmental benefit gained from implementing the control measure.

6.3.3 Type C

The decision context is determined to be Type C if the risks and impacts involve sufficient complexity, uncertainty, and interest from relevant persons to warrant a precautionary approach. The activity may be previously untested, and therefore lack consensus amongst subject matter experts or associated proven risk assessment methodologies. A combination of 'Good Practice', Engineering (or Environmental) Impact and Risk Assessment and Precautionary Approach are required.

ALARP is demonstrated when the precautionary approach is applied, such that it can be shown uncertainty is counterbalanced through conservative assumptions which include the 'worst-case' scenario that can be realised. Safety is expected to take precedence over economic considerations when completing a cost benefit analysis of additional controls.

6.3.4 Identification of Changes to Residual Impact and Risk

Following the ALARP evaluation, any changes to the predicted residual impacts and risks resulting from adopting alternate and/or additional control measures are identified to determine whether potential impacts and risks have been reduced to an acceptable level.

6.3.5 ALARP Statement

ALARP is demonstrated when it is apparent all available and effective control measures have been considered and implemented, where the cost is not grossly disproportionate to the environmental benefit gained from implementing the control measures. A corresponding statement of ALARP is provided for each event to justify the overall certainty and effectiveness of reducing potential impacts and risks to ALARP, using the adopted control measures.

6.4 Impact and Risk Acceptability

Regulation I© of the Environment Regulations requires an EP to demonstrate that the environmental impacts and risks of the activity have been reduced to an **Acceptable Level**. Further, regulation 13(5)(c) states an EP must include details of control measures that will be implemented to achieve this. The criteria used to determine whether the residual risks and impacts of an activity following the implementation of the control measures, and following the demonstration of **ALARP**, are at an **Acceptable Level**, are contained within **Table 40**.

For each criterion, 'acceptability questions' have been developed to assess compliance. Each activity, both planned and unplanned, has been assessed against the relevant criteria within **Sections 7** and **8**.

Impacts and risks classified as Type A are characterised as 'Acceptable' if the level of residual impact and risk are determined to be Moderate or less and compliance with the acceptable impacts stated in **Table 40** can be demonstrated. Impacts and risks classified as Type B or above are characterised as 'Acceptable' if the requirements in **Table 40** can be demonstrated and it can be determined that the predicted levels of impact and residual risk are at or below pre-defined **Acceptable Level** for that impact or risk, including those described in **Table 41**.

Acceptable levels of impact and risk have been developed to protect the values of specific receptors which have been determined as relevant to the routine operations of the activity (**Table 41**). Where risks and impacts are identified as Type B or above, an assessment against these levels has been undertaken to determine whether the predicted impact and risk are below an acceptable level of impact.

Table 40 General Impact and Risk Acceptability Criteria

Criteria	Acceptability Questions	Acceptability is Confirmed
Residual risk ranking	Is the level of residual risk determined to be **Moderate** or less?	The risk has been determined to be **Moderate** or less.
Ecologically sustainable development	ESD is defined as 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'. Section 3A of the EPBC Act sets out three main matters; the first of which is that the activity needs to be carried out in a manner consistent with the principles of ESD. Therefore, ESD is an integral aspect in determining risk/impact acceptability. Based on this, is the management of the risks/impacts associated with the proposed activities carried out in a manner that is consistent with the five principles of ESD as defined within the EPBC Act (**Section 2.1.2**)?	The Seismic Survey is consistent with the five principles of ESD.
SLB's Internal context	Does the management of the risks/impacts associated with the activity align with the internal policy of the titleholder (in this case SLB's QHSE Policy, **Section 1.6**)?	Internal or external audits of procedural systems confirm all policies in place that align with the EP.
Existing environmental context	Has the development of the control measures taken into account the environmental values and sensitivities at a local, regional or global level, where relevant?	With the implementation of the control measures, the potential impacts from each of the activities must be consistent with the general nature and quality of the receiving environment of the OA and EMBA.
	Are the values and sensitivities of the environment, including matters protected under Part 3 of the EPBC Act (World Heritage, National Heritage, Wetlands of International Importance, Listed threatened species and ecologically communities, Listed migratory species, Commonwealth Marine Environment) protected so that no significant impacts result to the environment?	
External Context – Management Plans, Species Recovery Plans and Conservation Advice	Is the management of the impacts/risks in accordance with the relevant species specific or protected area management plans, such as Conservation Advice, Management Plans, or Recovery Plans?	With the implementation of the control measures, the potential impacts from each of the activities must be consistent with all of the relevant management plans, conservation advice, recovery plans.
	Are the risks/impacts managed in alignment with the nominated conservation values defined within the Marine Bioregional Plan for the North-west Marine Region and, where relevant, the North Marine Region?	
Social Acceptance – Relevant persons expectations	Have any concerns regarding the risks/impacts which may arise from the activity been raised through consultation (described throughout **Section 5** and **Appendix I**) with relevant persons. If so, have the merits of these concerns been evaluated? Where it has been determined that the concerns have merit, have any relevant control measures been developed to address these concerns?	All relevant persons concerns and submissions have been responded to, adequately addressed and closed out.

Criteria	Acceptability Questions	Acceptability is Confirmed
External Context – Commonwealth and State Legislative Criteria	Does the management of the risks/impacts (including the proposed control measures) associated with the activity align with the relevant Australian and International legislation, conventions, and standards such as those outlined within **Section 2** (i.e. Policy Statement 2.1, MARPOL, Marine Notices, Marine Orders)?	Compliance with all of the legislative requirements, standards and policies and can be demonstrated when audited.
Industry best practice	Has the management of the risks/impacts been conducted in accordance with industry best practice, such as the APPEA Code of Environmental Practice and the International Associated of Geophysical Contractors (**IAGC**) Environmental Manual for Worldwide Geophysical Operation (**Section 2.2**)?	The impact of potential risk, through control measures is managed so that it is compliant with all relevant industry best practice guidelines.
ALARP	Are all reasonable and practicable control measures in place to reduce the impact or risk of the activity? Have the costs (financial or otherwise) of implementing further control measures been considered? Where it is considered that costs are disproportionate to the benefit gained, has this been identified?	General agreement that the residual risk from the Seismic Survey has been demonstrated to be **ALARP**.

Table 41 Specific Impact and Risk Acceptability Criteria

Criteria	Acceptable Level	Acceptability is confirmed
Marine Environmental Quality	There are no long-term or widespread impacts to the quality of water and sediment.	Predicted impacts to water and sediment quality are short-term and localised.
Plankton	Impacts to plankton communities are localised (within 100s of m from the acoustic source) and recoverable (< 1 week to recover). Note that the latter is considered sufficient to protect against population level impacts and impacts to the recruitment levels at surrounding habitats.	Predicted impacts to plankton communities do not extend beyond the spatial and temporal limits defined within the acceptable level.
Benthic Habitats (Banks, Shoals and Reef)	No detectable impacts to habitat forming benthic primary producers, such as coral, as a result of the Seismic Survey.	No impacts to habitat forming benthic primary producers are predicted
Benthic Invertebrates	Impacts to crustaceans and bivalves arising from the Seismic Survey will not result in mortality rates beyond the natural range of variation.	Predicted impacts to crustaceans and bivalves do not indicate mortality rates beyond the natural range of variation.
Non-Listed Marine Fauna (Cephalopods, Fish, Sharks, Rays)	No serious[17] or irreversible damage to a population of any Non-listed marine fauna species as a result of the Seismic Survey.	No serious or irreversible damage to a population of any Non-listed marine fauna species as a result of the Seismic Survey.

[17] In the absence of a definition of 'serious' environmental damage in relation to the Principles of ESD under the EPBC Act, SLB considers a serious impact to be impacts with the potential to result in a threat to population or community viability.

Criteria	Acceptable Level	Acceptability is confirmed
EPBC Act Listed marine fauna (Whale Sharks, Marine Turtles, Marine Mammals, Seabirds)	Impacts to EPBC Act Listed marine fauna are limited to minor, short term effects to individuals and do not preclude the continuation of biologically important behaviours, within and outside nominated BIAs.	Predicted impacts to marine fauna are limited to minor, short term effects do not preclude the continuation of biologically important behaviours within and outside the nominated BIAs.
Marine Protected Areas and Sensitive Areas	Meet the Oceanic Shoals Marine Park IUCN Category VI (Multiple Use Zone) objective to provide for ecologically sustainable use while conserving ecosystems, habitats and native species. Meet the Ashmore Reef Marine Park and Cartier Island Marine Park IUCN Category Ia (Sanctuary Zone) objective to provide for the protection and conservation of ecosystems, habitats and native species in as natural and undisturbed a state as possible. The ecosystem function and integrity of Commonwealth Marine Areas are maintained.	No impact to the ecosystem function and integrity of Marine Protected Areas/Sensitive Areas or conservation status of native species within Marine Protected Areas/Sensitive Areas. Predicted impacts do not compromise the ecosystem function and integrity of Commonwealth Marine Areas.
Cultural Heritage Values	No interference with other relevant persons/marine users, including access by traditional owners, to an extent greater than is necessary for the exercise of right conferred by the titles granted.	Predicted impacts to access and use (e.g., fishing) are managed such that they are not greater than is necessary for the exercise of right conferred by the titles granted.
Commercial Fisheries	No interference with other relevant persons/marine users to an extent greater than is necessary for the exercise of right conferred by the titles granted. No change to the sustainability status of the fishery; the Seismic Survey is undertaken in a manner that does not result in serious, irreversible or long-term impacts to key indicator commercial fish populations and to the extent that sufficient spawning fish biomass and recruitment of the stocks may be maintained such that stocks continue to be assessed by DPIRD as sustainable. There is no increased costs or loss of income for commercial fishing license holders.	Predicted impacts to access and use are managed such that they are not greater than is necessary for the exercise of right conferred by the titles granted.
Commercial Shipping	No disturbance to shipping outside the extent of the (10 km) caution zone.	Impacts to shipping are not predicted to occur beyond the (10 km) caution zone.
Tourism and Recreation	No disturbance to Tourism and Recreation activities outside the extent of the (10 km) caution zone or to a degree exceeding that previously agreed to be an acceptable level of disruption to tourism operators and recreational users.	Impacts to Tourism and Recreation are not predicted to occur beyond the (10 km) caution zone or to a degree exceeding that previously agreed to be an acceptable level.

Criteria	Acceptable Level	Acceptability is confirmed
Divers	No health impacts to divers or underwater recreational activities as a result of the Seismic Survey.	There are no predicted health impacts to divers or recreational users as a result of the Seismic Survey.
Petroleum exploration and production	No entry into established Petroleum Safety Zones surrounding petroleum installations and equipment.	There is no unpermitted entry into established Petroleum Safety Zones surrounding petroleum installations and equipment.
	No disturbance to SIMOPS outside the extent of the (10 km) caution zone or to a degree exceeding that previously agreed to be an acceptable level of disruption to petroleum exploration and production vessel activities.	Impacts to SIMOPS are not predicted to occur beyond the (10 km) caution zone or to a degree exceeding that previously agreed to be an acceptable level.
	Where the potential for concurrent MSSs to occur is identified, SIMOPS planning will include the implementation of a 40 km spatial separation between the Seismic Vessel and any other operating Seismic Vessel in the Bonaparte Basin area.	A 40 km spatial separation is maintained between the Seismic Vessel and any other operating Seismic Vessel in the Bonaparte Basin area.
Defence activities	No disruption to known defence activities	No impacts to known defence activities are predicted.
Research Activities	No disturbance to Research Activities outside the extent of the (10 km) caution zone or to a degree exceeding that previously agreed to be an acceptable level of disruption to Researchers.	Impacts to Research Activities are not predicted to occur beyond the caution (10 km) zone or to a degree exceeding that previously agreed to be an acceptable level.

SLB considers an impact or risk to be unacceptable where the residual risk or impact attributed to a planned or unplanned event is High or greater, or, where the assessment shows the defined **Acceptable Level** cannot be met. In **these** cases, SLB will not undertake the activity until such a time where the residual impact and risk ranking are reduced to Moderate or below, or it can be demonstrated that the defined **Acceptable Levels** can be met.

6.4.1 Acceptability Statement

Following demonstration that all effective and practicable control measures have been adopted to reduce the impacts and risks to **ALARP**, compliance with the pre-defined (general and/or receptor specific) **Acceptable Levels** of impact has been assessed. A corresponding statement is provided for each event to justify the outcome of this assessment.

6.5 Environmental Performance Outcomes and Standards

Regulation 13(7)(a–c) of the Environment Regulations requires every EP to:

- Set out the environmental performance outcomes against which the performance of the titleholder (in this case SLB) in protecting the environment is to be measured;
- Set environmental performance standards for the control measures; and
- Include measurement criteria that the titleholder will use to determine whether each environmental performance outcome and environmental performance standard is met.

Environmental performance outcomes (**EPOs**) are a specified measurable level of environmental performance that titleholders are seeking to achieve for the life of the activity. The EPOs developed are designed to support the effective management of aspects of an activity to the extent that any associated environmental impacts and/or risks are of an **Acceptable Level**. To this end, the EPOs should be equivalent to or better than the acceptable levels(s). Each activity associated with the Seismic Survey will include an environmental performance outcome which relates to all the environmental features that may be impacted or are at risk from the occurrence of the activity.

Environmental performance standards (**EPSs**) relate specifically to the performance of a control measure. They are parameters which control measures are assessed against to ensure they consistently perform to reduce the impact or risk to **ALARP** and to an **Acceptable Level**. These EPSs set levels at which an incident becomes a 'recordable incident' (**Section 10**) and will be utilised as part of performance monitoring of the Seismic Survey.

Measurement criteria define how the environmental performance outcomes and standards will be measured to determine whether the outcomes have been met during the Seismic Survey.

7 Environmental Impacts and Risks from Planned Activities

This section describes the results of the impact and risk assessment for planned activities using the methodology described in **Section 6** and identifies the control measures that will be in place to reduce the impacts and risks associated with the Seismic Survey to ALARP and to an Acceptable Level.

The impact and risk assessment has been undertaken for each planned activity listed in **Table 42**.

Table 42 Planned Activities Assessed

Planned activity	Section reference	Residual risk
Physical presence of Seismic Vessel and towed equipment	**Section 7.1**	Moderate
Acoustic disturbance to the marine environment	**Section 7.2**	Moderate
Routine permissible waste discharges	**Section 7.3**	Negligible
Atmospheric emissions	**Section 7.4**	Negligible
Artificial light emissions	**Section 7.5**	Low

7.1 Physical Presence of Seismic Vessel and Towed Equipment

7.1.1 Description of Source of the Impacts and Risks

During the Seismic Survey, the Seismic Vessel will tow a suite of equipment including the two sub-arrays of acoustic sources at a depth of 8 m below the surface, and 12 streamers. The streamers will be 8 km in length and will be towed at 10 – 20 m below the surface. Streamers will be spaced at intervals of 120 m, so the overall lateral spread of all streamers will be 1,320 m. Each streamer will be equipped with a tail buoy that has a radar reflector and light at the terminal end. A detailed description of the proposed activity and schematic diagram showing the general configuration of towed gear is provided in **Section 3** and **Figure 4**. The total AA affected by the towed gear is approximately 12,000 km^2.

A purpose-built Seismic Vessel will be contracted for the Seismic Survey that is capable of safely operating in the environmental conditions of the NWMR. The Seismic Vessel will be accompanied by one Support Vessel and one Chase Vessel at all times, which will manage potential interactions between the Seismic Vessel and other marine users. The Seismic Vessel, Support Vessel and Chase Vessel are collectively referred to as the 'survey vessels', where appropriate, throughout this section.

7.1.2 Evaluation of Known and Potential Impacts and Risks to Environmental Receptors

Using the information presented in **Section 2** to **Section 5**, the impact and risk assessment has been undertaken for those receptors determined to be relevant to the activity as listed in **Table 43**.

Table 43 Environmental Receptors Assessed

Receptor	Section reference
Whale sharks	**Section 7.1.2.1**
Marine turtles	**Section 7.1.2.2**
Marine mammals	**Section 7.1.2.3**

The physical presence of the survey vessels and towed acoustic equipment has the potential to result in the following effects on environmental receptors:

- Disruption to normal animal behaviours;
- Displacement of animals from preferred habitat; and
- Collision with or entanglement of animals in towed equipment.

7.1.2.1 Whale Sharks

The whale shark is a protected species listed as Vulnerable and Migratory under the EPBC Act. The OA overlaps with a foraging BIA for the whale shark (**Figure 18**). The foraging BIA represents waters where solitary whale sharks are known to forage during their migration from Ningaloo Marine Park (**NMP**), which occurs primarily in spring (September to November). Whale sharks are pelagic and are known to spend considerable time close to the sea surface (~2 m from the surface) (Wilson *et al*., 2006; Gleiss *et al*., 2013), which can make them vulnerable to vessel strike. During the seismic survey period (proposed to commence end of November 2022, but will not enter the whale shark BIA before December) it is not expected that whale sharks will be encountered in substantial numbers throughout OA, and any observations are likely to be infrequent.

The physical presence of vessels and towed equipment can result in risk of collision or entanglement with foraging whale sharks. There is evidence to indicate that vessel strike has caused damage to fins and result in long term scarring of whale sharks; likely as a the result of contact with the propeller (DPAW, 2013) as well as impalement on the bow of larger ships (Norman 1999) while no reports of whale shark mortality following vessel strike have been reported in Australia. As whale sharks are negatively buoyant evidence of mortality following vessel strike may however be inherently limited (DPAW, 2013). There is no evidence to suggest that current levels of anthropogenic activities including potential threats such as vessel strike from commercial and recreational vessels are having a demonstratable impact on whale shark aggregations off the Western Australian coast (DPAW, 2013). The presence of the seismic vessel will not substantially increase the number of vessel movements within the EMBA and subsequently it is not considered to create a greater threat to whale sharks than might already be present. There have been no reported cases of whale sharks or other marine fauna becoming entangled in seismic equipment in Australian waters.

Vessel speed is a key concern when considering risk of collision and the potential outcome. Slower moving vessels travelling along a designated route are however likely to provide greater time and opportunity for whale sharks to avoid collision compared to faster moving vessels with erratic movement patterns (Commonwealth of Australia, 2017a). Moreover, Vanderlaan and Taggart (2007) observed that an escalation in the speed of a vessel can increase in the severity of injury to large marine animals. During seismic data acquisition the Seismic Vessel will be moving along a set course and travelling at 4.5 knots, which will likely provide an opportunity for a whale shark to detect and actively avoid collision with the vessel and associated towed equipment.

Current best practise measures to avoid collision with whale sharks include:

- Taking action to avoid approaching or drifting closer than 30 m of a whale shark; and
- Not exceeding 8 knots within 250 m ('contact zone') of a whale shark (DPAW, 2013).

Based on implementation of proposed control measures (see **Section 7.1.5**) it is considered that the consequence of vessel collision with whale sharks would have no detectable adverse impacts on the population although it is considered feasible that individuals may interact with the seismic vessel and towed equipment.

Interactions between the seismic vessel and whale sharks are considered uncommon although they have been recorded to occur.

As such, the risk to populations of whale sharks arising from the physical presence of the survey vessels and towed equipment during the Seismic Survey has been assessed as **Low** (*Minor x Unlikely*) (**Table 38**).

7.1.2.2 Marine Reptiles

Two species of threatened sea snake may, or are likely to, occur in the OA and six species of threatened marine turtle are known or likely to occur (**Table 18**). The greatest potential consequence to these marine reptiles from the physical presence of the survey vessels and towed equipment, is collision or entanglement.

Historically, levels of sea snake bycatch in the Northern Prawn Fishery (**NPF**) have been high (Ward, 1996), with mortality rates linked to drowning or being crushed by the target catch weight (Wassenberg *et al*., 2001). While this suggests that the potential for entanglement with towed gear exists, physical interactions between sea snakes and seismic equipment are intrinsically different to those with a trawl net in that seismic equipment 1) has no mesh component to entrap animals and 2) no catch weight will crush individuals. On this basis, individual snakes that encounter towed gear will have a much higher chance of survival and the slow operational speed of the Seismic Vessel will promote the escape of any sea snake that does collide with towed seismic gear or the Seismic Vessel. Vessel strike is not listed as a key threat to sea snakes (Somaweera *et al*., 2021; Udyawer *et al*., 2018; DSEWPC, 2012d).

Turtles are vulnerable to vessel strike due to their relatively small size and the significant amount of time spent just below the sea surface (Commonwealth of Australia, 2017a). Collision avoidance is determined by the animal's response time, which is affected by both vessel speed and visibility. Hazel *et al*. (2007) found that 60% of green turtles were able to successfully flee from approaching vessels travelling at two knots. A turtle's ability to flee was severely reduced as the vessel's speed increased, with 22% successfully fleeing at six knots and only 4% at 10 knots. It was concluded that most turtles cannot avoid vessels travelling at speeds greater than approximately two knots (Hazel *et al.,* 2007). Turtles are likely responding to visual cues of the vessel instead of sound cues; if turtles were relying primarily on sound, the reverse result would be found with greater response rates to faster (and therefore louder) vessel approaches (Hazel *et al*., 2007). Vessel strike data for turtles is available for QL where at least 65 turtles were killed by vessel strike incidents between 1999 and 2002 (Hazel and Gyuris, 2006).

Tail buoys (at the end of each streamer) are the most likely part of the towed equipment to trap marine turtles. There are two main areas on the tail buoy which may trap turtles; between the buoy and the connecting chains (the most common area of entrapment), or underneath the buoy in the 'undercarriage' structure (Ketos Ecology, 2009). In order to become trapped in the tail buoy, the animal would have to come in close proximity to the buoy. There are two theories as to why turtles become trapped against seismic tail buoys; startle diving in front of the towed equipment, or as a result of foraging along the streamers (Ketos Ecology, 2009). Entanglement in tail buoys would be fatal due to water movement holding the turtle against the buoy, keeping the turtle from being able to reach the surface to breathe (Ketos Ecology, 2009).

Surface behaviour of the turtle increases its chance of entrapment. For example, those basking at or just below the water surface during hot and calm conditions are slow to react to threats, with dive reactions occurring at close range based on visual detections of the threat (Ketos Ecology, 2009). Startle dive reactions in turtles at the sea surface responding to approaching towed equipment and vessels have been observed at as little at 1 m from the threat (Weir, 2007). All species of marine turtle potentially present within the OA are expected to exhibit resting/basking surface behaviours, but green, hawksbill and loggerhead turtles are the species for which vessel collision is considered to be of potential concern in the NWMR (DSEWPC, 2012d); noting that collision with vessels is 'not of concern' for flatback, leatherback and olive ridley turtles (DSEWPC, 2012d).

Although there are no peer-reviewed literature documenting incidences of turtle entanglement in towed seismic equipment (Nelms *et al.,* 2016), 'turtle guards' were developed to prevent turtle interactions with tail buoys following anecdotal reports of turtle entrapments off the west coast of Africa (Nelms *et al.,* 2016) and the suggestion of entrapment as a growing concern (Ketos Ecology, 2009). Guards are fitted to the buoy and act as a physical barrier to exclude turtles from the space between the buoy and undercarriage (Ketos Ecology, 2009). Certain designs may also allow the turtle to be deflected away from the buoy. All tail buoys utilised in the Seismic Survey will be fitted with a turtle guard.

The '*National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna'* provides a guiding framework for mitigating the risk of vessel collisions with marine megafauna, including marine turtles (Commonwealth of Australia, 2017a). An intended outcome of the National Strategy is the development of a mitigation measures 'toolkit'. To date this toolkit has not yet been developed; however, installation of turtle guards on tail buoys and the slow speed of the Seismic Vessel are considered to be effective mitigation measures against ship strike and entanglement for marine turtles. There are no mitigation measures that will be implemented on board the Support Vessel to minimise the risk of collision with marine turtles; however, they will generally be operating at low speeds and any incidents with turtles will be reported, as recommended under the National Strategy.

With regard to disruption to normal animal behaviours and displacement from preferred habitat, vessel disturbance is particularly an issue for turtles in foraging habitats and nesting areas, particularly in shallow coastal areas where vessel traffic is typically high (Commonwealth of Australia, 2017a). Given the OA is located adjacent to a foraging BIA for flatback turtles, loggerhead turtles and olive ridley turtles; some disturbance to foraging behaviours and or displacement are possible for individuals of this species. Despite a 'known' or 'likely' presence (**Table 18**), other species of marine reptile are less likely to be disturbed or displaced on account of the presence of the survey vessels and towed acoustic equipment during the Seismic Survey as the OA is not identified as being particularly important habitat for other species of marine reptile.

Importantly, vessel densities within the OA are moderate, with the southern portion of the OA approaching a well-used shipping route. Therefore, it's expected that the presence of the survey vessels and towed gear will not result in a significant increase to any potential displacement in the context of broader vessel disturbance.

The risk to marine turtles arising from the physical presence of the survey vessels and towed equipment during the Seismic Survey has been assessed as **Low** (*Minor* x Possible).

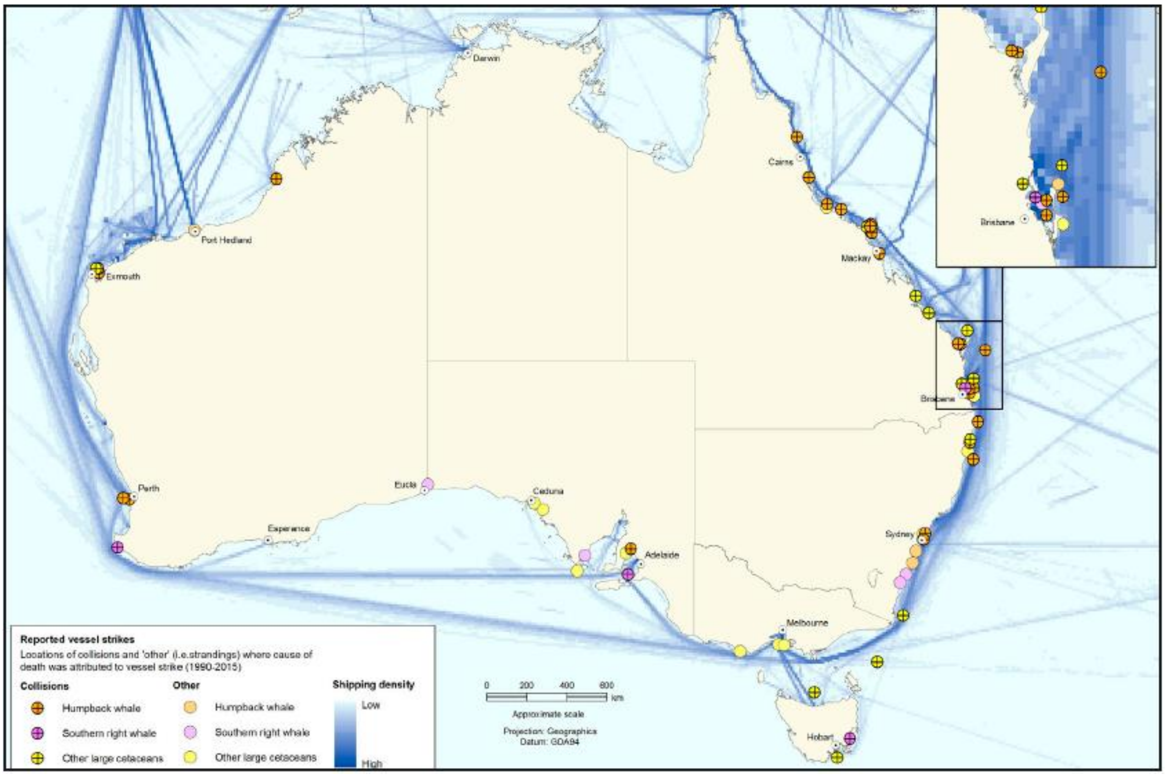
7.1.2.3 Marine Mammals

Disruption of normal animal behaviour and displacement is of particular concern when it occurs frequently or over a prolonged period and affects critical behaviours such as feeding, breeding and resting. The physical presence of the survey vessels and towed equipment may cause some temporary and localised changes in marine mammal behaviours and/or displacement from habitat. **Table 25** provides a summary timeline depicting the expected presence of marine mammals in the OA.

Marine mammals show two main stereotypical behaviours in the presence of vessels: avoidance or attraction (Wűrsig *et al*., 1998); both behaviours can affect energy expenditure and disrupt natural activities. Avoidance most commonly leads to an animal becoming displaced from an area; however, such disturbance is predicted to be temporary due to the transitory and temporary duration of seismic activities in any single location. Furthermore, marine mammals must be in relatively close proximity to the vessels and equipment in order to be affected by their physical presence.

The Commonwealth of Australia (2017a) reports that there were 109 records of ship strike on cetaceans in Australian waters from 1997 to 2015. Species affected included humpback (47%), southern right (13%), sperm (3%), pygmy blue (2%), blue (2%), pygmy sperm (2%), dwarf minke (2%), pygmy right (1%), fin (1%), Antarctic minke (1%), and 'unidentified' (26%) whales (Commonwealth of Australia, 2017a). Peel *et al*. (2018) revised this data and added to it by searching media archive databases. Their searches revealed 76 additional unreported records of vessel strike between 1877 and 2015 and overall, they concluded that of the 'known' species in the Australian ship strike record, humpback whales (59%), southern right whales (14%) and sperm whales (8%) were the most affected species. Incidents typically occurred within each species core distribution (noting that for southern right whales and sperm whales this was confined to the southern half of Australia) and there was a strong temporal correlation between ship strike and migration periods for humpback and southern right whales. Globally, the species most affected by vessel strike are fin whales, humpback whales, right whales, gray whales, minke whales, sperm whales and blue whales (Jensen *et al*., 2004).

Only one known ship strike or stranding event attributed to ship strike has been recorded in the vicinity of the OA, namely a humpback whale in the coastal waters of Broome (**Figure 44**). There are limited records of ship strike with dolphins in Australian waters (Commonwealth of Australia, 2017a). WA and the NT have the lowest number of documented whale strikes (Commonwealth of Australia, 2017a).



Source: Commonwealth of Australia, 2017a

Figure 44 Location of Reported Vessel Collisions with Whales or 'Other' Incidents where Cause of Death is attributed to Vessel Collision

Jensen *et al*. (2004) demonstrated that vessel type plays a role in the likelihood of a ship strike resulting in animal mortality. In a review of the global ship strike database, the majority of fatal strikes were caused by navy vessels and container/cargo ships/freighters, which typically travel faster than 15 knots. Seismic vessels (categorised in the study as 'research' vessels) accounted for only one ship strike incident out of a total of 292 reported incidents (Jensen *et al*., 2004).

The faster a vessel travels, the greater the likelihood of whale mortality. Jensen *et al*. (2004) reported a mean speed of 18.6 knots for vessels involved in lethal ship strikes. During data acquisition, seismic vessels typically travel at approximately 4 – 5 knots; three to four times slower than the mean fatal speed documented by Jensen *et al*. (2004). Records of sub-lethal effects are less reliable on account of the difficulty in assessing injury in free swimming cetaceans following a collision.

Marine mammals are most at risk of ship strike when exhibiting surface behaviours such as feeding and resting. Based on the assessed likelihood of encountering each cetacean species during the Seismic Survey, ship strike is of most concern for pygmy blue whales, humpback whales, fin whales, and sei whales, which are known or likely to occur in the OA.

While pygmy blue whales are not well represented in the Australian ship strike records (n < 5; Commonwealth of Australia, 2017a; Peel *et al*., 2018), collisions do occasionally occur. This species has the highest likelihood of presence during the Seismic Survey on account of the OA overlapping with their migration BIA along the NW coast of Australia into Indonesian waters. This spatial overlap increases their vulnerability to ship strike from the survey vessels. The behaviour of blue whales in response to commercial ship movement was documented in McKenna *et al*. (2015) who observed a dive reaction (a shallow dive during surface period) in response to an approaching vessel but no evidence of any lateral avoidance. This suggests that the ability of this species to avoid ships is limited (McKenna *et al*., 2015). SLB will implement additional controls to mitigate against effects of the Seismic Survey on pygmy blue whales. These controls include both spatial and temporal restrictions for acquisition in and around the blue whale migratory BIA, which has been identified as a key sensitivity for this species; the Seismic Vessel will not activate the acoustic source within this BIA or within 17 km of the buffer from mid-April (14th) to mid-January (14th) which is the period during which migrating whales are expected to be present. The controls also include the implementation of an extended observation zone if higher than anticipated numbers of blue whales/pygmy blue whales are observed (three or more blue whale/pygmy blue whale instigated shut-downs are made during the preceding 48-hour period) at any time or location during the survey. Humpback whales represent the single species of marine mammal with the highest number of ship strike records in Australian waters, although this may be a reflection on the reasonably high abundance of humpback whales in Australia (Peel *et al.,* 2018). While the EPBC Act Protected Matters Database indicates that humpbacks are likely to occur in the OA, their breeding season is well defined between late Jun to early Oct (How *et al*., 2020) and most breeding activity occurs in the coastal Kimberley Region south of the OA (between Camden Sound and Broome (Irvine *et al*., 2018). Outside of the breeding season this species migrates to high latitude Southern Ocean feeding grounds (Pomilla and Rosenbaum, 2005). As humpback whales only have a seasonal presence in the region and their winter breeding distribution is typically coastal and south of the OA, the Seismic Survey is not predicted to represent a collision or displacement threat to this species. The slow operational speed of the Seismic Vessel and the presence of MFOs/MMOs onboard will also serve as strong control measures against any potential ship strikes.

While the EPBC Act Protected Matters Database indicates that fin whales and sei whales are likely to occur in the OA, evidence suggests that:

- If fin whales do occur this far north, they will be in very low densities and their presence will be temporally constrained from Aug to Oct (Aulich *et al*., 2019). There is only one record of ship strike involving fin whales in Australian waters (Peel *et al.,* 2018); and
- Sei whales are infrequently sighted in WA waters (Commonwealth Government, 2005) and there are no records of ship strike involving sei whales in Australian waters (Peel *et al.,* 2018).

Smaller dolphin species are highly agile and are significantly less likely to collide with larger vessels (Van Waerebeek *et al*. (2007) and as a result vessel strike for these species during the Seismic Survey is not a concern.

Minimising vessel collision is ranked as a high priority action within the Conservation Management Plans for blue whales, and within the Conservation Advice for fin, sei, and humpback whales. The expected low incidence of vessel strike from the Seismic Survey will not affect the long-term recovery of these species in accordance with these plans.

The '*National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna*' acts as a guiding framework for identifying the species and areas most at risk and aims to provide appropriate mitigation measures to reduce the risk of ship strike. The National Strategy intends to develop a 'mitigation measures toolkit'. To date this toolkit has not been developed; however, once developed the mitigation measures for cetaceans will fall into three main categories: keeping vessels away from whales, slowing of vessel speeds, and implementation of avoidance manoeuvres (Commonwealth of Australia, 2017a).

The master of the Support Vessel will operate in accordance with the EPBC Regulations Part 8, Division 8.1 in regard to the minimum approach distances and vessel speed for "other craft" and follow the prescribed actions when adult cetaceans and/or calves are present within the caution zone[18]. In particular:

- The Support Vessel will operate at a constant speed of less than 6 knots and minimise noise, whilst ensuring the vessel does not drift or approach closer to than 50 m to a dolphin or 100 m to a whale;
- If the cetacean shows any sign of being disturbed, the vessel must be withdrawn from the caution zone at a speed of less than 6 knots. If an adult whale approaches the Support Vessel or comes within 100 m, the master must disengage the gears and let the whale approach or reduce the speed of the vessel and continue on a course away from the whale;
- If an adult dolphin approaches the Support Vessel or comes within 50 m, the master must not suddenly change course or speed of the vessel; and
- The master of the Support Vessel will make all efforts not to let a calf enter the caution zone; however, if a calf does enter the caution zone, then the master will immediately stop the vessel, turn off the vessel's engines, or disengage the gears, or withdraw the vessel from the caution zone at a constant speed of less than 6 knots.

These control measures are included in **Table 70**.

Due to the restricted manoeuvrability of the Seismic Vessel, no further mitigation measures can be applied to reduce the risk of ship strike from the Seismic Vessel; however, the Seismic Vessel will maintain speed and course in the presence of marine mammals, this, in addition to the already low speed of the vessel, allows greater time for individuals to detect the vessel, predict its pathway, and avoid a collision or entanglement in the towed equipment. Trained observers will be on-watch while the Seismic Vessel is acquiring during daylight hours. While this will not minimise the potential for vessel strike, any incidents (i.e. ship strike or entanglement) will be observed and reported. Ship strikes will be reported into the Australian Government National Ship Strike Database (DoEE, 2018b), as is required by the EPBC Act.

Although boat strike is a recognised threat to dugongs in coastal Australia, it is typically associated with small recreational vessels in areas where densities of both dugongs and boats are high (Marsh *et al.,* 2002). The probability of boat strike is greatest in water depth < 2 m which limits an individual's ability to take evasive action by diving (Maitland *et al*., 2005). Given their reliance on seagrass habitats, dugongs typically inhabit waters less than 3 m deep (Chilvers *et al*., 2004) and although some offshore movement across the Sahul Shelf has been reported (Whiting and Guinea, 2005), this preference for shallow habitat indicates that the likelihood of interactions with the survey vessels during the Seismic Survey is highly unlikely.

[18] 150 m radius around a dolphin, and 300 m radius around a whale

Although some marine mammals could interact with and become entangled in the towed equipment, it is highly unlikely that this would occur on account of marine mammals displaying exceptional abilities to detect and avoid obstacles in the water column and there being no loose surface lines associated with the towed equipment (Rowe, 2007). Unlike interactions with fishing gear, there is no food attractant associated with MSSs. To our knowledge, there has never been a reported case of a marine mammal becoming entangled in seismic equipment. In addition, the auditory range of many cetaceans overlaps with peak intensities of transiting ships (Allen and Peterson, 2012; Veirs *et al*., 2016), thus cetaceans should have the capacity to acoustically detect an oncoming ship (Allen and Peterson, 2012) and move away from the vessel/s, minimising the likelihood of a ship strike and entanglement.

The presence of the vessels may also act as an attractant to certain species, particularly smaller species of dolphin which may approach the vessel to bow-ride (Wűrsig *et al*., 1998). Bow-riding behaviours have been observed during periods of active seismic acquisition (e.g. Moulton and Miller, 2005). However, the seismic array is located a reasonable distance behind the bow waves that small dolphins like to play in.

As a result, the risk to marine mammals arising from the physical presence of the survey vessels and the towed equipment during the Seismic Survey has been assessed as **Low** (*Minor* x *Possible*).

7.1.3 Evaluation of Known and Potential Impacts and Risks to Relevant Persons and Marine Users

Using the information presented in **Section 2** to **Section 5**, the impact and risk assessment has been undertaken for those receptors determined to be relevant to the activity as listed in **Table 44**.

Table 44 Relevant Persons and Marine Users Assessed

Receptor	Section reference
Commercial Fisheries	**Section 7.1.3.1**
Commercial Shipping	**Section 7.1.3.2**
Tourism and Recreation	**Section 7.1.3.3**
Petroleum Exploration and Production	**Section 7.1.3.4**

The physical presence of the survey vessels and towed acoustic equipment has the potential to result in the following effects on environmental receptors:

- Displacement of marine users from regular routes or activity areas; and
- Collision with or entanglement of marine users with survey vessels and/or towed equipment.

7.1.3.1 Potential Impacts and Risks to Commercial Fishing Operations

The commercial fisheries that are most likely to be affected by the presence of the seismic, chase and support vessels (including towed equipment) are the Mackerel Managed Fishery, Northern Demersal Scalefish Management Fishery and the Indonesian Commercial Fisheries (see **Section 4.7.3**). The latter two have been shown to have a higher degree of spatial overlap with the OA (within respective economic exclusion zones), compared to the relatively less relative effort and spatial coverage that is recorded for the MMF within the OA (see **Section 4.7.3.2.2**).

The following represent the potential impact pathways commercial fishers could be affected by the presence of the seismic and support vessels including towed equipment:

- Temporarily exclusion fishers from their fishing grounds and inconvenience fishers as they will need to plan their fishing operations around the planned survey routes (discussed in **Section 7.1.3.1**); and
- Requirement to remove or delay the setting of fishing equipment within the OA during the acquisition period.

The Seismic Vessel will be restricted in its ability to manoeuvre while moving at a speed of 4 to 5 knots acquiring data and, in most instances, this prevents active avoidance of fishers and fishing gear in the water. For commercial fishers this could result in operational inconveniences (e.g., manoeuvring around the seismic vessel and requested area of avoidance) and temporary loss of access to fishing areas (i.e., displacement). Displacement could result in reduced catches and income and/or increased costs to operate elsewhere (i.e., relocation costs).

SLB will be requesting all marine traffic remain 10 km away from the Seismic Vessel and the towed streamers, this will essentially create a moving temporary exclusion zone around the Seismic Vessel. The size of this temporary effective exclusion zone will be ~520 km^2. Fishers will continue to be able to fish within the Acquisition Area; however, they will be temporarily impacted by the physical presence and buffer zone imposed around the Seismic Vessel, Chase Vessel and Support Vessel.

As discussed in **Section 4.7.3.2.1**, the area of fishing effort between 2015-20 within the Kimberley subregion of the NDSMF was 127,613 km^2, as shown in **Figure 30**. The temporary effective exclusion area around the Seismic Vessel of ~520 km^2 represents just 0.4% of the entire area fished within the Kimberly subregion of the NDSMF. In terms of the fishing effort recorded to have occurred within the AA (2015-20), being 6,290 km^2, the temporary effective exclusion area represents ~8% of this fished area.

In addition to fishing within NDSMF, there is a very minor amount of fishing regulated under the MMF within the OA (but not the Acquisition Area) as shown in **Figure 32**. While the Seismic Vessel will not traverse the two identified 10 x 10 NM CAES blocks shown to be within the OA in this figure, the temporary exclusion area around the Seismic Vessel will extend over ~27% of the single block located closest to the AA – this area represents 0.2% of the total fished area within the MMF over the 2015-2020 period. It should be noted that there were <3 vessels fishing in the single affected block over 2015-20 so the impact on any mackerel fishers will be insignificant.

Analysis of the apparent fishing effort of Indonesian fishing vessels in the Timor Sea between 2016 and 2021 is described in **Section 4.7.3.4**. This analysis indicates that, although the AA is utilised for some fishing effort (approximately 350 hours/year within the Acquisition Area), much more important fishing grounds are located over 200 km to the southwest and northeast of the Acquisition Area. The waters in which this overlap occurs is within the Indonesian Fishing Management Area 573 (which is described as the Indian Ocean of Southern Java, Southern Nusa Tenggara, Sawu Sea, and Western of Timor Sea), which covers an area of over 550,000 km^2 of water. The area of overlap with the AA is approximately 3,500 km^2, equating to approximately 0.63% of the available fisheries water within Fishing Management Area 573. Given this small spatial scale, and the known areas of more intensive fishing effort over 200 km away, it is considered that Indonesian commercial fishers may experience infrequent and short-term operational inconvenience and temporary displacement from fishing grounds around the area occupied by the Seismic Vessel.

Under Section 172 of the *WA Fish Resources Management Act* 1994 it is an offence to remove fish from any fishing gear or interfere with any fishing gear. The Chase Vessel will try to contact any vessel it sees in the exclusion area, and if there are traps remaining on the seabed (marked by surface buoys), the Chase Vessel would try to contact the fishers whose gear is still in the water in the first instance to warn of the oncoming survey vessel. In addition to reduce the potential spatial overlap of fishing and data acquisition effort, SLB will provide any potentially affected commercial fishers with 48-hour look-ahead plans of where the survey vessels will be to enable them to incorporate the survey route into their fishing plans. This look-ahead will be updated and distributed every 24 hours. It is however acknowledged that due to unforeseen circumstances, changes to where the seismic vessel may be required to traverse to acquire data may occur with limited notice to mariners making it difficult for commercial fishing operations to tightly coordinate fishing activities with planned vessel movements.

SLB acknowledges that consistent and timely communication on the location and timing of data acquisition activities is required to facilitate appropriate planning and to maximise the chance to share available spatial resources. Australian fishing licence holders that actively fish in the OA have been identified through the consultation process and continual communications and notification (e.g. 48-hour look-ahead plans) will take place with these licence holders and their respective associations to ensure they are aware of where the vessel will be throughout the duration of the survey. Likewise, all methods of communication will be made available to the licence holders to contact the survey vessels should they need to be in contact with SLB or the survey vessels at any time. In addition, the Seismic Vessel, Chase Vessel and Support Vessels will have an Indonesian language communication sheet onboard which will include key activity details (such as the timing and location information) to provide to an Indonesian fishers encountered during the activity.

Following consultation with WAFIC, SLB will implement the '*Commercial Fisheries Compensation Protocol for the Bonaparte MC3D Marine Seismic Survey'* to manage potential impacts from the Seismic Survey including the presence of support vessels on the commercial fishing industry in Australian waters. Further details of the proposed compensation protocol are provided in **Section 7.2.3**.

It is considered that the consequence the seismic and support vessels on commercial fisheries within the OA is minor; with any effects to be localised and only short-term disruptions to normal activities as well as minor adverse effects no natural resources expected.

Based on available evidence, it is considered possible (occurred in a minority of similar studies or projects) that the presence of the seismic and support vessels may result in changes to commercial fisheries to occur.

As such, the residual risk to commercial fisheries due to the presence of the seismic and support vessels has been assessed as **Low** (*Minor x Possible*) (**Table 38**).

7.1.3.2 Potential Impacts and Risks to Commercial Shipping

As discussed in **Section 4.7.4** and depicted in **Figure 3**, a variety of vessels travel through the OA. As discussed in Section **7.1.3.1**, SLB will be requesting all maritime traffic remain 10 km away from the Seismic Vessel and the towed streamers. Vessels will still be able to transit through the OA; however, the presence of the Seismic Vessel and its associated temporary exclusion area will cause a minor inconvenience to some vessels as they may need to alter their normal routes to deviate around the Seismic Vessel.

The Seismic Vessel and supporting vessels will intermittently cross areas of commercial shipping traffic. The presence of the Seismic Vessel and towed streamers presents a potential navigational hazard to commercial vessels transiting through the area due to the length of the towed streamer and the vessel's restricted ability to manoeuvre.

Due to the survey vessels constantly making way through the OA, any deviation that commercial ships will have to take to avoid the Seismic Vessel and the streamers is likely to be relatively minor given the notification they will receive through the Notice to Mariners, as well as the radar, Automatic Radar Plotting Aids (**ARPA**) and AIS notifications they will be able to receive, in addition to maritime radio communications. As a result, any change of course over the open ocean which the OA is within, is unlikely to add any significant time delays to the passage or result in any increased costs through avoiding large areas of ocean, to the commercial shipping companies. Any required deviations to a ship's course would be conducted without compromising navigational safety following the rules of the road at sea and would be undertaken in accordance with the COLREGS and the Notice to Mariners that would be issued, providing the information of the Seismic Vessel towing streamers up to 8 km long and being restricted in its ability to manoeuvre.

There have been no collisions to date involving seismic vessels and any commercial vessels (or recreational vessels) recorded within the Australian Transport Safety Bureau's marine safety database (ATSB, 2018) and likewise, SLBs most recent 2D MSS in the Otway Basin did not result in any collisions or near misses with commercial or recreational vessels. This is a result of the vessel Master's ability to manage the safe operation of their vessels out at sea through the appropriate communication processes, and that is also why SLB will have a Support Vessel and Chase Vessel on standby for the interception of any vessels that cannot be communicated with or are not aware there is any submerged gear behind the Seismic Vessel.

Pre-activity notification procedures for the Seismic Survey will facilitate the issuing of maritime warnings and a Notice to Mariners, which will be effective for the duration of the survey. These notifications enable commercial Vessel Masters to be aware of potential hazards in the area in which they are transiting and to safely plan their courses to avoid possible interference with those hazards such as the Seismic Survey. The vessel Masters of the survey vessels will maintain radio contact with all commercial vessels in the immediate vicinity of the area being surveyed within the OA that are detected on radar or AIS to ensure they are aware that they are a Seismic Vessel engaged in seismic activities (and therefore limited in their ability to manoeuvre).

With the presence of the Seismic Vessel in the offshore marine environment for up to three months, there is the potential that the Seismic Survey could displace commercial vessels transiting through the area causing them to alter their planned course. However, given the Seismic Vessel will be continually moving the actual zone of displacement that would influence commercial shipping will be transitory in nature. Therefore, the risk to commercial shipping operations due to the physical presence of the survey vessels and towed equipment during the Seismic Survey has been assessed as **Low** (*Minor* x *Likely*).

7.1.3.3 Potential Impacts and Risks to Tourism and Recreation

Tourism and recreation activities, including whale watching, cruise, sailing and boating activities, diving, snorkelling, and wildlife watching operations, and recreational fishing, take place within the broader EMBA of the NWMR and NMR (see **Section 4.7.2**). The tourism and recreation activities most likely to be potentially impacted by the presence of the Seismic Survey include vessel based tourism by cruise, sailing and other boating vessels (**Section 4.7.2.2**), and recreational fishing (**Section 4.7.2.4**). Whale watching operators (predominantly within the southwest region near Broome), and recreational divers, snorkellers, wildlife watchers and fishers (most often attracted to accessible shallow benthic habitats or structures such as shipwrecks) are not likely to be impacted due to the distance of these known activities (specific to particular areas and habitats of interest) from the OA.

Known vessel based tourism within the region is predominantly concentrated around natural and manmade features, with no key staging or stopover points identified within the OA. Similarly, recreational fishing within the region is predominantly concentrated around the coastline, with only 6% of all recreational fishing activity within the North Coast reported within pelagic or offshore demersal environments, so very limited recreational fishing activity is anticipated within the OA. However, some vessels may transit through the OA between key activity locations and overlap the proposed Seismic Survey Vessel operations. To manage this risk, SLB has consulted with key industry representative bodies, will issue maritime warning and a Notice to Mariners (described previously) effective for the duration of the survey, and maintain standard maritime radio communications.

The intermittent and transitory nature of the Seismic Survey Vessel operating within the OA is thought to present minimal displacement or inconvenience to tourism and recreation in the area. Therefore, the residual risk to tourism and recreation due to the physical presence of the survey vessels and towed equipment during the Seismic Survey has been assessed as **Negligible** (*Negligible* x *Unlikely*).

7.1.3.4 Potential Impacts and Risks to Petroleum Exploration and Production Operations

As an established hydrocarbon province in Australia, the Bonaparte Basin has numerous petroleum exploration and production operations occurring simultaneously year round. Currently a number of offshore petroleum titles exist within the OA, however these do not include operating fields (described further in **Section 4.7.5**). Within close proximity to the OA, within the broader EMBA, two operating fields have been identified and are considered here.

Of relevance to this EP are the Montara Venture, operated by Jadestone Energy and located 60 km from the AA and 12 km from the OA, as well as Woodside's Northern Endeavour FPSO, located ~40 km from the OA. Although both operating fields and associated infrastructure are outside of the OA, Jadestone Energy and Woodside have been consulted to ensure interactions offshore are minimised (see **Section 5**), and should the Seismic Survey be undertaken during operations which overlap (including commercial diving operations on underwater infrastructure), a SIMOPS plan will be developed in close collaboration with the relevant persons.

In addition to consulting with all petroleum operators overlapping the OA and those within the 30 km diving exclusion zone surrounding the Seismic Survey, SLB will also issue a maritime warning and a Notice to Mariners effective for the duration of the survey and maintain standard maritime radio communications.

The intermittent and transitory nature of the Seismic Survey Vessel operating within the OA is thought to present minimal displacement or inconvenience to petroleum exploration and production operations in the area. Therefore, the residual risk to petroleum and production operations due to the physical presence of the survey vessels and towed equipment during the Seismic Survey has been assessed as **Low** (*Minor* x *Likely*).

7.1.4 Decision Context

The decision context for physical presence of the Seismic Vessel and towed equipment has been assessed as Type A for most receptors, given the predicted impacts and risks are well understood and uncertainty is minimal, with little or no interest from relevant persons. However, given the level of interest raised by relevant persons regarding predicted impacts to commercial fisheries, the decision context for this receptor has been characterised as Type B.

7.1.5 Identification of Control Measures, Residual Risk Assessment and Demonstration of ALARP

Control/mitigation measures that will be implemented during the Seismic Survey to manage the impacts associated with the physical presence of the Seismic Vessel and towed acoustic equipment to **ALARP** have been listed in **Table 46**. SLB has considered a number of control measures to determine the benefits of their implementation towards risk reduction (**Table 46**), based on a Hierarchy of Controls methodology (**Table 45**). The control measures that will be adopted are those that have been assessed and characterised as effective and practicable to implement.

Table 45 Hierarchy of Control Measures for Physical Presence of the Seismic Vessel and Towed Equipment

Eliminate	Alternative data acquisition methods are not yet commercially available or proven to meet geophysical data quality objectives, operational safety, and reliability requirements. The Seismic Vessel and towed equipment are, therefore, required for data acquisition and cannot be eliminated. The presence of support vessels is a health and safety requirement which acts to reduce the risk of collision between the Seismic Vessel/towed equipment and other marine users and/or entanglement between marine fauna/fishing gear and seismic equipment.
Substitute	Alternative data acquisition methods are not yet commercially available or proven to meet geophysical data quality objectives, operational safety, and reliability requirements. The Seismic Vessel and acoustic equipment have been designed to meet the survey objectives and guarantee data quality. Due to the transient nature of the survey, the cost of substituting the equipment, for example to adopt the use of shorter streamers, are considered disproportionate to the limited (if any) environmental benefits gained.
Reduce	The impact from the physical presence of the Seismic Vessel and towed equipment will be reduced by the implementation of the adopted control measures, as described within **Table 46.** Streamers will be marked with tail buoys to notify other marine users of the presence of the towed equipment and reduce the risk of collision. Towed equipment will be retrieved when the Seismic Vessel is in transit to and from the OA (e.g., to and from Port) to reduce the risk of collision and entanglement.
Mitigate	To mitigate the impacts from the physical presence of the Seismic Vessel and towed equipment, a compensation protocol will be implemented to formally manage claims by commercial fishers for loss of catch, displacement and lost or damaged fishing gear as a consequence of the Seismic Survey (**Section 7.2.3.1**).

Table 46 Assessment of Control Measures for the Physical Presence of Seismic Vessel and Towed Equipment

Control measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Legislative Requirements:			
The Seismic Survey will be undertaken in accordance with the approved EP.	P = Yes E = Effective	All vessels undertaking an offshore activity in waters between 3 and 200 NM must undertake that activity in line with an approved EP. The approved EP outlines the measures that will be taken to ensure that environmental effects from the activity will be reduced to **ALARP** and **Acceptable Levels**, including the management of routine permissible waste discharges.	Yes
All survey vessels will adhere to the requirements of the national and international legislation, including the International Regulations for Preventing Collisions at Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (**SOLAS**) as implemented in Commonwealth Waters through the *Navigation Act 2012* and associated Marine Orders 21, 28, 30, 58 and the STCW Convention. The requirements give effect, but are not limited to, the following: • Appropriate use of lighting, navigation and radio communication at sea; and • 24-hour bridge and radar watch by qualified watch-keepers to monitor for other marine users.	P = Yes E = Effective	The survey vessels must adhere to the Navigation Act 2012. Procedures under the Navigation Act 2012 are standard and well-understood among commercial vessels. Control measures specific to appropriate use of lighting, navigation and radio communications and the use of 24-hour bridge and radar watch have been further descried below.	Yes
Adherence to the prohibition of entry into established Petroleum Safety Zones surrounding petroleum installations and equipment.	P = Yes E= Effective	Oil and gas installations and equipment have established Petroleum Safety Zones (PSZ) prohibiting any vessel approaching closer than 500 m without prior approval/provision of a permit. These are established under the OPGGS Act. A review of the gazetted notices for Petroleum or Greenhouse Gas Safety Zones published on NOPSEMA's website indicate the OA does not encroach into any PSZ. It is a legislative requirement.	Yes
Vessel masters' of the Support Vessel and Chase Vessel will comply, when safe to do so, with the relevant requirements of EPBC Regulations 2000 Part 8, Division 8.1, including: • Taking action to avoid approaching or drifting closer than 50 m to a dolphin or 100 m to a whale • Making all efforts not to let a calf enter the caution zone • Not exceeding a speed of six knots within the caution zone of a cetacean (300 m).	P = Yes E = Effective	The Support Vessel and Chase Vessel will comply with the EPBC Regulations 2000 Part 8, Division 8.1 in order to reduce the risk of disturbing cetaceans (adult and calf) and avoiding collisions between a cetacean and the support vessels. For safety reasons, the distance requirements are not applied to vessels with limited manoeuvrability, such as the Seismic Vessel It is a legislative requirement for vessels to comply with the EPBC Act and EPBC Regulations.	Yes
Good Industry Practice:			
Appropriate use of lights and visual communication at sea.	P = Yes E = Effective	The vessel will use standard international safety procedures for radio communication and the display of navigational lights and day shapes including the use of Automatic Radar Plotting Aids (**ARPA**) and AIS. AIS sends and receives ship information including identity, position, course, and speed, and updates as often as every two seconds. The Seismic Vessel will display day shapes and lights to indicate that the vessel is towing equipment and is restricted in its ability to manoeuvre. Tail buoys will be fitted with a light and radar reflector indicating the end of each streamer. Good industry practice, safety benefit outweighs additional cost.	Yes
Appropriate use of radio communications at sea.	P = Yes E = Effective	The vessel will use standard international safety procedures for radio to ensure survey vessels will be contactable by radio at all times (i.e. VHF and SSB radio). Good industry practice.	Yes

Control measure	Practicability/ Effectiveness	Justification	Will it be adopted?
24-hour bridge and radar watch by qualified watch-keepers to monitor for other marine users.	P = Yes E = Effective	The Seismic Survey will adopt standard flag and class practices for watch-keeping and radio use to ensure that warnings and preventative actions can be readily implemented. This will notify other marine users of the presence of the Seismic Vessel and equipment. Watch-keepers will have the relevant qualifications for the task. This practise is compliant with STCW Convention. Good industry practice, safety benefit outweighs additional cost.	Yes
At least one Support Vessel will accompany the Seismic Vessel when in operation and when save to do so (e.g., outside of inclement weather periods), to manage interactions with other marine users.	P = Yes E = Effective	Support vessels (Support Vessel and Chase Vessel) will be present around the Seismic Vessel to intercept other vessels in the area that are at risk of interacting with the Seismic Vessel and/or equipment. This is a health and safety requirement and is standard practice for all MSSs. Good industry practice, safety benefit outweighs additional cost.	Yes
Streamers are marked with tail buoys.	P = Yes E = Effective	Under COLREGS and the Navigation Act, all possible measures need to be taken to indicate the presence of a towed object. Tail buoys indicates the end of each towed streamer and will be fitted with markings to indicate the presence/location. Markings will include reflective tape, lights, and radar reflector. An AIS transponder will be fitted to each tail buoy to allow for the detection of the end of each streamer by other marine users with AIS receiving capabilities. Good industry practice, safety benefit outweighs additional cost.	Yes
Publication of a Notice to Mariners of survey presence and towed array, no less than four weeks before operations commence.	P = Yes E = Effective	Under the Navigation Act 2012, AHO can publish and distribute a Notice to Mariners. This Notice outlines potential hazards and restrictions to relevant persons The notice will be published no less than four weeks before operations commence. Good industry practice, safety benefit outweighs additional cost.	Yes
A communications protocol will be in place between the survey vessels and other relevant persons (e.g., commercial fishers known to utilise the OA, Petrofac), to actively manage concurrent activities.	P = Yes E =Effective	A communications protocol will be in place which details the methods used to contact third-party vessels prior to commencement of the Seismic Survey, throughout the survey duration and those identified only once at sea, to actively manage concurrent activities. Good industry practice, safety benefit outweighs additional cost.	Yes
Seismic Vessel, Chase Vessel and Support Vessels have a communication sheet in Bahasa and Tetum language detailing key information regarding the Seismic Survey to be provided to any Indonesian fishers if they area encountered during the Seismic Survey.	P = Yes E =Effective	The OA is known to be utilised and traversed by Indonesian fishers. The implementation of hard copy communications materials developed in foreign languages relevant to the region, such as Bahasa and Tetum, will assist to actively manage concurrent activities.	Yes
Daily look-ahead reports will be provided to relevant persons (e.g., e.g., commercial fishers known to utilise the OA), detailing the current vessel location and proposed timing and location of operations within the next 48 hour period.	P = Yes E =Effective	Communication with relevant persons allows those potentially affected by the Seismic Survey to plan activities in a manner that reduces the risk of interactions with the survey vessels and towed equipment (e.g. commercial fishers can avoid deploying gear in the path of the Seismic Vessel), including a 48 hour look-ahead and daily communications where requested. Provision of a daily 'look-ahead' plan which details the proposed operations for the next 48 hour period to is relevant persons. Information regarding proposed operations will include, as a minimum, the current positions of the survey vessels and the proposed timing and location of operations for the following 48 hour period. Good industry practice, safety benefit outweighs additional cost.	Yes

Control measure	Practicability/ Effectiveness	Justification	Will it be adopted?
EPBC Act Policy Statement 2.1: Part B.1 – Marine Mammal Observers. The use of suitably trained, dedicated and experienced MMOs/MFOs to undertake visual observations for whales and ensure that the appropriate mitigation measures outlined in this EP are implemented. A minimum of two MMOs/MFOs will be onboard the Seismic Vessel and, whenever practicable, both stationed on the bridge of the Seismic Vessel. A minimum of two MMOs/MFOs will be stationed on the Chase Vessel.	P = Yes E = Effective	The use of trained, dedicated and experienced MMOs/MFOs s is a recommendation of Part B.1 of the EPBC Act Policy Statement 2.1 when the likelihood of encountering whales is moderate to high. From the assessment undertaken within this EP (**Section 7.2**) it has been determined that the likelihood of encountering whales during the Seismic Survey is moderate-high. Therefore, SLB will have two dedicated, trained and experienced MMOs/MFOs onboard the Seismic Vessel for the duration of the Seismic Survey and two dedicated, trained and experienced MMOs/MFOs will be stationed on the Chase Vessel for the duration of the Seismic Survey. The role of MMOs/MFOs is to undertake all visual observations for marine fauna and to ensure that the appropriate mitigation measures, as outlined in this EP, occur in response to any marine fauna sightings. The use of two MMOs/MFOs onboard the Seismic Vessel and two onboard the Chase Vessel provides some redundancy in the event one MMO/MFO is unavailable. At least one MMO/MFO will perform marine mammal observations during daylight hours. If a whale is detected within any nominated observation zone during the Seismic Survey, an additional MMO/MFO will be stationed on the bridge of the vessel from which the detection was made to assist with observations. The only permissible exception to this is when the off-duty MMO/MFO is on a meal or toilet break or is standing-down having reached maximum shift duration for that particular working day. In these instances, a trained crew member will assist with marine mammal observations. The MMOs/MFOs used during the Seismic Survey must have logged a minimum of 20 weeks' relevant sea-time engaged in MSS operations in Australian waters as an MMO or MFO and have proven 'at sea' experience in whale identification and behaviour, and distance estimation. The MMOs/MFOs used must be confident in the identification of those species that the EP predicts will be present in the OA. Environmental benefit gained outweighs the additional cost.	Yes
Development and implementation of Marine Fauna Mitigation Plan.	P = Yes E = Effective	One of the roles of the MFOs/MMOs onboard the Seismic Vessel is to develop a Marine Fauna Mitigation Plan, to be submitted to SLB prior to the pre-mobilisation survey and audit commencing. This plan will demonstrate the following, at a minimum: • MFOs/MMOs are trained, dedicated and experienced • Responsibilities and authorities of MFOs/MMOs to ensure the plan is communicated and available to those roles that are required to implement the controls; • Communications protocols for relaying marine fauna observations to the Seismic Operator, Vessel Master and vessel crew as required. • Survey Plan – describes the proposed activity including location and timing, acoustic source and streamer configuration, equipment (vessels) and key geographic locations such as BIAs and nominated exclusion zones. • Implementation Plan – details how the marine fauna mitigation controls within the EP will be implemented; • Handling procedures for the retrieval of marine fauna entangled in towed equipment or seabirds on the vessels' deck. Good industry practice, environmental benefit outweighs additional cost.	Yes
Any vessel strike incident to marine mammals will be reported as soon as practicable via the National Vessel Strike Database at https://data.marinemammals.gov.au/report/shipstrike.	P = Yes E= Effective	Reporting ship strikes with cetaceans is request d by the DAWE's Australian Antarctic Division and allows the Australian Government and International Whaling Commission (IWC) to compile scientific data on vessel strike incidents, locations and trends so that further management can be considered. Good industry practice, environmental benefit outweighs additional cost.	Yes

Control measure	Practicability/ Effectiveness	Justification	Will it be adopted?
The Support Vessel and Chase Vessel, when safe to do so, will comply with the DPAW Whale Shark Management Programme (DPAW, 2013), in order to reduce the risk of disturbing whale sharks and avoiding collisions between a whale shark and the vessels: • Taking action to avoid approaching or drifting closer than 30 m of a whale shark; and • Not exceeding 8 knots within 250 m ('contact zone') of a whale shark.	P = Yes E= Effective	The use of two suitably trained, dedicated and experienced MMOs/MFOs to undertake visual observations for whale sharks and ensure that the appropriate mitigation measures outlined in this EP are implemented. Vessel speed and proximity to whale sharks are key concerns when considering risk of collision and the potential outcome. Slower moving vessels in proximity to a whale shark are likely to provide greater time and opportunity for whale sharks to avoid collision compared to faster moving vessels. For safety reasons, the distance requirements are not applied to vessels with limited manoeuvrability, such as the Seismic Vessel. Good industry practice, environmental benefit outweighs additional cost.	Yes
The Support Vessel and Chase Vessel will avoid travelling at close distance to marine turtles.	P = Yes E= Effective	The use of two suitably trained, dedicated and experienced MFOs/MMOs to undertake visual observations for marine turtles and ensure that the appropriate mitigation measures outlined in this EP are implemented. The support vessels will not knowingly travel at more than 6 knots within 300 m of a turtle to reduce the potential for vessel strike. For safety reasons, this control measure will not be applied to vessels with limited manoeuvrability, such as the Seismic Vessel, however, due to the slow speed of the Seismic Vessel, the speed restrictions will automatically be followed.	Yes
Installation of 'turtle guards' on streamer tail buoys.	P = Yes E = Effective	Almost all reported turtle entrapments during MSSs are associated with the 'undercarriage' of tail buoys (Ketos Ecology, 2009). 'Turtle guards' are fitted to the front of the tail buoys and act to physically exclude turtles from the gap at the front of the tail buoy undercarriage. SLB will ensure that the tail buoys used for the Seismic Survey has turtle guards fitted. Good industry practice, environmental benefit outweighs additional cost.	Yes

Control measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Compensation to fishers and vessel crews (i.e., the claimant) is demonstrated to have occurred for the following circumstances: • Interaction resulting in loss or damage to fishing equipment; • A temporary loss of fish landed catch due to damaged or lost fishing equipment; • Where displacement from fishing grounds results in additional costs incurred due to relocating; or • A temporary reduction in fish landed catch ('loss of catch') due to displacement from fishing grounds or due to the impacts of acoustic emissions. Displacement from fishing grounds can be as a result of seismic operational activities or as a result of avoiding contaminated waters following a fuel oil spill. Claims received from fishers in any circumstances other than those outlined above will not be assessed. Claims will be considered provided the interaction/displacement/loss of catch took place in the Adjustment Area where the Seismic Survey took place (plus any additional area of avoidance requested around the survey vessel/s and towed equipment, and in accordance with the Adjustment Protocol Timeframes stipulated in NERA (2021).. Note that for damaged or lost equipment claims, the interaction can have taken place in the Operational Area (not just Adjustment Area), plus any additional area of avoidance requested around the survey vessels and towed equipment. The adoption of the NERA (2021) protocol is an agreement reached between SLB and WAFIC. . If any changes are required as a result, these will be made through the management of change process.	P = Yes E = Effective	Where impacts of the Seismic Survey to the commercial fishing industry in Australian waters cannot be managed or avoided, and commercial fishers experience an economic loss as a result of the Seismic Survey, financial compensation will be considered. Compensation to fishers and vessel crews for loss or damage to fishing equipment, a temporary loss of fish landed catch due to damaged or lost fishing equipment, where displacement from fishing grounds results in additional costs incurred due to relocating, or a temporary reduction in fish landed catch due to impacts associated with acoustic disturbance or due to displacement from fishing grounds that is proven to have occurred as a result of the Seismic Survey will be considered on a case-by-case basis. Claims received from fishers in any circumstance other than these will not be assessed. Displacement from fishing grounds can be as a result of seismic operational activities and/or as a result of avoiding contaminated waters following a fuel oil spill. For SLB to accept a payment claim, fishers will need to provide suitable documented evidence and data to demonstrate their unavoidable economic loss in accordance with the NERA (2021) Commercial Fishing Industry Adjustment Protocol (**Section 7.2.3.1, Appendix M**). All fishing history and unavoidable economic losses should relate to the Adjustment Area and to the time of year that the seismic survey is conducted. The Adjustment Area is defined as an area extending 10 km around the perimeter of the Operational Area. Any consideration of claims (for claims for temporary reduction in catch due to the impacts associated with acoustic disturbance or due to displacement from fishing grounds) beyond the Adjustment Area and outside the operations period will be determined with reference to available and relevant peer reviewed information on the effects of seismic surveys, as well as the impact assessment outlined in the EP as accepted by NOPSEMA. To be eligible for compensation, claimants are required to provide sufficient evidence in accordance with the NERA (2021) protocol to support a claim for equipment being damaged or lost, being displaced from 'usual fishing grounds' (defined as an area where fishing activity has been recorded by the commercial fishing licence holder on Government statutory fishing returns for at least two out of the previous five years) and/or the identification of a reduction in fish landed catch. A completed Compensation Claim Application form (as per the NERA 2021 Application forms) must be submitted to SLB in accordance with the Adjustment Protocol Timeframes stipulated in NERA (2021). In assessing the merit of the claim, consideration will be given to the circumstances giving rise to the claim, including whether the circumstances could have been reasonably avoided. Having regard to the high variable nature of the spatial distribution and intensity of fishing operations over time, and that any potential impacts to fish, fish eggs and larvae as a result of acoustic disturbance are considered rapidly recoverable, a period of 12 months is considered sufficient to identify reduced CPUE compared to previous years for the same eligible claim as it relates to fishing event location by species by month. Subject to a claim being lodged, SLB (at their expense) in consultation with the claimant, will engage a suitably experienced/qualified independent person/organisation as the assessor of the claim, defined as a person or organisation with proven demonstrated experience in data analysis and data auditing processes and procedures within the industry. The adoption of the NERA (2021) protocol is an agreement reached between SLB and WAFIC over the course of consultation. If any changes are required as a result, these will be made through the management of change process. Good industry practice, socio-economic benefits outweigh additional cost.	Yes
Alternatives/Substitutes Controls Considered:			
Use of alternative geological imaging technology that does not require towed equipment.	P = No E = Unknown Effectiveness	Alternative technologies are not yet commercially available or have not been proven or demonstrated the ability to meet geophysical data quality objectives, operational safety, and reliability requirements (IOGP, 2017). Costs would be disproportionate to the benefit that may be gained.	No

Control measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Removal of support vessels.	P = No E = Limited	Support vessels are required to avoid interactions with other marine users (i.e. other vessels) as a health and safety requirement as well as implementing the control measures. Increased risks associated with the removal of the Support Vessel or Chase Vessel are disproportionately higher than the benefit of removing a vessel.	No
Reduction in the length of the towed equipment.	P = No E = Limited	The length of the streamers planned to be used for the Seismic Survey is 8 km. The acoustic equipment (including streamer length) has been designed to meet the survey objectives and guarantee data quality. Reducing the length of the towed equipment, or substituting with shorter streamers, will reduce the footprint of the Seismic Survey; however, as the vessel and towed equipment are continuously moving, the benefit to other marine users would be minimal and costs would be disproportionate to any benefit gained.	No
Additional Control Measures Considered:			
Where possible and safe to do so, marine fauna entangled within in-water equipment will be extricated and returned to sea.	P = Yes E = Effective	If safe and practicable to do so, marine fauna entangled within in-water equipment will be extricated and returned to sea. Good industry practice, socio-economic benefits outweigh additional cost.	Yes
Towed equipment will be retrieved when the Seismic Vessel is in transit to and from the OA (e.g., to and from port).	P = Yes E =Effective	Retrieval of towed equipment will reduce the potential for more coastal species interacting with the towed equipment whilst in transit. Good industry practice.	Yes
Retrieval of any equipment accidentally lost at sea, including streamers, where it is safe and practicable to do so to ensure it does not become a risk to other marine users.	P = Yes E =Effective	Any in-water equipment that is lost will be recovered when it is safe and practicable to do so. Pressure activated streamer recovery devices will be fitted along the streamers. Where equipment cannot be safely or practicably retrieved, the incident is reported to AMSA and AHO as soon as identified. Good industry practice, safety and environmental benefit outweighs additional cost.	Yes
Survey acquisition timed to avoid the migration periods for Pygmy Blue Whales. No operation of the acoustic source within 17 km of a pygmy blue whale migration BIA during the migration period (mid [14^{th}] - April to mid [14^{th}] - January).	P = Yes E = Effective	To ensure consistency with the Blue Whale Conservation Management Plan and the purpose of the 'Australian Whale Sanctuary' the Seismic Vessel will not activate the acoustic source(s) within the blue whale migratory BIA or buffer from mid-April (14^{th}) to mid-January (14^{th}) which represents the period during which migrating blue whales/pygmy blue whales have historically been known to be present in and around the OA. Good industry practice, safety and environmental benefit outweighs additional cost.	Yes
Survey acquisition time to avoid whale shark migration periods. No operation of the acoustic source within Whale Shark foraging BIA during the reported migration period (September to November).	P = Yes E = Effective	The northernmost section of the whale shark migration and foraging BIA overlaps with the OA. Whale shark foraging and migration within the BIA primarily occurs between September and November, and given the Seismic Survey is more likely to start at the end of November but will not enter the whale shark BIA with an active source before 1 December, there is very low potential for overlap of whale shark migrations and the proposed period of survey acquisition.	Yes
Survey acquisition time to avoid turtle internesting periods.	P = No E = Limited	Acquisition of the survey may overlap the nesting and breeding season for a number of marine turtles which utilise the region, however, the nearest marine turtle nesting or breeding BIA (Internesting at Cartier Island) is located 87 km from the OA. Good industry practice, safety and environmental benefit outweighs additional cost.	No
Daily contact with relevant persons to update on survey plans.	P = No E = Effective	It would not be possible to contact all relevant persons on a daily basis, particularly recreational users. If requested, relevant persons will be notified every 24 hours with the 48-hour look-ahead of vessel movements, a Notice to Mariners will be in place throughout the duration of the survey, and the survey vessels will be contactable on marine radio.	No
Seismic acquisition will only occur outside of fishing seasons.	P = No E = Effective	As commercial fishing activities occur year-round, SLB are unable to operate outside of all fishing seasons.	No

Control measure	Practicability/ Effectiveness	Justification	Will it be adopted?
A Bahasa speaker onboard either of the Seismic Vessel, Chase Vessel and Support Vessels.	P = No E = Effective	Although control measure would be effective in communicating with any Indonesian commercial fishers encountered during the Seismic Survey, the likelihood of this encounter is considered to be very low. Therefore, this would not reduce the likelihood of an interaction to any great extent over and above the control measures already proposed. The cost and logistics associated with ensuring an Indonesian speaker is present on one of the vessels throughout the Seismic Survey outweighs the benefits gained. Instead, information will be printed in Bahasa language that can be passed over to any Indonesian fishers.	No
All seismic acquisition will only occur during daylight hours.	P = No E: Limited	24/7 operations will occur to minimise the duration of the survey. Limiting all acquisition to daylight hours only extends the duration of the survey. Cost of additional time outweighs the benefit of restricting the Seismic Survey to daytime operations.	No
Increase of acquisition line spacing.	P = No E = Limited	Although increasing line spacing would reduce the spatial overlap of survey lines with fishing grounds, as well as the overall duration of the Seismic Survey, survey objectives would not be met on account of reduced data coverage. Costs would be disproportionate to the benefit that may be gained.	No
Vessel master of the Seismic Vessel will take evasive action to avoid marine fauna and other marine users.	P = No E = Ineffective	The Seismic Vessel has limited ability to manoeuvre. It is unlikely any attempt to avoid a collision will have the desired result. The Seismic Vessel will instead maintain a constant speed and will not deviate from survey lines with the exception of line turns.	No
Modification of survey/OA design - avoidance of commercial shipping routes.	P = No E = Limited	Major commercial shipping routes are generally based on a direct line from major ports and it has been shown that there is some overlap with the OA. Avoiding these shipping routes would result in very large data gaps meaning that the Seismic Survey would not meet survey objectives. Numerous control measures will be implemented during the Seismic Survey, such as the use of AIS and radar on the Seismic Vessel and towed equipment, broadcasting of Notices to Mariners, and radio contact with Seismic Vessel will reduce the likelihood of any interactions with commercial vessels. These measures are considered sufficient to manage vessel interactions. It is also noted that there has been no collision to date between Seismic Vessel and commercial vessels. Commercial vessels are able to plot courses and manoeuvre themselves to avoid the Seismic Vessel without compromising their overall transit times, especially with the advanced notification they will receive. Costs would be disproportionate to the benefit that may be gained.	No
Seismic acquisition will only occur during daylight hours to allow for visual identification of the Seismic Vessel and towed equipment.	P = No E = Limited	This measure would result in significant extensions to the time required to acquire survey data. Interactions between Seismic Vessel and other marine users could still potentially occur during daylight hours. The vessels associated with the Seismic Survey will display the appropriate navigation lights and will use ARPA and AIS for identification to other vessels. Vessels will be contactable through radio-communications at all times. The towed equipment will be visually identifiable through display of lights, radar reflectors and use of AIS transponder on the tail buoys to mark the end of all the streamers.	No
Seismic transects will run parallel with shipping routes to avoid interference.	P = No E = Limited	Careful consideration has been given to the survey design, including the orientation of survey lines. The quality of acquired data is maximised by running in the proposed direction across the sub-surface structures. Additional lines and time spent within the OA would be required in order to obtain the same quality level of data. Costs would be disproportionate to the benefit that may be gained.	No
Residual Risk of Impact (Receptor)	**Consequence**	**Likelihood**	**Residual Risk Ranking**
Whale Sharks	Minor	Unlikely	Low
Marine Reptiles	Minor	Possible	Low
Marine Mammals	Minor	Possible	Low

Control measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Commercial Fisheries	Moderate	Likely	Moderate
Marine Traffic	Minor	Likely	Low

ALARP Statement
The decision context has been assessed as Type B and the overall residual risk has been determined to range from Low to Moderate. SLB considers the adopted control measures minimise the risk of impacts from the presence of the Seismic Vessel and Towed Equipment and are appropriate to the localised nature and small scale of the predicted environmental impacts associated with the Seismic Survey. The proposed control measures have been developed in accordance with the legislative requirements, good industry practice, using professional experience and taking into account the specific environmental, social, economic and cultural characteristics of the OA and predicted impacts to other marine users. Additional control measures were considered as part of the assessment process; however, it was considered that they did not provide any further environmental benefit or were not reasonably practicable to implement. Therefore, the predicted impacts to receptors from the physical presence of the Seismic Vessel and Towed Equipment are reduced to **ALARP.**

7.1.6 Impact and Risk Acceptability

Table 47 Demonstration of General Impact and Risk Acceptability for Physical Presence of Seismic Vessel and Towed Equipment

Criteria for Acceptance	Acceptability Summary
Residual Risk Ranking	The residual risk has been determined to range from Low to Moderate.
Ecologically Sustainable Development	The management of the impacts associated with the presence of the Seismic Vessel and towed equipment proposed by SLB can be carried out in compliance with principles of ecologically sustainable development as defined within the EPBC Act. The risk assessment undertaken within this EP has not identified any adverse impacts, and is consistent with the principles of ESD, namely: • Decision-making processes integrated long-term and short-term economic, environmental, social and equitable considerations (e.g. exclusion of the blue whale BIA and the 17 km behavioural disturbance buffer from mid-April (14th) to mid-January (14th) to avoid peak periods for migration of blue whales); • No threats of serious or irreversible environmental damage were identified by the risk assessment; • The principle of inter-generational equity is maintained as potential disturbance impacts from the vessel presence is relatively localised and of short-term; • The conservation of biological diversity and ecological integrity were fundamental considerations in decision-making and development of control measures, for example the installation of turtle guards on the tail buoys will reduce possible impacts to any turtles in the area and retrieval of equipment during transit to and from port will lessen risks of equipment interactions with marine species; and • Proposed control measures have considered improved valuation, pricing and/or incentive mechanisms – control measures that had environmental benefits that outweighed the costs of their implementation were proposed to be undertaken.
SLB's Internal Context	The proposed management of the impacts and risks from the presence of the survey vessels and towed equipment are consistent with SLB's Environmental and QHSE Policy.
Existing Environmental Context	It is considered that the Physical Presence of the Seismic Vessel and Towed Equipment will not result in any significant impact on environmental values or sensitivities within the OA, including protected species such as whale sharks, marine mammals and marine turtles. The OA overlaps or is near (<50 km) to BIAs for the following species: whale sharks, pygmy blue whales, flatback turtles, loggerhead turtles, olive ridley turtles, and lesser frigate birds. While numerous commercially valuable fish stocks occur in the region, in recent years fishing effort in the OA has been limited to the Northern Demersal Scalefish Managed Fishery and the Mackerel Managed Fishery, with by far the majority of fishing effort occurring inshore of the OA. No Australian Marine Parks overlap with the OA, though the OA boundaries are contiguous with the Oceanic Shoals Marine Park Multiple Use Zone which is classified IUCN VI. The OA overlaps with one KEF being the Carbonate Bank and Terrace System of the Sahul Shelf. Environmental sensitivities within each AMP and KEF have been individually taken into consideration within the EP. In each case, primary environmental values include benthic-associated values. The physical presence of the Seismic Vessel and Towed Equipment will be of similar nature and scale to commercial vessels which traverse or utilise (e.g., commercial fishing vessels). Notably, the OA already experiences a high level of shipping traffic and has been the broader region has been subject to previous MSSs. The Seismic Vessel will be transit at a speed of 4.5 knots along predetermined sail lines, meaning that there is the capacity for relevant persons to plan around the activity where consultation has occurred and notification provided. Therefore, the predicted impacts to the identified environmental receptors are considered to be minor and short-term. The moderate impacts to commercial fishers are considered to be managed through the implementation of SLBs Commercial Fisheries Compensation Protocol.

Criteria for Acceptance	Acceptability Summary
External Context – Management Plans, Species Recovery Plans and Conservation Advice	The residual risk of the physical presence of the seismic vessel and towed equipment has been determined to range between Low to Moderate, and will not have a significant impact on a matter of national environmental significance in accordance with EPBC Act Policy Statement 1.1. **<u>Conservation Management Plan for the Blue Whale;</u>** **<u>Approved Conservation Advice for *Megaptera novaeanliae* (humpback whale); and</u>** **<u>Conservation Advice for Sei and fin Whales</u>** Minimising vessel collision has been ranked as a high priority action within the Conservation Management Plans for blue whale, humpback whale, fin whale and sei whale. During the development of mitigation measures for the Seismic Survey, the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna has been taken into account, reducing the potential for risks associated with ship strike to **ALARP** and **Acceptable Levels** with regard to marine mammals. **<u>Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017)</u>** The Recovery Plan for Marine Turtles in Australia outlines that the long-term recovery objective for marine turtles is to '*minimise anthropogenic threats*' and to '*allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list*'. The National Strategy for Reducing Vessel Strike on Cetaceans and Other Marine Megafauna has been taken into account during the development of mitigation measures including the use of best-practice mitigation measures (i.e. turtle guards). The low speed of the Seismic Vessel and installation of turtle guards on each tail buoy is considered to further reduce the potential for risks associated with vessel disturbance to **ALARP** and **Acceptable Levels** with regard to marine turtle populations in the OA. **<u>Conservation Advice for *Rhincodon typus* (Whale Shark)</u>** Boat strike from large vessels is identified as a threat to recovery of the species within the Whale Shark Conservation Advice. Conservation and management actions identified within the document include '*Minimising offshore developments and transit time of large vessels in areas close to marine features likely to correlate with whale shark aggregations (Ningaloo Reef, Christmas Island, Coral Sea) and along the northward migration route that follows the northern Western Australian Coastline along the 200 m isobath'*. Consistent with the Conservation and management actions of the Whale Shark Conservation Advice, the Seismic Survey is proposed to occur at the end of November, and outside of the primary migration period from September to November, is not likely to overlap with any known aggregation areas (e.g., Ningaloo Reef). Consideration has been given to the time at-sea has within the identification of control measures and, where practicable, limiting the Seismic Survey duration to the shortest possible timeframe has been prioritised. **<u>AMP Values, Management Prescriptions and IUCN Reserve Management Principle</u>** The environmental and socio-economic values of the AMPs will not be impacted by the Physical Presence of the Seismic Vessel and Towed Equipment. Therefore, the management measures are consistent with the IUCN management prescriptions and permissible use of the AMPs. **<u>Conservation values and objectives of the North-west Marine Parks Management Plan</u>** The physical presence of the Seismic Vessel and Towed Equipment are not expected to impact significantly on the environmental values or sensitivities of the North-west Marine Region at a local or regional level.
Social Acceptance – Relevant persons expectations	SLB are committed to ongoing consultation with relevant persons and will provide 48-hour look-aheads throughout the survey to all relevant persons that request this information. Under the Navigation Act 2012, AHO can publish and distribute a Notice to Mariners. In addition, in-field consultation with Indonesian commercial fishers is considered appropriate given their intermittent use of the area for fishing.
External Context – Commonwealth and State Legislative Criteria	The control measures for reducing the risk associated with the presence of the survey vessels and towed equipment throughout the duration of the Seismic Survey are consistent with the following relevant standards/documents: • International Maritime Organisation (**IMO**) conventions including STCW and SOLAS; • Relevant ship safety requirements under the Navigation Act 2012: • COLREGS; • Marine Order 21: (Safety of navigation and emergency procedures), 2012; • Marine Order 28: (Operations standards and procedures), 2012; • Marine Order 30: (Prevention of collisions), 2009; and • Marine Order 58: (Safe management of vessels), 2020 • Offshore Petroleum and Greenhouse Gas Storage Act 2006 and associated (Environment) Regulations; • Watch-keeping will occur in accordance with the standards set by the 'International Convention on Standards of Training, Certification and Watchkeeping for Seafarers'; and • Support vessels will adhere to the EPBC Regulations 2000 with regard to interacting with cetaceans.

Criteria for Acceptance	Acceptability Summary
Industry Best Practice	Implemented control measures are based on Industry Best Practice including: • The IAGC Environmental Manual for Worldwide Geophysical Operations. Geophysical vessels must exercise care to reduce risk to aquatic life, including marine fauna and other marine users and, where possible minimise interruption to operations and equipment of other marine users; and • The APPEA Code of Environmental Practice Details within this document relate mainly to offshore operations such as offshore exploration and/or drilling and production facilities where disturbance to marine fauna and other marine users should be reduced to ALARP and Acceptable Levels. It emphasises the importance of maintaining public health and safety during all phases of operations.
ALARP	The total elimination of survey vessels and towed equipment from the project cannot be achieved due to the offshore location of the Seismic Survey, lack of commercially available and proven alternative acquisition methods, and health and safety requirements for a MSS. Following the implementation of the control measures, the potential impacts to the marine environment and other marine users arising from the physical presence of the survey vessels and towed equipment will be short-term and restricted in extent to within the immediate vicinity of the vessels and equipment. Based on the discussions within the EP, including the potential impacts on the environment and the associated control measures to be implemented, the residual risk of impacts arising from the physical presence of the survey vessels and towed equipment throughout the Seismic Survey is considered to be **Moderate**. This impact is predicted to be a medium scale effect in terms of encounter with marine mammals and reptiles; however, it is envisaged that the control measures, especially the temporal and spatial controls will avoid displacement to the sensitive stages of blue whales, as will the adaptive management measures in the BIA. With the control measures in place, it is considered that the Seismic Survey will be acquired so that the environmental impacts and risk on the marine environment and associated receptors within and surrounding the OA are reduced to **ALARP**. Therefore, residual risk from the physical presence of the survey vessels and towed equipment associated with the Seismic Survey is considered to be at an **Acceptable Level**.

Table 48 Demonstration of Specific Impact and Risk Acceptability for Physical Presence of the Seismic Vessel and Towed Equipment

Receptor Category	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact	Acceptable
Commercial Fisheries	The peak industry body representative for commercial fishing, pearling, and aquaculture enterprises in Western Australia (WAFIC) raised concerns regarding the potential effects of the Seismic Survey on commercial catch level and displacement from fishing grounds. Commercial fisheries data and publications used to inform the impact assessment include: • Status Report of the Fisheries and Aquatic Resources of Western Australia 2019/2020: The State of the Fisheries (Gaughan and Santoro 2021) • Spatial and temporal patterns in fisheries catch and effort distribution (based on DPIRD 2015 – 2020 FishCube data) • North Coast Demersal Scalefish Resource Harvest Strategy 2017 – 2021 (DPIRD 2017), which describes the stock assessment and management approach (consistent with the principles of ESD), including annual fishing effort allocations, catch tolerance levels and sustainability (stock) status. • Global Fishing Watch website for VMS details on Indonesian commercial fishers.	Seismic activities are undertaken in a manner such that: • No interference with other marine users occurs to an extent greater than is necessary for the exercise of right conferred by the titles granted to carry out exploration activities. • There is no change to the sustainability status of the fishery; the Seismic Survey is undertaken in a manner that does not result in serious, irreversible or long-term impacts to key indicator commercial fish populations and to the extent that sufficient spawning fish biomass and recruitment of the stocks may be maintained such that stocks continue to be assessed by DPIRD as sustainable. • There is no increased costs or loss of income for commercial fishing license holders.	• The predicted level of interference to commercial fisheries is no greater than is necessary to exercise of right conferred by the titles granted to carry out exploration activities; • SLB will be requesting all marine traffic remain 10 km away from the Seismic Vessel and the towed streamers, this will essentially create a moving temporary exclusion zone around the Seismic Vessel. Based on a review of DPIRD FishCube data, the temporary effective exclusion area around the Seismic Vessel of ~520 km2 represents just 8% and 27% of fishing effort reported to have occurred by NDSMF and MMF license holders, respectively within or immediately beyond the AA (2015-2020). In addition, the temporary exclusion of Indonesian commercial fishers equates to approximately 0.63% of Indonesian Fishing Management Area 573. • Displacement to fisheries as a result of the physical presence of the Seismic Vessel and towed streamers are, therefore, likely to be localised and short-term. • The physical presence of the Seismic Vessel and Towed Equipment are not predicted to impact key indicator commercial fish populations, thereby having negligible effect on the overall sustainability status of the fishery. • The NERA (2021) Commercial Fishing Industry Adjustment Protocol will be implemented to formally manage claims by commercial fishers for loss of catch, displacement and lost or damaged fishing gear as a consequence of the Seismic Survey.	Yes

Acceptability Statement
Impacts and risks classified as 'Type B' or above are considered acceptable if the requirements in **Table 40** can be demonstrated and it can be determined that the predicted levels of impact and/or residual risk are at or below pre-defined Acceptable Levels for that impact or risk, including those described in **Table 41.** Based on the above evaluation, the potential impacts from the physical presence of the Seismic Vessel and Towed Streamers meets the requirements of the risk acceptability criteria. The control measures that will be implemented throughout the Seismic Survey have been developed in accordance with these criteria and are considered appropriate to manage the impacts of the physical presence of the Seismic Vessel and Towed Streamers on all receptors, including the associated disruption and interference with other marine users to an **Acceptable Level.**

7.1.7 Environmental Performance

Table 49 Environmental Performance Outcomes, Standards and Measurement Criteria for Physical Presence of the Seismic Vessel and Towed Equipment

Number	Environmental Performance Outcome	Environmental Performance Standard(s)
EPO 1	Seismic acquisition is undertaken in a manner such that it does not interfere with other marine users to a greater extent than is necessary for the exercise of right conferred by the titles granted to carry out exploration activities.	**EPS 1** to **EPS 4**, **EPS 10** to **EPS 37**, **EPS 47** to **EPS 49**
EPO 2	Seismic acquisition is undertaken in a manner that prevents any increased cost encumbrance or loss of income to commercial fishing license holders.	**EPS 1** to **EPS 3**, **EPS 10** to **EPS 37, EPS 47** to **EPS 49**
EPO 3	Seismic acquisition is undertaken in a manner that prevents collision or entanglement events between vessels or in-water seismic equipment and listed threatened, listed migratory or listed marine fauna protected under the EPBC Act.	**EPS 1**, **EPS 2**, **EPS 5 to EPS 9**, **EPS 38** to **EPS 51**

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
The Seismic Survey will be undertaken in accordance with the approved EP.	**EPS 1**: The Seismic Survey may only commence following acceptance of the EP by NOPSEMA.	Pre-mobilisation audit and inspection are completed prior to operations and confirm an accepted EP has been obtained. Audit records verify compliance with the requirements of the EP.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 2: The Seismic Survey will be undertaken in accordance with the accepted EP.	Bridge logs verify compliance with the requirements of the EP. Audit records verify compliance with the requirements of the EP.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
All survey vessels will adhere to the requirements of the national and international legislation, including the International Regulations for Preventing Collisions at Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (**SOLAS**) as implemented in Commonwealth Waters through the *navigation Act 2012* and associated Marine Orders 21, 28, 30, 58 and the STCW Convention. The requirements give effect, but are not limited to, the following: • Appropriate use of lighting, navigation and radio communication at sea; and • 24-hour bridge and radar watch by qualified watch-keepers to monitor for other marine users.	**EPS 3**: At all times the Vessel Masters comply with the requirements of national and international legislation and conventions including (but not limited to) the Navigation Act 2012 (specifically Marine Order Part 21, 27, 30, 58) COLREGS, Chapter IV (Radio communications) and Chapter V (Safety of Navigation) of SOLAS (International Convention on the Safety of Life at Sea 1974) and the STCW Convention.	Vessel Crew Training and Competency records demonstrate that all relevant marine crew are competent to STCW95/Elements of Shipboard Safety Standards. Pre-mobilisation audit and inspection are completed prior to operations and identify no records of survey vessels failing to comply with appropriate navigation and communication requirements under the Navigation Act 2012, associated Orders or conventions. Bridge logs verify this during the Seismic Survey.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
Adherence to the prohibition of entry into established Petroleum Safety Zones surrounding petroleum installations and equipment.	**EPS 4**: The Seismic Vessel will not enter within any established PSZ. There are no PSZ's within the OA; however, if for any reason the survey vessels did have to enter a PSZ, this would only be by prior arrangement with the installation master and all correct permits are obtained.	Bridge logs records demonstrate compliance.	Vessel Master
Vessel masters' of the Support Vessel and Chase Vessel will comply, when safe to do so, with the relevant requirements of EPBC Regulations 2000 Part 8, Division 8.1, including: Taking action to avoid approaching or drifting closer than 50 m to a dolphin or 100 m to a whale. Not exceeding a speed of six knots within the caution zone of a cetacean (300 m).	**EPS 5**: The Support Vessel/Chase Vessel will not intentionally approach or allow their vessel to drift closer than 100 m to any whale.	Bridge logs records demonstrate compliance. MFO/MMO daily and weekly logs verify compliance	Vessel Master MFOs/MMOs
	EPS 6: The Support Vessel/Chase Vessel Masters will not intentionally approach or allow their vessel to drift closer than 50 m from any dolphin.	Bridge logs records demonstrate compliance. MFO/MMO daily and weekly logs verify compliance	Vessel Master MFOs/MMOs
	EPS 7: If a cetacean approaches closer than the 100 m, the Vessel Master will either disengage gears or allow the whale to approach or reduce speed to less than 6 knots and steer a course away from the cetacean.	Bridge logs records demonstrate compliance. MFO/MMO daily and weekly logs verify compliance	Vessel Master MFOs/MMOs

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
	EPS 8: If a dolphin approaches closer than the 50 m, the Vessel Master must not change course or speed of the vessel suddenly.	Bridge logs records demonstrate compliance. MFO/MMO daily and weekly logs verify compliance	Vessel Master MFOs/MMOs
	EPS 9: The vessel master will make all efforts not to let a calf enter the caution zone (either whale or dolphin). However, if it occurs, the Vessel Master will immediately stop the vessel, turn off engines, or disengage gears, or withdraw the vessel from the caution zone at a constant speed of less than 6 knots.	Bridge logs records demonstrate compliance. MFO/MMO daily and weekly logs verify compliance	Vessel Master MFOs/MMOs
Appropriate use of lights and visual communication at sea.	**EPS 10**: Lighting and communications equipment onboard all vessels to adhere with COLREGS, the *Navigation Act 2012* and with AMSA Marine Orders Part 30: Prevention of collisions, Part 21: Safety and emergency arrangements and Part 27 (safety of navigation and radio equipment).	Pre-mobilisation audit and inspection are completed prior to operations and identify no records of survey vessels failing to comply. Bridge logs verify this during the Seismic Survey.	Vessel Master
	EPS 11: The Seismic Vessel displays day shapes and lights (during hours of darkness/poor visibility) to indicate that the vessel is towing equipment resulting in the Seismic Vessel being restricted in its ability to manoeuvre.	Pre-mobilisation audit and inspection are completed prior to operations and confirm that the relevant equipment is onboard, tested and operational. Bridge logs verify this during the Seismic Survey.	Vessel Master
	EPS 12: The Seismic Vessel is equipped with Radar and AIS systems which will be operating and monitored at all times for both transmitting and receiving vessel positions in the surrounding vicinity.	Pre-mobilisation audit and inspection are completed prior to vessel leaving port and confirm Radar and AIS are present and operational. Bridge logs confirm Radar and AIS are used during the Seismic Survey.	Vessel Master
	EPS 13: The Seismic Vessel will have ARPA onboard for the detection of other vessels. The ARPA system can track other vessels speed and heading and can monitor for the potential of any collisions so the vessels can be contacted prior to any situation occurring.	Pre-mobilisation audit and inspection are completed prior to vessel leaving port and confirm ARPA are present and operational. Bridge Logs confirm ARPA is used during the Seismic Survey.	Vessel Master
Appropriate use of radio communication at sea.	**EPS 14**: The survey vessels will have the appropriate communication equipment onboard and will be contactable and also able to communicate with other vessels by radio at all times (i.e. VHF and SSB radio).	Bridge logs confirm VHF and SSB radio communications are always available.	Vessel Master
24/7 bridge and radar watch by qualified watch-keepers to monitor for other marine users.	**EPS 15**: Qualified crew maintain 24/7 watch-keeping during the survey in compliance with the STCW Convention. Watch keeping duties includes monitoring of vessel position (radar and plotter) and water depth at all times during seismic acquisition.	Bridge logs verify watch has been undertaken during the Seismic Survey.	Vessel Master SLB Project Manager
	EPS 16: Watch keepers are qualified in accordance with STCW95 (or equivalent).	Pre-qualification process includes requirement for Contractor to review/provide qualifications/training of crew members. Induction records outline qualifications/training of all crew members.	Vessel Master
At least one Support Vessel will accompany the Seismic Vessel when in operation and when save to do so (e.g., outside of inclement weather periods), to manage interactions with other marine users.	**EPS 17**: The support vessels will manage vessel interactions through travelling between and maintaining communications with any third-party vessels in the OA.	Bridge logs verify support vessels have successfully communicated with all third-party vessels encountered in the OA.	Vessel Master
	EPS 18: In case of emergency, one support vessel will be capable of taking the Seismic Vessel under tow with all equipment deployed (to keep the vessel and in-water equipment under control and in forward motion).	Pre-qualification process includes assessment of support vessels capacity to take the Seismic Vessel under two. Contractors QHSE Plan confirms how this will be achieved.	SLB Project Manager Vessel Master

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
Streamers are marked with tail buoys.	**EPS 19**: The tail buoy on each streamer is appropriately marked to enable other marine users to determine the extent of the survey and associated array of towed equipment. Each tail buoy includes a radar reflector, lights and an AIS transponder to identify the end of each streamer to other vessels, especially those capable of receiving AIS data.	Pre-mobilisation audit and inspection are completed prior to vessel leaving port and confirm appropriate tail buoys are fitted to each streamer.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
Publication of a Notice to Mariners of survey presence and towed array, no less than four weeks before operations commence.	**EPS 20**: A Notice to Mariners will be published and distributed by the AHO under the Navigation Act 2012, informing other marine users of the Seismic Survey, no less than four weeks before operations commence.	Record of Notice to Mariners.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 21: Should any changes occur the survey acquisition plan throughout the duration of the survey, All Notice to Mariners will be updated as soon as reasonably practicable.	An updated Notice to Mariners will be issued.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
Compensation to fishers and vessel crews (i.e., the claimant) is demonstrated to have occurred for the following circumstances: • Interaction resulting in loss or damage to fishing equipment; • A temporary loss of fish landed catch due to damaged or lost fishing equipment; • Where displacement from fishing grounds results in additional costs incurred due to relocating; or • A temporary reduction in fish landed catch ('loss of catch') due to the impacts associated with acoustic disturbance or due to displacement from fishing grounds. Displacement from fishing grounds can be as a result of seismic operational activities or as a result of avoiding contaminated waters following a fuel oil spill. Claims received from fishers in any circumstances other than those outlined above will not be assessed. Claims will be considered provided the interaction/displacement/loss of catch took place in the Adjustment Area where the Seismic Survey took place (plus any additional area of avoidance requested around the survey vessel/s and towed equipment, and in accordance with the Adjustment Protocol Timeframes stipulated in NERA (2021). Note that for damaged or lost equipment claims, the interaction can have taken place in the Operational Area (not just Adjustment Area), plus any additional area of avoidance requested around the survey vessels and towed equipment.	**EPS 22:** NERA (2021) Commercial Fishing Industry Adjustment Protocol is adopted for the Seismic Survey.. If any changes are required as a result, these will be made through the management of change process.	Documentation of consultation demonstrates SLB has agreed to adopt the NERA (2021) Commercial Fishing Industry Adjustment Protocol, endorsed by WAFIC. Any changes suggested by WAFIC have been considered through the management of change process.	SLB Project Manager.
	EPS 23: Pre-survey consultation with commercial fishers known to utilise the OA, notifying them in writing of the Commercial Fisheries Compensation Protocol in place for the Seismic Survey, no less than 28 days before operations commence. Notification is to be provided in the form of a map, showing the Operational Area and associated Adjustment Area, plus digital files in formats such as shapefiles and a copy of the Protocol in full.	Documentation of consultation demonstrates the NERA (2021) Commercial Fishing Industry Adjustment Protocol, is in place for the Seismic Survey and was provided to commercial fishers known to utilise the OA no less than 28 days before operations commence. Information provided is demonstrated to include a copy of the Protocol in full, a map showing the Operational Area and Adjustment Area, plus digital files in formats such as shapefiles.	SLB Project Manager
	EPS 24: Eligible Commercial Fishers have been provided relevant application forms, as listed in the attachments in NERA (2021) Commercial Fishing Industry Adjustment Protocol,) and a contact point to relevant commercial fishers relating to lodging a claim or notification regarding loss of catch, displacement, or fishing gear loss of damage. Contact information will also be provided to WAFIC.	Documentation of consultation demonstrates the NERA (2021) Commercial Fishing Industry Adjustment Protocol has been adopted. This protocol incudes the relevant compensation claims application forms. Relevant information was attached to the pre-survey consultation with commercial fishers known to utilise the OA, and that contact point has been provided to commercial fishers and WAFIC.	SLB Project Manager
	EPS 25: Subject to a claim being lodged, a suitably experienced/qualified independent person/organisation will be engaged as the assessor of the claim, in consultation with the claimant. Suitably experienced and qualified is defined as a person or organisation with proven demonstrated experience in data analysis and data auditing processes and procedures within the industry.	Documentation of consultation with claimant around engagement of independent assessor, appropriate experience/qualifications of independent assessor, and agreements in place between SLB and independent assessor to engage their services for assessing the claim.	SLB Project Manager

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
The adoption of the NERA (2021) protocol is an agreement reached between SLB and WAFIC over the course of consultation. If any changes are required as a result, these will be made through the management of change process.	**EPS 26**: SLB will provide the assessor with a letter of instruction/project brief, which is to also be provided to the claimant as part of the assessment report.	Documentation of communications with assessor and claimant including provision of letter of instruction/project brief.	SLB Project Manager
	EPS 27: All compensation claims made by commercial fishing license holders or vessel crews for equipment damage/loss, displacement and loss of catch will be assessed for merit in accordance with the processes outlined in NERA (2021) Commercial Fishing Industry Adjustment Protocol (**Appendix M**), in accordance with the Adjustment Protocol Timeframes (NERA 2021).	Records demonstrate that claims made by commercial fishery license holders and vessel crew were assessed in accordance with the processes outlined in NERA (2021) Commercial Fishing Industry Adjustment Protocol (**Appendix M**).	SLB Project Manager
	EPS 28: Where a commercial fishing licence holder has been involved in an interaction leading to loss or damage to the licence holder's equipment or displacement from usual fishing grounds, all interactions between the commercial fishing licence holder and the survey vessels will be recorded by the MSS operator. Details to be recorded should include, but not be limited to: the time, date and location coordinates of where the gear interaction occurred or the fishing was aborted and where it recommended, the name of the vessel, the licence holder number on the fishing gear, and any details of communications between the commercial fishing licence holder and the vessel/s.	Records demonstrate documentation of interactions with commercial fishing licence holder leading to loss or damage of the licence holder's equipment or displacement from usual fishing grounds.	Vessel Master
	EPS 29: Where possible and safe to do so, the Vessel Master shall make attempts to recover any fishing equipment. Photos will be provided to SLB by the Vessel Master.	Records demonstrate attempts to retrieved fishing equipment and photos of retrieved equipment.	Vessel Master.
	EPS 30: The independent assessor is to provide SLB with an assessment report which is to include the following information: - A copy of the letter of instruction/project brief; - Confirmation (or otherwise) that the information provided in the claim is sufficient to conduct a meaningful assessment; - A summary of the claim details (survey, applicant, vessel, month/s); - For a loss of catch claim, monthly CPUE assessments as outlined in the Commercial Fisheries Compensation Protocol for the Bonaparte MC3D Marine Seismic Survey, including an estimation of any loss of catch and its market price; and - Any other information, comments, or views relevant to the assessment that the assessor may wish to include. Upon receiving and considering the assessment report, SLB will provide a copy of the report to the claimant and offer to meet with the claimant to discuss/address the claim.	Records demonstrate receipt of assessment report and consultation with claimant.	SLB Project Manager
	EPS 31: All claimants will be notified of the outcome of the claim (or request clarification/additional information from the claimant) as soon as practicable and in accordance with the timeframes set out in the NERA (2021) Commercial Fishing Industry Adjustment Protocol (**Appendix M**).	Records demonstrate claimants were notified of the outcome of the claim or request for clarification/additional information in accordance with NERA (2021) Commercial Fishing Industry Adjustment Protocol (**Appendix M**).	SLB Project Manager
	EPS 32: All claimants considered to have a claim of merit will receive compensation, in accordance with NERA (2021) Commercial Fishing Industry Adjustment Protocol **(Appendix M**), within 60 days of the claim determination. Claimants will be contacted via the email addressed provided within the claim application, unless requested otherwise. Compensation value paid will calculated based on the measures provided in the NERA (2021) Commercial Fishing Industry Adjustment Protocol (e.g. reduced kg caught per species multiplied by the market price per kg at the time the catch would have been sold for catch reduction claims).	Records demonstrate all claimants considered to have a claim of merit received compensation in accordance with NERA (2021) Commercial Fishing Industry Adjustment Protocol (**Appendix M**), within 60 days of the claim determination.	SLB Project Manager

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
	EPS 33: In the event that a claimant disagrees with a claim assessment outcome, and an agreement cannot be reached between SLB and the claimant, the claimant may opt to request that a suitably experienced/qualified independent third-party is engaged to review and determine the outcome of the claim. The appointment of the independent third party will be agreed mutually between SLB and the claimant. The dispute will be resolved within the timeframes set out in NERA (2021), with the costs of engaging the independent third-party assessor covered by SLB.	Records demonstrate that a claimant's dispute has been assessed by a suitable experience/qualified independent third-party, where requested, and that costs of engaging the independent third-party assessor have been covered by SLB Records document outcome of the independent third-party assessor's assessment and that the dispute has been resolved within the timeframes set out in NERA (2021).	SLB Project Manager
A communications protocol will be in place between the survey vessels and relevant persons (e.g., commercial fishers known to utilise the OA, Petrofac), to actively manage concurrent activities.	**EPS 34**: Relevant persons will be notified following the conclusion of the survey as per the following Post-Activity Notifications: • All relevant persons – relevant time post completion; • AMSA – relevant time post completion; • NOPSEMA – 10 days post completion advising the completion of the Seismic Survey; and • NOPSEMA – as soon as p practicable advising that all of the activities and obligations covered under the EP have been completed.	Documentation of consultation and consultation log demonstrate compliance.	SLB Project Manager
Seismic Vessel, Chase Vessel and Support Vessels have a communication sheet (in Bahasa and Tetum translation) detailing key information regarding the Seismic Survey to be provided to any Indonesian fishers if they area encountered during the Seismic Survey.	**EPS 35**: Seismic Vessel, Chase Vessel and Support Vessels all have Bahasa and Tetum language communication sheets available.	Records demonstrate that Bahasa and Tetum language communication sheet are available on Seismic Vessel, Chase Vessel and Support Vessels during the Seismic Survey.	SLB Project Manager Vessel Master
	EPS 36: Bahasa and Tetum language communication sheets will be provided to any Indonesian commercial fishers encountered during the Seismic Survey which provide all the details of the Seismic Survey.	Records demonstrate that any Indonesian commercial fishers encountered during the Seismic Survey were provided with a communication sheet in Bahasa and Tetum language.	SLB Project Manager Vessel Master
Daily look-ahead reports will be provided to relevant persons (e.g., e.g., commercial fishers known to utilise the OA or have indicated they could use the area (i.e. WTBF concession owners)), detailing the current vessel location and proposed timing and location of operations within the next 48 hour period.	**EPS 37**: A 48-hour 'look-ahead plan' will be provided to relevant persons identified throughout the relevant persons consultation process, detailing the survey activities over the next 48 hours. The 48-hour look-ahead plans will be updated and issued every 24 hours and distributed to relevant persons via email.	Documentation of consultation, consultation log and issuing of weekly and 48-hour look-ahead plans demonstrate compliance. Forms part of ongoing consultation strategy.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
EPBC Act Policy Statement 2.1: Part B.1 – Marine Mammal Observers. The use of suitably trained, dedicated and experienced MMOs/MFOs to undertake visual observations for whales and ensure that the appropriate mitigation measures outlined in this EP are implemented. A minimum of two MMOs/MFOs will be onboard the Seismic Vessel and, whenever practicable, both stationed on the bridge of the Seismic Vessel. A minimum of two MMOs/MFOs will be stationed on the Chase Vessel.	**EPS 38:** MFO/MMOs must have logged a minimum of 20 weeks' relevant sea-time engaged in marine seismic survey operations in Australian waters as an MMO or marine fauna observer (MFO) and have proven 'at sea' experience in whale identification and behaviour, and distance estimation. The MFO/MMOs used must be confident in the identification of those species that the EP predicts will be present in the OA.	Procurement process for engaging MFOs/MMOs includes the provision of compliant CVs. Induction records outline qualifications/training of each MFOs/MMOs.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 39: Two dedicated, trained, and experienced MFOs/MMOs will be onboard the Seismic Vessel at all times, with at least one MFO/MMO on the bridge of the Seismic Vessel during daylight hours for the visual detection of marine mammals.	Induction records outline qualifications/training of each MFOs/MMOs. MFOs/MMOs daily and weekly logs confirm two MFOs/MMOs were on board the Seismic Vessel to complete daylight visual observations.	Survey Environmental Advisor SLB QC and HSE Representative MFOs/MMOs Vessel Master

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
	EPS 40: Two dedicated, trained, and experienced MFOs/MMOs will be onboard the Chase Vessel at all times, with at least one MFOs/MMO on the bridge of the Seismic Vessel during daylight hours for the visual detection of marine mammals	MFOs/MMOs daily and weekly logs confirm two MFOs/MMOs were on board the Chase Vessel to complete daylight visual observations.	Survey Environmental Advisor SLB QC and HSE Representative MFOs/MMOs Vessel Master
Development and implementation of Marine Fauna Management Plan.	**EPS 41:** One of the roles of the MFOs/MMOs onboard the Seismic Vessel is to develop a Marine Fauna Mitigation Plan, to be submitted to SLB prior to the pre-mobilisation survey and audit commencing. This plan will demonstrate the following, at a minimum: • MFOs/MMOs are trained, dedicated and experienced; • Responsibilities and authorities of MFOs/MMOs to ensure the plan is communicated and available to those roles that are required to implement the controls; • Communications protocols for relaying marine fauna observations to the Seismic Operator, Vessel Master and vessel crew as required. • Survey Plan – describes the proposed activity including location and timing, acoustic source and streamer configuration, equipment (vessels) and key geographic locations such as BIAs and nominated exclusion zones. • Implementation Plan – details how the marine fauna mitigation controls within the EP will be implemented; • Handling procedures for the retrieval of marine fauna entangled in towed equipment or seabirds on the vessels' deck. Good industry practice, environmental benefit outweighs additional cost.	Pre-mobilisation audit and inspection confirms the Marine Fauna Management Plan has been developed. Induction records outline the content of inductions and personnel present. MFOs/MMOs daily and weekly logs and Bridge logs confirm the Marine Fauna Mitigation Plan is being implemented.	SLB QC and HSE Representative Survey Environmental Advisor MFOs/MMOs SLB Project Manager
Any vessel strike incident to marine mammals will be reported as soon as practicable via the National Vessel Strike Database at https://data.marinemammals.gov.au/report/shipstrike.	**EPS 42:** Any vessel strike incident to marine mammals will be reported via the National Vessel Strike Database as soon as practicable yet no later than seven days following completion of the survey .	MFO/MMO daily and weekly logs verify any vessel strike incident has been reported via the National Vessel Strike Database	MFOs/MMOs Survey Environmental Advisor SLB QC and HSE Representative
The Support Vessel and Chase Vessel, when safe to do so, will comply with the DPAW Whale Shark Management Programme (DPAW, 2013), in order to reduce the risk of disturbing whale sharks and avoiding collisions between a whale shark and the vessels: • Taking action to avoid approaching or drifting closer than 30 m of a whale shark; and • Not exceeding 8 knots within 250 m ('contact zone') of a whale shark.	**EPS 43:** SLB will adhere to the whale shark interaction code of conduct for vessel movements in the vicinity of whale sharks	MFO/MMO daily and weekly logs will contain sufficient details to demonstrate compliance with the code of conduct for vessels	Vessel Master MFO/MMO Survey Environmental Advisor SLB QC and HSE Representative
The Support Vessel and Chase Vessel will avoid travelling at close distance to marine turtles.	**EPS 44**: The Support Vessel and Chase Vessel will not knowingly travel at more than 6 knots within 300 m of a marine turtle.	MFO/MMO daily and weekly log confirm actions taken in presence of marine turtle. Bridge logs verify this.	Vessel Master MFOs/MMOs Survey Environmental Advisor SLB QC and HSE Representative
Installation of 'turtle guards' on streamer tail buoys.	**EPS 45:** Each streamer tail buoy will be fitted with protective 'turtle guards' that is appropriate for excluding turtles from entering gaps in the subsurface structure of the tail buoys.	Audit/inspection records verify turtle guards are installed.	Vessel Master SLB QC and HSE Representative

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
When safe to do so, efforts will be made to extricate and return to sea, any marine fauna entangled within in-water equipment .	**EPS 46:** When safe to do so, efforts will be made to extricate and return to sea, any marine fauna entangled within in-water equipment.	MFO/MMO daily and weekly logs verify the processes followed in the event of marine fauna entanglements	MFOs/MMOs Survey Environmental Advisor SLB QC and HSE Representative
Towed equipment will be retrieved when the Seismic Vessel is in transit to and from the OA (e.g., to and from port). No streamers will be towed within any water depths less than 40 m.	**EPS 47:** Towed equipment will be retrieved and brought onboard the Seismic Vessel when not required, including when in transit to and from the OA. No streamers will be towed outside the OA or over any areas with water depths less than 40 m.	Bridge logs verify vessel track records and timing of retrieval events. Pre-mobilisation audit and inspection confirms exclusion polygons on survey vessel's navigation system have been developed and are available for use.	Vessel Master Party Chief SLB QC and HSE Representative Survey Environmental Advisor
	EPS 48: Shape files will be loaded onto the survey vessels' navigation system outlining exclusion areas within which equipment cannot be towed through, against the boundary extents of the OA and AA.	Exclusion polygons on survey vessel's navigation system.	Vessel Master SLB QC and HSE Representative Survey Environmental Advisor
Retrieval of any equipment accidentally lost at sea, including streamers, where it is safe and practicable to do so to ensure it does not become a risk to other marine users.	**EPS 49:** Where practicable and safe to do so, any equipment accidentally lost at sea, including streamers, is retrieved.	Bridge logs verify vessel track records and timing of retrieval events.	Vessel Master Party Chief SLB QC and HSE Representative Survey Environmental Advisor
Survey acquisition timed to avoid the migration periods for Pygmy Blue Whales. No operation of the acoustic source within 17 km of a pygmy blue whale migration BIA during the migration period (mid [14th] - April to mid [14th] - January).	**EPS 50:** Consistent with the proposed timing of acquisition within this EP, Survey acquisition timed to avoid the migration periods for Pygmy Blue Whales.	Pre-mobilisation audit and inspection confirms the proposed survey is consistent with this EP. Bridge logs verify vessel track records and timing of survey.	MFO/MMO Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
Survey acquisition time to avoid whale shark migration periods. No operation of the acoustic source within Whale Shark foraging BIA during the reported migration period (September to November).	**EPS 51:** No operation of the acoustic source within Whale Shark foraging BIA during the reported migration period (September to November)	MFOs/MMOs daily and weekly logs confirm that the acoustic source was not operated within the whale shark BIA during the reported migration period (September to November) Vessel track records as well as AIS tracks and bridge logs confirm this.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative

7.1.8 Physical Presence Impact and Risk Summary

Based on the assessment above, including the identification of potential impacts on the environment and the associated control measures to be implemented, the residual risk of impacts arising from the physical presence of the survey vessels and towed equipment throughout the Seismic Survey is considered to range from **Low Moderate**, for the receptors identified.

The suite of control measures determined to be adopted have been developed in accordance with industry best practice and relevant legislation. In accordance with the Risk Ranking Descriptions in **Table 38**, where risk cannot be reduced to '**Low**', additional control measures must be evaluated to determine whether the risk is reduced to **ALARP**.

Additional controls have also been evaluated to determine whether they are effective and practicable to implement in **Table 46**. Where they are determined to effectively reduce the environmental impact and risk, and are practicable to implement, they have been adopted. Consequently, it is considered that the environmental impacts and risk on the identified receptors arising from the physical presence of the Seismic Vessel and towed equipment throughout the Seismic Survey, are reduced to **ALARP**.

In accordance with the acceptability requirements prescribed in **Section 6.4,** the suite of control measures, are considered appropriate to manage the impacts arising from the physical presence of the Seismic Vessel and towed equipment on all receptors, specifically commercial fishers, to an **Acceptable Level.**

7.2 Acoustic Disturbance to the Marine Environment

7.2.1 Description of Source of the Impact and Risk

Noise will be generated from two sources during the Seismic Survey, including the survey vessels, and the active acoustic source. The active acoustic source generates much higher noise levels than the vessels and would dominate overall underwater noise emissions at times when data acquisition is occurring.

7.2.1.1 Vessel Noise

Noise from ships (i.e. propellers, machinery, and the passage of the hull through water) is the dominant anthropogenic sound in marine waters and adds to the constant ambient noise level in the marine environment. In general, older vessels produce more noise than more modern vessels, and larger vessels produce more noise than smaller vessels (Gordon and Moscrop, 1996). Commercial vessels produce relatively loud and predominantly low frequency sounds, with the exact characteristics' dependant on vessel type, size, and operational mode (**Table 40**). A study undertaken by MacGillivray & Li (2018) recorded vessel noise in Haro Strait and found underwater noise generated by commercial vessels is significantly reduced at slower vessel speeds. For vessel noise, the strongest energy tends to be at frequencies below several hundred hertz, with source levels generally ranging from 180 – 190 dB re 1 µPa (Southall and Hatch, 2008). Despite the presence of many marine mammal species in coastal areas with high levels of shipping, relatively few studies have investigated the effects of ship noise on marine mammals (Blair *et al*., 2016).

Table 40 Noise Outputs from a range of Commercial Vessels

Source	Source level (dB re 1 µPa at 1 m)	Reference
Container ship (294 m & 298 m length)	184.2 – 186.6 & 188.1	McKenna et al., 2012
Container ship	183.8 – 199.1	MacGillivray & Li, 2018
Vehicle carrier (173 m & 199 m length)	180.0 & 180.8	McKenna et al., 2012
Vehicle carrier	183.6 – 195.2	MacGillivray & Li, 2018
Bulk carrier (167 m & 229 m length)	187.4 & 185.1	McKenna et al., 2012
Bulk carrier	181.9 – 193.9	MacGillivray & Li, 2018
Open hatch cargo ship (190 m & 213 m length)	183.8 & 181.1	McKenna et al., 2012
Chemical products tanker (148 m & 182 m length)	182.4 & 184.9	McKenna et al., 2012
Crude oil tanker (229 m & 243 m length)	181.3 & 182.1	McKenna et al., 2012
Product tanker (180 m & 228 m length)	181.8 & 182.7	McKenna et al., 2012
Tanker	183.6 – 195.2	MacGillivray & Li, 2018
Super tanker (266 m & 337 m length)	187 & 185	Thiele, 1983
Cruise ship	175.5 – 198.3	MacGillivray & Li, 2018
Fishing trawler	158	Malme *et al.*, 1988

Noise emissions from the survey vessels would be similar in level, frequency range and character to noise from general shipping traffic already in the study area and is not considered to represent a significant additional environmental impact above the noise from normal shipping activities (see **Section 7.2.1.1**).

7.2.1.2 Underwater Acoustic Modelling

7.2.1.2.1 Introduction

UAM was undertaken to predict received noise levels, or the 'footprint' of acoustic emissions generated from the Seismic Survey. UAM increases the understanding of the acoustic footprint over a given bathymetric environment with unique environmental parameters (i.e. sound speed profile and geology) for a specific acoustic source proposed for a seismic survey.

Results from this UAM are used to confirm the extents of the Precaution Zones required under the EPBC Act Policy Statement 2.1 and to enable an assessment of the potential risk to various marine fauna in the OA based on comparisons with known injury and behavioural onset thresholds. Potential risks to the ecological character of sensitive marine areas in the surrounding areas to the OA have also been considered.

The UAM was undertaken by JASCO (Connell *et al*., 2022) and its report which outlines the methodology and results is included in **Appendix A**.

In summary, the UAM approach involved three key components:

- Array source modelling – used to predict acoustic signatures and spectra accounting for individual airgun volumes, airgun bubble interactions, and array geometry. This modelling is used to yield accurate source predictions;
- Underwater acoustic propagation modelling – used to estimate sound levels over a large area around the acoustic array sources, taking into account source directivity and range-dependent environmental properties likely to be encountered within the Acquisition Area. Single-impulse (or per-pulse) and accumulated (24 hour) sound exposure fields were predicted; and
- Animal movement and exposure modelling (**animat modelling**) – this modelling considers the movement of both the sound source and animals over time. In this case, the animat modelling involved simulations to predict the distance at which migrating pygmy blue whales (*Balaenoptera musculus brevicauda*) are expected to be exposed above specified thresholds.

In the case of the Seismic Survey, UAM was conducted specifically for the discharge of the 3,000 in^3 source array. If the final source utilised for the Seismic Survey differs to that modelled by Connell *et al*. (2022), additional modelling will be undertaken to confirm that the far-field horizontal source level specifications are consistent with those assessed in this EP. As described in **Appendix A**, the selected sound speed profile (the month of March) represents a worst-case scenario (precautionary) for noise propagation and has been chosen so that in the event of any delays to the programme the predicted impacts are conservative, and representative of source locations and seasons expected to exhibit noise propagation over the greatest distances.

Geoacoustic parameters used for modelling at all sites were derived from sedimentary grain size measurements from the Australian Government's Marine Sediments (**MARS**) database (Heap 2009). There are no deep drill core samples available for the region. On average, the surficial grain size indicates silty sand is present throughout the modelled area, and this includes the banks of the shoals, particularly those on the continental shelf (Heyward et al. 1997).

JASCO notes that the geology used for the modelling is based on the geology under the modelled sites, rather than the geology of locations the active source is not passing over (i.e. the tops of the shoals off the continental shelf). When the acoustic source is next to the shoal, and thus typically over the banks / slope of the shoal, the source is over the softer sediment (Heyward *et al.* 1997). JASCO notes the shoals are not rock but are variable sediment and the western shoals in the OA are typically more covered in silt and silty sand, which is often linked to lower biota levels (Heyward *et al*. 1997). The shoals which are under the primary acquisition lines are typically covered in silty sandy substratum, which is also the predominate geology of the region (Heyward *et al*. 1997, Heap, 2009). This regionally predominate geology has the most influence on propagation loss, and when used in the range dependent acoustic models applied, will have the most substantial influence on the prediction of acoustic footprints.

Whilst the shallow sections of the shoals located off the edge of the continental shelf are often rubble, once off the shallowest section, the dominate substrate is once again sandy silt. The tops of smaller pinnacles are often partly buried by sediment indicating both ongoing dynamic sedimentary processes and environmental gradients (Heyward *et al*. 1997). Whilst there is likely carbonate bank underlying this sediment, the extent is likely localised, with sediment built up on the sides of the bank, and thus the carbonate is localised.

As the modelling primarily considered the geology under the active source, the shallowest shoal tops off the edge of the continental shelf, and their regions of localised rubble with underlying carbonate was not considered as a geology because it is not representative of the broader region. The silty sand likely to be present on the shoals on the continental shelf is incorporated into the geoacoustic profile considered in the modelling.

A total of four acquisition scenarios were considered using both acoustic propagation modelling and animat modelling, with one additional scenario considered using animat modelling only. All five scenarios considered continuous 24 hour acquisition, including on turns. Therefore, the simulated source tracks followed a ‘racetrack’ configuration. A speed of 4.5 knots and an inter-pulse interval of 16.66 m results in a total of approximately 12,000 impulses per scenario. At the time and location of each seismic pulse, the modelled source location with the closest distance was selected for exposure modelling. The track lines along with the acoustic modelling locations are shown in **Figure 45**.

The single impulse sites and the accumulated SEL scenarios were determined based on proposed survey line plans with lines orientated either at 26/206° or 159/339°. To approximate the sound field around a turn, modelled sites were reprocessed with five tow azimuths at angles of 0, 45, 90, 135, and 180° relative to the direction of the main survey line. The locations were selected based on their proximity to shoals and were inclusive of depths that support the greatest sound propagation into deep waters towards the pygmy blue whale migratory BIA. The single impulse sites and accumulated SEL scenarios are representative of the range of water depths and the potential sound propagation characteristics within the OA.

The ranges for the scenarios are highly transportable across the OA. For example, the acquisition lines of the southeastern part of Scenario 3 extend over the Carbonate Bank and Terrace System of the Sahul Shelf KEF and, whilst the lines for Scenario 5 are not strictly within this KEF (only by virtue of the KEF boundary coinciding with the Australian EEZ boundary), it is over a very similar bathymetry so the results are transportable to the areas of the KEF where no SEL modelling was undertaken (i.e. the southeast of the Acquisition Area). The shelf is rather flat, and the results are reasonably consistent in areas >15 km from the shelf break. The primary focus of the assessment was potential impacts on the pygmy blue whale migratory BIA and the shoals located along the eastern margin of the Acquisition Area.

Zero to peak pressure levels (**PK; L_{pk}**) were assessed at eight different representative depths within the AA (40, 50, 60, 75, 100, 125, 150, and 200 m) for receivers located 50 cm above the seabed, this being relevant to sponges, corals, fish, fish eggs, and larvae.

Peak to peak pressure levels (**PK-PK; L_{pk-pk}**) were assessed at six different representative depths within the AA (60, 75, 100, 125, 150, and 200 m) for receivers located 5 cm above the seabed, this being relevant to benthic invertebrates.

Particle motion was determined at four different representative depths within the AA (60, 75, 100, 150 m) at 5 cm above the seabed this being relevant to benthic invertebrates.

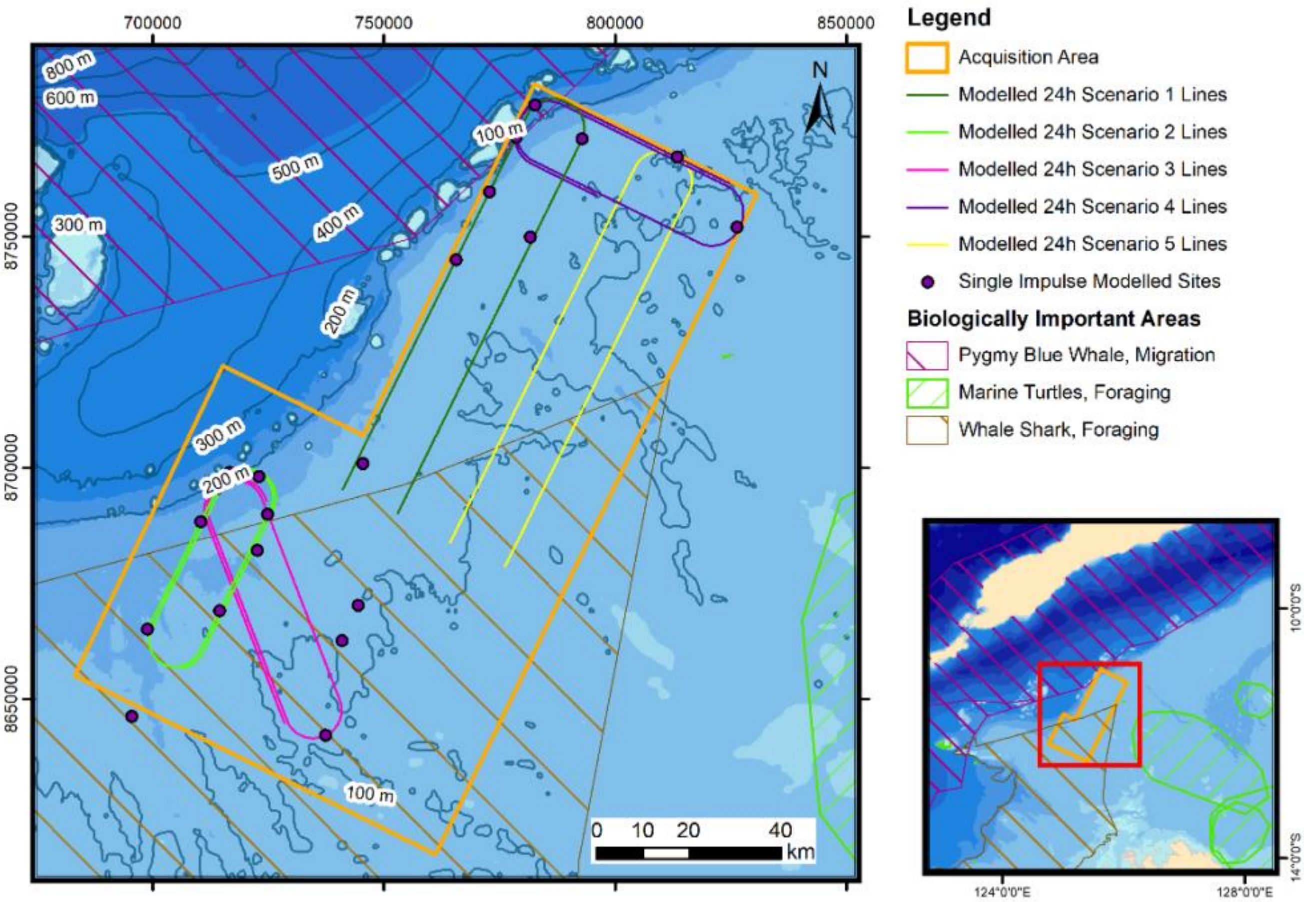


Figure 45 Overview of Modelled Sites and Acquisition Lines

7.2.1.2.2 Noise Effect Criteria

The following discussion is based on, and in some cases an excerpt from, the UAM contained within **Appendix A**, by Connell *et al.*, 2022.

The perceived loudness of sound, especially impulsive noise such as from an acoustic source, is not generally proportional to the instantaneous acoustic pressure. Rather, perceived loudness depends on the pulse rise-time and duration, and the frequency content. Several sound level metrics are commonly used to evaluate noise and its effects on marine life. The period of accumulation associated with SEL is defined, referencing either a "per pulse" assessment or over 24 hours (**Appendix A**). The acoustic metrics used reflect the updated ISO standard for acoustic terminology, ISO/DIS 18405:2017 (2017).

Whether acoustic exposure levels might injure or disturb marine mammals is an active research topic. Since 2007, several expert groups have developed SEL-based assessment approaches for evaluating auditory injury, with key works including Southall *et al*. (2007), Finneran and Jenkins (2012), Popper *et al*. (2014), United States National Marine Fisheries Service (NMFS 2018), and Southall *et al*. (2019). The number of studies that have investigated the level of behavioural disturbance to marine fauna by anthropogenic sound has also increased substantially. JASCO notes that research is ongoing into the relationship between sound and its effects on benthic invertebrates, including the relevant metrics for both effect and impact. Available literature suggests particle motion, rather than sound pressure, is a more important factor for crustacean and bivalve hearing. Particle motion relates to the movement of fluid particles in a sound field. Water depth and acoustic source size are related to the particle motion levels at the seafloor, with larger arrays and shallower water being related to higher particle motion levels, more likely relevant to effects on crustaceans and bivalves. Particle motion can be measured in terms of three different (but related) quantities: displacement (m), velocity (ms^{-1}), or acceleration (ms-^{2}). Acoustic particle motion has been reported in terms of acceleration.

The modelling methodology considered source directivity and range-dependent environmental properties. Estimated underwater acoustic levels are presented as sound pressure levels (**SPL; L_p**), PK, PK-PK, and either single-impulse (i.e., per-pulse) or accumulated sound exposure levels (**SEL; L_E**) as appropriate for different noise effect criteria. In addition, particle acceleration (ms^{-2}) was estimated at the seafloor.

The following noise criteria and sound levels for this study were chosen because they include standard thresholds, thresholds suggested by the best available science, and sound levels presented in literature for species with no suggested thresholds:

1. Peak pressure levels (PK; L_{pk}) and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from (Southall *et al*., 2019) for the onset of Permanent Threshold Shift (**PTS**) and Temporary Threshold Shift (**TTS**) in marine mammals;
2. Marine mammal behavioural threshold based on the current US National Oceanic and Atmospheric Administration (NOAA, 2019) criterion for marine mammals of 160 dB re 1 µPa (SPL; L_p) for impulsive sound sources;
3. Sound exposure guidelines for fish, fish eggs and larvae (including plankton) (Popper *et al*. 2014);
4. Peak pressure levels (PK; L_{pk}) and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from Finneran *et al*. (2017) for the onset of PTS and TTS in turtles;
5. Sea turtle behavioural response threshold of 166 dB re 1 µPa (SPL; L_p) (NSF 2011), as applied by the US NMFS, along with a sound level associated with behavioural disturbance 175 dB re 1 µPa (SPL; L_p) (McCauley *et al*.; 2000a; 2000b);

6. Peak-peak pressure levels (PK-PK; L_{pk-pk}) and particle acceleration (ms^{-2}) at the seafloor to help assess effects of noise on crustaceans through comparing to results in Day *et al*. (2016), Day *et al*. (2019), Day *et al*. (2016a), Day *et al*. (2017) and Payne *et al*. (2008);
7. A sound level of 226 dB re 1 µPa (PK; L_{pk}) reported for comparing to Heyward *et al*. (2018) for sponges and corals.

Additionally, to assess the size of the low-power zone required under the Australian Environment Protection and Biodiversity Conservation (EPBC) Act Policy Statement 2.1, Department of the Environment, Water, Heritage and the Arts (DEWHA, 2008), the distance to an unweighted per-pulse SEL of 160 dB re 1 µPa^2·s (LE) was assessed.

Further details of the relevant noise effect criteria used are presented in **Section 7.2.2.**

7.2.1.2.3 Acoustic Source Levels and Directivity

The Seismic Vessel will tow an acoustic array comprised of two sub-arrays with thirteen acoustic sources per sub-array (26 in total), providing an overall effective volume of 3,000 in^3 (**Figure 6** and **Table 7**).

The UAM methodology addresses the horizontal and vertical directionality of the emissions from the acoustic source based on the specific configuration to be used during the survey. Also considered within the model are the varying water depths found throughout the OA.

The source levels and directivity of the acoustic source presented in the UAM report included in **Appendix A** were predicted using JASCO's Airgun Array Source Model (**AASM**). AASM, which includes low- and high-frequency modules for predicting different components of the acoustic source spectrum, was used to predict the horizontal and vertical overpressure signatures and corresponding power spectrum levels for the acoustic sources, with results provided in Appendix B.3 of the report contained in **Appendix A**, along with the horizontal directivity plots for the selected source. All acoustic sources considered were modelled over AASM's full frequency range, up to 25 kHz.

Table 51 presents the peak and per-pulse SEL source levels in the horizontal-plane broadside (perpendicular to the tow direction), endfire (along the tow direction), and vertical directions for the modelled array signature (3,000 in^3 source). The vertical source level that accounts for the "surface ghost" (the out of phase reflected pulse from the water surface) is also presented to make it easier to compare the output of other acoustic source models.

Table 51 Far-field Source Level Specifications for 3,000 in^3 Source for an 8 metre Tow Depth

Direction	Peak source pressure level ($L_{S,pk}$; dB re 1 µPa m)	Per-pulse source SEL ($L_{S,E}$; dB 1 µPa^{2}m^{2}s)	
		10–2000 Hz	2000–25000 Hz
Broadside	250.1	225.3	185.4
Endfire	245.0	223.0	186.4
Vertical	256.3	228.8	195.1
Vertical (surface affected source level)	256.3	231.0	198.3

Note: Source levels are for a point-like acoustic source with equivalent far-field acoustic output in the specified direction. Sound level metrics are per-pulse and unweighted.

7.2.1.2.4 Single-impulse Sound Fields

Acoustic source and propagation modelling was done at 21 individual single-impulse sites, with some sites being modelled at several tow azimuths to account for acquisition on turns. The modelling assessed the sound fields in terms of maximum-over-depth SPL, SEL, PK, and seafloor PK and PK-PK. These metrics were assessed as they are used for peak thresholds, as inputs into 24-hour SEL scenarios or correspond with the relevant behavioural thresholds.

The maximum and 95% distances to per-pulse SEL and SPL metrics for the water column are presented in Tables 9 to 16 of the report contained in **Appendix A**. The water column SPL sound fields, and distances to relevant isopleths are shown on the contour maps presented in Figures 7 to 33 of the same report. The water column SPL sound fields are also presented in Figures 34 to 39 of the same report as vertical slices for selected sites along the endfire and broadside directions out to 50 km, with the airgun array in the centre. Two examples of the SPL sound fields are presented in

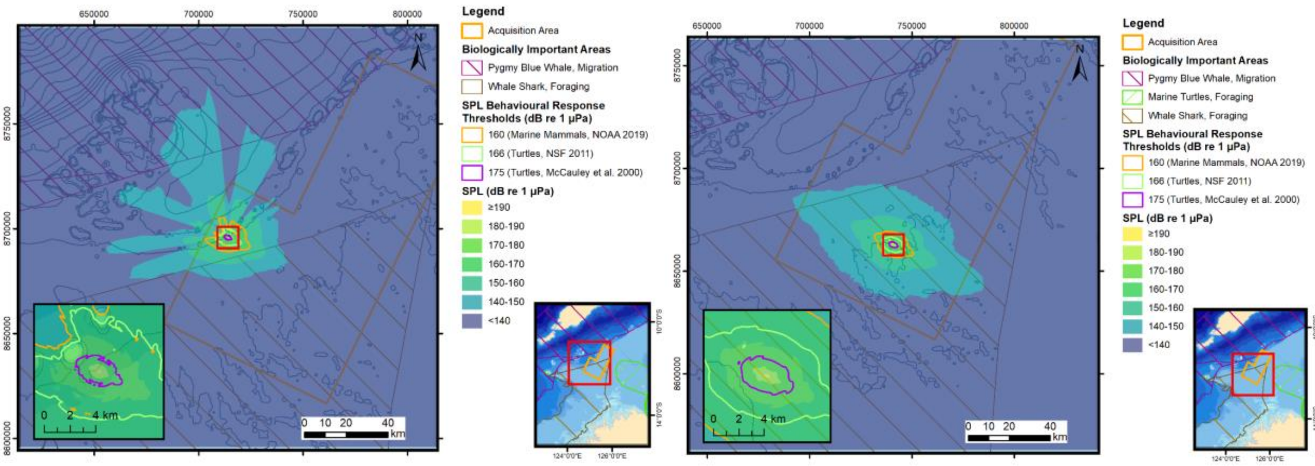


Figure 46. The implications of these estimations are presented in **Section 7.2.2**.

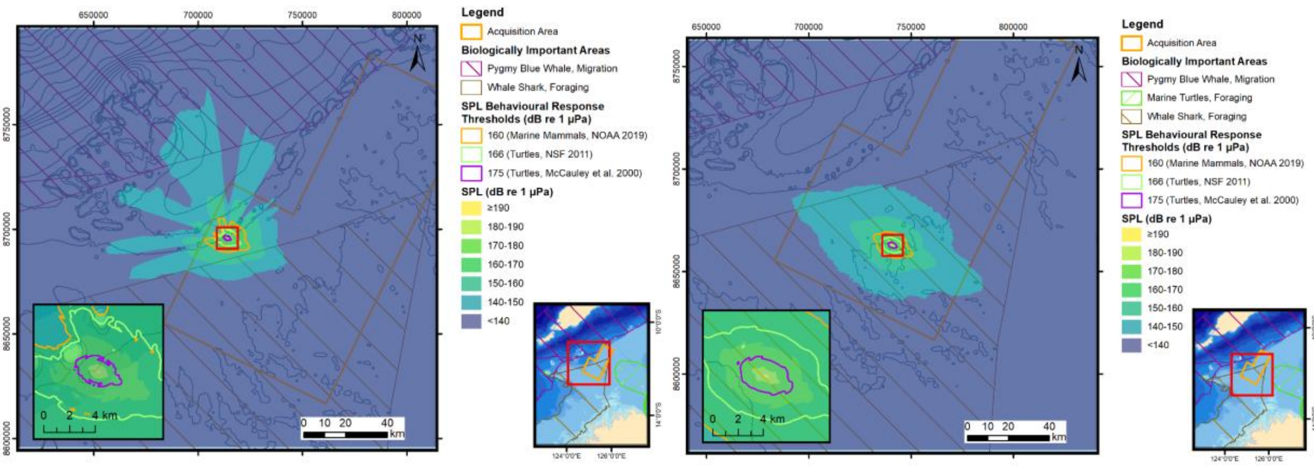


Figure 46 Example Sound Level Contour Maps of Unweighted Maximum-over-depth Water Column SPL Sound Field (Left: Site 8; Right: Site 6)

Specific modelling was undertaken to assess sound levels at the seafloor, with two receptor locations assessed (5 cm and 50 cm above the seafloor interface). Table 18 in the report contained in **Appendix A** presents the results for receptors located 50 cm above the seafloor (relevant to sponges, corals, and fish) and Table 19 of the same report presents the result for receptors located 5 cm above the seafloor (relevant to benthic invertebrates).

In addition, JASCO modelled particle acceleration for a receiver 5 cm above the seafloor at four water depths (60, 75, 100, and 150 m). These were modelled to a maximum distance of 1,000 m from the centre of the acoustic source in the endfire and broadside directions. The results show that the effects are greater for the broadside directions than the endfire directions (as shown in **Figure 47**). The maximum horizontal seafloor distance from the sound source to the particle acceleration threshold of 37.57 ms^{-2} (this threshold being derived from work on the impacts of seismic surveys on scallops presented in Day *et al*. (2016)) was 6 m and 10.5 m for the 60 m and 75 m depth scenarios, respectively. This threshold was not exceeded for the two deeper depths assessed (i.e. 100 and 150 m).

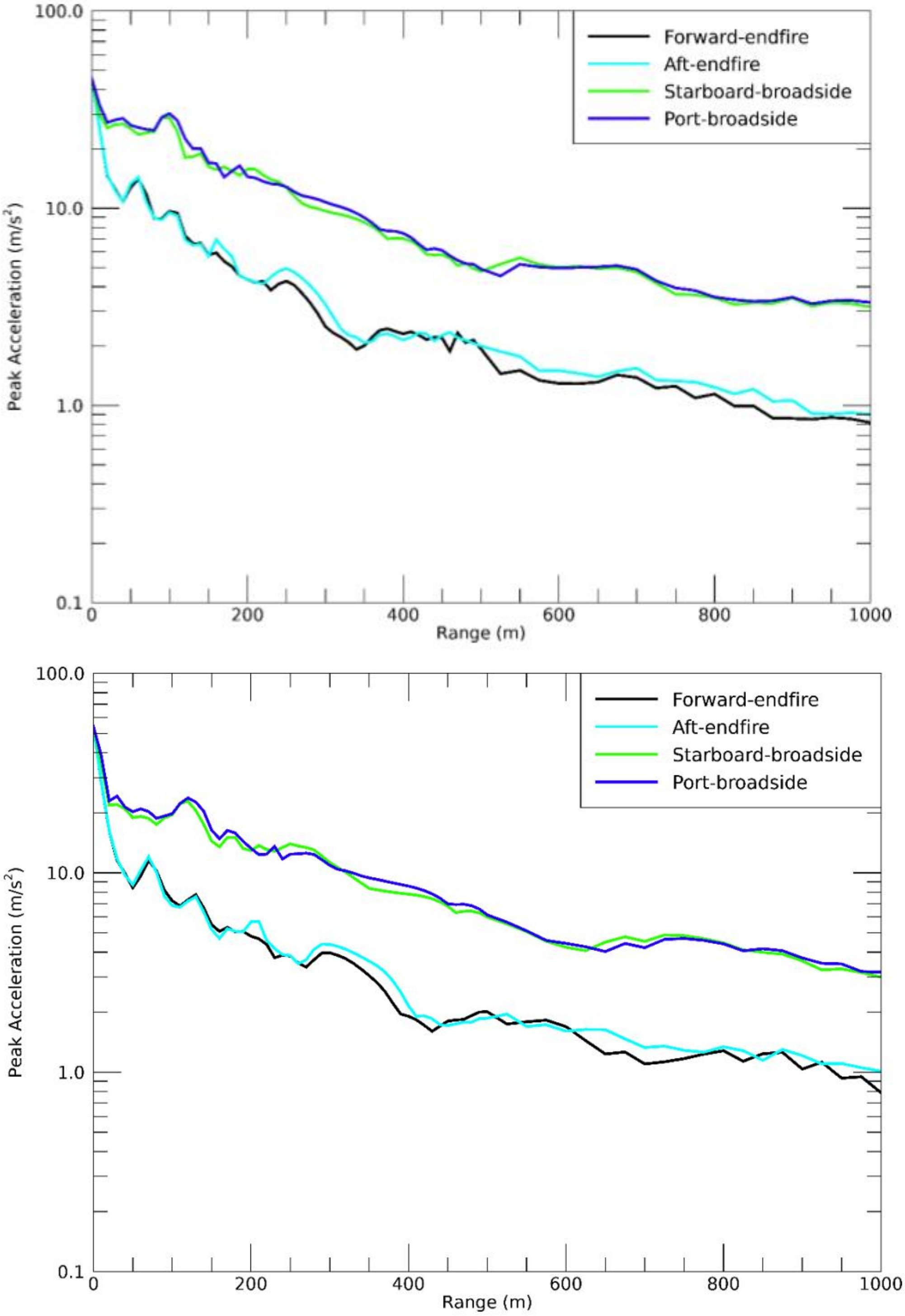


Figure 47 Peak Particle Acceleration at the Seafloor as a Function of Horizontal Range from the Centre of the Acoustic Source along four directions at 60 m (upper plot) and 75 m (lower plot) Water Depth

7.2.1.2.5 Multiple Source Sound Fields

Sound fields in terms of SEL accumulated over 24 hours of survey within the water column and at the seafloor were determined for the modelled scenarios. Frequency-weighted SEL_{24h} sound fields were used to estimate the maximum horizontal distances (R_{max}) to marine mammal and sea turtle PTS and TTS thresholds, and to estimate maximum distance and the area for mortality, injury, and TTS guidelines for fish.

The SEL_{24h} sound fields for water column and seafloor are presented as contour maps in Figures 43 to 50 of the report contained in **Appendix A** and an example of each is presented in **Figure 48**.

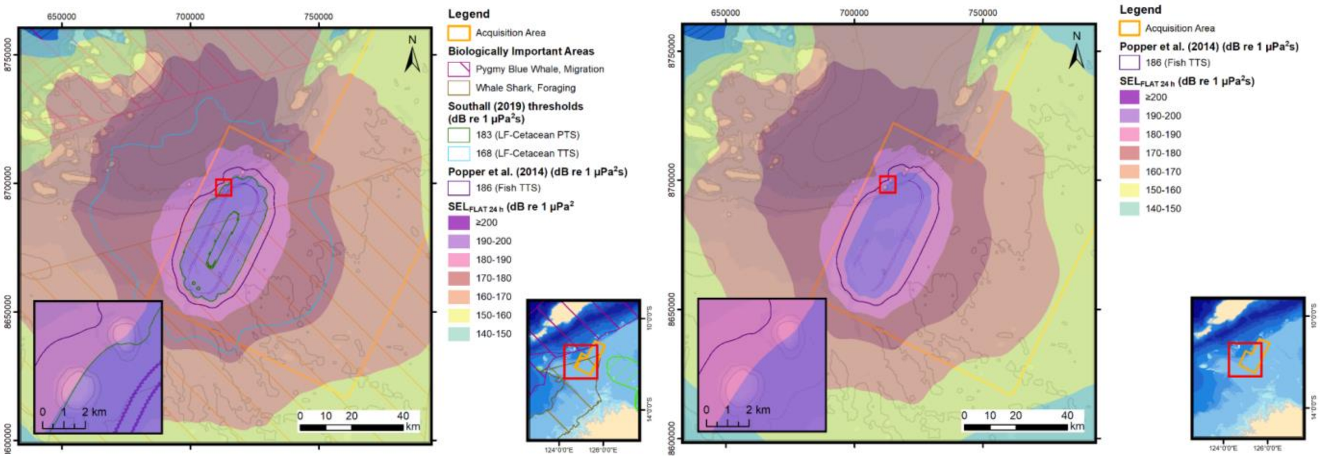


Figure 48 Example Sound Level Contour Map of Unweighted Maximum-over-depth Water Column SEL_{24h} Results (left) and Unweighted Seafloor SEL_{24h} (Both for Scenario 2)

7.2.1.2.6 Animal Movement and Exposure Modelling (Animat Modelling)

JASCO's Animal Simulation Model Including Noise Exposure (**JASMINE**) was used to predict the exposure of animats to sound arising from the seismic activity. JASMINE integrates the predicted sound field with biologically meaningful movement rules for each marine mammal species (pygmy blue whales in this case) that results in an exposure history for each animat in the model.

Animats are programmed to behave like the marine animals that may be present in an area. The parameters used for forecasting realistic behaviours (e.g., diving and foraging depth, swim speed, surface times) are determined and interpreted from marine mammal studies (e.g., tagging studies) where available, or reasonably extrapolated from related or comparable species – a depiction of animats movements in a moving sound field is shown in **Figure 49**, with the example animate (red) shown moving with each time step.

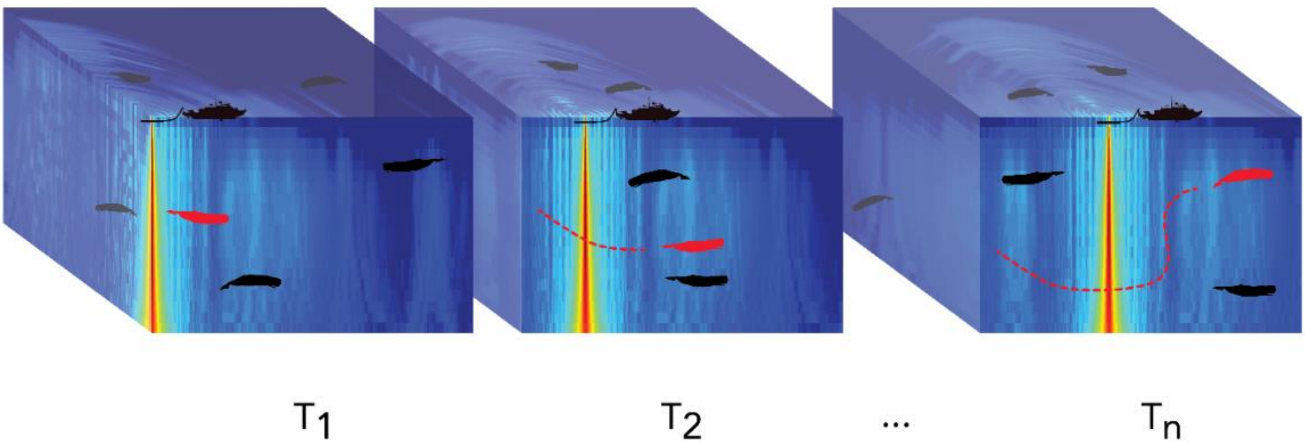


Figure 49 Depiction of Animats in a moving Sound Field

For cumulative metrics, an individual animats sound exposure levels are summed over a 24 h duration to determine its total received energy, and then compared to the relevant threshold criteria. For single-exposure metrics, the maximum exposure is evaluated against threshold criteria for each 24 h period.

The sound received by an animat at any given time depends on its location relative to the source. Because the true locations of the animats within the sound fields are unknown, realistic animal movements are simulated using repeated random sampling of various behavioural parameters. In this case the animat modelling involved simulations to predict the distance at which migrating pygmy blue whales (*Balaenoptera musculus brevicauda*) are expected to be exposed above threshold criteria for PTS, TTS, and behavioural response. Sound exposure distribution estimates were determined by moving large numbers of animats[19] through a modelled time-evolving sound field, computed using specialised sound source and sound propagation models. This approach provides the most realistic prediction of the maximum expected SPL and SEL_{24h} for comparison against the relevant thresholds.

A total of four acquisition scenarios were considered using both acoustic and animat modelling. A fifth scenario was included for animat modelling only, in this scenario the considered survey lines were further from the BIA, and it was considered with the aim of determining potential buffer zones around the BIA through the use of unrestricted animat seeding. All animat simulations were run in two configurations: one with animats restricted to the BIA, and another with unrestricted animat seeding.

[19] To generate statistically reliable probability density functions, model simulations were run with animat sampling densities of 4 animats/km^2.

7.2.2 Evaluation of Known and Potential Impacts and Risks to Environmental Receptors

Using the information presented in **Section 2** to **Section 5**, the impact and risk assessment has been undertaken for those receptors determined to be relevant to the activity as listed in **Table 52**.

Table 52 Environmental Receptors Assessed

Receptor	Section reference
Plankton	**Section 7.2.2.2.1**
Benthic Invertebrates	**Section 7.2.2.2.2, Section 7.2.2.3.1**
Fish	**Section 7.2.2.2.3, Section 7.2.2.3.2, Section 7.2.2.4.1**
Cephalopods	**Section 7.2.2.2.5, Section 7.2.2.3.4**
Marine Reptiles	**Section 7.2.2.2.6, Section 7.2.2.3.5**
Marine Mammals	**Section 7.2.2.2.7, Section 7.2.2.3.6, Section 7.2.2.4.2**
Elasmobranchs	**Section 7.2.2.2.4, Section 7.2.2.3.3**
Seabirds	**Section 7.2.2.2.8, Section 7.2.2.3.7**
Australian Marine Parks	**Section 7.2.2.5.1**
Biologically Important Areas	**Section 7.2.2.5.2**
Key Ecological Features	**Section 7.2.2.5.3**

7.2.2.1 Noise Effect Criteria

Noise exposure thresholds are indicative noise levels at which there is potential for certain effects (e.g. mortality, temporary hearing impairment, injury, behavioural changes) to occur to marine receptors. When noise exposure thresholds are published, the response of that particular receptor being exposed to that level of noise is generally defined for a single noise exposure or for cumulative exposure to successive events. For the purpose of this assessment, threshold criteria for different fauna have been selected to assist in determining and assessing potential physical, physiological, behavioural and, ultimately, ecological impacts. The threshold criteria are based on current relevant scientific literature, accepted industry and international standards and are considered to be appropriate for this assessment process.

Generally speaking, a high intensity external stimulus such as an acoustic disturbance will elicit a behavioural response in animals; typically, avoidance or a change in behaviour. The duration and intensity of an animal's observed response is impacted by the nature (continuous or pulsed), source (visual, chemical or auditory) and the intensity of the stimulus, as well as the individual's species, gender, reproductive status, health and age.

Behavioural responses are instinctive survival mechanisms that serve to protect animals from injury. Consequently, animals may suffer temporary or permanent physiological effects in cases when the acoustic disturbance is too high, or the animal is unable to elicit a sufficient behavioural response (e.g. swim away fast enough).

Depending on the exposure level and sensitivity threshold of each species, the effects of acoustic disturbance can include:

- Physiological effects – changes in hearing thresholds – TTS or PTS damage to sensory organs or traumatic injury; (**Section 7.2.2.2**);

- Behavioural effects (and related impacts) – displacement/avoidance, disruption of feeding, breeding or nursery activities etc. (**Section 7.2.2.3**);
- Perceptual effects (auditory masking) – interference with communication (**Section 7.2.2.4**) and detection of predators/prey; and
- Indirect effects – behavioural changes in prey species that affects other species higher up in the food chain and could lead to ecosystem level effects (discussed throughout **Section 7.2.2** as relevant, in particular see **Section 7.2.2.3.1**, **7.2.2.3.2, 7.2.2.3.6** and **7.2.2.3.7**).

The following subsections go through each of the different marine receptors that are likely to be present in the OA and a risk assessment is undertaken for those species expected to be exposed to the acoustic disturbance arising from the Seismic Survey. Threshold criteria for behavioural disturbance, TTS, PTS and other injuries are discussed in the following subsections and then summarised in **Table 65**, alongside the maximum distance from the acoustic source at which these thresholds were reported to occur.

7.2.2.2 Potential Physiological Impacts

Underwater noise, such as that produced during an MSS, has the ability to cause lethal and non-lethal physiological trauma or injury in marine organisms (Gordon *et al*., 2003).

Of particular concern with regard MSSs and marine organisms is the potential for auditory damage from the acoustic release. Tissue damage to sensory organs from MSS acoustic releases have been experimentally studied in captive/captured fish, cephalopods and invertebrates, while shifts in hearing thresholds have been experimentally observed in some small pinnipeds and small cetaceans and hypothesised based on observed effects in terrestrial animals. To date there is no direct evidence of damage to the ears of marine mammals from MSS acoustic releases (Gordon *et al*., 2003).

The following provides a discussion on the potential physiological effects of MSSs on marine organisms.

7.2.2.2.1 Plankton

The term 'plankton' describes the drifting organisms that inhabit aquatic environments and includes phytoplankton (plants) and zooplankton (animals), as well as fish and invertebrate eggs and larvae, called ichthyoplankton. There is currently no published information regarding the potential for noise-induced effects on phytoplankton and no functional cause-effect relationship has been established; therefore, impacts from acoustic disturbance on phytoplankton is not considered further.

In comparison to fish and mammals, less research has been conducted on the effects of seismic outputs on zooplankton. This is because zooplankton do not have hearing structures although they can detect changes in pressure (Richardson *et al.,* 2017). Zooplankton are generally the same density as the surrounding water column and as such, it is assumed that pressure changes associated with seismic activity will not cause physical damage (Parry & Gason, 2006).

Most studies have shown that exposure to emitted sound levels from a seismic survey has no significant adverse effects on the abundance or mortality of zooplankton, such as:

- CarbonNet (2018) assessed zooplankton communities in Australia's Gippsland Basin before and after a seismic survey. Ten sites were sampled during the pre-survey period, consisting of six sites occurring within the survey area and four reference sites. During the post-survey period, three sites were sampled near the survey line, as well as three reference sites. Post-survey sampling occurred within three days of acquiring the last survey line. Copepods, cladocerans and salps dominated the pre-survey samples, whereas the dinoflagellate *Noctiluca scintillans* dominated the post-survey samples. There was a high level of variance among samples and no lobster or scallop larvae occurred in any of the samples. Mortality rates were high in both pre- and post-survey samples and the high proportion of dead cladocerans was contributed to their delicate structure being destroyed by the sampling process rather than attributable to any MSS impacts; and
- Sætre & Ona (1996) examined the mortality rates for fish larvae and fry (taken from Booman *et al*., 1996) for five fish species (cod, saithe, herring, turbot and plaice) to investigate the consequences that seismic-induced mortality may have at the population level. Under a 'worst-case' scenario, the number of larvae killed during a typical seismic survey (>10 days) was 0.45% of the total larvae population. However, when compared with the high natural mortality rates for each species (e.g. cod and herring eggs/larvae have a natural daily mortality of 5 to 15%) the impacts of seismic surveys on these zooplankton at a population level were considered to be negligible.

In studies where seismic impacts have been observed, they are generally limited and localised to within a range of approximately 10 m from an operating seismic array (Richardson *et al*., 2017), with lost individuals quickly being replaced due to rapid generational turnover rates. For example, Kostyuchenko (1973), Booman *et al*., (1996), and Payne *et al.,* (2009) have reported physiological/pathological effects occurring in zooplankton exposed to an acoustic source up to 5 m away, and mortality occurring when exposed to an acoustic source up to 3 m away. Using a 10 m impact range, McCauley (1994) calculated that plankton mortality would be <1% of plankton in the surveyed area assuming total plankton mortality within this range.

In a recent study, Day *et al.* (2021) examined the potential impacts of seismic surveys on the larval stages of southern rock lobster to determine whether early development and recruitment of this species might be affected. This study assessed three aspects, the mortality rates following exposure, impairment of the righting reflex, and the development of exposed lobsters through assessment of progression through the moult cycle. The key results from this study on these three aspects are as follows:

- Exposure did not result in any elevated mortality for puerulus or juveniles;
- Righting was significantly impaired for all exposure treatments immediately after exposure compared to their respective controls which indicated that the impact range extended to at least 500 m from the source, which was the maximum range tested in the study; and
- The results provided evidence of a range threshold for recovery, where juvenile lobsters at a nominal distance of 500 m from the source recovered from impairment after the first moult. Increased intermoult duration suggested impacted development and potentially slowed growth, through the proximate cause was not identified.

In contrast to the studies outlined above, McCauley *et al*. (2017) found that after exposure to a single 150 in^3 acoustic source there was a statistically significant lower abundance of zooplankton, with a median 64% decrease one hour after exposure. McCauley *et al*. (2017) observed impacts out to the maximum 1.2 km range sampled, which was more than two orders of magnitude greater than the previously assumed impact range of 10 m. However, this study was compromised by methodological design (small samples sizes, large daily variability in the baseline and experimental data) and the statistical robustness of the data and conclusions (large number of speculative conclusions that appear inconsistent with the data collected over a two-day period).

Richardson *et al*. (2017), through the Commonwealth Scientific and Industrial Research Organisation (**CSIRO**) simulated the large-scale impact of a seismic survey on zooplankton in the Northwest Shelf region of WA, based on the mortality rate associated with seismic noise exposure reported by McCauley *et al.* (2017). The mortality rate associated with seismic exposure reported by McCauley *et al*. (2017) was applied alongside other natural/typical variable values. The survey area was 80 km by 36 km in water 300 – 800 m deep and the survey was conducted over 35 days. Overall, the results showed that zooplankton populations were substantially impacted within the seismic survey area out to a distance of 15 km. Impacts were barely discernible within 150 km of the survey area and there was no apparent effect at a regional scale. The simulation showed that, following exposure, there was a rapid recovery of zooplankton populations due to their fast growth rates and the dispersal and mixing of individuals from inside and outside of the impacted region (Richardson *et al.*, 2017). The assessment of these results by the IAGC (2017) review was that even if the full effect claimed by McCauley *et al*. (2017) did in fact exist, zooplankton abundance would not be adversely affected due to the extensive movements of water masses carrying zooplankton through survey areas and the rapid reproductive cycle and high reproductive potential characteristics of planktonic organisms. The IAGC (2017) review concluded that the purported findings of McCauley *et al*. (2017) were of no ecological consequence, given the life history parameters of zooplankton.

In addition to Richardson *et al*. (2017), Fields *et al.* (2019) exposed captive zooplankton (copepods) at a variety of distances from a seismic sound source in order to determine the effect of seismic blasts on *Calanus spp.*, which is a key food source for commercially important fish. The results of this study found that immediate mortality of copepods was significantly different from controls at distances of 5 m of less from the airguns, and mortality one week after the airgun blast was significantly higher (9% relative to controls) in the copepods placed 10 m from the airgun blast, but not significant different for those 20 m from the airgun blast. The increase in mortality (relative to controls) did not exceed 30% at any distance. Fields *et al.* (2019) concluded that these results suggest that seismic blasts have limited effects on the mortality of escape response of *Calanus sp*. within 10 m of the blast and no measurable impact at greater distances. Fields *et al.* (2019) also commented on the results of McCauley *et al*. (2017), stating that it is difficult to reconcile the high mortality reported by McCauley *et al*. (2017) with the low mortalities reported in the body of earlier research and the results in the experiment that Fields *et al.* (2019) undertook.

7.2.2.2.1.1 Plankton UAM

As outlined in **Section 7.2.2.2.1**, there are only a few studies in which threshold criteria for plankton can be based on. Popper *et al.* (2014) cites many of the references and studies on potential impacts of noise emissions on fish eggs and larvae prior to 2014, and results in Day *et al.* (2016) for embryonic lobsters and Fields *et al*. (2019) for copepods align with those presented in Popper *et al.* (2014). These studies conclude that mortality and sub-lethal injury are limited to within tens of metres of acoustic sources. It is also worth noting that the criteria defined by Popper *et al.* (2014) have been extrapolated from simulated pile driving signals which have a more rapid rise time, and greater potential for trauma than pulses from an acoustic source. The results of McCauley *et al*. (2017) indicate the potential for effects at a longer range, and at levels of 178 dB PK-PK; however, as outlined above, Fields *et al.* (2019) noted that it was difficult to reconcile the high mortality reported by McCauley *et al*. (2017) with the low mortalities reported in the greater previous body of earlier research and their own experiment.

Based on the above, the threshold values from Popper *et al.* (2014) have been utilised as part of the UAM report (**Appendix A**), with the results contained within **Table 53**.

Table 53 Noise Exposure Criteria and Zones of Impact for Mortality and Potential Injury for Zooplankton, Fish Eggs and Larvae

Zooplankton, Fish Eggs & Larvae	Mortality and potential injury threshold levels	Maximum threshold distance (m)
Based on Popper *et al.*, (2014) for fish eggs and larvae	PK: >207 dB re 1 µPa	200
	SEL_{24hr}: >210 dB re 1 µPa^2.s	80

7.2.2.2.1.2 Duration and Extent of Zooplankton Exposure

Natural mortality estimates for zooplankton are generally high and variable. Tang *et al*. (2014) reviewed available research and reported zooplankton daily mortality rates of 11.6% (average minimum) to 59.8% (average maximum) but in some instances these authors found that 100% of samples died within a day. Predation accounted for some of this mortality; however, non-predatory factors (e.g. inadequate food resources, physical exposure or poor water quality and diseases/parasites) have been estimated to account for approximately 25% - 33% of the total mortality among marine copepods (Fuiman and Werner, 2002; Tang *et al*., 2014; Dubovskaya *et al*., 2015). In other studies, Houde and Zastrow (1993) estimated the mean mortality rate for fish larvae to be 21.3% per day, and Saetre and Ona (1996) estimated zooplankton mortality to be 5-15% per day.

Compared to the high (5-59.8%) natural mortality rates reported by the above studies, seismic-related reductions in zooplankton abundance associated with the Seismic Survey are likely to be very low and cumulative effects of natural mortality and seismic-related mortality are likely to be within the range of natural mortality rates observed in other studies. This assessment is consistent with Richardson *et al*. (2017) who reported seismic impacts on zooplankton will only be discernible locally and are expected to be insignificant at a regional scale relative to the natural spatial and temporal variability in plankton abundance, and the very high rates of natural mortality.

In addition to the inconsequential seismic mortality rates in comparison to natural mortality rates, it is also important to consider the following points when assessing the predicted impact of the Seismic Survey on zooplankton:

- The simulation by Richardson *et al*. (2017) showed that, following exposure, there was a rapid recovery (on the scale of days) of zooplankton populations due to their fast growth rates and the dispersal and mixing of individuals from inside and outside of the impacted region. The high energy nature of the offshore marine environment in the OA will help promote rapid recovery of zooplankton populations on account of dispersal, mixing and replenishment by currents from non-impacted areas. Due to the short time required for zooplankton populations to replenish following any reductions in biomass that may occur due to the Seismic Survey, any effects will be temporary and short-lived and are not expected to have any ecological consequences on zooplankton populations;
- Due to the magnitude of such localised impacts is negligible (based on **Table 53**), it is not expected that these impacts will be discernible at a regional scale, especially when considering the variability and scale of plankton and spawning biomass in the wider region; and
- Zooplankton occurring within the OA will not be evenly distributed. They will move in accordance with the currents and are likely to exhibit considerable spatial patchiness zooplankton less likely to be impacted multiple times by a seismic gun.

Overall, there is the potential for localised temporary impacts to zooplankton as a result of the Seismic Survey; however, population recovery is expected within days after the Seismic Survey has ceased and no lasting ecosystem population impacts are expected based on the findings detailed above. As such, based on the scientific literature provided above, the Seismic Survey will not have any temporal or spatial impacts that are serious or irreversible on any areas that are known to have high productivity within the OA at certain times of the year and any impacts to local zooplankton populations as a result of the emitted sound levels from the Seismic Survey will be localised, temporary and recoverable in the short-term.

7.2.2.2.1.3 Ecological Impacts of Plankton Exposure

Zooplankton are an important food source to many fish species and cetaceans in the ocean, and any significant reductions in zooplankton biomass has the potential to affect the wider food chain due to cascading effects. This is particularly important to consider in sensitive areas like those associated with the carbonate bank and terrace system of the Sahul Shelf KEF and BIAs, which partially overlap with the OA (**Section 4.4.3**).

Ecological effects of reduced zooplankton biomass may include changes in the distribution of species which rely on zooplankton as a food source, such as pelagic fish, seabirds and some marine mammals, where they temporarily have to relocate to another foraging ground to find the food they require for survival.

For example, distributional changes in zooplankton (particularly krill) flow could have effects to whale sharks which are known to forage within the OA and for which there is a corresponding BIA. Catch rates of commercially fished species could also conceivably change in response to flow-on effects associated with changes in the abundance or distribution of zooplankton prey.

Based on the extensive literature reviews, the weight of the scientific literature supports that any potential flow-on effects to marine food webs through impacts on zooplankton are expected to be spatially restricted. For the Seismic Survey, the UAM (**Table 53**; **Appendix A**) predicts the zone of impact for zooplankton to be 200 m for fish eggs and larvae (based on Popper *et al*., (2014)). Baseline conditions are expected to resume relatively quickly after survey completion (see Richardson *et al*., 2017) due to replenishment of zooplankton back into the area.

There are unlikely to have any wider ecosystem-related impacts as a result of cumulative natural and seismic-related mortality effects. Even after they die, zooplankton remain available as a food source for higher organisms as their carcasses remain in the water column for several days. If they are not consumed, they then fall to the seafloor and where they are available as a food source for benthic organisms (Kirillin *et al*. 2012; Tang *et al*. 2014).

Overall, the residual risk to zooplankton physiology on a population level arising from acoustic disturbance during the Seismic Survey has been assessed as **Negligible** (*Negligible* x *Likely*).

7.2.2.2.2 Benthic Invertebrates

Research into the relationship between sound and its effect on benthic invertebrates is ongoing, including the relevant metrics for both effect and impact. Available literature suggests marine benthic invertebrates are most sensitive to the vibrational component of sound, owing to a lack of anatomical structures involved in detecting the pressure component of sound. Like elasmobranchs, marine invertebrates lack a gas-filled bladder and are thus unable to 'hear' the pressure changes associated with sound waves. Instead, marine invertebrates detect sound by sensing the particle motion component of sound in water and within seabed sediments through physiological structures such as statocysts, sensory hairs and muscles (Carroll *et al*., 2017). Though, most research on seismic impacts to invertebrates characterises received sound levels in terms of sound pressure, available literature suggests particle motion, rather than sound pressure, is a more important factor for benthic invertebrates such as crustaceans and molluscs. McCauley (1994) reported that for many benthic species, these receptors will perceive seismic acoustic outputs, but this will only occur within a few metres from the sound source.

Marine invertebrates can be free-living or sessile, are often localised to particular benthic microhabitats, and generally have lower mobility than pelagic species. Hence, they generally have a reduced ability to avoid acoustic emissions, and any potential associated impacts, by moving away. Studies investigating the physical and physiological impacts of seismic noise on marine invertebrates are relatively limited (Carroll *et al*., 2017). Where such studies exist, the acoustic signature and exposure scenarios applied are often not comparable to those of a typical (i.e. commercial) seismic survey. The findings of such studies are also highly variable and, in some cases, disparate. For example, exposure to noise has resulted in a few reports of immediate (Lagardère, 1982; McCauley *et al*., 2017a; Fields *et al.,* 2019) or delayed mortality (Day *et al*., 2017). In addition to mortality effects, a range of physiological impacts have also been observed including damage to sensory systems (Day *et al*., 2019; Day *et al*., 2022), disruption to immune system function (Fitzgibbon *et al*., 2017), stress biochemistry (Payne *et al.*, 2008; Day *et al*., 2022) and changes to metabolic rate. Conversely, a number of studies have reported no significant effects (Przelawki *et al*., 2018; Day *et al.*, 2016). In summary, the available literature does not clearly define an appropriate metric or identify relevant levels (pressure or particle motion) for assessment. Despite this, current industry practices for investigation and determining impacts and risk associated with acoustic emissions for marine invertebrates have been determined based on pressure levels presented in the literature for three taxonomic groups including crustaceans, bivalves and sponges and corals.

Of particular relevance to the Seismic Survey are impacts to decapods (crabs and shrimp), octocorals and sponges which inhabit the soft sediment and hard substrate, respectively, that comprise the OA (see **Section 4.5.2**). Whilst polychaete worms were identified as the most predominant invertebrate taxa within soft sediment habitats comprising license area AC/RL7 (ERM, 2012; O2 Marine, 2018), located in the western portion of the OA, the effects of seismic exposures on these organisms have not been studied. Hence, the precautionary principle applies, and it's assumed that polychaetes could experience worst-case effects analogous to those reported for other benthic invertebrate taxa.

Crustaceans

Crustaceans are the most studied marine invertebrate group with respect to impacts associated with low-frequency acoustic disturbance, such as that generated by seismic airguns (Carroll *et al.,* 2017),owing in-part to their economic value. Hence, studies are largely constrained to investigations of physical, behavioural and physiological effects and their implication upon catch rates of commercially important decapod crustaceans (lobsters, prawns, crabs) (Edmonds *et al*., 2016). Experiments on lobsters indicate that the main vibration receptors are in the statocyst and the walking legs (Day *et al.,* 2019; Aicher *et al*., 1983). The statocyst controls the righting reflex in lobsters, the coordination of which plays a vital role in predator evasion.

The reported impacts of seismic exposure on crustaceans are highly variable, though none have found any evidence of increased mortality of adults or life history stages and no direct impacts to the survivorship of exposed larvae have been reported (Carroll *et al.,* 2017; Day et al., 2016; Day et al., 2022). Likewise, studies investigating the influence of seismic exposure on commercially important species (e.g., snow crab and southern red lobster) do not appear to support the anecdotal contention that MSSs negatively affect catch rates in the short or long term (Morris *et al*., 2018; Parry and Gason, 2006).

As described in **Section 7.2.2.2.2**, current literature does not clearly define an appropriate metric or identify relevant effects levels for noise assessments. Adopted industry practice effects levels for crustaceans associated with no effects and sub-lethal effects attributable to seismic emissions have been derived based on exposure of a limited number of species to a range of seismic signals of variable representativeness when compared to a commercial seismic survey. A summary of relevant studies and findings upon which the adopted industry practice effects levels have been derived are provided below.

Payne *et al*. (2008) conducted a pilot study on the effects of seismic sound exposure on various health indicators on American lobster. Adult lobsters were exposed to an acoustic source for 20 or 200 pulses at an average pressure of 202 dB re 1 µPa PK-PK or 50 pulses to 227 dB re 1 µPa PK-PK. Studies subjects were located 2 m from the acoustic source. The study investigated potential changes to survival, food consumption, turnover rate and serum biochemistry. No immediate or delayed mortality was observed, nor damage to mechano-sensory systems and the ability of lobsters to right themselves when turned over. However, there was evidence of a decrease in serum enzymes and increases in food consumption in the weeks to months post exposure, interpreted to indicate potential stress effects or osmo-regulatory disturbance. On this basis, a PK-PK sound level of 202 dB re 1 µPa is broadly considered to be associated with no effect and therefore applied in the assessment.

To further understand the interactions between MSS and marine invertebrates, Day *et al*. (2016) investigated the effects of low frequency acoustic signals on adult rock lobsters, including egg carrying females. The study involved exposure of southern rock lobster to (up to four) passes of an active acoustic source, whilst placed in field sites consisting of comparable seabed morphology to the natural habitat of the subject species[20]. The study found that adult southern rock lobsters (*Jasus Edwardsii*) which were exposed to seismic sound levels up to a maximum of 212 dB re 1 µPa PK-PK did not show an increase in mortality and no lethal effects to embryos were observed. Evidence of sub-lethal effects in adult, exposed, lobsters included impairment of reflexes involved with tail control and righting, damage to the sensory hairs of the statocysts (balance organ), a reduction in the number of haemocytes (indicative of reduced immune response function). Though the study reported some improvement to condition and righting reflexes across the monitoring period (120 days post-exposure), the effects to the statocysts appeared somewhat persistent being observable at 365 days post-exposure and post-moult. There was no reported difference in fecundity between the control and exposed lobsters. Likewise, hatched larvae were found to be unaffected. There was no reported difference in the number and condition of hatched larvae between the control and exposed lobsters, suggesting that exposure during early embryonic stage did not impair embryo development.

[20] Of note, is that field sites were very shallow (10 to 12 m) and are not considered representative of a typical environment in which MSS would be undertaken.

The ecological significance of sub-lethal effects from seismic exposure are of equal interest. Uniquely, Day *et al*. (2016) found that control subjects collected from Crayfish Point Reserve, a site which experiences substantial levels of anthropogenic noise, showed a level of statocyst damage equivalent to that of seismic exposed treatments, including 'noise-naïve' subjects. Further, exposure to air gun treatments did not result in additional statocyst damage in the exposed treatment relative to the controls and there were no significant differences in righting time in these lobsters. The author concluded that the damage observed was pre-existing and not exacerbated by seismic exposure as a result of the experiment. Coupled with subsequent comparisons of the soundscape at each site, Day *et al*. (2022) contends that lobsters at Crayfish Point Reserve demonstrated an ability to cope with or adapt to mechanosensory damage arising from noise exposure. Long-term monitoring of lobsters at Crayfish Point Reserve suggests the population has reached carrying capacity (Kordjazi *et al.,* 2015), indicating the observed mechanosensory damage has not resulted in negative ecological impacts. Instead, the population is perceived to be thriving. Therefore, any effects to individual condition or survivability from mechanosensory damage are not significant and ecological implications are likely to be negligible. Day *et al*. (2019) further examined the impacts of seismic surveys on the physiology of southern rock lobster species. Exposure experiments were carried out at the seabed, in a field setting selected to emulate the natural habitat (seabed type and water depth) of the study species. The study found that adult southern rock lobsters (*Jasus Edwardsii*) which were exposed to seismic sound levels up to a maximum of 209 -212 dB re 1 µPa PK-PK did not show an increase in mortality, even at close proximities to the sound source. However, there was evidence of sub-lethal effects occurring following seismic sound exposure; specifically, impairment of reflexes involved with tail control and righting, damage to the sensory hairs of the statocysts, and a reduction in numbers of haemocytes. Reflex impairment and statocyst damage persisted up to 365 days post-exposure and did not improve following moulting. Ecological impacts were not evaluated as part of the study.

Life-history stage is a critical factor for considering individual impacts and potential ecological implications upon broadcast spawning marine invertebrates which rely on the production of many offspring to maintain recruitment of adult populations. Accordingly, Day *et al.* (2022) examined whether early life-history stage invertebrates may be vulnerable to aquatic noise, specifically examining how post-larval southern rock lobster were impacted by exposure to a commercial seismic survey. The sensitivity of juveniles and puerulus to an acoustic source up to a maximum of 219 dB re 1 µPa PK-PK was tested at close range (0 m) and 203 dB re 1 µPa PK-PK at a distance of 500 m from the sail line. To evaluate impact, lobster mortality rates, righting reflex and progression through moult cycle were assessed following exposure. Exposure did not result in mortality in either developmental stage, however, as has previously been reported in adults, acoustic source signals caused righting impairment to at least 500 m in lobsters sampled immediately following exposure. Impairment incurred due to close range exposure appeared to be persistent, whereas juveniles exposed at a more distance range showed recovery. Juveniles exposed at close range also showed potential for slowed development, growth and physiological stress as evidenced by the reported increase in intermoult duration for these subjects.

Though marine invertebrates are most sensitive to the vibrational component of sound, rather than sound pressure, it is not clear what level of particle motion relates to an adverse effect. Therefore, where available, sound level thresholds have been used to inform acoustic modelling (Connell *et al*., 2022). Whilst no published threshold criteria currently exist to enable an evaluation of potential mortality or lethal injury effects on crustaceans, a PK-PK sound level of 202 dB re 1 µPa (per pulse) from (Payne *et al*., 2008) is considered to be associated with no effect and therefore adopted for the purpose of the assessment (Connell *et al*., 2022). Results were also compared against PK-PK sound levels ranging from 209 -213 dB re 1 µPa PK-PK determined by Day *et al.*(2016) and Day *et al*. (2019) to result in potential sub-lethal effects (see **Appendix A**).

In a recently published study, Day *et al*. (2023) exposed wild-catch rock lobster puerulus and post-settlement juveniles to acoustic emissions from three 2,820 in^3 acoustic sources. Day *et al.* (2023) report that previous studies have been criticised over how accurately the exposure emulates 'real-world conditions', therefore the present study was conducted in conjunction with a full-scale acoustic array employed during a commercial seismic survey. Study specimens were assigned to one of three treatments; control (not exposed to acoustic signals), E0 (exposed to acoustic signals at a nominal range of 0 m from the vessel sail line), or E500 (exposed to acoustic signals at a nominal range of 500 m from the vessel sail line). The maximum exposures experienced at the E0 site in Day *et al*. (2016b) , although the cumulative exposures in Day *et al.* (2023) were greater due to shorter spaces operation of the acoustic source in time and space. Specimens were held in water depths of 51 m for control treatments and 58 m water depth for E0 and E500 treatments. Key findings of Day *et al*. (2023) are as follows:

- Exposure did not result in any elevated mortality in either puerulus or juvenile rock lobsters;
- Immediately after exposure, righting was significantly impaired for E0 and E500 treatments in juveniles (5 – 8 seconds), and E0 treatments (approximately 2.5 seconds) compared to their respective controls, indicating an impact range of at least 500 m from the acoustic source (the maximum range tested by Day *et al*., 2023). Impairment was correlated with damage to the sensory hairs of the statocyst;
- There was no significant difference in righting between juvenile control and E0 treatments following the first moult; however, when puerulus and juvenile results were pooled, the righting reflex of the combined E0 treatment was significantly impaired compared to controls. The impairment in righting compared to controls remained in juvenile E0 lobsters following the second moult;
- In the juvenile E500 treatment, righting was similar to that of controls following the first moult, indicating that the lobsters had recovered from prior impairment. This result remained following the second moult, further supporting recovery in this treatment.

Day *et al*. (2023) stated that the results found from the combined puerulus and juvenile treatments indicated that puerulus and juvenile E0 treatments did not show capacity for recovery, however, E500 lobsters recovered from impairment after the first moult, with 500 m suggested as a possible range beyond which permanent impact is unlikely. Intermoult period was significantly increased in E0 juvenile lobsters, and juvenile E500 lobsters showed a moderate, non-significant increase in moult duration. The authors suggest that an increased intermoult duration may impact development and potentially slow growth (Day *et al*., 2023). Day *et al*. (2023) further state that impairment at close range (i.e. combined E0 puerulus and juveniles) is persistent, although exposure at a more distant range may not cause lasting impairment to righting.

Bivalves

As is the case for crustaceans, studies undertaken on bivalves are largely constrained to commercially important taxa such as scallops and oysters. Recent Australian studies have focussed on Southern Scallops, *Pecten fumatus*, and found no evidence of immediate mortality or change in condition following exposure to seismic disturbance. However, sub-lethal effects to scallops were observed, including a compromised capacity for homeostasis and potential immunodeficiency over acute (hours to days) and chronic (months) timescales following exposure (Day *et al*., 2016; 2017).

Day *et al*. (2016; 2017) concluded that repeated exposure to seismic disturbance resulted in physiological damage, changes in behaviour and reflexes and increased risk of mortality, though not beyond naturally occurring rates of mortality. Injured scallops did not recover over the four-month period of the experiment. The authors reported that, compared with unexposed scallops, the daily mortality odds were found to be 0.1%, 1.2%, and 1.3% higher in scallops exposed to 1, 2 and 4 acoustic passes, respectively. Though the size of the air gun appeared to have no effect (Day *et al*., 2017). Uniquely, Day *et al*. (2017) measured the response of *Pecten fumatus* to ground roll acceleration associated with different experimental regimes as a proxy for particle acceleration. As particle motion is the more relevant metric to invertebrate sensory systems, the study provides novel insight into bivalve response to seismic disturbance.

In contrast, a study conducted by Przeslawski *et al*. (2018) found no evidence of increased scallop mortality, or effects on scallop shell size, adductor muscle diameter, gonad size, or gonad stage attributable to exposure to seismic disturbance. However, this study did not examine any long-term sub-lethal effects.

No published threshold criteria currently exist to enable an evaluation of potential mortality or lethal injury effects on bivalves. Likewise, the literature does not present a sound level associated with no impact. Consequently, the maximum measured particle acceleration reported within Day *et al*. (2017) of 37.57 ms^{-2} has been adopted to represent the level of acoustic disturbance known to elicit reduction in physiological condition for the purpose of this assessment.

Sponges and Corals

There is limited published literature on the potential impacts of seismic noise on hard and soft corals and sponges. Unlike other faunal groups, currently there is no peer-reviewed criteria against which potential noise impacts to corals and sponges can be assessed.

Heyward *et al*. (2018) monitored the condition of Scleractinia corals at South Scott Reef, within the NWMR, before and after a 3D seismic survey. There were no observable impacts to coral mortality, skeletal damage or visible signs of stress immediately after and up to four months following the acoustic disturbance event. Similarly, there was no evidence of a behavioural response, such as polyp withdraw or flaccidity in the soft corals assessed. The survey involved a maximum peak sound level of 226 dB (i.e., 226 dB re 1 µPa PK) at the coral monitoring sites.

In lieu of published threshold criteria, a PK sound level of 226 dB re 1 µPa (per pulse) is adopted for the purpose of the assessment (Connell *et al*., 2022). Importantly, this is not a threshold above which impacts are expected to occur, but a level at which no short term or long-term effects were observed.

7.2.2.2.2.1 Benthic Invertebrate UAM

As outlined in **Section 7.2.2.2.2**, there are few studies upon which threshold criteria for benthic invertebrates can be suitably developed. Based on the above, the threshold values used to inform the UAM report (**Appendix A**) and corresponding threshold distances are described in **Table 54**.

Table 54 Noise Exposure Criteria and Zones of Impact for Mortality and Potential Injury for Crustaceans, Bivalves and No Effect Threshold for Corals/Sponges

Benthic Invertebrates	Potential sub-lethal effects threshold levels	Maximum threshold distance (m)
Based on Day *et al*. (2019) and Day *et al*. (2016) for crustaceans	PK-PK: >209 dB re 1 µPa	421
Based on Day *et al.* (2017) for bivalves	37.75 ms^{-2}	10.5
	No effect threshold level	Maximum threshold distance (m)
Based on Payne *et al*. (2008) for crustaceans	PK-PK: >202 dB re 1 µPa	778
Based on Heyward *et al.* (2018) for corals and sponges	PK: >226 dB re 1 µPa	11

The results of the UAM indicate that:

- The adopted criteria of 209 dB re 1 µPa PK-PK for crustaceans, which is representative of possible sub-lethal effects, was not detected at horizontal distances greater than 281 (at 200 m depth) and 421 m (at 60 m depth) for the 3,000 in^3 source;
- The adopted criteria of 202 dB re 1 µPa PK-PK for crustaceans, which is a minimum level that is representative of no effects, was not detected at horizontal distances greater than 307 (at 75 m depth) and 778 m (at 60 m depth) for the 3,000 in^3 source;
- The adopted criteria of 37.57 ms^{-2} for bivalves was not detected at horizontal distances greater than 6 and 10.5 m from the acoustic source for the modelled scenarios comprising a seafloor depth of 60 m and 75 m, respectively. It was not reached at horizontal distances at any of the deeper modelled depths (i.e., 100, 125, 150, and 200 m); and
- The adopted criteria of 226 dB re 1 µPa PK for sponges and coral was not detected at horizontal distances greater than 11 m from the acoustic source in waters of 40 m and was not detected at any horizontal distance from the acoustic source at any of the deeper modelled depths (50, 60, 75, 100, 125, 150, and 200 m).

7.2.2.2.2.2 Sub-lethal effects and potential effects

The distribution and composition of benthic invertebrate communities depends on many environmental and biological process, including light availability, substrate type, and prey availability (Abdul Wahab *et al*., 2019; Lesser *et al*., 2009; Kahng *et al.*, 2014). As described in **Section 4.5.2**, the OA comprises sparsely distributed epibenthic fauna, predominantly polychaetes, crab and shrimp, which are commonly found in soft-sediment habitat throughout the broader NWMR. Localised communities of sessile benthic invertebrates, consisting of hard and soft corals, sponges, whips fans, and bryozoans, occur in association with complex geomorphic features such as banks and shoals of the Sahul Shelf KEF (Brewer *et al*., 2007). Banks which rise to within 45 m water depth are reported to support more biodiversity and are recognised as biodiversity hotspot for sponges (NERP MBH, 2014). As described **Section 4.4.3**, the area of overlap between the Carbonate bank and terrace system of the Sahul Shelf KEF and the OA is approximately 9,900 km², which represents roughly 24% of the designated area of the KEF, though the sail lines comprising the AA cover only a small portion of this area of overlap.

Based on the UAM, the effects on benthic invertebrates that dominate the OA are likely to include sub-lethal effects to crustaceans to a maximum threshold distance of 778 m from the acoustic source. Reported sub-lethal effects have included anatomical damage to sensory setae, impairment of reflexes, changes to haematology and serum biochemistry, immune competency and metabolic rate (Payne *et al*., 2008; Day *et al*., 2016, 2017, 2019; Fitzgibbon *et al*., 2017). These sub-lethal effects could result in a reduction in fitness to some individuals, though the potential impacts are considered to be localised in the context of the wide availability of suitable habitat. Sub-lethal effects and increased risk of mortality for molluscs are predicted to be highly localised and constrained to within 10.5 m of the acoustic source. Based on the criteria for corals and sponges (i.e. 226 dB re 1 µPa PK), any potential short-term or long-term effects are predicted to be highly localised and constrained to within 11.0 m of the acoustic source. Given the response of polychaete worms to seismic exposure has not been studied, it's considered they could experience a range of sub-lethal effects.

Where sub-lethal effects to adult's and juvenile crustaceans do occur, these effects are not anticipated to result in population-level impacts. Day *et al*., 2022 found populations exposed to anthropogenic acoustic disturbance have demonstrated an ability to cope with or adapt to sub-lethal effects arising from noise exposure, such as statocyst damage, and the capacity to recover from minor impairment to stress biochemistry and righting reflexes following exposure, except where impairment is incurred due to exposure at close range. (Day *et al.*, 2022; Day *et al.,* 2016). Further, at received sound levels of 209 dB re 1 µPa PK-PK, Day *et al*., (2016) did not observe any impacts to fecundity in adult lobsters or embryo development, where the quantity and quality of hatched larvae was found to be unaffected. Hence, recruitment should be unaffected.

No indirect impacts on higher trophic level species that prey on benthic invertebrates, such as demersal fish, are expected. Following the passing of the seismic source, benthic invertebrates are still available to forage and any increased mortality that may occur (e.g. in the case of bivalves) over the weeks or months following exposure is not expected to exceed natural rates of variation in mortality associated with environmental conditions (Day *et al*., 2017; Payne *et al*., 2007, 2008).

Based on the available evidence, no impacts to populations or ecological function and integrity to benthic invertebrates are anticipated. However, in the absence of clearly defined and appropriate effects levels and therefore the relative uncertainty of the assessment, an Acquisition Exclusion Zone will be applied to areas in waters less than 60 m deep plus an additional 421 m horizontal buffer to ensure potential sub-lethal effects on benthic invertebrates are avoided. The Acquisition Exclusion Zone is shown in **Figure 50**. Reducing the exposure of areas less than 60 m deep to seismic emissions that exceed 209 dB will reduce potential impacts on benthic invertebrates by eliminating seismic emissions within the identified reef and shoal habitats of the Sahul Shelf KEF where biomass and diversity of benthic invertebrates is typically greatest. The sound level of 209 dB, and associated area of impact, is considered appropriate to use as it was derived through exposure to seismic emissions comparable to those which will be incurred during a commercial marine seismic survey and beyond which no impacts to recruitment are anticipated.

In the event that repeat passes of a given acquisition line occurs, due to infill or in response to shutdown management measures, it is likely that mobile and sessile invertebrates will experience repeat exposure to the acoustic source. Based on the findings of Day *et al*. (2016; 2017), it is possible that repeat exposure could result in an increased incidence of sub-lethal effects and elevated mortality rates up to 1.3% higher than those of unexposed individuals (reported to range between 11 – 51%, Day *et al*., 2017). Though, the areas over which repeat pass may occur will likely constitute a small portion of the OA and SLB will ensure there is a minimum 24 hours before undertaking any infill runs as a precautionary measure (**Section 3.4.3**).

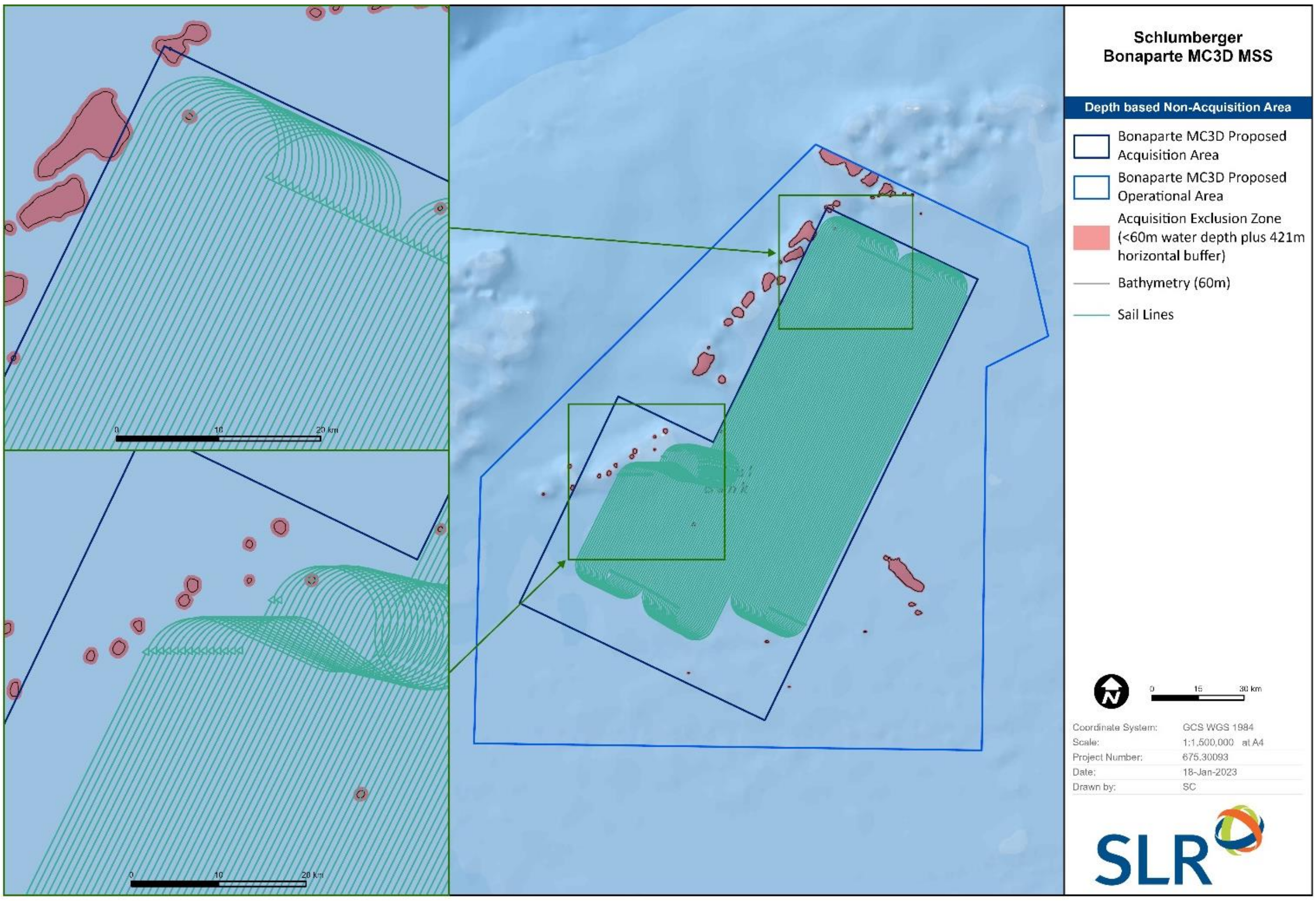


Figure 50 Acquisition Exclusion Zone within the Operational Area

It is considered that based on the results of the UAM, in conjunction with the assessment of potential impacts to benthic invertebrate larvae completed in **Section 7.2.2.2.1**, and proposed implementation of an Acquisition Exclusion Zone, that the consequence of seismic emissions on benthic invertebrates is minor; with no detectable effects on populations expected. Based on the available evidence, it is considered that sub-lethal effects associated with exposure to seismic emissions are likely.

As such, the residual risk, based on the implementation of mitigation measures, to benthic invertebrates arising from acoustic disturbance during the Seismic Survey has been assessed as **Low** (*Minor x Likely).*

7.2.2.2.3 Bony Fish

All fish tested to date have displayed the ability to detect sound and vibration to some degree (Dale *et al.*, 2015). The hearing range and sensitivity of individual species of fish is however highly variable (e.g., Ladich and Fay 2013).

Based on their morphology, Popper *et al.* (2014) classified fishes into the following categories that are generally associated with families and species of commercially important species common to Australian waters as well as eggs and larvae:

- Group I: Fishes without a swim bladder that can sink and settle on the substrate when inactive; e.g., mackerel, Scomberomorus spp., some species of tuna (skipjack tuna, albacore tuna), Thunnus sp. and sharks (Casper *et al.,* 2012; Popper *et al.,* 2014; Carroll *et al.,* 2017);
- Group II: Fishes with swim bladders whose hearing does not directly involve the swim bladder or other gas volumes; e.g. snappers, emperors, groupers and rock cods (Lutjanids and Lethrinids such as Pristipomoides spp., Lethrinus spp., Lutjanus spp., and family Serranidae), and some species of tuna (bluefin tuna, yellowfin tuna) (Tavolga and Wodinsky 1963; Higgs *et al.,* 2006; Braun and Grande 2008; Engineering-Environmental Management, Inc. 2008; United States Department of the Navy 2008; Caiger *et al.*, 2012; Bertrand and Josse 2000; Song *et al.*, 2006);
- Group III: Fishes whose hearing does directly involve a swim bladder or other gas volume; e.g., family Clupeidae (herrings, sardines, pilchards and shads) and some Haemulidae (grunters and sweetlips) (Nedwell *et al.,* 2004; Braun and Grande 2008; Popper *et al.*, 2014); and
- Fish eggs and larvae

The current industry practise for investigating and determining impacts and risks associated with seismic emissions for fish are based on these classifications.

7.2.2.2.3.1 Mortality and Mortal Injury

Fish mortality directly attributable to exposure to seismic emissions even when discharged at close proximity (1-7 m) has not been clearly demonstrated (see Worcester 2006). Some experiments have recorded mortality following exposure to seismic emissions however these were likely associated with experimental artefacts rather than the exposure treatment (Worcester 2006; *Carroll et al.*, 2017). A range of other experiments have not reported mortality following both realistic and unrealistic exposure to exposure levels (see McCauley *et al*. 2003a; *Carroll et al.*, 2017; Meekan *et al.*, 2021). Outcomes of previous seismic surveys completed along the west Australian coastline have not reported mortality of fish that are site attached or those that are considered pelagic from seismic data acquisition activities that have been undertaken. Similarly, these previous surveys have not recorded any substantial changes or impacts to commercial fisheries in these areas.

Adopted industry practice levels associated with mortality or mortal injury attributable to seismic emissions vary between the four classifications as defined by Popper *et al.* (2014) (**Table 55**). These adopted industry practise levels were derived from the adoption of limits calculated following exposure of a limited number of fish species to pile driving activities that included exposure to 960 sound events at 1.2 sec intervals. As such Popper *et al.* (2014) suggested that these values are not definitive, are conservative, and should be treated as interim. The Canadian Science Advisory Secretariat completed a review of available literature and reported that based on available information that fish mortality could occur at levels that exceed 220 dB (Worcester 2006) while acknowledging that adult fish mortality is considered unlikely from exposure to typical seismic survey arrays.

In terms of the noise generated from the Seismic Survey itself, and as discussed in **Section 7.2.2.3.2**, fish will typically move away from the source of acoustic emissions if they are uncomfortable with the noise, thereby minimising their exposure and the potential deleterious effects (Vabø *et al*., 2002; Pearson *et al*., 1992; Wardle *et al*., 2001; Hassel *et al*., 2004; Boeger *et al*., 2006). Due to this ability and behavioural traits enabling fish to avoid exposure at various spatial scales (even those species that display site specific behaviours) it is likely that mortality (if a potential outcome from exposure to seismic emissions) would occur at levels that exceed Popper *et al.*, 2014 interim values and are likely to >220 dB_{peak} (Worcester 2006). As such it is considered that exposure to a threshold of > 220 dB_{peak} likely represents a more realistic while still conservative level of exposure to seismic emissions to assess the potential risk of fish mortality and potential mortal injury due to seismic activities associated with the current project. Despite the conservatism of the Popper *et al.* (2014) levels, that are currently considered industry practise and have been adopted for this assessment.

The JASCO UAM (2022) indicates that Popper *et al.* (2014) adopted industry practice levels for mortality and potential mortal injuries of 213 dB_{peak} are not detected at horizontal distances greater than 80 m from the acoustic source in waters ranging in depth between 104 m and 221 m. At 50 cm above the seafloor seismic levels of 213 dB_{peak} were detected at distances that ranged between 44 m in 200 m depths and 130 m in 50 m depths from the acoustic source (**Appendix A**) (**Table 55**). Adopted industry practice levels for mortality and potential mortal injuries for Group II and Group III fishes as well as eggs and larvae of 207 dB_{peak} are not detected at horizontal distances greater than 200 m from the acoustic source in waters ranging in depth between 104 m and 221 m. At 50 cm above the seafloor seismic levels of 207 dB_{peak} were detected at distances that ranged between 148 m in 200 m depths and 252 m in 75 m depths from the acoustic source (**Appendix A**) (**Table 55**).

Of note, the JASCO UAM (2022) indicates that >220 dB_{peak} levels are not detected at any horizontal distance from the acoustic source in waters ranging in depth between 101 m and 221 m. At 50 cm above the seafloor seismic levels of 226 dB_{peak} were detected at distances of 11 m in 40 m depths from the acoustic source while this level was not detected on the seafloor at depths that ranged from 50 m to 200 m (**Appendix A**).

Table 55 Fish Sound Exposure Adopted Industry Practise Levels associated with Mortality of Individuals, Eggs and Larvae

	Mortality and potential mortal injury	
	Per Pulse (peak)	SEL_{cum}
Group I: Fishes without a swim bladder that can sink and settle on the substrate when inactive	>213 dB	>219 dB
Maximum modelled distance (horizontal) (at model scenario depth) (m)	80 (104-221)	80
Maximum over seafloor modelled distance (at model scenario depth) (m)	130 (50)	-

	Mortality and potential mortal injury	
Group II: Fishes with swim bladders whose hearing does not directly involve the swim bladder or other gas volumes **Group III**: Fishes whose hearing does directly involve a swim bladder or other gas volume **Eggs and larvae**	>207 dB	Group II, fish eggs and larvae: 210 dB Group III: 207 dB
Maximum modelled distance (horizontal) (at model scenario depth) (m)	200 (104)	80 (for both Group II (incl. fish eggs and larvae) and Group III)
Maximum over seafloor modelled distance (at model scenario depth) (m)	252 (75)	-

Site attached fish (those that rely on benthic habitats) associated with shallow complex habitats including reefs and shoals within the OA may have limited ability to move away from the seismic emissions. Some of these species may instead remain or seek shelter in within habitat structures. This may be particularly true for species of Syngnathidae that have limited swimming ability or are highly dependent on habitat features. Other fishes that are generally considered site attached including a range of commercially targeted species such as species of emperors, snappers and groupers targeted by commercial fisheries would be able to undertake movements to avoid seismic emissions that may cause mortality or mortal injury while as documented for red emperor remaining generally within the vicinity of the complex habitat (Meekan *et al.*, 2021). Despite the potential vulnerability of site attached fish with limited mobility to seismic emissions, assemblages that have been exposed to anthropogenic acoustic disturbances have been reported to exhibit high levels of resilience and quick recovery following exposure (Woodside, 2007; Lefèvre and Bellwood 2015; Syms and Jones, 2000).

The biomass and diversity of site attached fishes is typically greatest in the photic and upper mesophotic zones (<60 m depth) which subsequently decreases with increasing depth (Abdul Wahab *et al.*, 2018). Moreover, deeper areas (up to 60 m depth) that are proximal to reef and shoal habitats typically contain a higher abundance and diversity of fish than areas of similar depth that are not associated with reef and shoal habitats (Abdul Wahab *et al.*, 2018; Currey-Randall *et al.*, 2021). Based on UAM there is greater potential for mortality or mortal injury to occur in site-attached fishes up to a maximum range of 228 m from the acoustic source in water depths of 60 m (JASCO 2022). As discussed in **Section 7.2.2.2.2,** an Acquisition Exclusion Zone will be applied to areas in waters less than 60 m deep plus an additional 421 m horizontal buffer to ensure potential sub-lethal effects on benthic invertebrates are minimise. The 421 m buffer distance is greater than the 228 m distances required to reduce the potential impacts on site attached fish within the OA, meaning the proposed buffer distance will ensure site attached fish are also protected. The Acquisition Exclusion Zone is shown in **Figure 50**. Reducing the exposure of areas less than 60 m deep to seismic emissions that exceed 207 dB would reduce the potential impacts on site attached fish, including those that are commercially targeted within the OA.

Pelagic species within the OA including those that are targeted and retained in the Mackerel Managed Fishery include Spanish mackerel and various other mackerels (e.g., grey mackerel), as well as various species of tuna and billfish (see **Section 4.7.3**). These species typically do not have a large swim bladder if present at all and as such mortality and mortal injury is based on conservative industry practice levels predicted to occur within a maximum horizontal distance of 80 m from the acoustic source (**Table 55**). Species that inhabit the pelagic environment can avoid areas that exceed current conservative industry practise levels. Moreover, as the seismic emission source is moving pelagic fishes would have a period as the source approaches to avoid the area and thus avoid exposure to levels that may cause mortality or mortal injury.

It is considered that based on the results of the JASCO modelling, the limited and at times contradictory evidence to suggest seismic emissions can result in fish mortality and the conservative threshold levels used for this assessment and the proposed mitigation measure to not acquire data from areas that are less than 60 m deep (including within a 421 m horizontal buffer zone around these depths) that the consequence of seismic emissions on fishes both site attached and pelagic (including commercially important species retained as part of the NDSF and MMF) is considered to be minor; with no detectable adverse effects on fish populations and rapid recovery from any impact is expected to occur.

Based on available evidence, it is considered that fish mortality associated with exposure to seismic emissions may occur in exceptional circumstances.

As such, the residual risk based on implementation of identified mitigation measures of fish mortality due to exposure to seismic emissions associated with the MSS has been assessed as **Low** (*Minor x Rare*) (**Table 38**).

7.2.2.2.3.2 Fish Egg and Larvae Mortality

Fish eggs and larvae have been reported to be susceptible to mortality or mortal injury when exposed to seismic emission levels of >207 dB_{peak} and >210 dB_{SEL} (Popper *et al.,* 2014). Throughout the OA there are no known specific spawning aggregation sites critical for the ongoing viability of fish species present including goldband snapper, grey mackerel, red emperor, and ruby snapper that targeted and retained in commercial fisheries that operate within the area. These species are generally widely distributed and have extended spawning seasons (e.g. red emperor between October and March, goldband snapper between January and April as well as Spanish mackerel between October and January (Newman *et al.*, 2008, Mackie *et al.*, 2010). Within these spawning periods individuals typically spawn multiple times and generally display broadcast spawning strategies. Furthermore, populations of species such as goldband snapper, red emperor and grey mackerel (primary targets for the Northern Demersal Scalefish Management Fishery and the Mackerel Managed Fishery) are considered to consist of single genetic stocks within WA waters (Newman *et al.*, 2008, Mackie *et al.*, 2010. As such, reproductive success and subsequent recruitment into the population and the fishery is not dependent on biological processes operating at small spatial scales but rather at a regional scale.

Spawning multiple times over an extended spawning period can offset potential risks and high inherent levels of mortality experienced by fish eggs and larvae. Natural rates of mortality experienced by fish eggs and larvae can be very high in some cases greater than 50% per day and often more than 20% per day (Houde and Zastrow 1993; Tang *et al.*, 2014). Spreading reproductive investment and output reduces the potential that an individual batch of eggs and larvae experience adverse environmental conditions, predation or exposure to deleterious effects at both local and regional scales.

Under a 'worst-case' scenario Sætre & Ona (1996) reported that mortality rates for fish larvae and fry (taken from Booman *et al*., 1996) for five fish species (cod, saithe, herring, turbot and plaice) due to exposure to seismic emissions is likely to represent 0.45% of the total larvae population. Based on these results it was concluded that mortality rates caused by exposure to acoustic source sounds are so low compared to natural mortality that the impact from seismic surveys must be regarded as insignificant (Sætre & Ona, 1996). In addition, as both the source of seismic emissions and the water body in which fish eggs and larvae are present are moving, exposure of fish eggs and larvae to industry practise levels that may result in mortality or mortal injury would at worst occur over a very short time period for eggs and larvae originating from any particular location. Fish eggs and larvae that are released during subsequent spawning events during the extended spawning period would not be exposed to the same conditions and risk of exposure to seismic emissions. Due to these factors impacts to fish eggs and larvae associated with the seismic survey would be orders of magnitude smaller than regional scale environmental drivers that influence survival and recruitment of fish species to natural environments and into commercial fish stocks that are harvested by commercial fisheries operating in the area.

When Atlantic bluefin tuna spawn, which typically occurs at night, each female can release over 10 million eggs. This high release rate of eggs is to help ensure survival of the species, where it is considered that each individual egg has a 1 in 40 million chance of surviving and maturing into a full-grown adult tuna (ACES, 2023).

After spawning, the eggs float just below the surface where most are eaten by other fish. Three days after the eggs are fertilised, they hatch and begin to grow very quickly.

Yellowfin tuna spawn at the surface at night mostly within 10^{o}C of the equator when temperatures exceed 24-26^{o}C with the main spawning season between November to April. Yellowfin tuna are serial spawners, spawning every few days throughout the peak season (MPI, 2023). During a single spawning season, an individual yellowfin tuna can produce up to 1,500,000 eggs which is a mechanism to mitigate low natural survival rates (Wild Fisheries Research Programme, 2009).

There are two fisheries for yellowfin tuna in Australia, along both the east and west coasts; however, the commercial catches of yellowfin tuna are a long way south of the Operational Area - see below (source: Yellowfin tuna | Australian Fisheries Management Authority (afma.gov.au)).

It is considered that the consequence of seismic emissions on fish eggs and larvae within the OA (including for commercially important species retained as part of the NDSF and MMF) is minor; with no detectable adverse effects on fish populations and rapid recovery from any impact is expected to occur.

Based on available evidence, it is considered likely that fish egg and larvae mortality associated with exposure to seismic emissions and has occurred at very small scale during other similar seismic data acquisition projects.

As such, the residual risk of fish egg and larvae mortality based on exposure to seismic emissions associated with the MSS has been assessed as **Low** (*Minor x Likely*) (**Table 38**).

7.2.2.2.3.3 Recoverable Injury

Exposure to seismic emissions have been reported to cause recoverable injuries to fish. These recoverable injuries have included fin hematomas and capillary dilation (*Popper et al.*, 2014). Temporary reduction in hearing sensitivity (**TTS**) due to damage to sensory hair cells can also result from exposure to seismic emissions (Worcester, 2006; *Popper et al.*, 2014). Industry practise levels for recoverable injuries and TTS in each of the three fish classifications derived by Popper *et al.* (2014) are provided in **Table 56**. Based on JASCO UAM (2022), the maximum distances recoverable injury industry practise levels were exceeded for Group I fishes was 80 m horizontally in the water column and 130 m horizontally on the seafloor at a depth of 50 m from the acoustic source (**Table 56**). The maximum distances recoverable injury industry practise levels were exceeded for Group II and Group III fishes was 200 m horizontally in the water column and 252 m horizontally on the seafloor at a depth of 75 m from the acoustic source (**Table 56**). The maximum distances temporary impairment due to TTS based on industry practise levels were exceeded for Group I, Group II and Group III fishes was 6,480 m horizontally in the water column and 10,500 m over the seafloor from the acoustic source (**Table 56**).

Table 56 Fish Sound Exposure Adopted Industry Practise Levels and Predicted Maximum Distance for Recoverable and Temporary Reduction in Hearing Sensitivity (TSS)

	Recoverable injury		TTS	
	Per Pulse (peak)	SELcum	Per Pulse (peak)	SELcum
Group I: Fishes without a swim bladder that can sink and settle on the substrate when inactive				
Sound exposure industry practise	213 dB PK	216 dB SEL_{24}	-	186 dB SEL_{24}
Maximum modelled distance (horizontal) (at model scenario depth) (m)	80 (101-221)	80	-	6,480
Maximum over seafloor modelled distance (at 50 cm above seafloor) (m)	130 (50)	80	-	10,500
Group II: Fishes with swim bladders whose hearing does not directly involve the swim bladder or other gas volumes **Group III:** Fishes whose hearing does directly involve a swim bladder or other gas volume				
Sound exposure industry practise	207 dB PK	203 dB SEL_{24}	-	186 dB SEL_{24}
Maximum horizontal modelled distance (horizontal) at model scenario depth (m)	200 (101)	100	-	6,480
Maximum over seafloor modelled distance (at 50 cm above seafloor) (m)	252 (75)	100	-	10,500

The effects of TSS are considered likely to be reversed within 18 to 24 hours following exposure depending on the level of exposure although it is acknowledged that this recovery period could be substantially less (*Popper et al.*, 2014). During the short recovery period fishes may have reduced ability to detect prey and predators and perceive inputs from the surrounding environment (Popper *et al*., 2014). Following exposure to seismic emissions no significant changes in the diversity and abundance of fish species on various reef and non-reef habitats in western Australian waters have not been reported (Woodside, 2007; Miller and Cripps, 2013, Meekan *et al*., 2021). These results indicate that even if fish experience TSS, the effect is not detectable at a population level within a short-, medium- and long-term following exposure.

Species of fish could theoretically experience seismic emissions that exceed TSS industry practise levels through cumulative exposure over 24 hrs up to 10,500 m from the source. This result does not mean that fish travelling within this radius of the source will be impaired, but rather that an animal could be exposed to the sound level associated with impairment if it remained within that distance for 24 hours. As the survey vessel is constantly moving along each sail line that range in length up to 140 km at an average speed of 4-5 knots to exceed industry practice levels it would require a fish to actively follow the course of the vessel for a 24 hr period to be exposed to seismic emissions that are considered capable of causing TSS.

It is considered that based on the results of the JASCO modelling, the fast recovery speeds and the implausibility of how cumulative exposure resulting in TTS that the consequence of seismic emissions resulting in recoverable injury for fishes, both site attached and pelagic (including commercially important species retained as part of the NDSF and MMF) is considered to be minor; with no detectable adverse effects on fish populations and rapid recovery from any impact is expected to occur.

Based on available evidence, it is considered that recoverable injuries to fish associated with exposure to seismic emissions may occur in exceptional circumstances.

As such, the residual risk of recoverable and TTS injury to fish due to exposure to seismic emissions associated with the MSS has been assessed as **Low** (*Minor x Rare*) (**Table 38**).

7.2.2.2.4 Elasmobranchs

Very little research has been undertaken on the effects of acoustic noise or MSSs on elasmobranchs. Sharks differ to bony fish in that they have no swim bladder or other gas filled chambers that can act as secondary hearing organs in the body, so are unlikely to respond to changes in pressure like bony fish may be due to the physiological differences (Myrberg, 2001; Casper, 2011). As a result, sharks cannot detect pressure changes associated with sound waves (Carrol *et al*., 2011). The lateral line system of shark also does not respond to normal acoustic stimulus and is not able to detect sound-induced water displacements beyond a few body lengths, even with large sound intensities (Myrberg, 2001). There have been reports of sharks approaching and biting active acoustic source in both New Zealand and Australia while sharks including blue sharks and mako sharks have been sighted close to seismic vessels while the source is active. These interactions may be influenced by changes to electromagnetic field associated with the use of data acquisition equipment.

Industry practice seismic levels associated with mortality or mortal injury attributable to seismic emissions on fish with no swim bladders is >213 dB_{peak} Popper *et al.* (2014) (**Table 55**). Based on JASCO AUM this threshold is expected to be experienced a maximum of 80 m from the seismic vessel in waters ranging in depth from 101 m to 221 m deep. As sharks have been observed to bite streamers and towed data acquisition equipment it is unlikely that exposure to seismic emissions as detailed in industry practise levels will be deleterious to shark species within the OA. Should shark species detect and be affected by seismic emissions, it is likely that individuals will avoid the source emissions rather than remain in a position to experience deleterious impacts.

The whale shark migration and foraging BIA overlaps with the OA. Whale shark foraging and migration within the BIA primarily occurs between September and November which is unlikely to overlap with the proposed period of seismic data acquisition at the end of November within the OA as SLB will not enter the whale shark BIA until 1 December 2022. Should whale sharks be present within the OA during the survey period it is expected that like other shark species these mobile individuals would actively avoid the source of seismic emissions should it be having a negative effect on an individual. The whale shark Approved Conservation Advice (TSCC 2015) or previous in force Whale Shark Recovery Plan 2005 – 2010 (DEH 2005a) have not identified seismic sound emissions as a threat to the species. Moreover, noise pollution is also not identified as a pressure to whale sharks in the Marine Bioregional Plan for the North-west Marine Region (DSEWPaC, 2012b) or in the Ningaloo Coast: World Heritage nomination report (CoA, 2010).

It is considered that based on the available evidence that the consequence of seismic emissions on elasmobranchs is minor; with no detectable adverse effects on populations and rapid recovery from any impact is expected to occur.

Based on available evidence, it is considered that effects to elasmobranchs associated with exposure to seismic emissions may occur in exceptional circumstances.

As such, the residual risk to elasmobranchs due to seismic emissions associated with the MSS has been assessed as **Low** (*Minor x Rare*) and considered to be acceptable (**Table 38**).

7.2.2.2.5 Cephalopods

As described in **Section 4.5.4**, cephalopods that could be found in or around the OA include nine species of cuttlefish, twelve species of squid, and one species of octopus, none of which are listed as EPBC threatened fauna and none of the species are being commercially fished within the EMBA.

Given their pelagic lifestyle, where they spend the daytime near the seabed and then rise to the surface waters to feed at night, there is the potential for squid and cuttlefish to come near the acoustic source during the Seismic Survey. Octopus, on the other hand, are primarily reef dwelling benthic species so are less likely to be encountered in concentrations of significance in the OA.

Acoustic trauma has been observed in captive cephalopods. Andre *et al*. (2011) exposed four species (two squid, one octopus and one cuttlefish species) to low frequency sounds with SELs of 157 ± 5 dB re 1 µPa (peak levels at 175 re 1 µPa). All exposed animals exhibited changes to the sensory hair cells (statocysts) responsible for balance, with damage becoming more pronounced in animals continuously exposed for up to 96 hours. This study estimated that trauma effects could occur out to 1.5 – 2 km from an operating acoustic source.

Fewtrell (2003) found that southern calamari squid (*Sepioteuthis australis*) were able to detect acoustic noise at approximately 158 dB re 1 µ Pa, or at a distance of 2.1 km from a 2,678 in^3 acoustic source, although no trauma examination was conducted. However, Fewtrell (2003) did conclude that MSS noise of up to 192.4 dB re 1 µ Pa (0.2 km from a 2,678 in^3 acoustic source) is not lethal for *S. australis*.

In regards to octopus, there are no reported studies regarding the response of octopus to an acoustic source. Fewtrell and McCauley (2012) have studied responses of squid through a number of experiments to examine the received per-pulse SEL for caged squid. In one trial, where the received level of the first impulse of the acoustic source was 162 dB re 1 $\mu Pa^2 \cdot s$, the squid inked. During the trial, this response was not observed again; however, the authors stated that it was unknown whether this was due to depleted ink reserves or habituation. Two other trials used an acoustic source with lower initial received levels (132 and 146 dB re 1 $\mu Pa^2 \cdot s$ per-pulse SEL), and no inking behaviour was observed. It was hypothesised by the authors that the results suggest a gradual increase in received sound levels and prior exposure to impulses from an acoustic source could decrease the severity of alarm responses in squid. More recent work by Jones *et. Al*. (2020) supports this where potential rapid, short habituation was found in squid in response to impulsive nose. However, a similar response was observed to impulsive noise 24 hours later, which indicates that squid may re-sensitise to acoustic noise.

As a result of the Fewtrell & McCauley (2021) findings, where 162 dB re 1 $\mu Pa^2 \cdot s$ per-pulse SEL was associated with inking, this was considered to be a startle response level for squid.

Carroll *et al*. (2017) undertook a literature review on the physiological and physical effects of MSSs on fish and invertebrates, including cephalopods (**Table 57**). Carroll *et al*. (2017) categorised relevant studies into the presence or absence of a response from cephalopods depending on the level of exposure. The level of exposure was determined to be either “*realistic*” for MSSs (i.e. few short bursts of low frequency sound at >1 – 2 m), or “*unrealistic / unknown*” (i.e. continuous sound exposure, >100 bursts of near-field sound exposure in aquaria).

Table 57 A Summary of the Potential Impacts of Low Frequency Sound on Cephalopods

Effects	Cephalopod
Physical	
Otolith/statocyst damage	3
Organ/tissue damage	1
Mortality/abnormality	1
Physiological	
Metabolic rates*	1
Stress bio-indicators	1
Immune response	
Energy stores	
Behavioural	
Startle response	5
Sound avoidance	1
Predator avoidance	
Foraging	
Reproduction	
Bioturbation	
Key	
(green)	No response at either realistic or unrealistic exposure levels
(red)	Response at realistic exposure levels
(yellow)	Response at unrealistic/unknown exposure levels
(light blue)	Possible response (conflicting results)
(grey)	No data, has not been tested

Notes: *Includes proxies for metabolic rate such as food consumption, growth, respiration, developmental rate.

Numbers represent the number of studies reporting the result (as reported by Carroll *et al*., 2017).

Impacts are classified according to the sound exposure treatments as realistic (i.e. short bursts of low-frequency sound at a distance of >1 – 2 m) or unknown/unrealistic (i.e. long duration and/or short distance of <2 m to sound source, nearfield sound exposure in aquaria).

Source: Table adapted from Carroll *et al.*, (2017)

Carroll *et al*. (2017) found no studies that had used "*realistic*" exposure levels and five that had used "*unrealistic/unknown"* exposure levels, including Andre *et al*. (2011), described above. Three had found damage to the statocyst (Andre *et al*., 2011, Solé *et al*., 2013; 2013a), one found respiratory suppression (Kaifu *et al.*, 2007), and another found wider ecosystem consequences / stress bio-indicators (Solan *et al*., 2016).

Keevin and Hempen (1997) provide a literature review of the effects of underwater noise on aquatic invertebrates. The studies, most of which took place in the 1940s and 1950s, often lacked good experimental design such as adequate sample size, control, and measurements of pressures at distance from the blast. While cephalopods were not present in any of the studies, shrimp, crab and oysters featured most often. Nonetheless, Keevin and Hempen (1997) conclude that invertebrates are insensitive to pressure related to underwater noise. This is plausible since they speculate that this could be due to the lack of gas containing organs, such as a swim bladder, which has been implicated in the mortality of fish in similar experiments.

Recently, Day *et al*. (2023) undertook an experimental study to assess 1) whether exposure to signals from a seismic survey had an impact on the behaviour, physiology or fishery catch of adult pale octopus (*Octopus pallidus*), 2) whether exposure had an impact on the development of eggs, hatching rates and competency of resultant hatchlings, and 3) outline threshold distances for potential impacts of seismic survey. Wild-caught octopuses were held in fishery pots in approximately 50 m water depth, with pots assigned to one of four treatments; control (pots placed in the turning radius of the vessel where guns were not active), E0 (pots placed at a nominal range of 0 m from the vessel sail line), E500 (pots placed at a nominal range of 500 m from the vessel sail line), or E1000 (pots placed at a nominal range of 1,000 m from the vessel sail line). Octopuses were exposed to a commercial scale seismic survey with three 2,820 in^3 acoustic sources firing alternatively every five seconds. The following results were reported by Day *et al*. (2023):

- Short term declines in catch per unit effort were reported in individual fishers' catch histories but the methods employed in the current study were not sensitive enough to detect any differences;
- Exposure did not result in mortality in either male or female octopus and there was no indication of harm to the offspring, with hatches generally completing fully with live, competent hatchlings;
- Handling stress was evident in all treatments, but was synergistically exacerbated by exposure; and
- Immune parameters showed various impacts with a high degree of variation between individuals. This made it difficult for the authors to conclude whether there was an impact from acoustic exposure to octopus.

Day *et al*. (2023) concluded that there was no evidence of mortality in either the short- or long-term of exposed octopus although behavioural changes were observed (see **Section 7.2.2.3.4**). Observed impacts to the immune function and oxidative stress systems were not likely to be severe or persistent enough on their own to suggest long-term damaging effects or impairment. Overall, the authors state that based on the sound and physiology metrics measured, the overall level of impact on octopus was negligible at 500 m and almost non-existent at 1,000 m.

The effect of MSSs on cephalopod larvae and eggs is unknown, although larvae and juveniles are most often found in shallow coastal waters (AFMA, 2018d), which are mostly outside the OA.

Squid are generally short-lived, fast growing species with high fecundity rates and studies have shown that squid can produce eggs year-round. So, if there was any potential for loss in recruitment over a three-month period, then the squid's life history traits mean they are well adapted to disturbance and the populations would not be at the same risk as those species which only spawn once a year.

The survey design of 720 m line spacing's that SLB have proposed, with 140 km long survey line lengths which will take approximately 32 hours to acquire will also assist in reducing any focused effects in a given area, and at this spatial scale would be at the levels that would not cause any population effects to fish eggs or larvae as a result of their life history traits. Given this is the closest threshold value we have from published literature to apply to the eggs and larvae of squid we would expect similar zones of impact as being applicable to squid eggs and larvae.

This, combined with the finding that a relatively high SEL, was found to be non-fatal to squid, and that larvae and juveniles are most often found in shallow coastal waters, suggests that there is no anticipated long-term risk to squid populations presented by the Seismic Survey.

There is no evidence to suggest that other cephalopod species are more prone to physiological impacts from underwater noise then squid, consequently, the residual risk to cephalopod physiology arising from acoustic disturbance during the Seismic Survey has been assessed as **Low** (*Minor* x *Unlikely*).

7.2.2.2.6 Marine Reptiles

As described in **Section 4.5.5**, two threatened sea snakes and six threatened marine turtles are known or are likely to be present in the OA. An additional 15 non-threatened sea snake species may also have a presence in the OA; indeed, the Timor Sea is regarded as a sea snake biodiversity hotspot (Guinea and Whiting, 2005; Minton and Heatwole, 1975; Smith, 1926).

To date, very little information is available regarding the hearing sensitivities for sea snakes and the potential impacts from exposure to seismic surveys. The first ever investigation of sea snake hearing abilities was undertaken by Chapuis *et al*. (2019) who measures auditory evoked potentials for two individual Stoke's sea snakes. This study found that hearing sensitivity for this species spans the range 40 – 600 Hz, with peak sensitivity occurring at 60 Hz (response elicited at 163.5 dB re. 1 µPa) and a secondary peak at 300-500 Hz (response elicited at 169.1 dB re. 1 µPa). The basis for this study stemmed from the concern that declining sea snake densities at Ashmore Reef may be linked to an increase in seismic survey activities in the vicinity, noting that without an understanding of sea snake hearing, assessing the effects of underwater noise on these animals is virtually impossible. The findings of this study concluded that, compared to other marine vertebrates (i.e. bony fish and marine turtles) sea snakes possess a relatively low hearing sensitivity for both sound pressure and particle acceleration. This aligns well with the fact that all snakes (including sea snakes) lack an external ear and a tympanic middle ear; hence snakes are generally considered to be less sensitive to sound (Hartline and Campbell, 1969). Despite this low sensitivity, Chapuis et al. (2019) suggests that high amplitude sounds (such as those from seismic operations) are likely still detectable in close proximity to the active source as well as vibrations in the substrate and water column. No noise exposure criteria to predict physiological effects on sea snakes are available but given the low relative sensitivity they would presumably occur at closer distances to the source than those predicted for turtles which are discussed below.

Nelms *et al*. (2016) conducted a thorough literature review of studies that investigate the behavioural and physical impacts of seismic surveys on turtles. Nelms *et al*. (2016) reported that for those marine turtle species for which hearing sensitivities are known (loggerhead, green, leatherback and Kemp's ridley turtles – of which all but Kemp's ridley turtles have a potential presence in the OA), all can detect frequencies between 50 and 1600 Hz, and that this range overlaps with the peak amplitude low frequency sound produced during seismic surveys (10 – 500 Hz). This suggests that turtle hearing will detect seismic operations, although hearing sensitivity is relatively poor compared to marine mammals (Finneran *et al*., 2017) and no studies have assessed physical (tissue) damage to hearing structures. One study (Gurjao *et al.*, 2005), looked for evidence of turtle mortality during 2D seismic surveys off the coast of Brazil. Of the eight dead turtles found in the vicinity, five appeared to have been recently caught and damaged by fishing activity and had subsequently died. The authors do not speculate as to the cause of death for the other three dead turtles, and it is unclear whether any post-mortems were conducted on these individuals.

TTS has been induced in captive playback experiments where loggerhead turtles were exposed to a few hundred seismic pulses at a distance of 65 m (Moein *et al.,* 1994, cited in National Science Foundation, 2011). While this demonstrates that hearing damage is theoretically possible, the results of captive experiments are of questionable relevance when assessing effects of seismic surveys in an open ocean setting as captive animals are unable to move away from the sound source. Instead, the impact of underwater noise on turtles is likely to be influenced by the exposure duration, where acute noise from seismic surveys is most likely associated with behavioural effects (see **Section 7.2.2.3.5**) rather than physiological effects (Commonwealth of Australia, 2017b). Physiological effects for marine turtles are probably limited to situations when animals might be exposed at close range for unusually long periods (National Science Foundation, 2011), such situations are unlikely during the Seismic Survey as the vessel will be moving continuously along pre-determined sail lines; hence exposure to high levels of underwater noise will be transitory for any turtles in the OA.

The underwater noise exposure criteria for physiological effects on sea turtles are presented in **Table 58**. These criteria are based on the recommendations of the US Navy (Finneran *et al*., 2017) which, on account of there being no published data regarding TTS and PTS in marine turtles from impulsive noise sources, base threshold values on extrapolations from other animal groups. UAM results for the proposed Seismic Survey do not predict PTS or TTS for marine turtles from exposure to a single pulse, but PTS could occur if a turtle was to remain within 80 m of the active source for 24-hours or TTS is possible for turtles that remain within c. 6 km of the active source for 24-hours. Noting that the likelihood of cumulative exposure is dramatically reduced on account of the movement of the Seismic Vessel, where at a speed of 4.5 knots the Seismic Vessel will travel up to 200 km in 24 hours, and the ability for turtles to spend time with their heads above the water surface to avoid exposure.

Table 58 Noise Exposure Criteria (Finneran *et al.,* 2017) and Modelled Zones of Impact (Maximum Distances from Source to Impact Threshold) for PTS and TTS in Sea Turtles

	PTS		TTS	
	Criteria	Maximum Threshold Distance (m)	Criteria	Maximum Threshold Distance (m)
Single pulse PK	232 L_{pk}; dB re 1 µPa	-	226 L_{pk}; dB re 1 µPa	-
Cumulative Weighted SEL_{24hr}	204 $L_{E,24h}$; dB re 1 µPa²·s	80	189 $L_{E,24h}$; dB re 1µPa²·s	1,820 – 6,110

Notes: A dash indicates the threshold is not reached within the limits of the modelling resolution (20 m).

Acute noise from seismic surveys is considered in the Recovery Plan for Marine Turtles in Australia 2017-2027 (Commonwealth of Australia, 2017b). This report acknowledges that loggerhead turtles are known to be sensitive to sounds of between 100 – 400 Hz, and that green, leatherback and hawksbill turtles can detect frequencies up to 1600 Hz, but despite this very little is known of the impact of noise on marine turtles. The report also states that "*Given that the impacts of noise are unknown, a precautionary approach should be applied to seismic work, such that surveys planned to occur inside important inter-nesting habitat should be scheduled outside the nesting season*." In accordance with Appendix B of the Recovery Plan (Commonwealth of Australia, 2017b), the risk assessment results presented therein for noise interference on turtle stocks of relevance to the OA are as follows, where the most critical aspect of the threat is provided in brackets:

- Green turtles on Northwest Shelf = moderate consequence, unknown likelihood (acute and chronic);
- Green turtles at Ashmore Reef = no long term effect, unlikely (acute and chronic);
- Loggerhead turtles in Western Australia = minor consequence and likely (acute);
- Flatback turtles at Cape Domett and Southwest Kimberley = minor consequence and likely (acute);
- Flatback turtles in the Arafura Sea = minor consequence and possible (acute);
- Hawkesbill turtles in Western Australia = minor consequence and possible (acute); and
- Leatherback turtles in Australia = minor consequence, but of unknown likelihood (acute and chronic).

While this clearly indicates that some effects of seismic surveys are expected on marine turtles in the region, the Recovery Plan anticipates effects to be minor in most cases, where 'minor' is defined as "individuals are affected, but no effect at stock level". The only instance for which a 'moderate' consequence is predicted is for green turtles on the Northwest Shelf, where the Recovery Plan defines a moderate consequence as "stock recovery stalls or reduces". The closest nesting and inter-nesting habitat from the OA for green turtles is at Ashmore Reef where nest numbers in the low hundreds occur annually (Whiting *et al.*, 2000) and nesting occurs on a year-round basis, peaking in summer (DEH, 2005). Ashmore Reef is also an important feeding site (DSEWPC, 2012d). The closest green turtle critical habitat and BIAs (foraging, mating, nesting and inter-nesting buffer) are located approximately 87 km west of the OA in the vicinity of Ashmore Reef (see **Section 4.4.4**).

As identified in **Section 4.4.4**, the OA appears to overlap with a flatback turtle foraging BIA. Flatback turtles are classified by the EPBC Act as vulnerable and migratory. In addition, loggerhead turtle and olive ridley turtle foraging BIAs have been identified nearby (approximately 9 km to the east of the OA), and both these species are classified by the EPBC Act as endangered and migratory. The JASCO UAM (2002) modelling predicts that 24-hour cumulative TTS effects for marine turtles could occur out to 6 km from the active source and lower hearing sensitivities for sea snakes suggest that the zone of impact for these species would be even smaller. While individual turtles or sea snakes could theoretically be subject to cumulative TTS during the Seismic Survey, over a 24-hour period the Seismic Vessel could travel up to 200 km, so continual exposure to an individual during that time is unlikely. The zone of impact for 24-hour cumulative PTS is restricted to 80 m around the active source; hence, the risk of PTS for individual turtles or sea snakes is very low, and no anticipated population level effects are predicted. Individual turtles could occur within the highly restricted zone (<20 m) in which PTS or TTS from single pulse exposure is expected; however, individual turtles would presumably be displaced from this area by the hull of the Seismic Vessel (which precedes the acoustic source). Consequently, the residual risk to marine reptile physiology arising from acoustic disturbance during the Seismic Survey has been assessed as **Low** (*Minor* x *Possible*).

7.2.2.2.7 Marine Mammals

Marine mammals are highly vocal and are dependent on sound for almost all aspects of their lives; foraging, reproduction, communication, detection of threats, and navigation, and as a result, are particularly sensitive to anthropogenic noise (Weilgart, 2007; Williams *et al*., 2015; Erbe *et al*., 2018). Marine mammals may suffer lethal and sub-lethal physiological effects (e.g. damage to body tissues resembling decompression sickness in humans, damage to hearing, and chronic stress (Gordon *et al*., 2003)) when exposed to high intensity underwater noises at close range. The sound intensities that would result in such effects are largely unknown for most species, with current knowledge of traumatic thresholds based on a relatively small number of experimental species and inferred for those species for which captive studies are not possible (Southall *et al*., 2019). All thresholds for permanent hearing injury are inferred for ethical reasons (Southall *et al*., 2019).

The likelihood that exposure to shipping noise would be sufficient to permanently damage the hearing of marine mammals is remote (Southall and Hatch, 2008), however, long-term exposure may induce a stress response similar to that found in humans that live near busy roads or airports (Wright *et al*., 2007).

The first evidence of chronic stress in whales in response to vessel noise was demonstrated by Rolland *et al.* (2012) in North Atlantic right whales. Vessel traffic densities and movements were significantly reduced in the Bay of Fundy, California following the events of September 11, 2001, resulting in a corresponding reduction in background noise level. This reduction in noise correlated with decreased baseline levels of stress-related faecal hormone metabolites in right whales (Rolland *et al*., 2012). Although no other factor was found that could explain the difference, the results must be interpreted with caution as analysis was based on a non-repeatable event, sample sizes were relatively small, and there are no comparable acoustic recordings from the Bay of Fundy in years other than 2001 (Rolland *et al*., 2012).

Although tissue damage by shock waves from explosives has been demonstrated for terrestrial animals, pressure pulses from acoustic sources have longer rise times and are less likely to cause tissue damage than explosives. To date there is no definitive evidence of acute physical damage or mortality to marine mammals from acoustic sources or seismic surveys (Gordon *et al*., 2003; Broker, 2019); however, one incident of severe behavioural distress, followed by ataxia has been noted for a pantropical spotted dolphin near a seismic array, suggesting a link between acoustic exposure and physiological damage (Gray and van Waerebeek, 2011) and Mann *et al*. (2010) reported several incidences of hearing loss in stranded odontocetes for which exposure to high levels of anthropogenic noise cannot be ruled out.

Chronic stress and physiological changes can supress the immune system, compromising the health of an animal (Weilgart, 2013). Increases in stress hormones have been observed in captive beluga whales and bottlenose dolphins exposed to sound emissions from an acoustic source (Romano *et al*., 2004; Yang *et al*., 2021).

Exposure to high intensity noises can result in a 'threshold shift'; that is changes in the ability of an animal to hear, usually at a certain frequency, whereby sensitivity to one of more frequencies is lost (Southall *et al*., 2007; Southall *et al*., 2019). Threshold shifts can be temporary, with recovery after minutes or hours, or be permanent. A TTS results in a temporary loss in hearing sensitivity that will return to normal after some time (David, 2011). Threshold shifts in marine mammals are more commonly temporary on account of their mobile, free-ranging nature which means they are usually able to avoid dangerously high SELs. However, exposure to sounds that cause TTS can cause PTS if an animal is repeatedly exposed to such levels (Kastelein *et al*., 2016). It is believed that to cause immediate permanent physiological damage to marine mammals, levels of acoustic exposure would need to be very high (Richardson *et al*., 1995; Southall *et al*., 2019).

The magnitude of any TTS effect is dependent on the frequency, bandwidth, noise level, the noise exposure duration, the recovery period, whether the noise is continuous or intermittent and the subject species (Popov *et al.,* 2013). Most TTS studies to date have been conducted on odontocetes as these are the species typically held in captivity on which controlled exposure experiments can be conducted (e.g. Finneran *et al*., 2015). No TTS studies to date have been conducted on baleen whales; hence, all estimates of TTS onset for these species are based on extrapolation from species for which data does exist (Southall *et al*., 2019).

The duration of TTS recovery depends on the magnitude of the TTS (i.e. how much hearing sensitivity has changed). For example, bottlenose dolphins exposed to 30 minutes of continuous 160 dB re.1µPa tonal noise exhibited a TTS of 8 dB five minutes after exposure, and full recovery occurred within an hour (Nachtigall *et al*., 2004), whereas dolphins exposed to continuous tonal noise of 186-194 dB re.1µPa exhibited a TTS of 45 dB with almost no recovery in the first hour post-exposure and complete recovery requiring up to four days (Finneran *et al*., 2007). Comparisons between intermittent and continuous sound exposures have been made and reveal that intermittent exposure resulted in a lower TTS than continuous exposure indicating a partial recovery during the pauses of intermittent exposure (Finneran *et al.*, 2010).

More recently Finneran *et al*. (2015) measured TTS in bottlenose dolphins from impulsive acoustic sources and found that exposure to impulsive noises elicited much lower threshold shifts than those caused by continuous tones. In this study a 150 cubic inch (2,000 PSI) acoustic source at a range of 3.9 m to the subject dolphins exposed the animals to SPLs of 200-212 dB re.1µPa; however, the maximum TTS recorded was only 9 dB. This study also documented an intriguing anticipatory behaviour whereby two of the three individuals tested independently learnt to turn their heads away from the acoustic source just before each impulse was generated in what is thought to represent an attempt to 'self-mitigate' against the noise. While Finneran *et al*. (2015) did not comment on TTS recovery duration following acoustic source exposure, given the relatively low TTS responses observed, the recovery durations would nearly certainly be short (i.e. less than one hour: cf. Nachtigall *et al*., 2004). Indeed, most TTS studies on marine mammals to date document full recovery within 24 hours of exposure (NMFS, 2018). Popov *et al*. (2013) demonstrated that regardless of frequency, an increase in exposure duration resulted in increases to both the magnitude of the TTS and the time to recovery. It is noteworthy that individuals of the same species exposed to the exact same noise under identical experimental conditions can exhibit considerably different TTS responses, indicating significant inter-individual variability in susceptibility to temporary hearing impairment (Popov *et al*., 2013).

Establishing the distance at which threshold shifts are predicted to occur from a given sound source in the marine environment is dependent on the characteristics of the acoustic source, such as frequency, sound speed profile within the water column, seabed composition, water depth and exposure duration (David, 2011). UAM is required to relate the sound source to the predicted sound pressure levels at a specific location, which enables an estimation to be made of the distance at which a threshold shift onset could occur. For intermittent noise exposures in the marine environment, cumulative SEL, defined as the total SEL calculated over the time the noise source is active, is often used to characterise exposure (Finneran, 2015). The cumulative SEL considers the received level of sound and the duration of exposure (NMFS, 2018), typically over a 24-hour period and for an individual activity only.

In order to assess the effects of underwater noise on marine mammal auditory function, marine mammals are characterised by 'hearing groups' (**Table 59**) based on their generalised hearing range (Southall *et al*., 2019). Outside of this hearing range, the risk of auditory impacts from sound is unlikely. Based on their assigned hearing groups, thresholds for the onset of TTS and PTS in marine mammals were determined by Southall *et al*. (2019) and are presented in **Table 59.**

The predicted zones of impact from a single pulse of the acoustic source for the Seismic Survey have been determined by UAM and are provided in **Table 59** along with the predicted zones of cumulative impact over a 24 hour period, during which approximately 12,000 pulses would occur (including during line turns). For this EP, the single pulse and the cumulative modelling results are used to assess the potential zones of impact on marine mammals; however, the larger threshold distance generated by the cumulative results have the greatest influence on the formulation of ecological conclusions. In reality, both scenarios are imperfect as the length of time that free-ranging wild animals would spend near the active source would inevitably be longer than a single pulse, but shorter than the 24-hour period used as the cumulative metric. Additional animal movement modelling has been undertaken for pygmy blue whales to more realistically represent the time that they might be present around the Seismic Vessel on account of the overlap between the OA and the blue whale migratory BIA.

Whales, as defined by the EPBC Act Policy Statement 2.1 include baleen whales and larger toothed whales, (e.g. sperm whales, killer whales, false killer whales, pilot whales and beaked whales). For the purpose of interpreting the UAM results it is important to note that baleen whales are classified as low frequency cetaceans, while the larger toothed whales are typically high-frequency cetaceans. The only very-high-frequency cetacean species with a potential presence in the OA are the pygmy sperm whale and dwarf sperm whale.

Table 59 PTS and TTS Onset Thresholds for Marine Mammals Exposed to Impulsive Noise (Southall *et al.*, 2019) and Predicted Zones of Impact (Maximum-Over-Depth-Distances from Source to Onset Threshold; Range for Six Different Single Pulse Sites, and Four Different Cumulative Scenarios

Hearing group	PTS and TTS onset thresholds – impulsive noise events							
	PTS onset				TTS onset			
	Single pulse PK		Cumulative Weighted SEL24hr		Single pulse PK		Cumulative Weighted SEL24hr	
	PK (dB re 1µPa)	Maximum predicted distance (m)	Weighted SEL24hr (dB re 1µPa2.s)	Maximum predicted distance (m)	PK (dB re 1µPa)	Maximum predicted distance (m)	Weighted SEL24hr (dB re 1µPa2.s)	Maximum predicted distance (m)
Low frequency cetaceans	219	-	183	5,750-6,840	213	80	168	38,900-47,500
High-frequency cetaceans	230	-	185	-	224	-	170	70-80
Very-high-frequency cetaceans	202	290-480	155	80	196	790-920	140	180-500
Sirenians	226	-	190	-	220	-	175	80

Note: Low frequency cetaceans include all mysticete whales, i.e. all baleen whales,
High frequency cetaceans include most dolphins, beaked whales, sperm whales and killer whales
Very high frequency cetaceans include true porpoises, most river dolphins, pygmy/dwarf sperm whales, and Commerson's, Chilean, Heaviside's, Hector's hourglass and Peale's dolphins
Sirenians include dugongs
A dash indicates that the threshold is not reached within the limits of the modelling resolution (20 m)

In addition to acoustic propagation modelling results (i.e. UAM, as presented in **Table 59**), animal movement modelling ('Animat' modelling) was also undertaken using movement simulations for pygmy blue whales, being the cetacean species most likely to be encountered during the Seismic Survey. This modelling allowed estimations of the distance within which 95% of the TTS and PTS threshold exceedances would occur ($ER_{95\%}$), along with the probability that a blue whale within that distance would be exposed above the relevant threshold (P_{exp}). Exposure ranges from animat modelling for PTS and TTS thresholds are typically shorter than those predicted using acoustic propagation modelling because of the shorter dwell time of moving animals which represents a more realistic approach for free-ranging pelagic marine mammals. The results of the animat modelling are presented in **Table 60**, in all scenarios PTS and TTS exposure ranges were substantially less than those estimated by UAM (**Table 59**). For animat modelling, five scenarios were run both with BIA-restricted animat seeding (i.e. simulated animal movements began only in the blue whale migratory BIA) and unrestricted seeding (i.e. simulated animal movements began randomly irrespective of the BIA boundaries). Where seeding was unrestricted, the $ER_{95\%}$ distances were larger as simulated whales under this paradigm would have more opportunities to be exposed to sound fields for a longer time; this is the more conservative model approach and for this reason more emphasis is placed on the unrestricted seeding results.

As stated by Connell *et al*. (2022) in **Appendix A**, the probability of exposure within $ER_{95\%}$ varied between 10-96% for unrestricted scenarios, indicating that some, but not all, animats exposed within the 95th percentile range were exposed above threshold. This is because simulated whales can move in and out of the modelling range and change their vertical position in the water column. Hence the length of time they are within the exposure radius is moderated by their movements. For example, a whale within the predicted exposure range that is traveling quickly will not accumulate as much exposure as a whale that is travelling slower. Likewise, individual whales may spend more time at depths with quieter sound levels.

Table 60 Summary of Animat Modelling Results for Five Different Scenarios relative to Pygmy Blue Whales

Threshold		Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	
	dB	$ER_{95\%}$ (m)	P_{exp} (%)	$ER_{95\%}$ (m)	P_{exp} (%)	$ER_{95\%}$ (m)	P_{exp} (%)	$ER_{95\%}$ (m)	P_{exp} (%)	$ER_{95\%}$ (m)	P_{exp} (%)
BIA-restricted seeding											
PTS	183	50	93	-	-	-	-	60	80	-	-
TTS	168	14,000	63	-	-	-	-	11,700	58	-	-
Unrestricted seeding											
PTS	183	980	20	1,000	16	1,240	10	1,390	12	1,140	24
TTS	168	15,040	75	14,750	82	17,110	75	14,570	70	16,990	71

Dashes indicate no simulated whales were exposed above threshold.

The key results from both the UAM and the animat modelling can be summarised as follows:

- The UAM predicts that if baleen whales are present within 6,840 m (max.) of the active source over a 24-hour period they could experience PTS due to cumulative exposure. The animat modelling results, however, predict that the onset distance for cumulative PTS reduces to a maximum of approximately 1,400 m for pygmy blue whales when animal movement is accounted for;
- Temporary hearing damage (i.e. a TTS) could occur for baleen whales within approximately 48 km if they remain near the active source for 24 hours. The animat modelling results, however, predict that the onset distance for cumulative TTS for pygmy blue whales is approximately 17 km;
- Exceedance of the onset threshold for PTS in high-frequency cetaceans is not predicted within the resolution limits of the acoustic propagation model. This means that even if high-frequency cetaceans are within 20 m of the active source for extended periods, no permanent hearing damage is expected. A TTS could occur if high-frequency cetaceans are within 80 m of the active source for 24 hours. However, the likelihood of this occurring is virtually nil as free-ranging pelagic animals would only be expected to remain near the source for a short time even if they were curious enough to investigate the towed seismic equipment at close range; and
- Very-high-frequency cetaceans within 80 m of the active source could suffer cumulative PTS over a 24-hour period and TTS could occur due to cumulative exposure if high-frequency cetaceans are present within 500 m of the active source. The UAM results suggested that exposure to a single pulse could elicit threshold shifts beyond these distances, with PTS out to 480 m and TTS out to 920 m. Because of this discrepancy the EP has assessed the effects of underwater noise of these species using the maximum onset distances of 480 m and 920 m respectively for PTS and TTS.

All Australian marine mammals are fully protected under the EPBC Act, so the potential for causing physiological damage during any MSS is taken extremely seriously. This is particularly important for those species that have a threat classification; of which the following have been identified as having a 'known or likely' presence in the OA during the Seismic Survey (see **Section 4.5.6**): blue whales (*endangered*), fin whales (*vulnerable*), sei whales (*vulnerable*), and humpback whales (*migratory*).

Based on the modelling results for cumulative TTS and PTS onset distances, the standard shutdown zones recommended in the EPBC Act Policy Statement 2.1[21] are insufficient to manage the risk of auditory impairment to baleen whales during the Seismic Survey. This coupled with the high likelihood of encountering pygmy blue whales in and around the blue whale migratory BIA for most months of the year (see **Table 21**) mean that additional management procedures are necessary to address the risk that the Seismic Survey poses to baleen whales.

Animat modelling was undertaken to better understand the risk that the Seismic Survey poses to pygmy blue whales. This modelling incorporated species-specific ecological parameters to understand how pygmy blue whale movement during migration (vertically and horizontally) will affect risk of exposure and on this basis provides exposure ranges that are significantly more realistic than those produced by UAM (Connell *et al*., 2022). For PTS, the $ER_{95\%}$ distance for pygmy blue whales is 1.4 km. Likewise, the onset distance for TTS is predicted to be 17 km. Based on the findings of the animat results, the following additional management procedures are proposed for blue whales/pygmy blue whales during the seismic survey:

- An extended 5+ km observation zone such that MFOs/MMOs observe for blue whales/pygmy blue whales at all times throughout the OA. This means that MMOs/MFOs will be required to scan as far as possible towards the horizon given the prevailing sightings conditions. The minimum Observation Zone permissible will be 5 km throughout the OA when the source is active during daylight hours, a minimum of two experienced MMOs will be on-duty to increase the detection rate of blue whales/pygmy blue whales. To achieve this, at least one MMO will be on-duty on the Seismic Vessel and at least one MMO will be on duty on the Chase Vessel. An Extended 5+ km Shut-down Zone for blue whales/pygmy blue whales will be implemented throughout the entire OA, where shutdowns will be triggered by a blue whales/pygmy blue whale sighting at any distance, and to a minimum of 5 km from the acoustic source from the acoustic source. On this basis a low power zone is deemed unnecessary;
- A 17 km buffer will be established around the blue whale migratory BIA where it overlaps with the OA;
- The Seismic Vessel will not activate the acoustic source(s) within the blue whale migratory BIA or buffer from mid-April (14th) to mid-January (14th) which represents the period during which migrating blue whales/pygmy have historically been known to be present in and around the OA;
- If higher than anticipated numbers of blue whales/pygmy blue whales are observed (three or more BW/PBW instigated shutdowns are made during the preceding 48-hour period) at any time or location during the survey, the following controls will apply:
- The acoustic source will be shut-down and the Seismic Vessel will relocate to another area at least 17 km away from the last blue whales/pygmy blue whales sighting, and outside of the blue whale migratory BIA or buffer, before commencing Pre Start-up Visual Observations and Soft-start Procedures;
- An extended 10+km Observation Zone will be adopted such that MMOs observe for blue whales/pygmy blue whales as far as practicable, and to a minimum of 10 km from the acoustic source;
- The Extended 10+ km Observation Zone will be monitored using the Chase Vessel as an additional observation platform with two MMOs onboard. During the adoption of these adaptive management measures, the Chase Vessel will travel approximately 5 km ahead of the Seismic Vessel and will conduct visual surveillance for marine mammals during daylight hours;
- Night-time or low visibility operations shall cease; and

[21] A 3+ km observation zone, a 2 km low power zone and a 500 m shutdown zone.

- Normal operations may only resume after 48 hours of no blue whales/pygmy blue whales instigated shut-downs.
- If a blue whale/pygmy blue whale mother and calf pair is observed during the Seismic Survey, the acoustic source will be immediately shut-down and the Seismic Vessel will relocate to another area at least 17 km away (and outside of the blue whale migratory BIA or buffer) before commencing Pre Start-up Visual Observations and Soft-start Procedures; and
- When species identification is uncertain, a precautionary approach will be taken, and the additional management procedures for blue whales/pygmy blue whales (as listed above) will be followed until identification is otherwise confirmed.

Regarding 'other' baleen whale species (i.e. all other species of baleen whale, excluding blue whales), the UAM results (**Table 59**) predict that 24-hour cumulative PTS could occur out to a maximum of c. 7 km, but that exposure to a single pulse from the active acoustic source would not elicit PTS even if an animal was very close to the source (< 20 m). The maximum onset distance for 24-hour cumulative TTS is predicted to be 48 km while the single pulse onset distance for TTS is 80 m. It is noteworthy that UAM results show a high degree of variance between modelling scenarios, and, unlike the animat modelling, they do not account for animal movement.

The following other baleen whale species could have a potential presence in the OA (see **Section 4.5.6**): humpback, fin, sei, Bryde's, Omura's and dwarf minke whales. A very brief summary of distribution and density for these species in relation to the OA is provided in **Table 61**.

Table 61 Other Baleen Whales and their Distribution and Density in the OA

Species	EPBC Protected Matters Database; presence ranking in OA	Distribution and Density Considerations
Humpback whale	Likely	Well documented breeding distribution and migratory pathway south and inshore of OA. But seasonal presence (late Jun to early Oct; How *et al.*, 2020) at low densities has been assumed for OA. See **Section 4.5.6.1**.
Fin whale	Likely	Distributional information is limited, but this species is either thought to occur south of OA or at very low densities in vicinity of OA. A seasonal presence (May to Oct; Aulich *et al.*, 2019) at very low densities has been assumed for OA. See **Section 4.5.6.3**.
Sei whale	Likely	Distributional information is very limited but known to feed during summer months at high latitudes. Infrequently sighted in WA (Commonwealth, 2005), hence density is assumed to be very low and seasonal (c. Apr to Nov). See **Section 4.5.6.5**.
Bryde's whale	May	Distributional information is limited, but year-round acoustic presence at Scott Reef (McCauley, 2011). No density data available. Year-round presence in OA assumed. See **Section 4.5.6.6**.
Omura's whale	-	Distributional information is limited, but year-round acoustic presence at the Barossa Field to the northeast of the OA (McPherson *et al.*, 2016). No density data available. Year-round presence in OA assumed. See **Section 4.5.6**.
Dwarf minke whale	-	Distributional information is limited, but acoustic detections from Scott Reef from May to Sep (McCauley, 2011). No density data available. Seasonal presence in OA assumed. See **Section 4.5.6**.

It is noteworthy that for those species considered by the EPBC Protected Matters Database as having a 'likely' presence in the OA, evidence suggests that densities will be low or very low. Contrary to this, those species that are not included in the EPBC Protected Matters Database (Omura's whale and dwarf minke whale) or are recorded by the database as having an uncertain presence in the OA (Bryde's whales) are potentially the species with a more consistent presence here (**Table 61**). This discrepancy suggests that, even if Bryde's whales, Omura's whales or dwarf minke whales do have a higher likelihood of presence in the OA than what is indicated by the EPBC Protected Matters Database, their density here is presumably low.

On the basis that other baleen whales are probably only present in the OA at low or very low densities and that UAM does not account for animal movement, it is considered that the 24-hour cumulative UAM results are excessively conservative for defining the extent of observation or shut-down zones for other baleen whales. Instead, the following mitigations are proposed for other baleen whales during the Seismic Survey on the basis that free-ranging pelagic animals are not expected to remain in the vicinity of the Seismic Vessel for extended periods and the movement of the Seismic Vessel means that any potential exposure will be transitory. In accordance with the precautionary approach and to reduce the potential for confusion in implementing different control measures for different marine mammal groups, it is proposed that the controls below apply to all whales[22] except blue whales/pygmy blue whales, from herein referred to as 'other whales'

- Soft-start procedures throughout the OA will be limited to conditions that allow visual inspection of the 5+ km Observation Zone. If no whales have been sighted within the relevant shut-down zone (within 2 km of the active source for other whales, and any sighting of a blue whale) soft-start procedures will commence over a 30-minute period;
- A 2 km Extended Shut-down Zone for 'other whales' will be implemented throughout the entire OA at all times. On this basis a low power zone is deemed unnecessary;
- A PAM system will run 24-hours per day on the Seismic Vessel during the Seismic Survey, with dedicated, trained and experienced PAM Operators conducting acoustic monitoring for the presence of cetaceans while the acoustic source is active and during the 30 minutes before the commencement of any Soft-start Procedures. Two dedicated, trained and experienced PAM Operators will be on the Seismic Vessel for the duration of the survey, with at least one PAM Operator maintaining 'acoustic watch' at all times while the acoustic source is active and during the 30 minutes before the commencement of any Soft-start Procedures;
- If three or more 'other whale' instigated shut-downs occur within a 24-hour period, the Seismic Vessel will relocate at least 10 km away before commencing Pre Start-up Visual Observations and Soft-start Procedures; and
- If an 'other whale' mother and calf pair is observed during the Seismic Survey, the acoustic source will be immediately shut-down and the Seismic Vessel will relocate to another area at least 10 km away before commencing Pre Start-up Visual Observations and Soft-start Procedures.

A full description of the control measures to be implemented to address the effects of underwater noise on marine mammals are detailed in **Table 70** and a summary of all proposed marine mammal control measures is provided in **Appendix K**.

[22] Defined by the EPBC Act Policy Statement 2.1 as 'baleen whales and large toothed whales, such as sperm whales, killer whales, false killer whales, pilot whales and beaked whales'.

While UAM results suggest that there is the potential for cumulative TTS to occur over distances out to 48 km if an individual baleen whale is exposed to repeated noise impulses over a 24-hour period (**Table 59**), the likelihood of this occurring is low on account of both Seismic Vessel movement and the free-ranging nature of any exposed animals. For pygmy blue whales, the animat modelling suggests that the 95th percentile exposure range for 24-hour cumulative TTS is c. 17 km and not all animals within this range will be exposed above threshold levels.

It is noteworthy that the Blue Whale Conservation Management Plan includes the following action: "*Anthropogenic noise in biologically important areas will be managed such that any blue whale continues to utilise the area without injury and is not displaced from a foraging area*" (see Action Area A.2). In addition, one of the recovery plan interim objectives (Interim Objective 4) is that "anthropogenic threats are demonstrably minimised" and in particular "*Robust and adaptive management regimes leading to a reduction in anthropogenic threats to Australian blue whale are in place*" (Target 4-1).

The proposed additional management procedures for blue whales/pygmy blue whales have been developed to ensure consistency with the above requirements. It is noteworthy that the modelling undertaken was highly conservative, where 1) the worst-case scenarios for noise propagation were modelled to produce maximum estimates of onset distances for physiological effects, and 2) the modelled source locations and seasons were those expected to exhibit noise propagation over the greatest distances. In addition, the EP takes a precautionary approach in relation to predictions about blue whale presence in and around the OA. In particular, the following points were fundamental to developing appropriate additional controls for blue whales/pygmy blue whales:

- The EP assumes a blue whale migration period of mid-April to mid-January which encompasses the entire shoulder season of both the north and south migration seasons. Tagging data suggests the peak of the southward migration has passed by the end of November, yet the EP has assumed stragglers could be present until mid-January;
- Data suggests that the migratory corridor in the vicinity of the OA is highly dispersed; hence blue whale density at this latitude is low. Thums *et al*., (2021) found good alignment between locational data from tagged whales and the boundaries of the migratory BIA; hence, outside the BIA, densities are predicted to be even lower; and
- The EP notes that blue whales do engage in bouts of feeding while migrating, but evidence suggests that in the vicinity of the OA, travel associated with migration is the most prevalent behaviour. The most important migratory path at this latitude appears to be along the west coast of Timor (Thums *et al*., 2021) through the Savu Sea.

The 17 km onset distance for cumulative TTS has been used to define a buffer zone around the BIA and no acquisition will occur within the BIA or buffer during the blue whale/pygmy whale migration season. This spatio-temporal measure has been designed to eliminate any physical or behavioural effects on migrating blue whales/pygmy blue whales; hence to comply with the requirement of the Blue Whale Conservation Management Plan that blue whales can continue to use biologically important areas without injury. On this basis, the protection afforded to blue whales/pygmy blue whales in the BIA is very strong. In addition, an Extended 5+ km Shut-down Zone will be implemented, and several adaptive management measures have been proposed in the event that higher than anticipated numbers of blue whales/pygmy blue whales are observed. The Extended 5+km Shut-down Zone for blue whales/pygmy blue whales effectively means that any sighting of a blue whale/pygmy blue whale by MMOs/MFOs onboard the Seismic Vessel or Chase Vessel at any distance from the acoustic source will result in a Shut-down or Start-up Delay procedures.

In light of the conservative approach taken by both the modelling and the EP, the proposed controls clearly demonstrate consistency with the objective of the Blue Whale Conservation Management Plan (that "*anthropogenic threats are demonstrably minimised"*) and the purpose of the Australian Whale Sanctuary (that cetaceans are not killed, injured, or interfered). On this basis, acoustic injury to blue whales/pygmy blue whales can be avoided throughout the OA, hence anthropogenic threats (as they relate to physiological impacts from underwater noise) are minimised through robust and adaptive management measures. These proposed measures also are in accordance with the 'Guidance on key terms within the Blue Whale Conservation Management Plan' which was released by the Department of Agriculture, Water and the Environment in September 2021 and defines injury as both permanent and temporary hearing impairment.

While the additional management procedures for other whales does not eliminate the risk of cumulative PTS or TTS on all baleen whales during the Seismic Survey, the extended 2 km Shut-down Zone provides complete protection from short-term exposure to underwater noise and both vessel and animal movement will ensure that the likelihood of physiological impacts on other whales remains low. In summary and given the control measures that will be implemented during the Seismic Survey, it is unlikely that any whale will approach close enough to the active acoustic source during periods of full operational power for PTS to occur. The potential for temporary hearing damage to individual whales has been identified, although this would only occur if a whale went undetected inside the proposed precaution zones or if they remain in the general vicinity of the active source for 24 hours.

Based on this information, the residual risk to whale physiology arising from acoustic disturbance during the Seismic Survey has been assessed as **Low** (*Minor* x *Unlikely*) as no detectable adverse effects to whale populations are predicted.

With specific regards to the objectives of the Blue Whale Conservation Management Plan, the Seismic Survey will be consistent with the objectives within this recovery plan, and it is considered that anthropogenic noise in and around the blue whale migratory BIA will be managed through survey design and control measures so that any blue whale/pygmy blue whale may continue to utilize the area without injury; and will not be displaced from migratory pathways (based on the spatial and temporal measures to protect whales during the migration season). The spatio-temporal controls that will be implemented in and around the blue whale migratory BIA represent best international practise for minimising noise disturbance in areas of high density and biological importance during key periods (following Chou *et al*., 2021).

The EPBC Act Policy Statement 2.1 does not require any shut-downs for smaller dolphins or dugongs, so any of these species that make close approaches to the active acoustic source could theoretically be subject to physiological effects. The UAM results for high-frequency cetaceans and dugongs (**Table 59**) indicate that no PTS is expected and that TTS could only occur if individuals were to remain within 80 m of the Seismic Vessel for extended periods; however, generally marine mammals move away from the Seismic Vessel as the generated sound levels gradually increase (Weir and Dolman, 2007). Consequently, the residual risk to the physiology of high-frequency cetaceans and dugongs from underwater noise during the Seismic Survey has been assessed as **Negligible** (*Negligible* x *Rare*).

7.2.2.2.8 Seabirds

Since high intensity acoustic disturbances such as those from an MSS have the potential to cause physiological harm to marine mammals and fish, it is reasonable to assume that seabirds could also suffer physiological damage. Seabirds resting on the sea surface are typically startled by an approaching Seismic Vessel and would therefore be displaced from the immediate vicinity of the acoustic source, limiting their exposure to seismic emissions. Birds on the sea surface are unlikely to suffer physiological effects as the Lloyd Mirror effect means that noise levels at the surface are lower than those deeper in the water column (Carey, 2009).

Physiological damage might only occur to those seabirds within the OA that exhibit diving behaviours, and which are in extremely close proximity to the acoustic source. Due to their largely aquatic existence and lack of flight ability, seabirds such as little penguins are expected to be more susceptible to effects from MSSs than other seabirds though they are not anticipated to occur within the OA (Pichegru *et al*., 2017).

Seabirds chase small bait fish as their prey, and it is likely that these small fish would be displaced from the immediate vicinity of the active acoustic source. Seabirds are expected to detect this change in fish distribution and cease any foraging, which would in turn reduce their exposure to any potential physiological effects.

To date there is limited evidence of effects of MSSs on seabirds, with all documented effects limited to behavioural effects (see **Section 7.2.2.3.7**).

Consequently, the residual risk to seabird physiology arising from acoustic disturbance during the Seismic Survey has been assessed as **Low** (*Minor* x *Rare*).

7.2.2.3 Potential Behavioural Impacts

Behavioural responses are a demonstrable change in the activity of an animal in response to a disturbance (Nowacek *et al.,* 2007) and include movement away from an area in order to avoid a disturbance, or a change in normal behaviours such as diving, respiration, and swimming speed. In addition to avoidance response, some animals may be attracted to areas of disturbance. The most commonly observed behavioural response to active seismic operations is avoidance, which has been widely documented for marine mammals (e.g. Goold, 1996; Stone and Tasker, 2006; Thompson *et al*., 2013) and fish (e.g. Engas *et al*., 1996; Slotte *et al*., 2004), and which can lead to the displacement of animals from preferred habitat.

Displacement from an area can lead to relocation into sub-optimal or high-risk habitats, resulting in negative consequences such as increased exposure to predators, decreased foraging or mating opportunities, alterations to migration routes etc. Displacement could also have indirect effects, for instance feeding activities of predators could be disrupted by the displacement of prey species which could lead to energetic consequences.

Discussions on the behavioural impacts from vessel noise and the acoustic source on marine fauna are provided in the subsections below for each environmental receptor. Where possible, discussions have paid particular focus to species that have been identified to be potentially present within the OA through the development of this EP. Perceptual impacts (i.e. changes in vocalisations and masking) are discussed in **Section 7.2.2.4** while physiological impacts have been addressed in **Section 7.2.2.2**.

7.2.2.3.1 Benthic Invertebrates

Exposure to seismic sound can elicit various behavioural responses in benthic invertebrates. Hawkins *et al*. (2015) reports that, at lower sound levels, behavioural responses are more likely to occur than physical and/or physiological responses. Behavioural responses are, however, the most difficult to monitor *in situ* and consequently, many studies investigating the effects of seismic operations on the behaviour of benthic invertebrates are conducted under laboratory conditions or by deploying caged individuals in the field (Carroll *et al*., 2017). The limitations of these approaches are discussed in **Section 7.2.2.3.2**.

Behavioural responses have the potential to adversely affect a population by, for example, reducing foraging and/or predator avoidance rates. Conversely, they may elicit responses that are brief and pose no overall risk (e.g. a startle response). Research has shown that avoidance behaviours to sound have longer-lasting effects on populations than startle responses. For example, in the former, individuals may move away from an area where MSSs have occurred.

Carroll *et al*. (2017) provided a summary of the potential impacts of low frequency sound on the behavioural responses of marine invertebrates based on a review of the relevant literature. For decapods, foraging, reproduction and bioturbation response at unrealistic or unknown exposure levels were each reported by one study; three studies reported a possible response, conflicting or anecdotal results with respect to predator avoidance; two studies reported a possible response, conflicting or anecdotal results for startle response; and one study reported no response to sound avoidance. Studies which examine the behavioural responses of marine decapods and bivalves to seismic acoustic exposure are discussed below.

Payne *et al*. (2008) found that when the American lobster was exposed to a seismic acoustic source, a significant increase in food intake occurred for several weeks after the exposure under both laboratory and field conditions. In the laboratory, the acoustic source reached an average peak-to-peak pressure of around 202 dB with a peak energy density of 144 – 169 dB re 1 μPa^2/ Hz; in the field, the average exposure reached 227 dB peak-to-peak and had an average peak energy density of 187 dB re 1 μPa^2/ Hz. The authors hypothesised that this may have been due to an increase in stress.

Christian *et al*. (2003) examined the behaviour of snow crabs before, during and after exposure to seismic outputs and observed that, in the laboratory, they reacted slightly when sharp sounds were made near them. However, in the field, caged crab showed no readily visible reactions to the 200 in^3 acoustic source 50 m above them. Tagged crabs did not undergo any large-scale movements out of the area.

For decapods, alarm response to sound have been shown to be highly localised, with alarm behaviour occurring only when they were <10 cm away from the sound source (Goodall *et al*., 1990) and they have shown no such behaviour in response to seismic sound at distances of 1 m or more (Goodall *et al*., 1990; Christian *et al*., 2003).

There is a lack of information with regards to the behavioural effects of MSSs on shellfish. As reported by Carroll *et al*. (2017), two studies have shown evidence of a startle response in bivalves at realistic sound exposure levels (Day *et al*., 2016a; Roberts *et al*., 2015), although only one of these studies used seismic outputs as the sound source. Day *et al*. (2016a) reported that scallops exposed to seismic outputs display a distinctive flinching response, an increase in burial rate and were slower at righting themselves than control scallops. It is possible that the slowed righting response could lead to higher predation rates; however, the ecological implications of this are not clear. No energetically costly responses, such as swimming, have been observed in scallops as a result of exposure to an acoustic source.

The OA has relatively deep waters throughout, where more than 52% of the water depths of the OA are greater than 100 m. This water depth not only determines what benthic invertebrate species are living within the OA, but it also provides a large separation distance between the acoustic source and the seabed. The typical distances between the acoustic source and the seabed within the OA are far greater than most of the scientific experiments conducted in the literature to assess potential effects of seismic on marine receptors, as referenced within this EP. As such, the residual risk for behavioural impacts to benthic invertebrate species from exposure to seismic sound has been assessed as **Low** (*Minor* x *Unlikely*).

The effects of acoustic surveys on catch rates and fisheries which may manifest as a result of behavioural responses discussed in this section are assessed in **Section 7.2.3**.

7.2.2.3.2 Fish

If observed, studies generally report short-term and localised impacts of acoustic disturbance on fish behaviour, with normal behaviour returning within approximately one hour after the removal of the acoustic source (McCauley *et al*., 2000; Pearson *et al*., 1992; Wardle *et al*., 2001). The behavioural responses of fish to acoustic disturbance vary depending on species traits, particularly sensory systems and the presence or absence of a swim bladder (Worchester, 2006; Carroll *et al*., 2017). Species which have swim bladders (or other gas-filled chambers) are considered more sensitive and likely to have a behavioural response to sound exposure compared to species with small or no swim bladders (Popper *et al.,* 2014).

Behavioural changes resulting from exposure to acoustic disturbance have been reported to include startle responses (Pearson *et al*., 1992; Wardle *et al*., 2001; Hassel *et al*., 2004; Boeger *et al*., 2006); modification in schooling patterns and swimming speeds (Pearson *et al*., 1992; McCauley *et al*., 2000; Fewtrell and McCauley, 2012); freezing (Sverdrup *et al*., 1994); and changes in vertical distribution in the water column (Pearson *et al*., 1992; Fewtrell and McCauley, 2012). Evidence of habituation through a decrease in the degree of startle response following multiple exposure events (Hassel *et al*., 2004) suggests responses may be associated with predator avoidance behaviour (Skaret *et al*., 2005) particularly for naïve fish.

Laboratory experimental approaches to examining the effects of MSSs on fish behaviour typically involve exposing caged individuals to an acoustic source often at intensities and exposure durations that are unlikely to be encountered in the field (Gray *et al*., 2016). In 2007, Woodside engaged a team of more than 20 specialists in the fields of underwater acoustics, coral reef ecology and reef fish biology to design and execute comprehensive investigations into the impacts of seismic airgun noise on (amongst other things) fish behaviour (Woodside, 2007). Behavioural observations of free-swimming fish showed that at close range, airgun noise emissions appeared to cause prominent, short-term effects on fish behaviour. As the vessel approached, fish ceased normal behaviours and moved downward from the water column towards the seabed. Fish began to feed and behave normally again within 20 minutes after the Seismic Vessel had passed. Once the vessel had travelled beyond a distance of ~1.5 km fish numbers and behaviour had returned to normal baseline levels. For caged fish, agitation levels increased with increasing received sound exposure level for the three holocentrid (squirrel fishes and soldier fishes) species studied but were not detectable for the bluestripe seaperch. Alarm responses were too infrequent to analyse (Woodside, 2007). Sonar observations of free-swimming fish showed that individuals tended to move deeper into the water column on approach of the operating seismic array consistently out to 400 m either side of the survey test line. Within 200 m of the survey test line, fish schools moved to the seabed after passage of the operating seismic array and stayed significantly closer to the seabed out to 63 minutes post-exposure. The overall conclusion from the behavioural seismic acoustic exposure experiments was that there was minimal impact on fish behaviour and that any changes that were observed were short term and unlikely to have caused any significant biological or ecological impacts (Woodside, 2007).

Meekan *et al.* (2021) undertook a large-scale balanced before-after-control-impact (**BACI**) experiment to examine the effect of seismic surveys on demersal fish fauna on the north west shelf of Western Australia. Following exposure to the acoustic source no impacts to fish behaviour or movement patterns were recorded for a range of demersal fish species including a range of commercially retained species from families such as Lutjanidae (Snappers), Lethrinidae (Emperors) and Epinephelidae (Groupers) at a short (days-weeks) and long-term (months) scale. Acoustically tagged red emperor provided no evidence of any long-term displacement following exposure to the acoustic source with tagged individuals generally remaining within 0.15 km^2 of the location they were first detected (Meekan *et al.*, 2021).

Pelagic fish that target zooplankton as prey could be subject to indirect effects associated with changes to the abundance and distribution of zooplankton (see **Section 7.2.2.2.1**). These potential flow-on effects to marine food webs are expected to be spatially restricted to within a few kilometres of the Seismic Vessel with baseline conditions resuming relatively quickly after the survey line is complete (see Richardson *et al*., 2017). The energetic consequences of a small shift in foraging habitat will likely be negligible for pelagic fish.

It is considered that the consequence of seismic emissions on fish behaviour within the OA (including for commercially important species retained as part of the NDSF and MMF) is negligible; with no predicted adverse effect to populations expected and recovery from any impact is expected to occur.

Based on available evidence, it is considered that under exceptional circumstances changes to fish behaviour associated with exposure to seismic emissions may occur.

As such, the residual risk of negative impacts to fish behaviour based on exposure to seismic emissions associated with the MSS has been assessed as **Negligible** (*Negligible x Rare*) (**Table 38**)

7.2.2.3.3 Elasmobranchs

Sharks are part of an important commercial fishery within Australian waters and the Gippsland Marine Environmental Monitoring Project (Przeslawski *et al*., 2018; 2018a) found that seismic operations resulted in no evidence of consistent adverse effects on commercial catch rates of sharks, with some species (i.e. elephant fish, broadnose and school sharks) having increased catch rates following the MSS, while others (i.e. gummy shark and saw shark) showed decreased catch rates.

Elasmobranchs detect sound via particle motion and some of the highest sound sensitivity to low frequency sound (~20 Hz to ~1,500 Hz) (Myrberg, 2001; Casper, 2011; Casper *et al*., 2012), which is the largest proportion of sound frequency that is generated during an MSS (Carroll *et al*., 2017). However, given what has been stated above, elasmobranchs will still show a response to noise; where Klimley and Myrberg (1979) found that sharks would withdraw from high intensity sound source that was more than 20 dB re 1 µPa above broadband ambient SPL once within 10 m of the source location.

Many species of shark are predatory and use their ‘hearing’ to locate prey. Therefore, any interruptions to their ability to find/detect food through excessive noise in the environment could impact on the sharks feeding ability (Popper, 2003). Free-swimming elasmobranchs (such as pelagic shark species) have been found to have more sensitive hearing apparatus (specifically the *Macula neglecta*) than bottom-dwelling species (Corwin, 1978), possibly placing the pelagic species at greater chance of hearing damage if subjected to high intensity noise sources.

Based on the available information presented in this section and the likely physiological effects to elasmobranchs (**Section 7.2.2.2.4**), significant impacts on elasmobranchs, including whale sharks which are a protected species under the EPBC Act, and predicted to be foraging through the southern part of OA and EMBA, from the Seismic Survey are predicted to be unlikely.

As a result, the residual risk of behavioural impacts to elasmobranchs from seismic sound exposure during the Seismic Survey has been assessed as **Low** (*Minor* x *Unlikely*).

7.2.2.3.4 Cephalopods

Behavioural changes have been documented for cephalopods (squid and octopus species) in response to acoustic disturbance. Caged cephalopods that were exposed to acoustic sources demonstrated a startle response above 151 – 161 dB re 1 µPa and tended to avoid acoustic disturbance exhibiting surface behaviours (McCauley *et al*., 2000). During this study it was found that the use of soft-starts effectively decreased the startle response, and as included within **Table 70**, SLB will be operating in accordance with the EPBC Act and undertaking soft-starts when commencing a survey line if the source is not already active.

A subsequent study corroborated these findings and further demonstrated that a source level of 147 dB re 1 µPa was necessary to induce an avoidance reaction in squid. Throughout this experiment, other reactions were also observed including alarm responses (inking and jetting away from the source), increased swimming speed and aggressive behaviour. It was noted that the reaction of the animals decreased with repeated exposure to the sound suggesting either habituation or impaired hearing (Fewtrell and McCauley, 2012). McCauley *et al*. (2000) suggested that thresholds affecting squid behaviour occur at 161 – 166 dB re 1 µPa rms.

Fewtrell (2003) looked at the response of southern calamari squid (*Sepioteuthis australis*) to MSS noise, finding avoidance behaviours once noise levels exceeded 158 dB re 1 µPa, and significant increases in alarm responses with noise exceeding 158–163 dB re 1 µPa. However, there was a decrease in the frequency of alarm response for repeated exposures, perhaps suggesting that they became habituated. In a similar study, Fewtrell and McCauley (2012) found that there was a significant increase in alarm response from squid as acoustic release noise levels increased beyond 147–151 dB re 1 µPa SEL, and that there were fewer alarm responses with continued exposure to acoustic source noise. Samson *et al*. (2014) found that cuttlefish became habituated to repeated 200 Hz pips at 150 dB and 165 dB, and Mooney *et al*. (2016) found that squid became habituated during sound exposure trials using 140 – 165 dB.

Fewtrell (2003) found that feeding squid ate immediately after noise exposure, suggesting rapid recovery, where it was noted that food appears to be a powerful stimulus to these animals - "*…. The presence of food in an area could override the stimulus to leave an area affected by seismic survey noise*". This is supported by McCauley *et al*. (2000a), who found that captive squid strongly associated the service dinghy with feeding, to the point where squid approached the dinghy to be fed immediately after the cessation of acoustic noise operations (from the same location). McCauley *et al*. (2000a) also found that cephalopods moved to the water surface during MSS simulation and given sound exposure is lower at the surface due to the 'Lloyd Mirror Effect' this could indicate avoidance behaviour to the sound.

Day *et al*. (2023) observed changes in octopus behaviour in both male and female octopus exposed to a commercial seismic survey. Exposed males showed reduced 'adventurousness' through a reduced rate of escaping from their tanks and depressed feeding in octopus directly under the acoustic source when compared to feeding rates later in the study. Females demonstrated a reduction in maternal care of eggs correlated to exposure.

Carroll *et al*. (2017) undertook a literature review on the behavioural (and other) effects of acoustic noise from MSSs on fish and invertebrates, including cephalopods (**Table 57**). The authors categorised relevant studies into the presence or absence of a response from cephalopods depending on the level of exposure. The level of exposure was determined to be either "*realistic*" for MSSs (i.e. few short bursts of low frequency sound at >1 – 2 m), or "*unrealistic / unknown*" (i.e. continuous sound exposure, >100 bursts of nearfield sound exposure, in aquaria).

Carroll *et al*. (2017) found four studies where cephalopods exhibited a startle response to realistic MSS noise. These included Fewtrell and McCauley (2012), McCauley *et al*. (2000a), Samson *et al*. (2014), and Mooney *et al*. (2016), all described in the preceding text. Carroll *et al*. (2017) included a fifth study in this list, Komak *et al*. (2005), where juvenile cuttlefish were exposed to local sinusoidal water movements of different frequencies (0.01–1,000 Hz) produced by a vibrating sphere placed 5 mm above their heads. This resulted in a startle response with no evidence of habituation, but the methods are not realistic or comparable to an MSS under the Carroll *et al*. (2017) definition.

Given their pelagic lifestyle, there is the potential for squid and cuttlefish to come near the acoustic source during the Seismic Survey. However, squid are generally short-lived, fast growing species with high fecundity rates. These life history traits mean they are well adapted to disturbance, and it follows that there is no anticipated long-term risk to squid populations given the 720 m line spacing the actual footprint the acoustic source will cover will be small compared to the actual OA.

None of the cephalopod species recorded in the OA are included in the EPBC Act List of Threatened Fauna and octopus species potentially present within the EMBA are most likely to be affiliated with reefs and coastal waters.

A typical behavioural response to an acoustic source is likely to include being startled (McCauley *et al*., 2000); however, studies have shown that squid quickly become habituated (Fewtrell and McCauley, 2012), and this behavioural disturbance does not appear to influence feeding (McCauley *et al*., 2000a). The life history traits of cephalopods (see previous section) mean they are well adapted to disturbance and combined with the above findings that they appear to become habituated to acoustic release and display other behaviour that indicates rapid recovery, suggests that there is no anticipated long-term risk to squid populations presented by the Seismic Survey. Consequently, the residual risk of behavioural impacts to cephalopod species from seismic sound exposure during the Seismic Survey has been assessed as **Low** (*Minor* x *Unlikely*).

7.2.2.3.5 Marine Reptiles

As described in **Section 4.5.5**, two threatened sea snakes and six threatened marine turtles are known or are likely to be present in the OA. An additional 15 non-threatened sea snake species may also have a presence in the OA; indeed, the Timor Sea is regarded as a sea snake biodiversity hotspot (Guinea and Whiting, 2005; Minton and Heatwole, 1975; Smith, 1926).

Given the OA exists within offshore oceanic waters, away from nesting and interesting areas, the primary pathway for behavioural effects on marine turtles is considered to be through alterations to at-sea foraging behaviours and migration between critical habitat such as nesting, breeding and feeding grounds (Commonwealth of Australia, 2017b).

Nelms *et al*. (2016) conducted a thorough literature review of studies carried out world-wide to investigate the behavioural and physical impacts of seismic surveys on turtles. Compared to cetaceans and fish, research on the impacts of underwater noise on turtles is scarce.

Lenhardt (1994) found that loggerhead turtles managed to minimise exposure to seismic simulations in a confined environment by swimming to and remaining at the water surface. Also, in a confined environment, McCauley *et al*. (2000a) observed an alarm response (rapid swimming) in caged loggerhead and green turtles when acoustic source levels exceeded 166 dB re 1 µPa rms, this level has been widely adopted as the 'behavioural response' threshold for marine turtles (NFS, 2011). Swimming behaviour was described as more erratic once acoustic source levels reached 175 dB re 1 µPa rms and this level has subsequently been adopted as the 'behavioural disturbance' threshold (see Connell *et al*., 2022).

As Nelms *et al*. (2016) points out, studies carried out within the confines of a cage or tank are biased by the acoustic properties of the immediate environment, and results may differ in an open ocean setting where behaviour may change because turtles are able to swim away from the acoustic source. Observations of turtle behaviour at sea are difficult because they require calm sea conditions, and it is often difficult to distinguish behavioural response from variables other than the acoustic source sounds, such as the presence of the Seismic Vessel, the towed equipment, and the observation vessel. Nelms *et al*. (2016) also raises the issue of subjective and variable interpretation of turtle behaviour by different observers, giving the example of one study reporting "no signs of panic of distress" during a seismic survey, where "behaviour consisted of either 'steady swimming' or 'diving' to avoid the vessel" (Pendoley, 1997). Similar studies, according to Nelms *et al*. (2016), categorised diving as a startle response or avoidance behaviour.

JASCO UAM (2022) indicates that sound pressure levels >166 dB re 1µPa and >175 166 dB re 1µPa are not detected at any horizontal distances greater than 2.44 km and 7.68 km, respectively, in waters ranging in depth between 95 m and 221 m. However, as turtles spend substantial periods of time at or near the sea surface, exposure may be avoided to some degree if their heads are out of the water or moderated by the Lloyd Mirror Effect (Carey, 2009). This effect is produced by destructive interference between the direct path of a low-frequency sound and the sea surface reflection of that sound, and results in an area of acoustic shadowing where the sound is attenuated (much quieter) or cancelled in the top 0.5 - 2 m of the water column (Gerstein, 2002 as cited in O'Shea and Poche, 2006).

Table 62 Behavioural Threshold Levels for Individual Turtles – Impulsive Noise Events

Threshold	Zones of impact – maximum horizontal distance from source to impact threshold levels	
	Criteria - RMS SPL (dB re 1µPa)	Maximum threshold distance (m)
Behavioural response	166	7,680
Behavioural disturbance	175	2,440

Impacts associated with anthropogenic activities, such as acoustic disturbance, are addressed in the Recovery Plan for Marine Turtles in Australia 2017-2027 (Commonwealth of Australia, 2017b). Whereby, '*Management of anthropogenic activities in Biologically Important Areas to ensure that biologically Important Behaviour can continue'* is a requirement.

As identified in **Section 4.4.4**, the OA appears to overlap with a flatback turtle foraging BIA. Notably, this BIA is situated beyond Australia's EEZ does not appear to be reflect any published data on flatback turtle foraging behaviour or environmental features associated with high value turtle foraging habitat (Thums *et al*., 2017). In this context, the small size and localised nature and size of the BIA polygon also appears inconsistent with the reported nature of spatial change in environmental conditions characteristic of pelagic oceanic waters (**Figure 13, Figure 20**). Therefore, it is unclear whether this BIA correctly represents habitat where biologically important behaviours occur, or whether it has been reported in error. Despite this, and in accordance with the precautionary principle, this BIA is recognised and considered throughout this EP.

Loggerhead turtle and olive ridley turtle foraging BIAs have been identified nearby (approximately 9 km to the east of the OA), though outside the maximum threshold distance predicted to elicit a behavioural response. The OA is not within proximity of any nesting or inter-nesting buffer BIAs or any habitat critical as defined in the Recovery Plan(Commonwealth of Australia, 2017b).

As Thums *et al.* (2017) points out, flatback turtles nesting on the Lacepede Islands have been shown to migrate to the terraces, deep holes and valleys of the Sahul Shelf to forage during the Austral spring and summer. These foraging grounds are associated with and intersect the carbonate bank and terrace system of the Sahul Shelf Key Ecological Feature and, in part, overlap the OA.

The JASCO UAM (2022) modelling outputs indicate that some behavioural effects to flatback turtles within the BIA overlapping the OA and foraging grounds of the Sahul Shelf Key Ecological Feature are expected. However, due to the transitory nature of the active acoustic source, whereby at a speed of 4.5 knots the Seismic Vessel will travel up to 200 km in 24 hours, any effects are expected to be minor, short-term and affect only a small number of individuals likely to be present within the OA. For example, based on the modelled ranges for behavioural response and disturbance, an individual turtle may respond to the acoustic source for approximately one hour and exhibit stronger signs of disturbance for less than 30 minutes. These minor, short-term effects are not expected to preclude the use of the localised BIA or key foraging grounds by foraging flatback turtles. Additionally, it is considered unlikely that the discrete area comprising the BIA is representative as it does not appear to comprise benthic geomorphology determined to be associated with high value turtle foraging habitat, such as terraces, deep holes and valleys, and given the nature of spatial change in environmental conditions characteristic of pelagic oceanic waters (**Figure 13, Figure 20**)(Thums *et al*., 2017).

An Observation Zone of 500 m for marine turtles is proposed around the seismic source and a Shut-down Zone of 250 m will be adopted throughout the OA to reduce the potential for physiological impacts (as discussed in **Section 7.2.2.2.6**). MFOs/MMOs onboard the Seismic Vessel will implement these requirements, along with soft starts and start up delays.

With regards to managing behavioural effects on marine turtles, adaptive management procedures are proposed. Therefore, if higher than anticipated numbers of marine turtles are encountered within the OA, adaptive management will be implemented to minimise potential behavioural impacts to an **Acceptable Level.** Acknowledging the relative importance of flatback turtle foraging grounds associated with the Sahul Shelf KEF, the acoustic source will not be discharged within 8 km of the Carbonate bank and terrace system of the Sahul Shelf KEF (**Figure 51**) if there have been more than three marine turtle instigated shut-downs within the preceding 24 hour period(see **Table 70, Table 71, Table 72**).

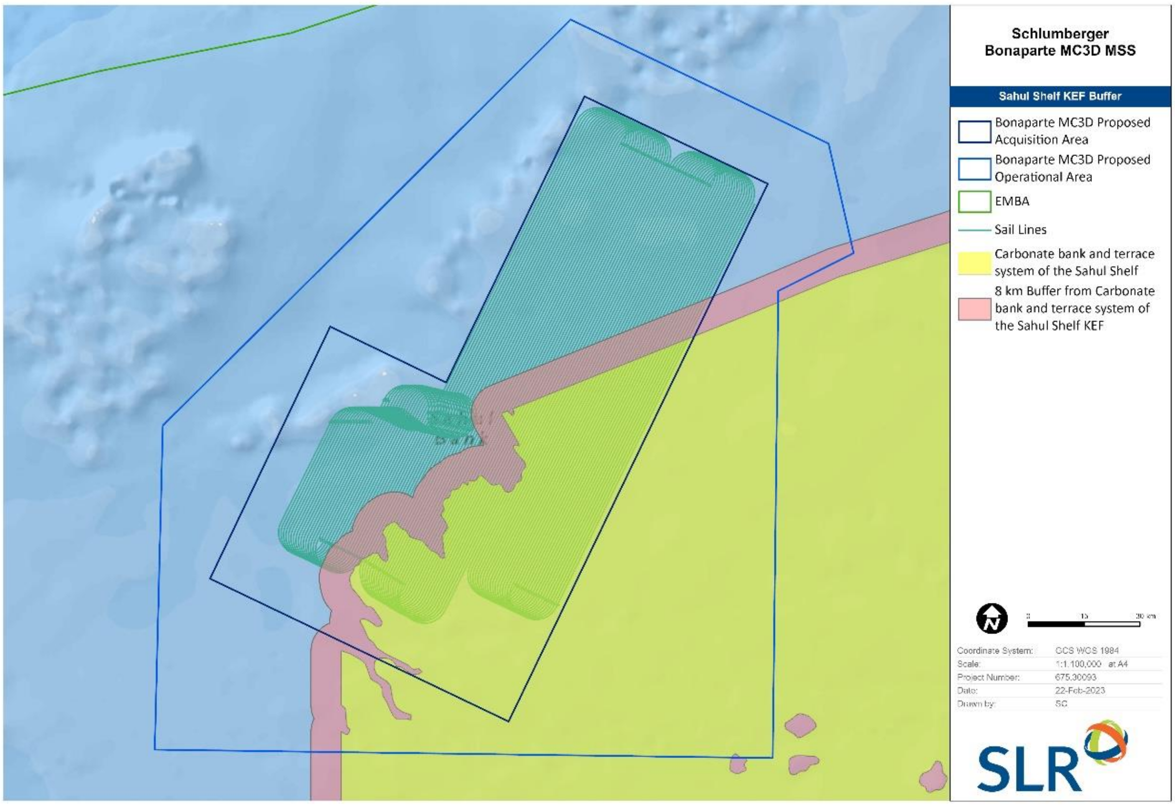


Figure 51 Key Marine Turtle Foraging Area Mitigation Measure, Sahul Shelf KEF and Associated 8 km Buffer

Consistent with the requirements of the Recovery Plan for Marine Turtles in Australia 2017-2027 (Commonwealth of Australia, 2017b), acoustic emissions are not anticipated to impact the continuation of biologically important behaviours within the loggerhead, olive ridley and flatback turtle foraging BIAs located approximately 9 km to the east of the OA, with no behavioural response or disturbance predicted to occur. Likewise, no seismic acquisition will occur within the defined interesting BIAs, interesting buffers or habitat critical.

Based on 1) the results of the JASCO UAM (2022) modelling, 2) the transitory nature of the active acoustic source and therefore short-term nature of any potential behavioural effects on individual turtles present within the OA, and 3) the proposed adaptive management procedure to cease acquisition within the Sahul Shelf KEF (including within an 8 km buffer zone around the perimeter of the KEF) if higher than anticipated numbers of marine turtles are encountered; it is considered that the consequence of acoustic emissions on marine turtles is minor; with no detectable effects on populations and rapid recovery from any short-term effects is expected to occur.

Based on the available evidence, it is considered that behavioural effects to marine turtles from exposure to acoustic emissions are possible. As such, the residual risk of behavioural impacts to marine turtle species from underwater noise exposure during the Seismic Survey has been assessed as **Low** (*Minor* x *Possible*).

The way in which seismic surveys influence the behaviour of sea snakes is virtually unknown. The only study that has attempted to investigate this was conducted by the Australia and Pacific Science Foundation (AP Science, 2015) and involved 10 days of field experiments in the Ningaloo Marine Park (WA) in August 2013. A baited camera system was deployed at a fixed distance from an underwater speaker playing noise from an acoustic source. None of the six olive sea snakes assessed showed an observable change in behaviour either when the sound was initiated or during the sound treatment. During the experiments, sea snakes were exposed to a peak sound pressure of 66.3 dB re 1µPA at 1 m with dominant frequencies between 20 and 100 Hz. It is considered that the source was not loud enough to trigger reactions of wild sea snakes to underwater sound, even though nearby reef fish demonstrated a startle response. The level of exposure which would elicit a behavioural response in sea snakes remains unknown; however, Chapuis *et al*. (2019) found that sea snakes demonstrate a relatively low hearing sensitivity compared to other marine vertebrates (i.e. bony fish and marine turtles). On this basis the behavioural threshold for sea snakes is assumed to be lower than that of marine turtles and the residual risk of behavioural impacts from underwater noise exposure during the Seismic Survey has been assessed as **Low** (*Minor* x *Unlikely*).

7.2.2.3.6 Marine Mammals

Noise produced by the Seismic Vessel has the potential to disrupt typical behaviours (e.g. foraging, resting) or cause displacement away from the noise source. Difficulties arise in separating the effects of shipping noise from those of the physical presence of the vessel in eliciting a response, and most studies generally involve smaller vessels (Aguilar Soto *et al*., 2006). While behavioural responses to vessels have been observed in numerous species (for reviews see Senigaglia *et al*., 2016; Machernis *et al*., 2018); it is only recently that the sensory drivers behind these behavioural responses have been linked to vessel noise specifically (Sprogis *et al*., 2020).

Blair *et al.* (2016) found evidence of behavioural responses in humpback whales to increasing vessel noise. Significant effects on foraging such as a reduction in the number of bottom-feeding events per dive, slower descent rate and fewer side-roll feeding events (evidence of a cessation of feeding or a switch to another feeding method) per dive corresponded with increasing ship noise. Such behavioural changes and interruptions to foraging events may impact on foraging rate and efficiency. Explanations presented to explain these behavioural effects include the whales perceiving the vessel as a threat, alterations to prey behaviour, or masking effects reducing foraging efficiency (Blair *et al*., 2016). Blair *et al*. (2016) suggests that although humpback whales show habituation towards vessel noise, they are unable to completely adjust to the disturbance. This is likely to be the case for other cetacean species too.

The behavioural response of Atlantic right whales was experimentally tested to controlled sound exposures; recordings of ship noise, the social sounds of conspecifics, and an 'alert' signal designed to get some form of response from the whales (Nowacek *et al*., 2007). Although the whales reacted strongly to the alert signal, and mildly to the conspecific sounds, no behavioural response was observed when subject to play-back of vessel noise. A lack of measurable response was also found when whales were approached by a vessel (Nowacek *et al*., 2007).

Dyndo *et al*. (2015) experimentally exposed penned harbour porpoises to play-back of noise from vessel passages. The penned animals reacted to vessel noise recordings by porpoising, suggesting a high level of disturbance to low levels of vessel noise (Dyno *et al*., 2015).

Disturbance from vessel noise has recently been linked to reduced foraging time for the endangered southern resident killer whale in the Pacific waters of the Salish Sea (DFO, 2017). To address this, a voluntary vessel speed reduction trial was undertaken, during which both acoustic monitoring and behavioural monitoring were conducted. This trial concluded that vessel speed reductions of 2.1 – 7.7 knots (for general cargo ships and container ships respectively) resulted in vessel noise source level reductions of 5.9 – 11.5 dB which equated to significant benefits to killer whales; reducing the affected foraging time by up to 11.5% (Vancouver Fraser Port Authority, 2018). This clearly demonstrates that reducing vessel speed is an effective way of reducing the underwater noise generated at the vessel source.

Behavioural effects from seismic surveys on marine mammals include avoidance or displacement, and changes in swimming or diving behaviour (Gordon *et al*., 2003; Miller *et al*., 2009) both of which have the potential to lead to significant reductions in sightings rates across large areas of marine ecosystem (Kavanagh et al., 2019). While behavioural responses may not have direct lethal effects on marine mammals, concern has been raised on the potential for sub-lethal effects such as increases in energy expenditure and demand, decreased foraging efficiency, disruption of group dynamics (e.g. group cohesiveness), and lowered reproductive rates leading to population-wide effects (Weilgart, 2007; 2013). Effects may also be harmless (Weilgart, 2007). Studying the behavioural effects of a MSS on marine mammals can be difficult as reactions vary depending on factors such as the species, individual, age, sex, prior experience with noise, and behavioural state (Weilgart, 2007), with studies typically focusing on opportunistic observations of surface behaviours (Verfuss *et al*., 2018). In addition, behavioural responses may be subtle and barely detectable, with the potential to incorrectly suggest an apparent tolerance (Weilgart, 2007). In open seas it is unlikely that temporary displacement would have significant energetic consequences for migrating whales, but displacement could have more significant consequences in confined waterways. An RMS SPL of 160 dB re 1 µPa has been identified for the level at which adverse behavioural disturbance could occur (NOAA, 2019). During the Seismic Survey, the maximum distance at which this threshold could be exceeded varies between 8.79 and 14.3 km from the acoustic source (**Table 63**) (following Connell *et al*., 2022).

An increase in surface behaviour (e.g. breaching or increased time spent at the surface) has been interpreted as a way of reducing exposure to the higher sound's levels from the acoustic source on account of the 'Lloyd mirror effect' (Carey, 2009) which significantly reduces sound intensity in the upper-most part of the water column. Other stress-related behaviours have also been documented for some species in the vicinity of seismic surveys (or under simulated conditions) including changes in respiration rates (Richardson *et al*., 1995), swim speed (Stone and Tasker, 2006), and diving behaviour (Richardson *et al*., 1995). Such changes were observed in bowhead whales up to 54 – 73 km from an active acoustic source at received levels as low as 125 dB re 1 µPa (Richardson *et al*., 1995).

McCauley *et al*. (2000) made aerial observations on the response of southern migrating humpback whales off Australia's east coast before, during, and after a 3D MSS. A change in sighting rate from the seismic vessel was observed, with sighting rate considerably higher near the vessel with no active source compared to operational periods, suggesting a localised avoidance during operations. Observations suggest that humpback whales spent extended periods of time in surface waters reducing the received sound loading (McCauley *et al*., 2000). During periods where the acoustic sources were alternated between on and off compared to continuously on or off periods, sighting rates increased suggesting either a startle or investigative response of the whales that brought them to the surface. Active whales consistently undertook avoidance manoeuvres (altered course and speed) at >4 km to pass no closer than 3 km behind an operating seismic vessel, while those engaged in sedentary behaviour avoided the operating vessel at a range of 7 – 12 km (McCauley *et al*., 2000). Approach trials were also carried out using a single operating acoustic source; mean SELs for avoidance behaviours to occur was 140 dB re 1 µPa SPL and startle responses were observed at 112 dB re 1 µ Pa SPL (McCauley *et al*., 2000).

Avoidance responses of humpbacks such as increased distance from an acoustic source and reduced travel speed have also been observed in more recent studies such as Dunlop *et al.* (2016), supporting the findings of McCauley *et al*. (2000). Dunlop *et al*. (2015) also surveyed southward migrating humpback whales off Australia's east coast and suggested that the whales show little or no behavioural response to acoustic source emissions; however, as the received levels were low (close to background levels up to 156 dB re 1 µPa), they may not have been high enough to elicit an observable and consistent behavioural response (Dunlop *et al*., 2015). McCauley *et al*. (2000) hypothesised that actively migrating whales are less sensitive to seismic emissions and were at a low risk to seismic activities, while whales engaging in resting behaviours at key habitats (e.g. resting grounds), and cow-calf pairs were particularly sensitive (McCauley *et al*., 2000). This highlights the importance of considering the context of exposure where animals engaged in certain behaviours are likely to be disproportionately affected by noise disturbance (Gomez *et al*., 2016).

Following the Dunlop *et al*. (2015) study, Dunlop *et al.* (2017) aimed to further quantify responses of migrating humpback whales and looked at the recovery of whales following the cessation of acoustic emissions. This was then compared to normal behaviours (e.g. dive time, respiration rate, various surface behaviours, and group movement) to assess the biological significance of any response. No abnormal behaviours such as separation of cow-calf pairs or sustained bouts of high energy surface behaviours were observed, and 'typical' behaviours such as singing, surface slapping, conspecific socialising and continuation of general southward migratory travel continued. This led the authors to conclude that the addition of the Seismic Vessel and acoustic emissions had little impact on typical behaviours and there was no evidence the whales were under significant additional stress. Small and temporary changes in typical behaviours were observed; however, these were within the normal behavioural repertoire of migrating groups. Speed of southward movement was slower in trials with active acoustic sources, although this reflected deviance from course instead as opposed to reduction in travel speed. While Dunlop *et al*. (2017) did not determine whether this deviation in migration path would have long-term effects, they did note that migrating whales are only likely to be exposed to a seismic survey for a short period of time before moving away as part of their migration. Dunlop *et al*. (2017) observed that changes in movement behaviour are likely to occur within 4 km from the Seismic Vessel at received levels over 135 dB re 1 µPa. Clear course changes of migrating humpback whales were observed by Dunlop *et al*. (2017) at received levels of 144 – 151 dB re 1 µPa, lower than that of Dunlop *et al*. (2015).

Blue whales are suggested to be more sensitive to emissions from seismic surveys than other baleen whales such as humpback whales (McDonald *et al*., 1995). Tracking data from a blue whale located in an area where an active Seismic Vessel was operating recorded a long-range avoidance response beginning 10 km from the vessel. The whale's track diverged from that of the vessel by approximately 80° and from its original course by approximately 120°. Estimated received levels at the whale's location were 143 dB re 1 µPa peak-to-peak (McDonald *et al*., 1995). This study only tracked a single blue whale, so the sensitivity of this species to seismic surveys remains somewhat unclear, although in the absence of more data this information is certainly informative.

Avoidance behaviours of minke (likely Antarctic minke), sei and fin whales have also been reported. In an analysis of reports from Seismic Vessels operating in UK waters from 1998 – 2003, Stone (2003) concluded that ranges of minke, sei and fin whales to Seismic Vessels were higher for sightings made during surveys than at other times, suggesting avoidance of the operating vessel. Avoidance of MSSs by fin whales is supported by the findings of Castellote *et al*. (2012) who observed extended displacement which lasted well beyond the duration of the survey.

Studies into behavioural responses of sperm whales to MSSs have revealed variable results. Mate *et al*. (1994) observed a significant decrease in sperm whale abundance in the Gulf of Mexico, with the closest whales observed at least 50 km away from an active seismic survey. However, results of Jochens *et al.* (2016)*,* Weir (2008), Stone and Tasker (2006) and Madsen *et al*. (2002) contradict those of Mate *et al.* (1994). In Weir (2008), encounter rates did not differ with operational status of the acoustic source array, and although the mean distance to initial sighting was greater during full-operations, this effect was not statistically significant. In Madsen *et al*. (2002), sperm whales receiving sound pressures of 124 dB re 1 µPa did not change behaviours or elicit an observable avoidance of the area, and whales instead remained in the area for at least 13 days of exposure. More recently sperm whale distribution was monitored by satellite tag (n = 51 tagged whales) in relation to seismic survey activity in the Gulf of Mexico. Statistical analysis to determine if whale distribution varied from that expected under spatially random conditions concluded that there was no evidence of horizontal avoidance (Winsor *et al*., 2017).

In a review of over 200 seismic surveys in UK waters, Stone and Tasker (2006) also found no statistically significant behavioural effects of seismic activity on sperm whales. Jochens *et al.* (2016) report on a multi-year (2000 – 2003) sperm whale tagging study in the Gulf of Mexico. Eight sperm whales were tagged and tracked before, during, and after playback of seismic noise. All whales continued on their course of travel and did not avoid the Seismic Vessel throughout the playback; however, two whales showed dive changes indicative of avoidance by deep-diving during full-array exposure, and all whales responded in a fashion expected to result in reduced energetic expenditure (i.e. lowered number of pitching movements); evidence of an effect on foraging behaviour (Jochens *et al*., 2016). Observations of distance response was conclusive with that of Madsen *et al.* (2002) whereby there was no obvious response to pulses at a range of 20 km (Jochens *et al*., 2016). Jochens *et al*. (2016) suggests that conflicting results may reflect a broad spread in sensitivity of sperm whales to sound based on age and sex or history of sound exposure.

During a 3D MSS off Nova Scotia, Moulton and Miller (2005) observed the behaviours of a number of smaller odontocete species: long-finned pilot whales, common dolphins, Risso's dolphins, striped dolphins, and Atlantic spotted dolphins. Except for the long-finned pilot whale and Atlantic spotted dolphins, all these species have been identified within the NWMR (**Section 4.5.6**). Dolphins were consistently observed during periods when acoustic sources were active; however, some dolphins exhibited localised avoidance behaviours on account of distance to initial sighting being significantly less during non-operational periods. Some dolphins were observed riding the bow of the seismic vessel (a distance of 350 m from the active source) and exhibiting feeding behaviours during active operations. Within 700 m of the active source, dolphins would be exposed to sound levels exceeding 180 dB re 1 µPa (rms) (Moulton and Miller, 2005). Goold (1996) also suggests a localised avoidance of common dolphins to a 2D MSS, with dolphins tolerating seismic emissions outside a 1 km radius.

Harbour porpoises were displaced from an active 470 in^3 acoustic source array over ranges of 5 – 10 km during a 2D MSS over a range of 5–10 km at received peak-to-peak sound pressure levels of 165 – 175 dB re 1 µPa and sound exposure levels of 145 – 151 dB re 1 µPas-1 and were temporarily displaced (Thompson *et al*., 2013). However, these animals were detected again at the affected sites within a few hours after exposure (Thompson *et al*., 2013). Thompson *et al*. (2013) concluded that prolonged MSSs did not lead to broad-scale displacement of marine mammals and that impact assessments should focus on sub-lethal effects. However, it is noted that the acoustic source used for this study was far smaller than the source proposed by SLB for the Seismic Survey; hence, the zone of influence around the 3,000 in^3 source is expected to be larger.

The results of Moulton and Miller (2005), Goold (1996) and Thompson *et al.* (2013) studies are inconsistent with the Stone and Tasker (2006) analysis which suggested small odontocetes (i.e. dolphins) exhibit the strongest lateral spatial avoidance of airguns compared to mysticetes, killer whales, and long-finned pilot whales (Stone and Tasker, 2006). As discussed in the EPBC Act Policy Statement 2.1, smaller dolphins and porpoises are less likely to be disturbed by an MSS (and are less vulnerable to acoustic trauma) than baleen and larger toothed whales. This is on account of the frequency produced in an MSS being lower than the high frequency peak sensitivities of the smaller dolphin species.

Killer whales remain further from an acoustic source when active indicating some level of spatial avoidance, although no reduction in sighting rate in response to an active acoustic source has been observed (Stone and Tasker, 2006). Long-finned pilot whales also show little response to an active acoustic source; the only observed effect is a change in orientation with more moving away from, and fewer towards a vessel during seismic activity (Stone and Tasker, 2006).

The behavioural impacts of seismic surveys on beaked whales are largely unknown as beaked whales are very difficult to observe whilst at sea but based on their observed responses to mid-frequency active sonar (i.e. increased swim speed, unusual dive behaviours and multiple unusual mass stranding events that have ultimately caused the death of individuals) this group is believed to be particularly sensitive to anthropogenic noise (Stimpert *et al*., 2014). Although sonar represents a vastly different sound source to what is used in an MSS, in the absence of any data on the effects of seismic surveys on beaked whales, their responses to sonar provide a useful indication of what might be expected of other underwater noise sources.

In addition to avoidance responses, there is also anecdotal evidence of marine mammals being attracted to seismic operations. For example, common dolphins have been observed repeatedly approaching an operating Seismic Vessel to bow ride as it entered shallow coastal waters. McCauley *et al*. (2000) observed what were believed to be male humpback whales approaching an operating acoustic source and hypothesised that this was due to the similarity to sounds produced by humpback whale breaching.

Typically, the distribution of marine mammals is closely linked to that of their prey (see Fielder *et al*., 1998), therefore avoidance of the Seismic Vessel could lead to abandonment of valuable feeding grounds (e.g. large aggregations of krill or fish) or reduced foraging effort. Resident marine mammals that consistently use the Timor Sea as a foraging ground (e.g. Bryde's and Omura's whales) are of particular note in this regard due to the spatial overlap between foraging areas and the acoustic footprint of the Seismic Survey.

In addition, changes in abundance and distribution of prey species are also well recognised as potential indirect effects of seismic surveys (Simmonds *et al*., 2004) whereby the availability of prey species can change as a result of acoustic disturbance (e.g. fish; Pearson *et al*., 1992; McCauley *et al*., 2000; Colman *et al*., 2008; Handegard *et al*., 2013, and zooplankton; McCauley *et al*., 2017). Such indirect effects could lead to decreased foraging efficiency, higher energetic demands, lower group cohesion, higher predation rates and decreased reproduction rates in marine mammals (Weilgart, 2007). Such indirect effects are much more difficult to detect and measure than direct effects; however, as with direct effects, they are likely to vary with species, individuals, age, sex, past exposure and behavioural state (IWC, 2007). As discussed in **Section 7.2.2.2.1**, acoustic disturbance has been linked to changes in abundance and distribution of zooplankton. Distributional changes in zooplankton (particularly krill) could have flow on effects to foraging baleen whales.

If behavioural impacts do occur during the Seismic Survey, the discussion above highlights those impacts are generally greater for baleen whales than odontocetes and that threatened species that are reliant on biologically important habitat in the proximity of the OA or resident species for which understanding of population and conservation status is unclear are of potential concern. On this basis, the species listed below are of note:

- Pygmy blue whales (endangered/migratory) – potential migratory presence from late Apr to mid-Jan;

- Fin whales (vulnerable/migratory) – potential presence from May to Oct, but at very low densities;
- Sei whales (vulnerable/migratory) – potential presence from Apr to Nov, but at very low densities;
- Humpback whales (migratory) – potential presence from Jun to early Oct, mostly inshore of OA;
- Bryde's whale (migratory) – potential year-round presence in OA; and
- Omura's whale – potential year-round presence in OA.

The underwater noise level at which behavioural disturbance is likely to occur for most marine mammal species is generally accepted to be SPL 160 dB re 1 µPa (NOAA, 2019) (**Table 63**). However, (and as discussed earlier in this section), behavioural effects resulting from seismic operations have been documented in some species at levels lower than this (see McCauley *et al*., 2000; Dunlop *et al*., 2017; 2017a; McDonald *et al*., 1995) indicating substantial variance in behavioural response between species, individuals and sound levels. It is also noteworthy that severe behavioural responses are not consistently associated with higher source levels but are context dependent as well (i.e. influenced by what behaviour an individual is engaged in) (Gomez et al., 2016; Pirotta *et al*., 2021).

Table 63 Behavioural Disruption Threshold for Marine Mammals – Impulsive Noise Events (NOAA, 2019)

Marine mammal hearing group	Zones of impact – maximum horizontal distance from source to impact threshold levels		
	Criteria - SPL (dB re 1µPa)	Water Depth (m)	Range of maximum threshold distance (km)
All hearing groups	160	all	8.79 – 14.3

The following suite of survey design features, mitigations and management procedures are being proposed to minimise potential behavioural impacts to an **Acceptable Level** (see **Table 71** for further detail). Noting that the application of both standard management procedures (in accordance with the EPBC Act Policy Statement 2.1) and additional management procedures is necessary to ensure that potential impacts from the proposed Seismic Survey to marine mammals are managed to an acceptable level on account of 1) the Seismic Survey having a 'moderate to high likelihood' of encountering whales, and 2) the OA overlapping with biologically important habitat. The following controls have been developed to ensure consistency with the objective of the Blue Whale Conservation Management Plan (that "*anthropogenic threats are demonstrably minimised*") and the purpose of the Australian Whale Sanctuary (that cetaceans are not killed, injured, or interfered).

Management Procedures (MP) – all whales

- MP 1: During daylight hours at least one MMO or MFO will be on duty at all times from the Seismic Vessel and one MMO will be on duty at all times from the Chase Vessel to undertake continuous visual observations for marine mammals[23].
- MP 2: Throughout the OA, MMOs/MFOs will implement a 5+ km Observation Zone from the acoustic source. In practise this means that MMOs/MFOs will be required to scan as far as possible towards the horizon given the prevailing sightings conditions. The minimum Observation Zone permissible will be 5 km[24].

[23] Note that this measure goes above and beyond the requirements of the standard management procedures outlined in the EBPC Act Policy Statement 2.1 and, hence, is an additional management procedure.
[24] Note that this measure goes above and beyond the requirements of the standard management procedures outlined in the EBPC Act Policy Statement 2.1 and, hence, is an additional management procedure.

- MP 3: During daylight hours, Pre Start-up Visual Observations for the presence of whales will be undertaken for at least 30 minutes before the commencement of the Soft-start Procedure;
- MP 4: If no whales have been sighted within the relevant Shut-down Zones, Soft-start Procedures will commence over a 30-minute period.
- MP 5: A 2 km Extended Shut-down Zone for all whales will be implemented throughout the entire OA at all times. On this basis a low power zone is deemed unnecessary[25].
- MP 6: A Start-up Delay will occur if a whale enters or is detected in the relevant Shut-down Zone during the soft-start. Whale presence within the Shut-down Zone will trigger an immediate and complete Shut-down, and Soft-start Procedures may only resume after the whale has been observed to move outside the relevant Shut-down Zone, or when 30 minutes have lapsed since the last whale sighting;
- MP 7: If a whale is detected within any nominated observation zone during the Seismic Survey, an additional MMO/MFO will be stationed on the bridge of the vessel from which the detection was made to assist with observations. The only permissible exception to this is when the off-duty MMO is on a meal or toilet break or is standing-down having reached maximum shift duration for that particular working day. In these instances, a trained crew member will assist with marine mammal observations;
- MP 8: Stop Work Procedures will be implemented for the entire duration in which operations are underway as follows: the acoustic source will shut-down whenever a whale is detected in the relevant Shut-down Zone. Soft-start Procedures may only resume after the whale has been observed to move outside the relevant Shut-down Zone, or when 30 minutes have lapsed since the last whale sighting;
- MP 9: Low visibility or night-time operations may occur provided that there have not been three or more whale instigated power-down or shut-down situations during the preceding 24-hour period[26]; and
- MP 10: When species identification is uncertain, a precautionary approach will be taken, and the additional management procedures for blue whales/pygmy blue whales will be followed until identification is otherwise confirmed.

Adaptive Management Procedures (ADMP) – other whales[27]

- ADMP 1: If three or more ‘other whale’ instigated shut-downs occur within a 24-hour period, the Seismic Vessel will relocate at least 10 km away before commencing Pre Start-up Visual Observations and Soft-start Procedures[28]; and
- ADMP 2: If an ‘other whale’ mother and calf pair is observed during the Seismic Survey, the acoustic source will be immediately shut-down and the Seismic Vessel will relocate to another area at least 10 km away before commencing Pre Start-up Visual Observations and Soft-start Procedures[29].

[25] Note that this measure goes above and beyond the requirements of the standard management procedures outlined in the EBPC Act Policy Statement 2.1 and is superseded only by Additional Management Procedure applicable to blue whales/pygmy blue whales.
[26] Note that this measure is superseded only by Additional Management Procedure applicable to blue whales/pygmy blue whales.
[27] Where ‘other whales’ means all baleen whales excepting blue whales or pygmy blue whales, and all large, toothed whales.
[28] Note that this adaptive management procedure is superseded only by Additional Management Procedure applicable to blue whales/pygmy blue whales.
[29] Note that this adaptive management procedure is superseded only by Additional Management Procedure applicable to blue whales/pygmy blue whales

Additional Management Procedures (AMP) – general

- AMP 1: Soft-start Procedures throughout the OA will be limited to conditions that allow visual inspection of the 5+ km Observation Zone;
- AMP 2: Marine mammal observations made during the Seismic Survey will be undertaken by dedicated, trained and experienced MMOs/MFOs. MMOs/MFOs must have logged a minimum of 20 weeks' relevant sea-time engaged in marine seismic survey operations in Australian waters as an MMO/MFO and have proven 'at sea' experience in whale identification and behaviour, and distance estimation. The MMOs/MFOs used must be confident in the identification of those species that the EP predicts will be present in the OA;
- AMP 3: A minimum of two MMOs/MFOs will be onboard the Seismic Vessel for the duration of the Seismic Survey and two additional MMOs/MFOs will be stationed on the Chase Vessel;
- AMP 4: A PAM system will run 24 hours per day on the Seismic Vessel during the Seismic Survey, with dedicated, trained and experienced PAM Operators conducting acoustic monitoring for the presence of cetaceans[30] while the acoustic source is active and during the 30 minutes before the commencement of any Soft-start Procedure;
- AMP 5: Two dedicated, trained and experienced PAM Operators will be on the Seismic Vessel for the duration of the survey, with at least one PAM Operator maintaining 'acoustic watch' at all times while the acoustic source is active and during the 30 minutes before the commencement of any Soft-start Procedure;
- AMP 6: PAM Operators must have logged a minimum of 20 weeks' relevant sea-time engaged in seismic survey operations in Australian waters as a PAM Operator. PAM Operators will need to be able to demonstrate competency in the acoustic identification of the species that are likely to be present during the Seismic Survey, and in interpreting acoustic software and estimating distance to any detected whale calls;
- AMP 7: A full replacement PAM system will be kept onboard the Seismic Vessel and will be used as a back-up if the PAM system malfunctions and is unable to be repaired; and
- AMP 8: The PAM system will be programmed to receive/recognise vocalisations of whales within the frequencies 10 Hz to 200 Hz. The frequency range will theoretically be tuned to detect both low frequency vocalisations of baleen whales and the high frequency echolocations of sperm whales; and
- AMP 9: PAMGuard software will be incorporated into the PAM system to assist with locating and classifying the vocalisations of marine mammals, and the PAM Operators will be suitably trained in using the PAMGuard software.

Additional and Adaptive Management Procedures (BMP) – blue whales/pygmy blue whales

To ensure consistency with the objective of the Blue Whale Conservation Management Plan (that "*anthropogenic threats are demonstrably minimised*") and the purpose of the Australian Whale Sanctuary (that cetaceans are not killed, injured, or interfered) the following controls will be applied to blue whales/pygmy blue whales:

- BMP 1: A 17 km buffer will be established around the blue whale migratory BIA where it overlaps with the OA;

[30] Note, PAM is not considered to be a particularly reliable method for detecting low-frequency cetaceans. On this basis, management measures for baleen whales have been developed to remove the reliance on PAM while still maintaining a high level of protection.

- BMP 2: The Seismic Vessel will not activate the acoustic source(s) within the blue whale migratory BIA or buffer from mid-April (14th) to mid-January (14th) which represents the period during which migrating blue whales/pygmy blue whales have historically been known to be present in and around the OA;
- BMP 3: Throughout the OA when the source is active during daylight hours, a minimum of two experienced MMOs/MFOs will be on-duty to increase the detection rate of blue whales/pygmy blue whales. To achieve this, at least one MMO/MFO will be on-duty on the Seismic Vessel and at least one MMO/MFO will be on-duty on the Chase Vessel;
- BMP 4: An Extended 5+ km Shut-down Zone for blue whales/pygmy blue whales will be implemented throughout the entire OA, where shut-downs will be triggered by a blue whale/pygmy blue whale sighting at any distance, and to a minimum of 5 km from the acoustic source. On this basis a Low Power Zone is deemed unnecessary;
- BMP 5: A Start-up Delay will occur if a blue whale/pygmy blue whale enters or is detected in the 5+ km Extended Shut-down Zone during the soft-tart. Blue whale/pygmy blue whale presence at any distance will trigger an immediate and complete shut-down, and Soft-start Procedures may only resume when 30 minutes have lapsed since the last blue whale/pygmy blue whale sighting;
- BMP 6: If higher than anticipated numbers of blue whales/pygmy blue whales are observed (three or more blue whale/pygmy blue whale instigated shut-downs are made during the preceding 48 hour period) at any time or location during the survey, the following adaptive management controls will apply:
  a) the acoustic source will be shut-down and the Seismic Vessel will relocate to another area at least 17 km away from the last blue whale/pygmy blue whale sighting, and outside of the blue whale migratory BIA or buffer, before commencing Pre Start-up Visual Observations and Soft-start Procedures;
  b) An Extended 10+ km Observation Zone will be adopted such that MMOs/MFOs observe for blue whales/pygmy blue whales as far as practicable, and to a minimum of 10 km from the source.
  c) The Extended 10+ km Observation Zone will be monitored using the Chase Vessel as an additional observation platform with two MMO's/MFOs onboard. During the adoption of these adaptive management measures, the Chase Vessel will travel approximately 5 km ahead of the Seismic Vessel and will conduct visual surveillance for marine mammals during daylight hours;
  d) While the Extended 10+ km Observation Zone is being implemented, all measures applicable to Observation Zones and relevant to blue whales/pygmy blue whales will adopt this distance;
  e) Night-time and low visibility operations shall cease; and
  f) Normal operations may only resume after 48 hours of no blue whale/pygmy blue whale instigated shut-downs.
- BMP 7: If a blue whale/pygmy blue whale mother and calf pair is observed during the Seismic Survey, the acoustic source will be immediately shut-down and the Seismic Vessel will relocate to another area at least 17 km away (and outside of the blue whale migratory BIA or buffer) before commencing Pre Start-up Visual Observations and Soft-start Procedures.

The survey design also confers a degree of mitigation against disturbance to marine mammals as 1) The OA is located in open ocean; hence, will not impact any confined water body; and 2) The long survey lines with 720 m line spacing will ensure that the Seismic Vessel will not focus in any specific area for a long period of time or expose any marine mammals to potential cumulative effects from acoustic noise being concentrated in one location.

Dedicated, trained, and experienced MMO's will be on watch at all times during daylight hours to monitor for marine mammals. The5+ km Shut-down Zone for blue whales/pygmy blue whales provides excellent protection to blue whales/pygmy blue whales from behavioural disturbance, and the 17 km buffer zone around the BIA and associated spatio-temporal controls well exceed the predicted onset distance for behavioural impacts (which according to UAM results could occur out to 14.3 km). On this basis, full protection against significant behavioural disturbance for these species within the biologically important area is provided. The 2 km Shut-down zone for 'other whales' will not fully protect other baleen whale and large toothed whales species from behavioural disturbance, it does however represent a significant extension on the standard Shut-down Zone of 500 m for whales as required by the EPBC Policy Statement 2.1 and on account of the low densities of whales anticipated in the OA (**Table 61**), no detectable adverse effects to any whale populations are predicted.

SLB will also implement both spatial and temporal exclusions to minimise the potential effects of underwater survey noise on blue whale/pygmy blue whale migration, whereby no seismic operations will occur in the BIA or buffer during the period in which blue whales/pygmy blue whales are expected to be migration. Acquisition within this zone will be limited to the period of 15 Jan to 13 Apr when the least number of blue whales are expected to be in the area. This spatio-temporal control represents best international practise for minimising noise disturbance in areas of high density and biological importance during key periods (following Chou *et al.*, 2021).

In accordance with the Blue Whale Conservation Management Plan (Action Area A2) "*anthropogenic noise in biologically important areas will be managed such that any blue whale continues to utilise the area without injury and is not displaced from a foraging area*". The implementation of the the 17 km buffer zone around the BIA for blue whales/pygmy blue whales and the exclusion of seismic operations in the blue whale migratory BIA and buffer during the migration season when the acoustic source is active in the BIA and buffer will protect blue whales from both injury and behavioural disturbance (i.e. displacement), ensuring the continuation of biologically important behaviours throughout the duration of the Seismic Survey. Therefore, it is considered that the Seismic Survey can operate in accordance with the requirements of the Blue Whale Conservation Management Plan and that residual environmental impacts and risks of the proposed Seismic Survey on blue whales are managed to an **Acceptable Level**.

As Conservation Management Plans are not available for all other marine mammal species that have been identified as having a potential presence in and around the OA, the following considerations contribute to the ERA results:

- Behavioural responses (especially displacement) are expected for most marine mammals within 10 – 15 km of the acoustic source and serve to protect marine mammals from hearing injury;
- Most other baleen whales are probably only present in and around the OA at low or very low densities (see **Table 61** and related discussion);
- On account of their different hearing sensitivities, odontocetes are less likely to be disturbed by seismic survey noise; and
- The closest important dugong habitat is well beyond the 14.3 km zone of behavioural impact.

In summary, with the implementation of the extensive control measures that have been specifically developed to take into account all the different marine mammal sensitivities within the OA and surrounds, the residual risk of behavioural impacts to marine mammal species from acoustic disturbance during the Seismic Survey has been assessed as **Moderate** (*Minor x Certain*) as while some avoidance behaviours are expected, no detectable adverse effects to populations are predicted.

7.2.2.3.7 Seabirds

Although there is little information about the behavioural effects of MSSs on seabirds, a number of authors have raised the possibility of disruption to feeding activities. For instance, Goudie and Ankney (1986) suggested that seabird feeding behaviours could possibly be interrupted by acoustic disturbance from the Seismic Vessel passing through feeding grounds; and MacDuff-Duncan and Davies (1995) postulated that birds in the area could be alarmed as the seismic operations pass close-by, causing them to temporarily stop diving. In addition to the potential direct displacement of seabirds, the displacement of bait fish could lead to a reduction in the diving activities and foraging potential for seabirds in the immediate vicinity of the seismic operations.

Lacroix *et al*. (2003) assessed the effect of seismic operations on the foraging behaviour of moulting male long-tailed ducks in the Beaufort Sea. Long-tailed ducks are incapable of flying during the moult and, in order to compensate for this nutritionally costly moult process, increase their foraging time during this period. The findings of Lacroix *et al*. (2003) indicated that the abundance and distribution of ducks in both seismic and control areas changed similarly following the start of seismic operations suggesting that other influencing factors (e.g. wind) were more important for duck distribution than seismic activities, and that seismic activity did not significantly change the diving intensity of ducks. Overall, Lacroix *et al*. (2003) concluded that there was no evidence to suggest any displacement away from active seismic operations.

Pichegru *et al*. (2017) assessed the foraging behaviour of African penguins before, during and after an MSS that occurred within 100 km of breeding colonies. Penguins foraging within 100 km of the active acoustic source showed a change in foraging direction, increasing the distance between feeding area and Seismic Vessel. Displaced penguins reverted back to normal foraging behaviours following the cessation of seismic activities, suggesting effects are relatively short-lived. It is worth noting that although the Pichegru *et al*. (2017) study was unable to differentiate between penguins shifting foraging activities in direct response to the survey (i.e. behavioural effect) or indirectly due to a change in prey distribution, a behavioural response was determined as the most likely cause. While the penguins were able to locate alternative feeding grounds, the displacement from traditional grounds resulted in an increase in energy expenditure (Pichegru *et al.,* 2017).

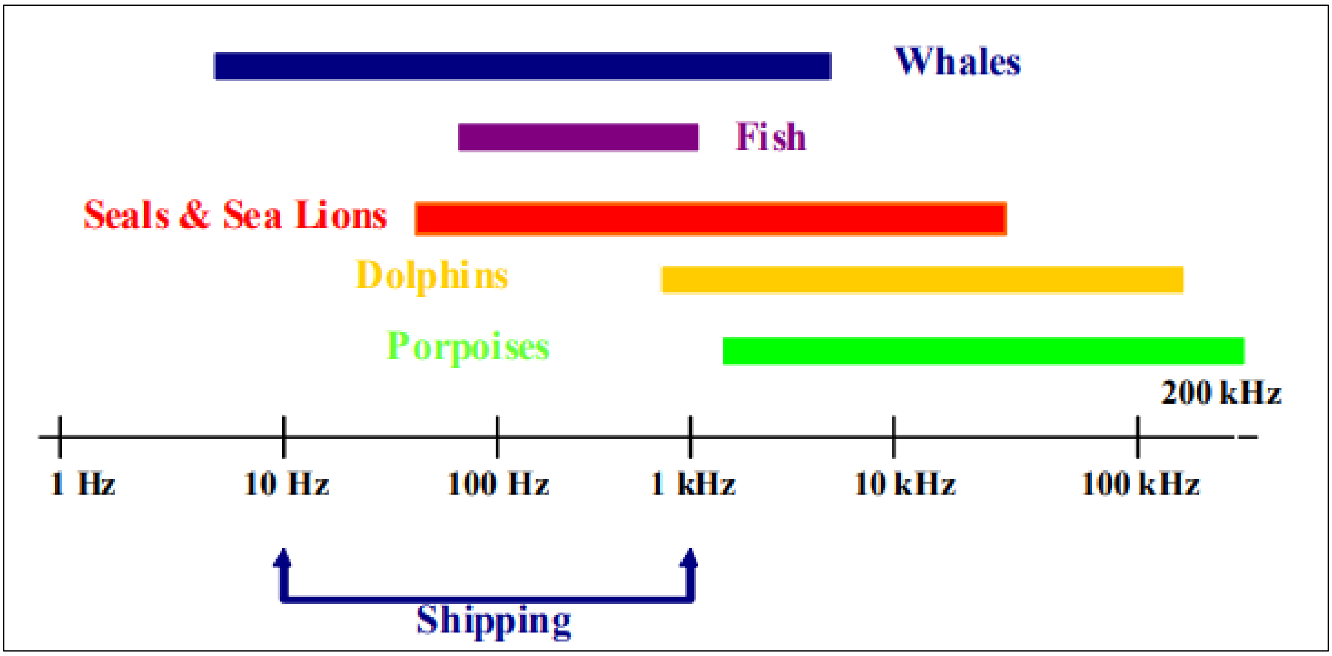
Although the Lacroix *et al.* (2003) and Pichegru *et al*. (2017) studies were not carried out on species potentially present within the OA, and found differing results, their results suggest that at most seabirds will be temporarily displaced from areas of active seismic operations, and displacement effects will be short-lived, with animals able to return to traditional feeding grounds after the Seismic Vessel has moved away. The 720 m line spacing's will assist in minimising the disturbance to seabird's behaviour during the Seismic Survey.

Consequently, the residual risk of behavioural impacts to seabird species from seismic sound exposure during the Seismic Survey has been assessed as **Low** (*Minor* x *Possible*).

7.2.2.4 Potential Perceptual Impacts

Marine animals produce sound for a variety of functions (e.g. navigation, communication, predator and prey detection), and even those that do not produce sound utilise sounds around them to learn about and gain an overall awareness of their environment (Fay and Popper, 2000). The ability to perceive biologically important sounds is therefore crucial to these animals. The addition of anthropogenic noise into the marine environment can disrupt an animal's ability to communicate and/or detect biologically important signals (Dunlop *et al.,* 2010). 'Masking' is an increase in the threshold for detection of discrimination of one sound as a consequence of another (Brumm and Slabbekoorn, 2005) and can be either complete, whereby the signal is not detected at all, or partial, whereby the signal is detected but unable to be properly understood (Clark *et al*., 2009). The effects of masking on an animal's fitness and survival include: blocking/alteration of signals alerting to the presence of predators (Lowry *et al*., 2012), incorrect assessment of the quality of rivals or potential mates lowering reproductive success (Halfwerk *et al.,* 2011), and disruption in group cohesion through a breakdown in communication particularly between parents and offspring (Leonard and Horn, 2012).

The general low frequency band of shipping noise overlaps with the frequencies generated by marine fauna, particularly fish, whales, and pinnipeds (**Figure 52**) (Southall and Hatch, 2008). Masking of biologically significant sounds has been suggested to be the primary effect of vessel noise on marine fauna (Southall, 2005).



Source: Southall and Hatch, 2008.

Figure 52 Typical Frequency Bands of Sound Produced by Marine Fauna compared to Sounds associated with Commercial Shipping

The following provides a discussion on the effects of masking on auditory communication of fish and marine mammals (particularly cetaceans).

7.2.2.4.1 Fish

Some fish species produce sounds for communication purposes, with vocalisations typically within a frequency band of 100 Hz to 1 kHz (Ladich *et al*., 2006; Bass and Ladich, 2008). There have been no studies into the effects of MSSs on sound masking in fish, although other anthropogenic sounds (e.g. boat noise) have reportedly caused masking (see Picciulin *et al*., 2012). For example, Codarin *et al*.(2009) experimentally confirmed that vessel noise can substantially increase detection thresholds for biological sounds in two species of reef fish (brown meagre drums and Mediterranean damselfish).

Popper *et al*. (2014) indicate that for fish species with good hearing there is a greater likelihood of masking further from the acoustic source than close to it as masking is more likely for these fish when the animals are far enough away from the source for the sounds to merge and become more or less continuous rather than distinct events. Although little is known of the potential masking effects of MSS on fish, Radford *et al*. (2014) suggest five ways in which fish might temporarily adapt to overcome or reduce the effect of masking communications:

- Avoidance of noise: This can occur either spatially or temporally. Temporal avoidance involves taking advantage of gaps or fluctuations in competing noise, e.g. silver perch vocalise less frequently when recordings of a predator (bottlenose dolphin) were played (Luczkovich *et al*., 2000);
- Temporal adjustments: Signal detection enhances as signal duration increases as a consequence of an increase in the probability that some of the signal is detected during a quieter period, e.g. male toadfish increase their call rate to compete acoustically in the presence of rival males (Fine and Thorsen, 2008);
- Frequency shifts: Broadband sounds are more difficult to detect in a noisy environment than pure tones, e.g. freshwater gobies in waterfall habitats produce vocalisations in a frequency that differs from that of the waterfall noise; they utilise available 'windows' in the background frequency range (Lugli *et al*., 2003); and
- Change in signalling modality**:** The repertoire of a species usually consists of more than one signal component; hence when one signal type is ineffective, the caller may swap to another signal type to increase the chance of detection, e.g. a change from vocalisations to visual signals.

It is considered that masking of fish communication because of seismic emissions (including for commercially important species retained as part of the NDSF and MMF) is minor; with no detectable adverse effect to the populations and recovery from any impact is expected to occur.

Based on available evidence, it is considered that is possible that masking of fish communication may occur with exposure to seismic emissions may occur.

As such, the residual risk of negative impacts to masking of fish communication based on exposure to seismic emissions associated with the MSS has been assessed as **Low** (*Minor x Possible*) (**Table 38**).

7.2.2.4.2 Marine Mammals

Marine mammals produce sounds that are used to inform a range of behaviours: foraging, navigation, communication, reproduction, parental care, avoidance of predators, and to gain overall awareness of the environment (Thomas *et al*., 1992; Johnson *et al*., 2009). Hence, the ability to perceive biologically important sounds is fundamental to the survival of these animals. Anthropogenic sounds in the same frequency as biological signals can mask biologically important sounds and potentially lead to significant individual effects (Gausland, 2000). Masking is a common effect of underwater noise on marine mammals (Erbe *et al*., 2016) and activities that generate anthropogenic noise are increasing both spatially and temporally in coastal and oceanic environments worldwide (Hatch *et al*., 2016).

The level of masking that will occur depends on several factors other than the noise doing the masking, such as the location of the sender and receiver, source level and spectral characteristics of the signal, and the receiver's auditory capabilities (Erbe *et al*., 2016).

Marine mammals are broadly separated into categories based on hearing capability (Southall *et al*., 2019). The following categories are of relevance to the species potentially present during the Seismic Survey:

- Low frequency cetaceans (auditory bandwidth between c. 0.007 kHz and 22 kHz). Include all mysticete whales, i.e. all baleen whales. Species from this group that could occur in the OA include blue whale, fin whale, sei whale, Bryde's whale, humpback whale, Omura's whale and dwarf minke whale;
- High-frequency cetaceans (auditory bandwidth between c. 0.15 kHz and 160 kHz). Include most dolphins, beaked whales, sperm whales and killer whales. Species from this group that could occur in the OA include sperm whales, Blainville's beaked whale, Cuvier's beaked whale, killer whale, false killer whale, pygmy killer whale, short-finned pilot whale, melon-headed whale, Risso's dolphin, bottlenose dolphins (3 types), spinner dolphin, striped dolphin, spotted dolphin, rough toothed dolphin, common dolphin, Fraser's dolphin, Australian snubfin dolphin, Australian humpback dolphin;
- Very-high frequency cetaceans (auditory bandwidth between 0.2 kHz and 180 kHz). Include true porpoises, most river dolphins, pygmy/dwarf sperm whales, and Commerson's, Chilean, Heaviside's, Hector's hourglass and Peale's dolphins. Pygmy sperm whales and dwarf sperm whales are the only species from this group that could occur in the OA; and
- Sirenians (auditory bandwidth between 5 kHz and 60 kHz with peak sensitivity c. 5 kHz). Include dugongs and manatees. Dugongs are the only species from this group that could occur in the OA.

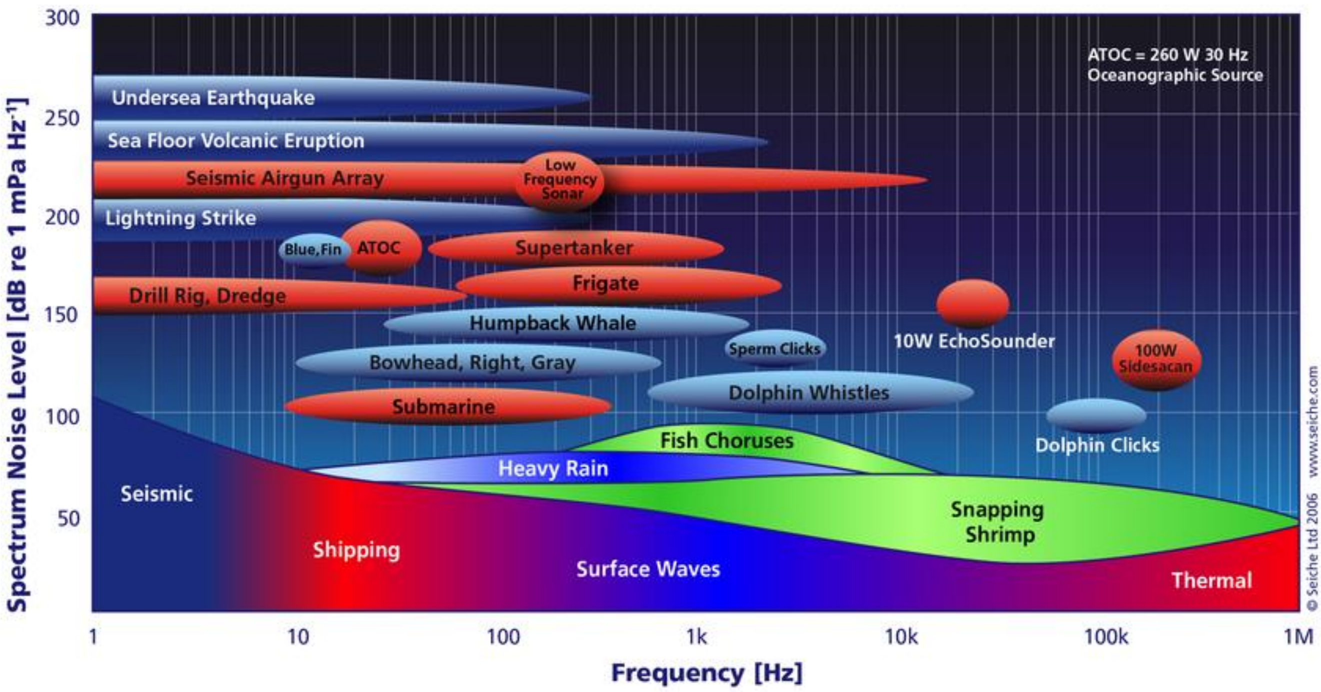
Aguilar Soto *et al*. (2006) reported on preliminary data showing that elevated received noise levels from a passing large ship (with a closest point of approach of 700 m) coincided with an unusual foraging dive in Cuvier's beaked whales, suggesting that elevated noise from shipping may interrupt foraging behaviours by masking echolocation and communication. Evidence suggests that blue whales (McDonald, 2006), killer whales (Holt *et al,* 2008), and North Atlantic right whales (Parks *et al*., 2007) can adjust the frequency and loudness of their calls to compensative for masking by vessel noise, while fin whales alter bandwidth and duration of calls in response to increasing background noise from shipping (Castellote *et al.,* 2012). Communication in two delphinid species (bottlenose dolphin and pilot whales) was also demonstrated to be reduced in the presence of vessel traffic, with communication range reduced by 26% within 50 m of a vessel travelling at 5 knots (Jensen *et al.,* 2009).

The sound frequencies that are emitted by seismic acoustic sources are broadband, but with most of the energy concentrated between 0.1 kHz and 0.25 kHz. The greatest potential for interference with cetacean vocalisations is at the highest end of the seismic spectrum and the lowest end of the cetacean vocalisation spectrum (**Table** 64); i.e. the lowest frequency cetaceans are particularly affected since they have the most overlap with the frequencies of the seismic survey acoustic sources (**Figure 53**). Auditory masking of high- and very-high-frequency cetacean vocalisations is less likely as these species generally operate at higher frequencies than those generated by a seismic survey. The same goes for dugongs that produce sounds for short-range communication in a range much greater than that generated by seismic surveys and have peak hearing sensitivity at around 8 kHz (Southall et al., 2019).

Table 64 Cetacean Communication and Echolocation Frequencies

Species	Communication Frequency (kHz)	Echolocation Frequency (kHz)
Minke whale	0.06 – 6	N/A
Sei whale	1.5 – 3.5	N/A
Blue whale	0.0124 – 0.4	N/A
Fin whale	0.01 – 28	N/A
Humpback whale	0.025 – 10	N/A
Sperm whale	<9	0.1 – 30
Pygmy sperm whale	No data available	60 – 200
Beaked whales*	3 – 16	2 – 26
Common dolphin	0.5 – 18	0.2 – 150
Pilot whale	1 – 18	1 – 18
Killer whale	0.1 – 35	12 – 25
Bottlenose dolphin	0.2 – 24	0.5 – 130
Dugongs	0.15 – 18	NA
* = using the bottlenose whale as an example		

Source: summarised from Simmonds *et al.*, 2004



Source: Professor Rodney Coates, The Advanced *SONAR* Course, Seiche (2002)*; from* www.seiche.com

Figure 53 Ambient and Localised Noise Sources in the Ocean

A number of studies have documented adaptive responses (anti-masking strategies) to anthropogenic underwater noise (Erbe *et al*., 2016). Anti-masking strategies include changes in vocalisation strength, frequency, and timing. For example, blue whales increased their calls (emitted during social encounters and feeding) when a seismic survey is operational in the area (Di lorio and Clark, 2010). Such adaptations have been documented in species such as humpback whales (McCauley *et al*., 1998; 2003b), beluga whales (Lesage *et al*., 1999), right whales (Parks *et al*., 2007, 2011), killer whales (Holt *et al.*, 2008), and bottlenose dolphins (van Ginkel *et al*., 2017) where it is thought that increased calling increases the probability that communication signals will be successfully received by conspecifics by reducing the effects of auditory masking.

Marine mammals may also cease vocalising in response to anthropogenic noise, as has been demonstrated in humpback whales at breeding grounds off Angola in response to an MSS whereby singing activity declined with increasing received levels of the seismic pulses (Cerchio *et al*., 2014). Cessation in singing at a breeding ground was implied to have the potential to affect mating behaviour and success (Cerchio *et al*., 2014). This response is not novel to seismic surveys, with humpbacks also halting vocalisations in response to emissions from acoustic fisheries tools (Risch *et al.,* 2012). Cessation in clicking was also observed in sperm whales by Bowles *et al.* (1994) in response to weak seismic survey pulses (received level of 115 dB re 1 µPa); however, contradictory to the findings of Bowles *et al.* (1994), Madsen *et al*. (2002) did not document any changes in male sperm whale clicks in response to an MSS off Norway. Sperm whales did not cease clicking and did not seem to alter their normal acoustic behaviour during feeding (Madsen *et al*., 2002).

Decreases of three echolocation parameters (number of clicks per minute, minutes with detectable click trains and feeding buzz frequency) were also reported for harbour porpoises in the Danish North Sea within an 8 – 12 km radius of an MSS (Sarnocinska *et al*., 2020). The authors of this study provided evidence to suggest that displacement of porpoises was not the main driver of this effect, but instead that the results instead suggest a change in echolocation behaviour representing a decrease in porpoise foraging efficacy.

The calling rates of bowhead whales near an MSS were found to vary with changes in received SELs (Blackwell *et al*., 2015). In this study, at very low SELs (only just detectable) calling rates increased. As SELs continued to increase, calling rates levelled off (as SELs reached 94 dB re 1 µPa^2-s), then began decreasing (at SELs greater than 127 dB re 1 µPa^2-s), with whales falling virtually silent once SELs exceeded 160 dB re 1 µPa^2-s. Hence adaptations to masking for some species may be limited to circumstances when whales are subject to only low to moderate SELs. Similar results were also reported by Thode *et al*. (2020) where bowhead whale call density increased with exposure to weak SELs from MSS (a 10 – 15 dB increased above ambient noise) and then dropped with increasing cumulative SELs. This study confirmed that whales could completely compensate for MSS noise at low received levels (with whale call volume increasing by nearly 20 dB), but this ability increasingly diminished as MSS noise levels rose; to the point where a 40 dB increase in cumulative SEL (from MSS) prompted call level increases of only a few dB whereby whale communication space was substantially compromised.

Blue whales vocalise at a low frequency (average of 0.01 – 0.110 kHz) (McDonald *et al*., 2001; Miller *et al*., 2014), meaning that their calls can travel hundreds of kilometres underwater. The amplitude of their calls can reach levels of up to 188 dB re 1ųPa m-1 (Aroyan *et al*., 2000; Cummings and Thompson, 1971). Passive acoustic monitoring has proven to be ineffective at detecting the low frequencies of blue whale calls and some other baleen whales. While SLB will utilise a PAM system during the Seismic Survey (**Appendix J**) this system will be useful for detecting some low-frequency vocalisations and of high- and very-high- frequency cetaceans, (particularly sperm whales). Mitigations for baleen whales have been designed without reliance on PAM detections.

While our understanding of the sound pressure component of whale vocalisations is reasonable, Mooney *et al*. (2016) demonstrated that acoustic fields generated by singing humpback whales include significant particle velocity components as well and these are also detectable over long distances. Further research is warranted with regard to the role that particle motion plays in whale communication and how anthropogenic noise might affect this.

It is likely that marine mammals in the vicinity of the OA during the Seismic Survey may be subject to some masking effects. In particular, the frequency of baleen whale calls overlaps directly with the low frequency seismic operations (**Figure 53**). The long survey lines and the 720 m line spacing of the Seismic Survey will reduce the potential for significant masking effects as underwater noise from the active source will be transitory throughout the OA (i.e. not focused in any one area for an extended period). Several control measures will be implemented during the Seismic Survey to reduce and minimise potential impacts to cetaceans that may arise from the effects of acoustic disturbance (**Table 70**).

Masking levels are difficult to predict, and no auditory thresholds exist for masking effects on marine mammals (Erbe *et al*., 2016); however, as outlined above masking responses (e.g. changes in calling rates) have been documented to occur at relatively low exposure levels (i.e. lower than would elicit any behavioural response). The UAM results for the Seismic Survey clearly predict relatively high cumulative SELs (**Table 59**); hence sound levels sufficient to elicit masking will certainly occur in the OA and surrounding waters. Any masking effects will however cease at the completion of the survey and are highly unlikely to have detectable population level effects on any marine mammal species. On this basis the residual risk of impacts to noise perception by marine mammal species from seismic sound exposure and vessel noise during the Seismic Survey has been assessed as **Moderate** (*Minor* x *Certain*).

Table 65 Summary of Horizontal Distances from 3,000 in^3 Acoustic Array in the Water Column and Seabed at which Potential Impacts to Marine Receptors may occur

Receptor and Source	Behavioural		Impairment						Mortality/ Potential Mortal Injury/ Potential Sub-lethal Effects	
			TTS		PTS		Recoverable Injury			
	Threshold Criteria	Distance (m)	Threshold Criteria	Distance (m)	Threshold Criteria	Distance (m)	Threshold Criteria	Distance (m)	Threshold Criteria	Distance (m)
Fish eggs & larvae (also relevant for plankton)										
Popper *et al*. (2014)									SEL_{24hr} :>210 PK:>207	80 150-200
Benthic Invertebrates										
Crustaceans (Day *et al*., 2016; 2017) Bivalves (Day *et al*., 2016a) Sponges and Corals (Heyward *et al*. 2018)									Crustaceans PK >209 Bivalves 37.57 ms^{-2} Sponges & corals PK:>226	281 – 421 10.5 at depth 75m 11 at depth 40 m
Fish (Popper *et al*. (2014)										
No swim bladder			SEL_{24hr}: >>186 dB	Water column: 6,480 – 10,500 Seabed: 6,480-9,310			SEL_{24hr}: >216 PK: >213	Water column: 80 Seabed: NR Water column: 80 Seabed: 44-130	SEL_{24hr}: >219 PK: >213	Water column: 80 Seabed: NR Water column: 80 Seabed: 44-130

Swim bladder – not involved with hearing			SEL$_{24hr}$: >>186	Water column: 6,480 -– 10,500 Seabed: 6,480-9,310			SEL$_{24hr}$: 203 PK: >207	Water column: 100 Seabed: NR Water column: 200 Seabed: 148-252	SEL$_{24hr}$: 210 PK: >207	Water column: 80 Seabed: NR Water column: 150-200 Seabed: 148-252
Swim bladder – that is involved with hearing			SEL$_{24hr}$: 186	Water column: 6,480 – 10,500 Seabed: 6,480-9,310			SEL$_{24hr}$: 203 PK: >207	Water column: 100 Seabed: NR Water column: 200 Seabed: 148-252	SEL$_{24hr}$: 207 PK: >207	Water column: 80 Seabed: NR Water column: 150-200 Seabed: 148-252
Marine Reptiles										
Sea Turtles (NSF, 2011; Finneran *et al.*, 2017; McCauley *et al.*, 2000b)	RMS SPL: 166 (response) RMS SPL: 175 (disturbance)	7,680 2,440	SEL$_{24hr}$: 189 PK: 226	1,820 – 6,110 -	SEL$_{24hr}$: 204 PK: 232	80 -				
Marine Mammals (NOAA, 2019; Southall *et al.*, 2019)										
Low frequency Cetaceans	RMS SPL: 160	8,790 – 14,300	SEL$_{24hr}$: 168 PK: 213	38,900 – 47,500 80	SEL$_{24hr}$: 183 PK: 219	5,750 - 6,840 -				
High frequency Cetaceans	RMS SPL: 160	8,790 – 14,300	SEL$_{24hr}$: 170 PK: 224	70 – 80 -	SEL$_{24hr}$: 185 PK: 230	- -				

Very high frequency Cetaceans	RMS SPL: 160	8,790 – 14,300	SEL_{24hr}: 140 PK: 196	180 – 500 790 – 920	SEL_{24hr}: 155 PK: 202	80 290 – 480				
Sirenians (Dugong)	RMS SPL: 160	8,790 – 14,300	SEL_{24hr}: 175 PK: 220	80 -	SEL_{24hr}: 190 PK: 226	- -				

Note: Peak sound pressure levels (PK): dB re 1 µPa;

Cumulative sound exposure level (SEL24hr): dB re 1 µPa2 ·s;

Per-pulse SEL: dB re 1 µPa2 ·s

RMS SPL: dB re 1 µPa

* At a distance of 20 km from the source, distortion and reflection effects will result in smearing of the distinct peak in in the noise pulse that occurs very close to the source. The 20 km distance assumes there is no smearing, i.e. the difference between the noise levels remans 29.6 dB at all distances, an extremely conservative assumption at this distance.

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

7.2.2.5 Potential Impacts and Risks on Protected and Sensitive Areas in the Marine Coastal Environment

A number of protected and sensitive environments, species and habitats have been identified in the waters within the EMBA (**Section 4.4**). These include AMPs, State Marine Parks, KEFs, BIAs, the Australian Whale Sanctuary, Ramsar wetlands, National Heritage places and Commonwealth Heritage sites.

The following sections provides an assessment on the values within these protected and sensitive environments from the proposed Seismic Survey. It is worth noting that the following sections have only focused on those sensitive areas that may be impacted by the acoustic disturbance associated with the Seismic Survey, which includes AMPs (specifically the Oceanic Shoals Marine Park), BIAs and KEFs.

7.2.2.5.1 Australian Marine Parks

There are no AMPs located within the OA. However, five AMPs were identified within the EMBA and their associated separation distances from the Seismic Survey are listed below, in order of proximity:

- Oceanic Shoals Marine Park (1.5 km from the OA, 17 km from the Acquisition Area);
- Kimberley Marine Park (69 km from the OA, 79 km from the Acquisition Area);
- Cartier Island Marine Park (100 km from the OA, 122 km from the Acquisition Area);
- Ashmore Reef Marine Park (140 km from the OA, 155 km from the Acquisition Area); and
- Joseph Bonaparte Gulf Marine Park (290 km from the OA, 345 km from the Acquisition Area).

The conservation and management of these AMPs falls under the relevant NWMR and NMR Management Plans, which sets out the management zoning and IUCN categorisation within each AMP and determines the activities allowed within each zone in accordance with the EPBC Act.

The categorisation and zoning consider the purposes for which the reserves were declared, the objectives of the Management Plans, and the requirements of the EPBC Act and associated regulations. The IUCN Category Zones for each of the AMPs is outlined within **Table 11**, and discussion on the key management principles and purpose of each AMP is outlined within **Section 4.4.1**.

Due to the separation distance between the AA and the AMPs (listed above), the following discussion focuses on the AMP that is most likely to receive sound levels above which impacts may occur on the conservation values within that AMP; that being the Oceanic Shoals Marine Park. Based on the findings of acoustic modelling conducted by JASCO (Connell *et al*., 2022) and due to their further distance from the OA, noise levels within the Kimberley, Cartier Island, Ashmore Reef, and Joseph Bonaparte Gulf Marine Parks are not expected to elicit behavioural or physiological changes to marine receptors and are, therefore, not considered further within this section.

The Oceanic Shoals Marine Park has multiple IUCN Categories associated within it; however, the most proximate to the Seismic Survey is Multiple Use Zone (IUCN VI) seen in **Figure 14**. The NMR Management Plan allows for seismic surveys to continue within areas classified as IUCN Category VI (Special Purpose Zone and Multiple Use Zone) if effects from such activities allow the following objectives to be met:

- Provide for the protection and conservation of biodiversity and other natural and cultural values of the North-west and North Network; and
- Provide for ecological sustainable use and enjoyment of the natural resources within the North-west and North Network where this is consistent with the above objective.

Activities considered appropriate must be consistent with the Australian IUCN Reserve Management Principles as provided for within Schedule 8 of the EPBC Regulations; those that are relevant to IUCN Category VI are as follows:

- The biological diversity and other natural values of the reserve or zone should be protected and maintained in the long term;
- Management practices should be applied to ensure ecologically sustainable use of the reserve or zone; and
- Management of the reserve or zone should contribute to regional and national development to the extent that this is consistent with these principles.

As outlined within **Section 5**, SLB consulted with DNP about the Seismic Survey in February 2022. This consultation confirmed that as the proposal is not within an AMP, no authorisation requirements from the DNP are required. However, the DNP outlined some of the specific values of the Oceanic Shoals Marine Park that this EP needs to consider, due to the proximity of the proposed activity to the AMP. These values include, but are not limited to, the following:

- Species listed as threatened, migratory, marine or cetacean;
- BIAs including foraging and internesting habitat for marine turtles;
- Carbonate bank and terrace systems of the Van Diemen Rise—an area characterised by terraces, banks, channels and valleys supporting sponges, soft coral, polychaetes, ascidians, turtles, snakes and sharks;
- Carbonate bank and terrace system of the Sahul Shelf—an area characterised by terraces, banks, channels and valleys, supporting sponges, soft corals, sessile filter feeders, polychaetes and ascidians;
- Pinnacles of the Bonaparte Basin—an area that contains the largest concentration of pinnacles along the Australian margin, where local upwellings of nutrient-rich water attract aggregations of fish, seabirds and turtles; and
- Shelf break and slope of the Arafura Shelf—an area characterised by continental slope, patch reefs and hard substrate pinnacles that support over 280 demersal fish species.

Although the Seismic Survey does not specifically overlap the Oceanic Shoals Marine Park itself, it does overlap with some features that are identified values within the Marine Park. To avoid unnecessary duplication in this EP, the values associated with the Oceanic Shoals Marine Park and where the potential impacts on those values are addressed within this EP are outlined in **Table 66.**

Table 66 Conservation Values within the Oceanic Shoals Marine Park that may be affected by Acoustic Disturbance

Conservation Values	Location in EP for full assessment of acoustic effects on conservation values
Carbonate bank and terrace system of the Sahul Shelf KEF	This KEF is regionally important due to its role in enhancing biodiversity and local productivity relative to its surrounds by providing elevated hard substrates to which organisms can adhere and expose filter-feeders to the maximum amount of passing nutrients. As outlined in **Section 7.2.2.2.2**, while there is limited published literature on the potential impacts of seismic noise on sponges and other sessile benthic invertebrates, any impacts are expected to be temporary, localised and restricted to the parent population. However, changes at the community level will unlikely be discernible from the natural variation observed. The potential risk to benthic invertebrates and sponges within the KEF has been assessed as low. Due to the temporary and localised nature of the effects, biodiversity will be protected and maintained in the long-term and the functioning and integrity of these benthic communities will be maintained. The Seismic Survey will not be inconsistent with the IUCN VI principles and the objectives of the Management Plan.
Pygmy blue whale migration BIA	Potential impacts on pygmy blue whales have been assessed in **Section 7.2.2.2.7** (physiological impacts) and **Section 7.2.2.3.6** (behavioural impacts), which in turn directly relates to the potential impact on the BIA. The results of these two sections found that, based on the control measures being in place, the impacts are at worst moderate. Due to this, and the control measures in place to manage any potential impacts on blue whales, it is considered that the Seismic Survey will not be inconsistent with the IUCN VI principles and the objectives of the Management Plan.
Whale shark foraging BIA	The whale shark foraging BIA represents waters where solitary whale sharks may forage during the migration from Ningaloo, which occurs primarily in spring (September to November) and partially overlaps the OA. Potential impacts from the Seismic Survey on whale sharks has been discussed within **Section 7.2.2.2.4** (physiological impacts) and **Section 7.2.2.3.3** (behavioural impacts), which in turn relates to potential impacts on the BIA itself. Based on the assessments within these sections and the control measures to be implemented during the Seismic Survey, it is considered that the Seismic Survey will not be inconsistent with the IUCN VI principles and the objectives of the Management Plan.
Olive Ridley, Loggerhead and Flatback turtle foraging and internesting BIAs	As outlined in **Section 4.5.5** there are several BIAs for marine reptile species, including Olive Ridley, Loggerhead and Flatback turtle, in the region, including within the OA, along the coastline and offshore islands adjacent to the OA, and within or close to the EMBA. Potential impacts from the Seismic Survey on the species associated with the foraging and internesting BIAs are discussed within **Section 7.2.2.2.6** (physiological impacts) and **Section 7.2.2.3.5** (behavioural impacts). The conclusion of both of these sections is that the impacts from the Seismic Survey on marine reptiles is low. Based on this, the Seismic Survey will not be inconsistent with the IUCN VI principles and the objectives of the Management Plan.
Cultural values within the NT northern region and the Kimberley region	As outlined within **Section 4.6**, there are no cultural values located within the OA itself; however, there are values located inshore of the OA, within the EMBA. Due to this separation distance, the potential impacts from the Seismic Survey on cultural values are limited to those unplanned activities (i.e. potential hydrocarbon spill). As such, an assessment of the potential impacts on cultural values is discussed within **Section 8.3.3** in relation to the unlikely event of a hydrocarbon spill. Based on these assessments, the Seismic Survey will not be inconsistent with the IUCN VI principles and the objectives of the Management Plan.

An EP cannot be approved if the activity is likely to result in unacceptable impacts that are inconsistent with the IUCN principles and relevant Management Plan objectives. Based on the discussions within **Table 66**, and the assessments on the various conservation values associated with the Oceanic Shoals Marine Park throughout **Section 7**, along with the implementation of the control measures, it is considered that the Seismic Survey will not be inconsistent with the IUCN principles and the NMR Management Plan objectives when operating within the OA.

7.2.2.5.2 Biologically Important Areas

BIAs are spatially defined areas where aggregations of individuals of a species are known to display biologically important behaviours. These areas have no legal status; however, a number of Conservation Management Plans outline recommendations for MSSs operating within a defined BIA. BIAs for mammals, reptiles and seabirds has been registered within the OA and/or EMBA.

BIAs associated with 21 different threatened and/or migratory species were identified as potentially occurring within the OA (four BIAs for three different species; Pygmy Blue whale, Whale shark and Flatback Turtle) and the EMBA (28), 32 BIAs in total, see summary in **Table 13**. The BIAs are linked to behaviours as; foraging, distribution, migration, resting, breeding, calving and nursing.

There are eleven seabird BIAs represented by nine different threatened and/or migratory species (classified by the EPBC Act) of relevance to the EMBA, none of these overlap with the OA. As discussed in **Sections 7.2.2.2.8** (physiological impacts) and **7.2.2.3.7** (behavioural impacts), the consequence of potential impacts from seismic sound exposure during the Seismic Survey on seabirds have been assessed as **Low** (*Minor* x *Rare*) for all potential impacts.

A foraging BIA for whale shark (classified as vulnerable and migratory) overlaps with the OA. The potential impacts of acoustic disturbances on whale shark have been discussed in detail in **Sections 7.2.2.2.4** (physiological impacts), **7.2.2.3.3** (behavioural impacts), and **7.2.2.4.1** (perceptual impacts). As a result, the residual risk of impacts to elasmobranchs from seismic sound exposure during the Seismic Survey has been assessed as **Low** (*Minor* x *Rare*) for potential physiological impacts and as **Low** (*Minor* x *Unlikely*) for potential behavioural impacts.

The OA overlaps with a flatback turtle foraging BIA. Flatback turtles are classified as vulnerable and migratory. In addition, loggerhead turtle and olive ridley turtle foraging BIAs have been identified nearby (approximately 9 km to the east of the OA), and both these species are classified as endangered and migratory. The potential impacts of acoustic disturbances on these turtles have been discussed in detail in **Sections 7.2.2.2.6** (physiological impacts) and **7.2.2.3.5** (behavioural impacts). As a result, the residual risk to marine reptile physiology arising from acoustic disturbance during the Seismic Survey has been assessed as **Low** (*Minor* x *Possible*) for potential physiological impacts and **Low** (*Minor x Unlikely*) for potential behavioural impacts.

Pygmy blue whale migration and known distribution BIAs overlaps with the northwest part of the OA. The nearest blue whale feeding BIA is located 294 km southwest of the OA. Pygmy blue whales are classified as endangered. There is a high likelihood of encountering pygmy blue whales in and around the migratory BIA for most months of the year. The potential impacts of acoustic disturbances on blue whale have been discussed in detail in **Sections 7.2.2.2.7** (physiological impacts), **7.2.2.3.6** (behavioural impacts), and **7.2.2.4.2** (perceptual impacts).

All Australian marine mammals are fully protected under the EPBC Act, so the potential for causing adverse effects during any MSS is taken extremely seriously. The animat modelling results for cumulative TTS and PTS onset distances shows that the standard Shut-down Zones recommended in the EPBC Act Policy Statement 2.1 are insufficient to manage the risk of auditory impairment to baleen whales during the Seismic Survey. Based on the findings of the modelling results, additional management procedures and control measures are proposed and will be implemented for blue whales during the seismic survey when the acoustic source is active in the BIA and buffer area (see proposed control measures in **Sections 7.2.2.2.7**, **7.2.2.3.6**, **7.2.2.4.2** and a summary of all control measures for managing acoustic disturbance during the Seismic Survey in **Table 70**).

With specific regards to the objectives of the blue whale recovery plan, the Seismic Survey will be consistent with the objectives within this recovery plan, and it is considered that anthropogenic noise in the blue whale migratory BIA will be managed through the survey design and implementation of the additional control measures so that any blue whale may continue to utilize the area without injuries or behavioural disturbances. Therefore, it is considered that the residual environmental impacts and risks of the proposed Seismic Survey on blue whales are managed to an **Acceptable Level**.

The residual risk of potential physiological impacts on blue whales arising from acoustic disturbance during the Seismic Survey has been assessed as **Low** (*Moderate* x *Rare*). The residual risk of behavioural impacts to blue whales from acoustic disturbance during the Seismic Survey has been assessed as **Moderate** (*Moderate x Likely*). The residual risk of impacts to noise perception on blue whales from seismic sound exposure and vessel noise during the Seismic Survey has been assessed as **Moderate** *(Minor x Certain).*

Based on the risk assessments for all marine receptors, the total residual risk to all BIAs within the EMBA arising from the Seismic Survey has been assessed as **Low** (*Minor x Unlikely*).

7.2.2.5.3 Key Ecological Features

The OA overlaps with one KEF, the Carbonate Bank and Terrace System of the Sahul Shelf. There are five KEFs within the wider EMBA. A summary of the relevant KEFs and area of overlap is described in **Table 12** and displayed in **Figure 15.**

The Carbonate Bank and Terrace System of the Sahul Shelf KEF is recognised for its role in enhancing biodiversity, which values apply to both benthic and pelagic habitats. The banks are also known as a biodiversity hotspot for sponges, in addition to foraging areas for several turtles. Humpback whales and green and freshwater sawfish are also likely to occur in the area (Donovan *et al*., 2008). The KEF does not overlap with the blue whale BIAs.

The known and potential impacts from acoustic disturbances associated with the Seismic Survey on all identified marine receptors supported by this KEF, have been discussed throughout **Sections 7.2.2.2** (potential physiological effects) and **Section 7.2.2.3** (potential behavioural effects), as well as **Section 7.2.2.4** (potential perceptual effects) together with a residual risk assessment for each receptor.

The residual risk of potential impacts on marine receptors, apart from marine mammals, arising from acoustic disturbance during the Seismic Survey has been assessed as **Low.** The residual risk of potential impacts on marine mammals arising from acoustic disturbance during the Seismic Survey has been assessed as **Low** – **Moderate**.

Based on the risk assessments for all marine receptors, the residual risk to Carbonate Bank and Terrace System of the Sahul Shelf KEF arising from the Seismic Survey has been assessed as **Low** (*Minor x Unlikely*).

7.2.3 Evaluation of Known and Potential Impacts and Risks on Commercial Fisheries

The following represent the potential impact pathways commercial fishers could be affected by the MSS data acquisition activities:

- Seismic sounds affecting fish species that are targeted and retained by the commercial fisheries.

The commercial fisheries that are most likely to be affected by the potential impact pathways are the Mackerel Managed Fishery, Northern Demersal Scalefish Management Fishery and the Indonesian Commercial Fisheries (see **Section 4.7.3**). The latter two have been shown to have a higher degree of spatial overlap with the OA (within respective economic exclusion zones), compared to the relatively less relative effort and spatial coverage that is recorded for the MMF within the OA (see **Section 4.7.3.2.2**).

7.2.3.1 Seismic Emission on Commercial Fisheries

Seismic emissions have been reported to have the potential direct effects on marine taxa targeted and retained by commercial fisheries operating within the EMBA including but not limited to recoverable injury, temporary changes to hearing sensitivity, behaviour, communication masking (Worcester, 2006; *Popper et al.*, 2014; McCauley *et al*., 2000; Pearson *et al*., 1992; Wardle *et al*., 2001; Codarin *et al.,* 2009), and spawning activities (Sætre and Ona, 1996) (see **Section 7.2.2.2** to **Section 7.2.2.4**). It is however considered that seismic emission will not have any detectable impacts on populations of these taxa within the OA or EMBA (see **Section 7.2.2.2** to **Section 7.2.2.4**). Moreover, seismic emissions are not considered likely to result in any indirect impacts to these targeted taxa through temporarily effects to zooplankton and phytoplankton abundance or diversity and subsequently modify the foraging behaviour of species that rely directly or indirectly on this resource (e.g. if predating on taxa dependent on zooplankton and phytoplankton) (see **Section 7.2.2.2.1**).

Examining catch rates of four fish species (gummy shark, tiger flathead, silver warehou, school whiting) in the Gippsland Basin, Bass Strait, Thomson *et al*. (2014) found no consistent relationships between catch rates and effects from 183 seismic surveys undertaken in the area. While Bruce *et al*. (2018) concluded following examining the impacts of a 2D MSS in Australia's Gippsland Basin on catches that there is little evidence of consistent catch rate changes induced by the seismic surveys. A further desktop study in 2015 targeted a single seismic survey and found that catch rates had increased for six of the 15 species examined, three showed reduced catch rates, and five species showed no change (Przeslawski *et al.,* 2016a).

International studies have reported no significant effects of seismic activities on catch rates from a variety of taxa including crustaceans, cephalopods, and teleosts, (Pickett *et al*., 1994; La Bella *et al*., 1996; Jakupsstovu *et al*., 2001). Some studies have indicated that catch rates have decreased or increased following seismic activities however these changes have been reported to be temporary (Bendell, 2011, Streever *et al*., 2016), and it has been suggested that the results of some studies have been influenced by a range of confounded experimental factors (Skalski *et al*., 1992; Gausland, 2003; Richardson *et al*., 2017). Where catch rates have been detected to reduce following exposure to seismic emissions a number of studies have reported that post-survey catch levels return to pre-survey levels following the cessation of seismic activities (e.g. Carroll *et al.,* 2017).

Meekan *et al.* (2021) undertook a large-scale experiment that assessed the impacts of a seismic survey on tropical demersal fish species including emperors, snappers, and groupers/rock cods including those taxa targeted by the NDSMF on the North West Shelf of Western Australia. The behaviours and movements of fishes were assessed at sites that were exposed to high, medium, and low levels of seismic emissions, as well as at control sites. The results showed there were no short-term or long-term effects on the composition, abundance, size structure, behaviour, or movement of the studied fishes. The study found there to be little evidence that fish were displaced by the exposure to the acoustic source – movements of fish occurred over a limited area and there was no evidence for the departure of fish after exposure. There was little evidence to suggest that seismic surveys had impact on demersal fishes in this study (Meekan *et al.*, 2021).

Given the evidence of fish returning to survey areas following the cessation of seismic/acoustic activities, it is considered that any effects on fish and fish populations will be temporary, and fish will return to normal behaviour and distributions within days of any acoustic exposure.

Commercial Fishing Industry Adjustment Protocol for the Bonaparte MC3D Marine Seismic Survey

SLB will implement the *National Energy Resources Australia Commercial Fishing Industry Adjustment Protocol*, developed as part of the Collaborative Seismic Environment Plan Project (NERA 2021). This protocol sets out an agreed approach for economic adjustment to manage potential impacts from the Seismic Survey on the commercial fishing industry in Australian waters. In the event that such impacts cannot be managed or avoided, and commercial fishers experience an economic loss as a result of the Seismic Survey, then financial compensation will be considered in accordance with the NERA (2021) Commercial Fishing Industry Adjustment Protocol (**Appendix M**). The NERA protocol was developed in consultation with State, Territory and Commonwealth commercial fishing licence holders that are active in Western Australia. As a result, it is considered that both government and the commercial fishing sector are in general agreement with this approach in regard to potential risks from MSS's. The groups consulted included:

- Western Australian Fishing Industry Council;
- Northern Territory Seafood Council;
- Commonwealth Fisheries Association;
- Department of Primary Industry and Regional Development WA;
- Fisheries Division in the Department of Industry, Tourism and Trade NT;
- Australian Fisheries Management Authority;
- Department of Industry, Science, Energy and Resources;
- Australian Petroleum Production and Exploration Association; and
- International Association of Geophysical Contractors.

Consultation with licence holders has not yielded any feedback despite several attempts to reach them to provide sufficient information on the Seismic Survey. Sufficient time has lapsed since the first round of information was provided to the licence holders, with the most recent attempt facilitated by WAFIC who emailed an updated information sheet and spreadsheet of GPS coordinates directly to them. WAFIC provided licence holders with a two-week period to raise any feedback or concern they held. It is possible that the minimal feedback received is due, in part, to the low level of overlap between the AA and commercial fishing activity areas identified within the commercial fisheries assessment (**Section 4.7.3.2.1** and **Section 4.7.3.2.2**). Despite not being able to consult further with the licence holders, SLB has continue to consult with WAFIC, and as a result of this consultation, and as requested by WAFIC, will implement the NERA (2021) Commercial Fishing Industry Adjustment Protocol for the Bonaparte MC3D Marine Seismic Survey. The purpose is to ensure an agreed process between SLB and WAFIC is in place which is intended to mitigate any loss or damage to gear, displacement cost or loss of catch should that be proven to have resulted from the Seismic Survey.

SLB will consider claims from fishery licence holders and vessel crews (i.e. the claimant) on a case-by-case basis, and in the following circumstances where an economic loss is demonstrated as a result of the Seismic Survey operations in Australian Waters:

- Interaction resulting in loss or damage to fishing equipment;
- A temporary loss of fish catch due to damaged or lost fishing equipment;
- Where displacement from fishing grounds results in additional costs incurred due to relocating. Displacement from fishing grounds can be as a result of seismic operational activities and as a result of avoiding contaminated waters following a fuel oil spill; or
- A temporary reduction in fish catch due to the impacts associated with acoustic disturbance or due to displacement from fishing grounds.

For any claimant to be eligible for compensation, all claimants must provide sufficient evidence in accordance with the NERA (2021) protocol to support a claim for: (1) any equipment being lost or damaged, (2)being displaced from their ‘usual fishing grounds’ and/or (3) temporary loss of fish landed catch. Application forms (which are included in the NERA 2021 protocol) are to be used and sent to environment@slb.com. Any application for a compensation claim must be made in accordance with the Adjustment Protocol Timeframes stipulated in NERA (2021).

Consultation with commercial fishers known to utilise the OA will occur in writing no less than 28 days before operations commence, notifying them of the inclusion of the NERA (2021) *Commercial Fishing Industry Adjustment Protocol* to the EP. This consultation will be carried out by WAFIC. Notification is to be provided in the form of a map, showing the OA and associated Adjustment Area (defined as an area extending 10 km around the perimeter of the OA), plus digital files in formats such as shapefiles, and a copy of the NERA (2021) protocol document in full. The protocol includes information on the principles, scope of application and approach to compensation, including guidance on how to make a claim, eligibility and claim information requirements, assessment timeframes and the mechanisms through which disputes can be independently assessed with the objective of being resolved.

Claims for damaged or lost equipment will be considered provided the interaction took place in the OA where the Seismic Survey took place plus any additional area of avoidance requested around the survey vessels and towed equipment, and the event occurred during the period of Seismic Survey operations only. Claims for loss of fish catch (due to damaged or lost equipment), relocation costs from displacement, and temporary reduction in catch due to the impacts associated with acoustic disturbance or due to displacement from fishing grounds will be considered provided the interaction or impact took place in the Adjustment Area plus any additional area of avoidance requested around the seismic vessels and towed equipment and occurred during the period of Seismic Survey operations only. Claims for temporary reduction in catch due to the impacts associated with acoustic disturbance will be considered provided the impact took place in the Adjustment Area plus any additional area of avoidance requested around the seismic vessels and towed equipment, and occurred during the period of Seismic Survey operations, plus six months following completion of the survey. The relevant compensation claim application forms are included in the NERA (2021) Commercial Fishing Industry Adjustment Protocol. The information/evidence required to support the different types of claims are outlined in **Table 67**.

Table 67 Information/evidence required for each claim type under the NERA (2021) Commercial Fishing Industry Adjustment Protocol

Claim type	Information/evidence required
Damaged or lost equipment	Where a claimant has been involved in an interaction leading to loss or damage to the claimant's equipment, all interactions between the claimant and the survey vessel/s should be recorded by both the Vessel Master and the claimant. This should include, but not be limited to, the time, date and location coordinates of where the interaction occurred, the name of the vessel, the licence holder number on the fishing equipment, and any details of communications between the claimant and the survey vessel/s. Claims should include costs for the equipment to be repaired or replaced, including supporting evidence such as a quote or receipt. **Claimant should fill out Appendix 4 Fishing Gear Loss Or Damage Application Form in NERA (2021)**
Loss of fish catch due to damaged or lost equipment	Where a claimant has been involved in an interaction leading to loss or damage to the claimant's equipment, and the damage or loss led to a temporary loss of fish catch, the claimant should provide evidence about the loss or damage of equipment, as well as information about the loss of catch. In assessing compensation for temporary loss or reduction of catch, evidence must be provided to enable verification of average catch in previous years. This may include, but not be limited to, information in the form of income tax returns, catch data, fishing effort and/or Vessel Management System data. Claims must include details of: • Why and for how long fishing was aborted and when it was recommenced; • Anticipated loss of catch per fish species (reduced kg) and market price per reduced kg at the time the catch would have been sold at the point of landing; and • Effort, catch and disposal records for the trip during which the damage occurred, as well as recorded for the previous five years. If a reduction of catch is concluded, payment will be calculated based on the reduced kilograms caught per species multiplied by the market price per kilogram at the time the catch would have been sold. Evidence of market price at the time of the interaction must be provided from the normal fish receiver at the point of landing. **Claimant should fill out Appendix 2 Loss of Catch Application Form in NERA (2021); and Appendix 4 Fishing Gear Loss Or Damage Application Form in NERA (2021)**

Claim type	Information/evidence required
Displacement – relocation costs	In some instances, a claimant may incur additional costs (e.g. increased transit times, fuel and crewing) as a result of relocating on account of the Seismic Survey restricting access to usual fishing grounds. Where the claimant intends to relocate and potentially make a claim as a result of the Seismic Survey, the claimant/vessel must notify SLB at the time of relocating and state the reason that the Seismic Survey has caused them to relocate. All interactions between the claimant and the survey vessel/s should be recorded by both the Vessel Master and the claimant. This should include, but not be limited to, the time, date and location coordinates of where fishing was aborted and where it was recommenced, the name of the vessel, the licence holder number on the fishing equipment, and any details of communications between the claimant and the vessel/s. If a claimant suffers economic loss from the relocation costs after considering the landed catch, then a claim may be submitted to SLB for the relocation costs. For claims related to displacement from fishing grounds, the claimant is required to provide evidence that demonstrates their vessel/s has recently and consistently fished within the OA. This may include the previous 5 years of fishing effort, catch, and/or Vessel Management System data. Claims must include details of: • The vessel track, distance travelled and transit time to new fishing area; and • Additional costs incurred (e.g. increased travel time, fuel and crewing) as a result of the relocation, including supporting evidence such as fuel receipts. **Claimant should fill out Appendix 3 Displacement Application Form in NERA (2021)**

Claim type	Information/evidence required
Temporary reduction in catch due to displacement from fishing grounds, impacts associated with acoustic disturbance or ddisplacement from fishing grounds as a result of avoiding contaminated waters following a fuel oil spill.	Where a claimant intends to make a claim for economic loss in the form of a reduction in fish catch as a result of moving to a different area due to the Seismic Survey restricting access to usual fishing grounds, or the avoidance of contaminated waters following a spill event, the claimant/vessel is required to notify SLB at the time of relocating and state the reason that the Seismic Survey has caused them to relocate. Interactions between the claimant and the survey vessel/s should be recorded and include, but not be limited to, the time, date and location co-ordinates of where fishing was aborted and where it was recommenced, the name of the vessel, and any details of communications between the claimant and the survey vessel/s. Where a commercial fishing licence holder intends to make a claim for economic loss in the form of a reduction in fish catch due to impacts associated with acoustic disturbance from the Bonaparte MSS, the license holder/vessel is required to notify SLB within 30 days of initial identification of reduction in fish catch and a claim may be lodged up to 12 months of the notification. Claims may be made for the period of the survey and for a period of six months following completion of the survey. Claims relating to economic loss due to reduction in fish catch are assessed in accordance with Section 2.1 of the *NERA Commercial Fishing Industry Adjustment Protocol* (NERA 2021). Economic loss must be demonstrated through a reduction in CPUE of fish, compared to that claimant's 5-year (or another time-period agreed with SLB) average historical CPUE for that species in the corresponding month/season in the same statistical fishing block (at highest available resolution). Catch and effort history covering the prior 10 years is required to provide an average CPUE value that is subject to minimal influence from fish stock recruitment and environmental fluctuations. CPUE will be defined in kilograms of landed catch and the unit of effort will be defined in hours (decimal hours where available) fished for trawl, hours fished, or kilometres of line set or number of hooks per kilometre for line fishing or number of trap lifts, resulting in the landed catch. Claims must include details of: • Anticipated loss of catch (kg) per target species; • Market price per kg per target species at the time the catch would have been sold at the point of landing; • Effort, catch and disposal records for the trip during which the displacement occurs; • Monthly catch and disposal records for the last five years to allow calculation of historical average catch levels. **Claimant should fill out Appendix 2 Loss of Catch Application Form in NERA (2021).**

Every claim will be assessed as soon as practicable and in accordance with the Adjustment Protocol Timeframes set out in NERA (2021) Commercial Fishing Industry Adjustment Protocol. . Claims will be assessed by a suitably experienced/qualified independent person or organisation (defined as a person/organisation with proven demonstrated experience in data analysis and data auditing processes and procedures within the industry) as the assessor of the claim, with the costs of contracting this assessor covered by SLB. The independent assessor will provide an assessment report to SLB, which, upon receiving and considering this report, SLB will provide a copy of the report to the claimant and offer to meet to discuss/address the claim. The assessment report will include the following information:

- A copy of the letter of instruction/project brief received by an assessor from SLB when engaged to carry out the independent assessment;
- Confirmation (or otherwise) that the information provided in the claim is sufficient to conduct a meaningful assessment;

- A summary of the claim details (survey, applicant, vessel, month/s);
- For a loss of catch claim, monthly CPUE assessments as outlined in the protocol including an estimation of any loss of catch (in kg) and its market price; and
- Any other information, comments, or views relevant to the assessment that the assessor may wish to include.

If the assessor determines that a claim is assessed to have merit, and compensation is recommended, payment will be made directly to the claimants nominated bank account within 60 days of the claim determination.

If a claimant disputes a claim assessment outcome and agreement cannot be reached, the claimant may opt to request that a suitably experienced and qualified independent third-party is engaged to review and determine the outcome of the claim. The appointment of the independent third-party will be agreed mutually between SLB and the claimant, and the costs of engaging the independent third-party will be covered by SLB. The dispute will be resolved within 60 days of receipt of the dispute by SLB. Through engagement with WAFIC, WAFIC provided details of a recommended third-party who has experience in fisheries compensation claims that could be used should such a dispute arise.

A summary of the timeframes from submission of a claim with SLB to payment of compensation (in the event of a successful claim) is provided in **Table 68**.

Table 68 Timeframes Provided Within SLBs Commercial Fisheries Protocol

Step in claim process	Timeframe
SLB notification to WAFIC of the details of the protocol and associated Adjustment Area in writing.	No less than 28 day before the Seismic Survey commences.
Displacement or relocation event occurs.	Claimant to notify SLB at the time of relocation.
Notification by claimant of intention to claim.	As soon as possible, and in accordance with NERA (2021).
Submission of completed Compensation Claim Application Form by claimant.	Within the applicable Adjustment Protocol Timeframes set out in NERA (2021)
Communication of outcome of the claim to the claimant (or request for clarification/additional information from the claimant).	As soon as practicable after receiving the application, and in accordance with NERA (2021)
Compensation payment to claimant.	Within 60 days of the claim determination.
Request by claimant to engage a suitably experienced/qualified independent third party to review and determine the claim outcome.	Dispute to be resolved within 60 days of dispute receipt by SLB, and in accordance with NERA (2021).

As a result of consultation between February 2023 to November 2023, SLB agreed with WAFIC to adopt the NERA (2021) Commercial Fishing Industry Adjustment Protocol. This provides transparency to WAFIC regarding the processes in place for economic adjustment for loss of catch, displacement and loss of fishing gear that may arise during the Seismic Survey. in the event of displacement, WAFIC supports the NERA (2021) Commercial Fishing Industry Adjustment Protocol, and over the course of ongoing consultation . if any changes are required as a result of discussions with WAFIC, these will be made through the management of change process.

It is considered that the consequence of seismic emissions on commercial fisheries within the OA (including for commercially important species retained as part of the NDSF, MMF and Indonesian Commercial Fisheries) is minor; with any effects to be localised and only short-term disruptions to normal activities as well as minor adverse effects no natural resources expected.

Based on available evidence, it is considered unlikely (uncommon but has been known to occur elsewhere) to occur that seismic emissions may result in changes to commercial catches.

As such, the residual risk of negative impacts to commercial fishery catches due to exposure to seismic emissions associated with the MSS has been assessed as **Low** (*Minor x Unlikely*) (**Table 38**).

7.2.4 Evaluation of Known and Potential Impacts and Risks on Commercial and Recreational Dive Operations

Human ears are most sensitive to waterborne sounds that range in frequencies from 400 Hz to 1 kHz, with a peak sensitivity at 800 Hz (Anthony *et al*., 2009). The sensitivity of the diver to underwater noise is largely influenced by the diving apparatus worn. SCUBA dive masks result in a 'wet' ear where the water floods the external auditory canal. In contrast, enclosed helmets most often used by commercial divers maintain a 'dry' ear. Hearing sensitivity is lower in divers using a 'wet' ear system, and therefore elevated noise levels are more damaging to divers using 'dry' ear systems (Anthony *et al*., 2009). Further hearing protection may be provided by neoprene hoods used by 'wet' ear divers, reducing noise attenuation, particularly in shallower water depths (Anthony *et al*., 2009; Cudahy and Parvin, 2001).

Effects of noise on human divers range from dizziness, disorientation, temporary paralysis of limbs, or TTSs, to PTSs, severe pain, and haemorrhaging of soft tissues (Cudahy and Parvin, 2001). For sounds with frequencies of 500 – 2,500 Hz, Parvin *et al*. (2005) reported temporary dizziness and related symptoms for bareheaded divers exposed to sound levels above 176 dB re 1 µPa, and vibration in forearms and thighs at sound levels above 180 dB re 1 µPa. Sounds were tolerated up to 191 dB re 1 µPa (the maximum used in the trial); however, from these results a threshold exposure level for human divers of 145 dB re 1 µPa was proposed for 100 – 500 Hz frequencies, and 155 dB re 1 µPa for 501 – 2,500 Hz.

In 2020 the Diving Medical Advisory Committee released Rev 2.1 of '*Safe Diving Distance from Seismic Surveying Operations*' Guidance Note which extended the threshold distances stated in previous revisions of the Guidance Note, with the following guidance (among others):

- Plans should be made to avoid overlapping seismic and diving activities; where this is not possible, the activities should be prioritised and a simultaneous operations plan developed;
- Where diving and seismic activity are schedule to occur within a distance of 45 km, it is good practice for all parties to be made aware of the planned activity where practicable, including clients/operators, diving and seismic contractors;
- Where diving and seismic activity will occur within a distance of 30 km a joint risk assessment should be conducted between the clients/operators involved in the seismic and diving contractors in advance of any simultaneous operations;
- The maintenance of effective communication and cooperation between the seismic vessel and the diving vessel is essential;
- Minimum safe distances should not be compromised by either party; and

- Should any diver in the water experience interference with communications, the noise level is considered to exceed acceptable exposure levels, feels sudden discomfort or places the diver at risk in any other way, the diver's exposure should be terminated.

Offshore oil and gas installations are typically noisy above and below water; therefore, commercial divers working around the offshore facilities are already exposed to high levels of noise (Anthony *et al*., 2009; Kirkland *et al.,* 1989). Dive operations at these installations are routinely carried out for inspection and maintenance works and may occur while the Seismic Survey is operating. The closest producing fields from the AA are;

- Northern Endeavour – 55 km; and
- Montara Venture – ~60 km.

As outlined within **Section 4.7.2.3**, recreational diving may occur within the EMBA, primarily concentrated around natural features such as reefs, islands and cay (e.g. Ashmore Reef located approximately 170 km from the acquisition area) and around structures such as shipwrecks (e.g. the Ann Millicent shipwreck located approximately 130 km from the acquisition area).

Although the UAM report in **Appendix A** does not provide the horizontal distances from the acoustic source for the 145 dB re 1 µPa isopleth as outlined as a threshold in Parvin *et al*. (2005), the results for 140 dB re 1 µPa have been utilised as a conservative value for assessing impacts to divers. Given the large separation distance to those sites utilised by recreational divers (> 130 km) from the acquisition area, the following assessment has focused on potential impacts to any dive operations undertaken at the nearby producing fields.

Interrogating the UAM report in **Appendix A** shows that for those sites modelled in closest proximity to the installations (being Site 25 and 15) the 140 dB re 1 µPa and 150 dB re 1 µPa isopleth do not extend out to the Northern Endeavour or Montara Venture, with ranges from 20 – 50 km. Although both installations are outside of the recommended safe distances under the Diving Medical Advisory Committee Guidance Note, and located further away than thresholds distance, all installation operators will be kept updated throughout the programme with the 48-hour look-ahead so that they may schedule any dive operations as they deem appropriate to ensure the safety of their divers as they undertake their own risk assessment as part of their diving procedures. SLB will be in regular contact with gas installation operators who will be able to schedule dive operations as they deem appropriate.

Consultation has also been conducted with potential dive operators in and around the OA, with no responses to date raising concerns with the proposed Seismic Survey.

Based on the above, and the control measures in place (such as ongoing consultation), the potential risk to divers from noise emissions during the Seismic Survey has been assessed as **Low** (*Rare x Moderate*).

7.2.5 Decision Context

The decision context for Acoustic Disturbance to the Marine Environment has been assessed as Type B, although the uncertainty is minimal, given the greater complexity associated with the predicted impacts and risks. The level of interested raised by relevant persons regarding predicted impacts to commercial fisheries and protected areas is consistent with this characterisation.

7.2.6 Identification of Control Measures, Residual Risk Assessment and Demonstration of ALARP

The control measures that will be implemented during the Seismic Survey to manage the impacts from acoustic disturbance to **ALARP** have been included in **Table 70**. SLB has considered a number of control measures to determine the benefits of their implementation towards risk reduction (**Table 70**), based on a Hierarchy of Controls methodology **Table 69**). The control measures that will be adopted are those that have been assessed and characterised as effective and practicable to implement.

Table 69 Hierarchy of Control Measures for Acoustic Disturbance to the Marine Environment

Eliminate	Noise emissions are a fundamental requirement of any MSS in order to produce the detailed geological images and meet survey objectives. As a result, noise emissions cannot be eliminated.
Substitute	Alternative data acquisition methods are not yet commercially available or proven to meet geophysical data quality objectives, operational safety, and reliability requirements. Therefore, no practicable substitutes are available.
Reduce	The maximum capacity of the acoustic source has been designed to be as low as possible while still maintaining the ability to meet survey objectives. Survey operations will run 24/7 (where possible) in order to reduce the total duration of the survey. During the survey planning stage, several source sizes were investigated, and the 3,000 in^3 acoustic source was selected on the basis of being the lowest power source still capable of achieving the survey objectives.
Mitigate	Control measures have been assessed within **Table 70** in order to mitigate the impacts from noise emissions to **ALARP** levels. Those which are appropriate and are not impracticable or unfeasible (**Table 70**) will be implemented for the duration of the Seismic Survey.

Table 70 Assessment of Control Measures for Managing the Acoustic Disturbance to the Marine Environment

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Legislative Requirements:			
The Seismic Survey will be undertaken in accordance with the approved EP.	P = Yes E = Effective	All vessels undertaking an offshore activity in waters between 3 and 200 NM must undertake that activity in line with an approved EP. The approved EP outlines the measures that will be taken to ensure that environmental effects from the activity will be reduced to **ALARP** and **Acceptable Levels**, including the management of routine permissible waste discharges.	Yes
Adherence to the EPBC Act Policy Statement 2.1 requirements, through the implementation of the following control measures with respect to all whales (baleen and toothed), throughout the entire OA for the duration of the Seismic Survey: • Observation zone^{AC} [31]: 5+ km horizontal radius from the acoustic source; • Shut-down Zone^{AC}: 2 km horizontal radius from the acoustic source; • Crew training: Crew are trained in the basic requirements of the EPBC Act Policy Statement 2.1 prior to the survey commencement and will also be familiar with the commitments in this EP; • Pre-start-up Visual Observations (daylight hours): 30 minutes prior to the commencement of Soft-start Procedure; • Soft-start Procedure: Commences only where no whales have been sighted within Shut-down Zone over a 30 minute Pre-start up Visual Observation period; • Start-up Delay Procedures: Will be implemented if a whale enters the Shut-down Zone during the soft-start; • Stop Work Procedures: Will be implemented whenever a whale is detected in the Shut-down Zone; • Night-time and Low Visibility Procedures: Will be implemented throughout periods of low visibility, including night-time, under rough seas or fog; • Compliance and Sighting Reports.	P = Yes E = Effective	Adherence to the EPBC Act Policy Statement 2.1 is a legislative requirement. Further detail regarding the suite of control measures to be adopted in accordance with the EPBC Act Policy Statement 2.1 has been provided below and within **Appendix J** and **Appendix K**. Note that the use of a 5+ km Observation Zone and 2 km Shut-down Zone goes above and beyond the requirements of the standard management procedures outlined in Policy Statement 2.1. Additional controls presented within the Legislative Requirements section, to assist in understanding the implementation of the total suite of whale management measures, are marked with AC superscript (e.g., control^{AC}).	Yes
EPBC Act Policy Statement 2.1: Precaution Zones: • Observation Zone^{AC}: 5+ km horizontal radius from the acoustic source; • Shut-down Zone^{AC}: 2 km horizontal radius from the acoustic source; and • An Extended 5+ km Shut-down Zone^{AC}for blue whales/pygmy blue whales.	P = Yes E= Effective	Precaution Zones are set based on the likely sound levels surrounding the acoustic source as demonstrated by acoustic modelling. The use of Precaution Zones provides the basis for the mitigation measures throughout the EPBC Act Policy Statement 2.1 and defines the zones where certain operational procedures will be implemented (e.g. shut-downs of the acoustic source when a whale enters/is sighted within the Shut-down Zone). In addition to the standard Precaution Zones prescribed within EPBC Act Policy Statement 2.1, for surveys exceeding received sound exposure levels of 160 dB re 1 µPa, additional Precaution Zones have been applied to protect pygmy blue whales and 'other whales' based on the outputs of UAM. The justification for additional Precaution Zones is further described under the Additional Controls within **Appendix J** and **Appendix K.** Additional Precaution Zones include: • Observation Zone^{AC}: 5+ km horizontal radius from the acoustic source; • An Extended 5+ km Shut-down Zone^{AC} for blue whales/pygmy blue whales; and An Extended 2 km Shut-down Zone^{AC} for 'other whales'.It is a legislative requirement to adopt control measure; environmental benefit outweighs additional cost.	Yes

[31] Additional controls presented within the Legislative Requirements section, to assist in understanding the implementation of the total suite of whale management measures, are marked with AC superscript (e.g., control^{AC}).

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
EPBC Act Policy Statement 2.1: A.2 – Crew training (General crew).	P = Yes E= Effective	Vessel crew are required to have sufficient training in order to implement the mitigation procedures of the EPBC Act Policy Statement 2.1. SLB will ensure that all crew are trained to understand the basic requirements of the EPBC Act Policy Statement 2.1 and the specific Precaution Zones that will be implemented as part of the Seismic Survey. Crew will be informed that they have a responsibility to report any opportunistic marine mammal sightings that they may make to an on-duty MFO/MMO. At the start of the survey a briefing will be provided to all crew on board the survey vessels on environmental matters, including information on the EPBC Act Policy Statement 2.1, whale identification and the environmental legal obligations for companies operating in Australian waters. This will constitute an environmental induction on the EP and it's requirements. Reference material will be provided and made available for the duration of the survey onboard the vessel(s), including the EPBC Act Policy Statement 2.1, the Department's Whale and Dolphin sighting report form and the APPEA CD Guide 'Search Australian Whales and Dolphins'. Appropriate visual aids such as binoculars will be available on board the vessel to aid in the identification and reporting of any whales sighted. The MFO/MMOs will have primary responsibility for whale observation and compliance with the Precautionary Zones; however, trained crew can act in a support role by immediately reporting any opportunistic marine mammal sighting (from either the Seismic Vessel or any of the support vessels) to the on-duty MFO/MMOs. Legislative requirement to adopt control measure; environmental benefit outweighs additional cost.	Yes
EPBC Act Policy Statement 2.1: A.3.1 – Pre-start-up visual observations procedures. The 5+ km Observation Zone[AC] will be monitored for the presence of whales for at least 30 minutes before the commencement of a Soft-start Procedures.	P = Yes E= Effective	Pre-start up visual observations are required under the EPBC Act Policy Statement 2.1. An Observation Zone[AC] of 5+ km for will be monitored from the Seismic Vessel. The 5+ km Observation Zone[AC] will be monitored for the presence of whales for at least 30 minutes before the commencement of a Soft-start Procedure. The dedicated, trained, and experienced MMOs/MFOs on both the Seismic Vessel and the Chase Vessel will have direct responsibility for undertaking pre-start-up visual observations and compliance with the Precautionary Zones, with trained crew (see above) support as required. Legislative requirement to adopt control measure; environmental benefit outweighs additional cost.	Yes
EPBC Act Policy Statement 2.1: A.3.2 – Soft-start procedures. Soft-start procedures will be limited to starting up in conditions that allow visual inspection of the 5+ km Observation Zone[AC]. No soft starts will occur within 15 km of the boundaries of the Oceanic Shoals AMP.	P = Yes E= Effective	Soft Start Procedures are a gradual increase of power over a set period with the intention of allowing adequate time for whales to leave the area before being exposed to the highest sound levels (Wright and Cosentino, 2015). They will also alert other marine fauna and allow them time to move away from the active source, avoiding potential physiological impacts. Soft-starts over a period of 30 minutes are a requirement of the EPBC Act Policy Statement 2.1, where their implementation allows the power of an acoustic source to be gradually increased prior to the survey commencing which ensures that any whales that go undetected during pre-start-up observations have an opportunity to leave the vicinity of the seismic array before full operational power is reached. No soft starts will occur within 15 km of the boundaries of the Oceanic Shoals AMP in order to provide protection to the sensitive environments within this AMP from acoustic emissions. UAM modelling has demonstrated that at this distance, the sound levels reaching the Oceanic Shoals AMP will not have any impact on the sensitivities within the AMP, meaning that the Seismic Survey is consistent with the IUCN management prescriptions and permissible use of the Oceanic Shoals AMP. Soft start procedures will be limited to starting up in conditions that allow visual inspection of the 5+ km Observation Zone[AC]. Legislative requirement to adopt control measure; environmental benefit outweighs additional cost.	Yes
EPBC Act Policy Statement 2.1: A.3.3 – Start-up delay procedures.	P = Yes E= Effective	During Soft -start Procedures in daylight hours, at least one MFO/MMO will be stationed on the bridge of the Seismic Vessel undertaking continuous visual observations for whales. If the whale enters a relevant Shut-down Zone (i.e., 5+ km for blue whales/pygmy blue whales and 2 km for all 'other whales'), the acoustic source will be immediately shut-down.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
		If the acoustic source is shut-down for an 'other whale' species, a soft-start procedure will only resume after the whale has been observed to move outside the 2 km Shut-down Zone[AC], or when 30 minutes has lapsed since the whale was last sighted within the Shut-down Zone. If the acoustic source is shut-down for a blue whale/pygmy blue whale, a Soft-start Procedure will only resume when 30 minutes has lapsed since the last blue whale/pygmy blue whale sighting. The 5+ km Extended Shut-down Zone[AC] for blue whales/pygmy blue whales effectively means that Start-up Delay Procedures will be implemented for any sighting of a blue whale/pygmy blue whale. The intention of these delays is to allow sufficient time for any whale/s to exit the Precaution Zones and avoid exposure to the highest sound levels. Start-up delays are a requirement of the EPBC Act Policy Statement 2.1. Legislative requirement to adopt control measure; environmental benefit outweighs additional cost.	
EPBC Act Policy Statement 2.1: A.3.5 – Stop work procedures. Stop work procedures will be implemented when: • A blue whale/pygmy blue whale is detected within the Extended (5+ km) Shut-down Zone[AC]; and • Any 'other whale' enters the Extended (2 km) Shut-down Zone[AC].	P = Yes E= Effective	Stop work procedures are a requirement of the EPBC Act Policy Statement 2.1. Stop work procedures will be implemented when: • A blue whale/pygmy blue whale is detected within the Extended (5+ km) Shut-down Zone[AC]; and • Any 'other whale' enters the Extended (2 km) Shut-down Zone[AC] This control measure will be implemented by dedicated, trained and experienced MFOs/MMOs that will be onboard the Seismic Vessel and the Chase Vessel for the duration of the Seismic Survey. After the whale has been observed to have left the Shut-down Zone or has not been detected for 30 minutes, the start-up procedures can commence again. Legislative requirement to adopt control measure; environmental benefit outweighs additional cost.	Yes
EPBC Act Policy Statement 2.1: A.3.6 – Night-time and low visibility procedures. During these periods, operations may proceed provided there have not been three or more whale instigated power-down or shut-downs during the preceding 24-hour period. If conditions prohibit visual inspection of the Observation Zones, Soft-start Procedures and activation of the acoustic source will not occur until such a time where pre-start observation procedures can be effectively undertaken. This control also addresses EPBC Act Policy Statement 2.1: B.2 – Night-time/Poor Visibility and B.6 Adaptive Management Measures.	P = Yes E= Effective	Specific night-time and low visibility procedures are a requirement of the EPBC Act Policy Statement 2.1. They allow the MSS to continue throughout periods of reduced/low visibility (e.g. night-time, or periods of rough seas or fog). During these periods, operations may proceed provided there have not been three or more whale instigated power-down or shut-downs during the preceding 24-hour period. If conditions prohibit visual inspection of the Observation Zones, Soft-start Procedures and activation of the acoustic source will not occur until such a time where pre-start observation procedures can be effectively undertaken. SLB has adopted the threshold of three or more whales based on what was recommended within the EPBC Act Policy Statement 2.1 Standard Management Procedures. Legislative requirement to adopt control measure; environmental benefit outweighs additional cost.	Yes
EPBC Act Policy Statement 2.1: A.4 – Compliance and Sighting Reports. All cetacean sightings will be recorded in the 'Cetacean Sightings Application' software.	P = Yes E= Effective	A report on the conduct of the survey and any whale interactions will be provided to the DoEE within two months of survey completion following the minimum content recommendations in the EPBC Act Policy Statement 2.1. All cetacean sightings will be recorded in the 'Cetacean Sightings Application' software. Legislative requirement to adopt control measure; environmental benefit outweighs additional cost.	Yes
Good Practice			
The minimum source size to acquire the survey data and meet the geophysical objectives of the survey will be selected.	P = Yes E = Effective	The acoustic source volume has been intentionally selected as it is considered to be the minimum source size identified to meet the geophysical objectives of the survey, taking into account the water depth, the depth of the geophysical targets and the properties of the underlying geology. Good industry practice, environmental benefit outweighs additional cost.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
The acoustic source size used will not exceed that which has been modelled (3,000 in^3) and for which the predicted impacts and risks have been assessed. If the source used for the Seismic Survey differs to that modelled in the EP, additional modelling will be undertaken.	P = Yes E = Effective	The sound propagation which will arise as a result of the acoustic source generation has then been modelled. The outcomes of this modelling are required to inform the environmental impact and risk assessment and ensure the activity is adequately managed. The maximum modelled zero to peak sound pressure level from the 3,000 in^3 acoustic source will be 256.3 dB re 1 µPa @ 1 m. If the acoustic source used for the Seismic Survey differs to that modelled in the EP (i.e. within Connell *et al*., 2022), additional modelling will be undertaken prior to the commencement of the Seismic Survey to confirm that the far-field horizontal source level specifications of the selected seismic source are consistent with those assessed in the EP and that the control measures and EPSs adopted for the Seismic Survey are appropriate and manage potential impacts to ALARP and Acceptable Levels. Changes will be documented as per the Management of Change requirements. Good industry practice, environmental benefit outweighs additional cost.	Yes
The acoustic source will not be activated outside of the OA. The acoustic source will only be activated outside of the AA for the purpose of oft-starts.	P = Yes E = Effective	The acoustic source will only be discharged at full power within the Acquisition Area. The acoustic source will only be discharged outside of the AA for the purpose of soft-starts. Good industry practice, environmental benefit outweighs additional cost.	Yes
Publication of a Notice to Mariners confirming the Seismic Survey will proceed, no less than four weeks before operations commence.	P = Yes E = Effective	Under the Navigation Act 2012, AHO can publish and distribute a Notice to Mariners. This Notice outlines potential hazards and restrictions to other marine users. The notice will be published no less than four weeks before operations commence. Good industry practice, safety benefit outweighs additional cost.	Yes
A communications protocol will be in place between the survey vessels and other relevant persons (e.g., commercial fishers known to utilise the OA, Petrofac), to actively manage concurrent activities.	P = Yes E =Effective	A communications protocol will be in place which details the methods used to contact third-party vessels identified at sea, to actively manage concurrent activities. Good industry practice, safety benefit outweighs additional cost.	Yes
Where the potential for concurrent MSSs to occur is identified, SLB will engage with proponents prior to commencing the Seismic Survey and develop a SIMOPS plan. SIMOPS planning will include the implementation of a 40 km spatial separation between the Seismic Vessel and any other operating Seismic Vessel in the Bonaparte Basin area.	P = Yes E = Effective	Multiple MSSs operating simultaneously in close proximity to each other would potentially increase the spatial extent of acoustic energy and the intensity of acoustic energy (if acoustic areas overlap). Spatially separating concurrent MSSs reduces the potential for cumulative noise impacts, through limiting sound source levels to those associated with a single acoustic source. Engagement with proponents prior and development of a SIMOPS plan will include the following: • Communications protocol • Work programming • Hazard management • Emergency Response Good industry practice, environmental benefit outweighs additional cost.	Yes
Notification of MSS commencement to diving operators (diving charters, dive schools, dive equipment stores and oil and gas operators) undertaking diving activities within 45 km of the acoustic source.	P = Yes E = Effective	Guidance note DMAC 12 issued by the UK Diving Medical Advisory Committee (DMAC) “Safe Diving Distance from Seismic Surveying Operations (DMAC 2019) recommends all parties should be made aware of a planned activity, where diving and seismic activities occur within 45 km of one another. Petrofac submitted on the 30-day public notification of the Seismic Survey in regard to potential diving operations. As a result, SLB will notify Petrofac prior to survey commencing as well as providing the 48 hour look-aheads. Good industry practice, safety benefit outweighs additional cost.	Yes
Where diving and seismic activities occur within 30 km of each other, a joint risk assessment will be conducted.		Guidance note DMAC 12 issued by the UK Diving Medical Advisory Committee (DMAC) “Safe Diving Distance from Seismic Surveying Operations (DMAC 2019) recommends a joint risk assessment be undertaken by the clients/operators involved in the seismic and diving contractors in advance of any simultaneous operations. Good industry practice, safety benefit outweighs additional cost.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Daily look-ahead reports will be provided to relevant persons (e.g., commercial fishers known to utilise the OA or have indicated they could use the area (i.e. WTBF concession owners) and those who registered for the service (Petrofac)), detailing the current vessel location and proposed timing and location of operations within the next 48 hour period.	P = Yes E =Effective	Communication with relevant persons allows those potentially affected by the Seismic Survey to plan activities in a manner that reduces the risk of interference with their activities. For example, this may allow commercial fishers to target locations away from the area of active acoustic data acquisition on any given day. This will also reduce the risk of interference with the survey vessels and towed equipment (e.g. commercial fishers can avoid deploying gear in the path of the Seismic Vessel). The communications protocol will incorporate a 48-hour look-ahead and daily communications where requested. Provision of a 48 hour 'look-ahead' plan which is distributed every 24 hrs allows relevant persons (e.g. commercial fishers or commercial shipping) to understand the future movements of the Seismic Vessel and plan accordingly to avoid interactions. Good industry practice, safety benefit outweighs additional cost.	Yes
Compensation to fishers and vessel crews (i.e., the claimant) is demonstrated to have occurred for the following circumstances: • Interaction resulting in loss or damage to fishing equipment; • A temporary loss of fish landed catch due to damaged or lost fishing equipment; • Where displacement from fishing grounds results in additional costs incurred due to relocating; or • A temporary reduction in fish landed catch ('loss of catch') due to the impacts associated with acoustic disturbance or due to displacement from fishing grounds. Displacement from fishing grounds can be as a result of seismic operational activities or as a result of avoiding contaminated waters following a fuel oil spill. Claims received from fishers in any circumstances other than those outlined above will not be assessed. Claims will be considered provided the interaction/displacement/loss of catch took place in the Adjustment Area where the Seismic Survey took place (plus any additional area of avoidance requested around the survey vessel/s and towed equipment, and during the period of seismic operations only. For loss of catch due to the impacts associated with acoustic disturbance, claims can be made for the period of seismic operations, plus a period of six months following completion of the survey, and in accordance with the Adjustment Protocol Timeframes set out in NERA (2021). Note that for damaged or lost equipment claims, the interaction can have taken place in the Operational Area (not just Adjustment Area), plus any additional area of avoidance requested around the survey vessels and towed equipment. The adoption of the NERA (2021) protocol is an agreement reached between SLB and WAFIC. . If any changes are required as a result, these will be made through the management of change process.	P = Yes E = Effective	Where impacts of the Seismic Survey to the commercial fishing industry in Australian waters cannot be managed or avoided, and commercial fishers experience an economic loss as a result of the Seismic Survey, financial compensation will be considered. Compensation to fishers and vessel crews for loss or damage to fishing equipment, a temporary loss of fish landed catch due to damaged or lost fishing equipment, where displacement from fishing grounds results in additional costs incurred due to relocating, or a temporary reduction in fish landed catch due to impacts associated with acoustic disturbance or due to displacement from fishing grounds that is proven to have occurred as a result of the Seismic Survey will be considered on a case-by-case basis. Claims received from fishers in any circumstance other than these will not be assessed. Displacement from fishing grounds can be as a result of seismic operational activities and/or as a result of avoiding contaminated waters following a fuel oil spill. For SLB to accept a payment claim, fishers will need to provide suitable documented evidence and data to demonstrate their unavoidable economic loss in accordance with the NERA (2021) Commercial Fishing Industry Adjustment Protocol (**Section 7.2.3.1, Appendix M**). All fishing history and unavoidable economic losses should relate to the Adjustment Area and to the time of year that the seismic survey is conducted. The Adjustment Area is defined as an area extending 10 km around the perimeter of the Operational Area. Claims for temporary reduction in catch due to the impacts associated with acoustic disturbance may be made for a period of six months following completion of survey operations. Any consideration of claims (for claims for temporary reduction in catch due to displacement from fishing grounds) beyond the Adjustment Area and outside the operations period (or more than six months following completion of the survey) will be determined with reference to available and relevant peer reviewed information on the effects of seismic surveys, as well as the impact assessment outlined in the EP as accepted by NOPSEMA. To be eligible for compensation, claimants are required to provide sufficient evidence in accordance with the NERA (2021) protocol to support a claim for equipment being damaged or lost, being displaced from 'usual fishing grounds' (defined as an area where fishing activity has been recorded by the commercial fishing licence holder on Government statutory fishing returns for at least two out of the previous five years) and/or the identification of a reduction in fish landed catch. . A completed Compensation Claim Application Form (as per the NERA 2021 Application forms) must be submitted to SLB in accordance with the Adjustment Protocol Timeframes stipulated in NERA (2021). In assessing the merit of the claim, consideration will be given to the circumstances giving rise to the claim, including whether the circumstances could have been reasonably avoided. Having regard to the high variable nature of the spatial distribution and intensity of fishing operations over time, and that any potential impacts to fish, fish eggs and larvae as a result of acoustic disturbance are considered rapidly recoverable, a period of 12 months is considered sufficient to identify reduced CPUE compared to previous years for the same eligible claim as it relates to fishing event location by species by month.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
		Subject to a claim being lodged, SLB (at their expense) in consultation with the claimant, will engage a suitably experienced/qualified independent person/organisation as the assessor of the claim, defined as a person or organisation with proven demonstrated experience in data analysis and data auditing processes and procedures within the industry. The adoption of the NERA (2021) protocol is an agreement reached between SLB and WAFIC over the course of consultation. . If any changes are required as a result, these will be made through the management of change process. Good industry practice, socio-economic benefits outweigh additional cost.	
Alternatives/Substitutes Considered			
Elimination of noise emissions from the acoustic source.	P = No E = Very Effective	Noise emissions are a fundamental requirement of any MSS in order to produce the detailed geological images and meet survey objectives. As a result, noise emissions cannot be eliminated.	No
Use of alternative seismic sound sources and alternative geological imaging technology.	P = No E = Unknown Effectiveness	Alternative technologies are not yet commercially available or have not been proven to meet geophysical data quality objectives, operational safety, and reliability requirements (IOGP, 2017). Therefore, no practicable substitutes are available.	No
Additional Controls Considered			
No operation of the acoustic source in water depths less than 60 m plus a 421 m horizontal buffer from this depth – henceforth referred to as the Acquisition Exclusion Zone.	P = Yes E = Effective	To reduce the potential impact on sub-lethal effects on benthic invertebrates (while also providing protection for site attached fish in high diversity and biomass areas) the acoustic source will not be discharged in waters less than 60 m deep plus a 421 m horizontal buffer from this depth throughout the OA – the Acquisition Exclusion Zone. The biomass and diversity of benthic invertebrates and site attached fishes is typically greatest in the photic and upper mesophotic zones (<60 m depth) which subsequently decreases with increasing depth (Abdul Wahab *et al*., 2018). Moreover, deeper areas (up to 60 m depth) that are proximal to reef and shoal habitats typically contain a higher abundance and diversity of fish than areas of similar depth that are not associated with reef and shoal habitats. Reducing the exposure of areas less than 60 m deep to acoustic emissions that exceed 209 dB and 207 dB would reduce the potential impacts on benthic invertebrates and site attached fish (including those that are commercially targeted within the OA), respectively. Up to 13 of the indicative sail lines traverse the Acquisition Exclusion Zone and, where this occurs, SLB will either A) stop the acoustic source before it enters the Acquisition Exclusion Zone and then re-activate it after it leaves the Acquisition Exclusion Zone, or B) the vessel will deviate around the Acquisition Exclusion Zone and ensure the acoustic source is not activated within the Acquisition Exclusion Zone. Option A) will only occur during daylight hours and periods of good visibility to ensure that the pause in acquisition under this control measure, which was developed to reduce potential impact(s) on benthic invertebrates and site attached fish, does not result in additional impacts on whales. Undertaking option A) during daylight hours and period of good visibility will ensure effective detection of whales when re-activating the seismic source after it leaves the Acquisition Exclusion Zone. Environmental benefit gained outweighs the additional cost.	Yes
The Seismic Vessel will not return to acquire any portion of any sail line, or area, until at least 24-hours has passed.	P = Yes E = Effective	Infilling and deviation from predetermined sail lines whilst the acoustic source is active have the potential to expose resident marine species, such as site attached benthic species (including fish species targeted by commercial fisheries), to a second dose of seismic energy within a relatively short period of time. SLB will ensure at least 24 hours has passed before returning to acquire any portion of any line. Should planned deviation from the predetermined sail lines occur, SLB will ensure the acoustic source will only remain active if at least 24 hours have passed. It is considered planned deviations from the predetermined sail lines may occur in order to circumnavigate the Acquisition Exclusion Zone. This 24-hour interval is expected to reduce the cumulative seismic exposure risk to site-attached species, based on the reported recovery period of 18 – 24 hours from TTS observed in fish (Popper et al., 2005).	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
A 500 m Observation Zone for marine turtles and whale sharks will be implemented and, once the source is active, a 250 m Shut-down Zone will be applied to marine turtles and whale sharks.	P = Yes E = Effective	Visual observations include observations for marine turtles and whale sharks within a 500 m radius of the acoustic source. Any sightings within the 500 m Observation Zone, and beyond the 250 m Shut-down Zone, trigger the use of Soft-tart Procedures. The acoustic source will be immediately shut-down, if a marine turtle or whale shark is observed within the 250 m Shut-down Zone while the survey is underway. This measure is considered to be protective (and conservative) against PTS and TTS effects to marine turtles given that marine turtles are slow swimming, relative to the survey vessel moving at a speed of 4.5 knots, and their limited sensitivity to sound (impairment impacts are limited to <20 m from the acoustic source). The UAM outputs indicate the potential for behavioural disturbance for marine turtles to occur within 2.52 km of the active acoustic source. Given the closest marine turtle BIA is located >8 km beyond the boundary of the Operational Area and ~25 km from the Acquisition Area, the use of Shut-down Zones is considered sufficient to ensure the continuation of biologically important behaviours. Despite this, the potential value of the broader carbonate banks and terrace system of the Sahul Shelf KEF as viable marine turtle foraging habitat is acknowledged and addressed through the implementation of night-time and low visibility and adaptive management procedures for marine turtles. This measure is also considered sufficient to minimise significant impacts on whale sharks, given the small number of individuals estimated to utilise/occur within the OA during the survey period for which the acoustic source will be active and due to whale sharks limited sensitivity to sound. Whale sharks are sensitive primarily to particle motion, and the modelled effects of particle motion are further constrained than the PK threshold distance for impairment impacts, which is limited to <80 m. The measure is considered practicable to implement given these precaution zones are lesser than those zones in place for marine mammals and, therefore, will already be visually monitored. A longer start-up delay is not considered practicable, as it could result in significant periods of shut-downs when turtles are beyond the distance from the acoustic source where they could experience impairment. Environmental benefit gained outweighs the additional cost.	Yes
The 500 m Observation Zone will be monitored for marine turtles and whale sharks for at least 30 minutes prior to Soft-start Procedures.	P = Yes E = Effective	Pre-start up visual observations for marine mammals are required under the EPBC Act Policy Statement 2.1. Pre-start up visual observations for marine turtles and whale sharks will also be implemented. The 500 m Observation Zone will be monitored for the presence of marine turtles and whale sharks for at least 30 minutes before the commencement of a soft-start procedure. This measure is considered practicable to implement given the pre-start observation procedures in place for marine mammals. Environmental benefit gained outweighs any potential additional cost.	Yes
Soft-start Procedures may only commence if no marine turtles or whale sharks have been sighted within the 250 m Shut-down Zones during the 30 minute pre-start observation period.	P = Yes E = Effective	Soft-starts over a period of 30 minutes are a requirement of the EPBC Act Policy Statement 2.1, where their implementation allows the power of an acoustic source to be gradually increased prior to the survey commencing which ensures that any whales that go undetected during pre-start-up observations have an opportunity to leave the vicinity of the seismic array before full operational power is reached. Soft-starts over a period of 30 minutes will afford marine turtles and whale sharks that go undetected during Pre-start-up Observations the same opportunity to move away from the seismic array before full operational power is reached. This measure is considered practicable to implement given the Soft-start Procedures in place for marine mammals. Environmental benefit gained outweighs any potential additional cost.	Yes
Start-up of the acoustic source will be delayed if a turtle or whale shark is observed within the 250 m Shut-down Zone.	P = Yes E = Effective	Start-up of the acoustic source will be delayed for 30 minutes if a turtle or whale shark is observed within the 250 m Shut-down Zone during the 30 minute pre-start observation period. The intention of these delays is to allow sufficient time for any marine turtle or whale shark to exist the 250 m Shut-down Zone and avoid exposure to the highest sound levels. Start-up delays are a requirement for the protection of marine mammals under the EPBC Act Policy Statement 2.1.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
		Environmental benefit gained outweighs the additional cost.	
EPBC Act Policy Statement 2.1: Part B.1 – Marine Mammal Observers. The use of suitably trained, dedicated and experienced MMOs/MFOs to undertake visual observations for whales and ensure that the appropriate mitigation measures outlined in this EP are implemented.	P = Yes E = Effective	The use of trained, dedicated and experienced MMOs/MFOs s is a recommendation of Part B.1 of the EPBC Act Policy Statement 2.1 when the likelihood of encountering whales is moderate to high. From the assessment undertaken within this EP (**Section 7.2**) it has been determined that the likelihood of encountering whales during the Seismic Survey is moderate-high. Therefore, SLB will have two dedicated, trained and experienced MMOs/MFOs onboard the Seismic Vessel for the duration of the Seismic Survey and two dedicated, trained and experienced MMOs/MFOs will be stationed on the Chase Vessel for the duration of the Seismic Survey. The role of MMOs/MFOs is to undertake all visual observations for marine fauna and to ensure that the appropriate mitigation measures, as outlined in this EP, occur in response to any marine fauna sightings. The use of two MMOs/MFOs onboard the Seismic Vessel and two onboard the Chase Vessel provides some redundancy in the event one MMO/MFO is unavailable. At least one MMO/MFO will perform marine mammal observations during daylight hours. The MMOs/MFOs used during the Seismic Survey must have logged a minimum of 20 weeks' relevant sea-time engaged in MSS operations in Australian waters as an MMO or MFO and have proven 'at sea' experience in whale identification and behaviour, and distance estimation. The MMOs/MFOs used must be confident in the identification of those species that the EP predicts will be present in the OA. Environmental benefit gained outweighs the additional cost.	Yes
EPBC Act Policy Statement 2.1: Part B.2 – Night-time/Poor Visibility.	P = Yes E = Effective	The EPBC Act Policy Statement 2.1 recommends that in areas where whales are expected to be encountered, the proponent should include measures to detect whale presence and apply measures to reduce the likelihood of encounters. Regarding this, a combination of PAM and adaptive management measures will be implemented to provide an effective spread of controls and, ultimately, level of protection to whales in the OA under night-time/Poor visibility conditions. Note that a combination of control and adaptive management measures are proposed to reduce reliance on PAM, which is not considered to be a particularly reliable method for detecting low-frequency cetaceans. The control measure discussed above and adopted for EPBC Act Policy Statement 2.1: A.3.6 (night-time and low visibility procedures) is considered to provide the necessary level of protection to whales in the OA under night-time/poor visibility conditions. Environmental benefit gained outweighs the additional cost.	Yes
EPBC Act Policy Statement 2.1: B.3 – Use of spotter aircraft and vessels to detect presence of cetaceans.	P = No E = Effective	The OA is located offshore and, subsequently, a long way from the nearest airport. The availability of a dedicated aircraft capable of flying long-range and long duration flights offshore for the purposes of cetacean detection is limited. Weather limitations for smaller planes will place further restrictions on when the aircraft could be in the air and the duration of aerial surveys. For the measure to be effective, aircraft would need to be flown consistently over the OA during daylight hours, however, the distance to the OA makes the required flight time prohibitive. As such, implementing control measures based on aircraft with a number of limitations is not practicable. Additionally, survey acquisition is timed to avoid the pygmy blue whale peak migration period. The use of a dedicated spotter plane would add significant costs to the survey and is considered grossly disproportionate to the environmental benefit of identifying marine mammals ahead of the Survey Vessel and Chase Vessel. Instead, a spotter vessel (i.e., Chase Vessel) will be used to support Marine Fauna Observations ahead of the Survey Vessel (See Table 63).	No

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
EPBC Act Policy Statement 2.1: B.4 – Increased Precaution Zones. Increased Observation Zones and Shut-down Zones will be in place for all whales during the Seismic Survey.	P = Yes E = Effective	The EPBC Act Policy Statement 2.1 defines the standard Shut-down Zone as being 500 m from the acoustic source with a Low-power Zone out to 2 km. In keeping with their precautionary approach, SLB have committed to extending the Shut-down Zone out to 5+ km from the acoustic source for blue whales/pygmy blue whales and 2 km from the acoustic source for all 'other whales'. When species identification is uncertain, a precautionary approach will be taken, and the additional management procedures for blue whales/pygmy blue whales will be followed until identification is otherwise confirmed. Environmental benefit gained outweighs the additional cost.	Yes
EPBC Act Policy Statement 2.1: B.5 – Passive Acoustic Monitoring The use of a Passive Acoustic Monitoring system to detect the presence of vocalising cetaceans, for the duration of the Seismic Survey. PAM is to be implemented by two (as a minimum) trained, dedicated and experienced PAM Operators, with at least one PAM Operator maintaining 'acoustic watch' at all times while the acoustic source is active and during the 30 minutes before the commencement of any Soft-start Procedures.	P = Yes E = Effective	Visual methods of scanning for whales are restricted to daylight hours and relatively calm weather conditions. Animal behaviour such as diving further reduces detection probability (Verfuss *et al*., 2018). PAM detects whale vocalisations in real-time and is useful during night-time, low visibility operations and for submerged animals. The use of PAM is a suggestion under Part B.5 (Additional Measures) of the EPBC Act Policy Statement 2.1 when the likelihood of encountering whales is moderate to high. SLB will run and monitor a PAM system around the clock while the acoustic source is active and during the 30 minutes before the commencement of any Soft-start Procedures; hence, detections of cetacean vocalisations will occur both at night and during daylight hours (to augment visual detections). The PAM system will be tuned to cover a frequency range of 10 Hz to 200 kHz to theoretically detect a) low frequency vocalisations of baleen whales, and b) the high frequency echolocation clicks of sperm whales. Two trained, dedicated and experienced PAM Operators will be on the Seismic Vessel for the duration of the survey, with at least one PAM Operator maintaining 'acoustic watch' at all times. PAM Operators must have logged a minimum of 20 weeks' relevant sea-time engaged in MSS operations in Australian waters as a PAM Operator (following the recommendation of the Marine Mammal Observer Association (MMOA, 2019). PAM experience will be a pre-requisite for the recruitment of personnel for these positions. A full replacement PAM system will be kept onboard the Seismic Vessel and will be used as a back-up in the event that the PAM system malfunctions and is unable to be repaired. Frequency sensitivity will be designed into the hardware to remove vessel noise at very low frequencies masking whale vocalisations which may limit the performance of PAM. PAMGuard software will be incorporated into the PAM system to assist with locating and classifying the vocalisations of marine mammals. This sophisticated software allows the trained PAM Operators to make robust decisions during real-time mitigation operations, such as requesting shut-downs based on whales entering the Precaution Zones. The full PAM specs that will be implemented for the Seismic Survey are provided in **Appendix J**. Environmental benefit gained outweighs the additional cost.	Yes
EPBC Act Policy Statement 2.1: B.6 Adaptive Management Measures: all whales. If there have been three or more whale instigated power-down or shut-down situations during the preceding 24-hour period, then low visibility or night-time operations must not occur.	P = Yes E = Effective	If there have been three or more whale instigated power-down or shut-down situations during the preceding 24-hour period, then low visibility or night-time operations must not occur. Decisions on the requirement for this control will be made daily, i.e. at dusk each day, the MMO/MFO on-duty will advise whether the threshold of three whale instigated shut-downs was reached in the preceding 24 hours and will therefore confirm if night-time operations can occur. The same applies for low visibility operations where decisions on whether to continue operating will be made each time low visibility conditions arise. The control measure discussed above and adopted for EPBC Act Policy Statement 2.1: A.3.6 (night-time and low visibility procedures) is considered to provide the necessary level of protection to whales in the OA under night-time/poor visibility conditions	Yes
EPBC Act Policy Statement 2.1: B.6 Adaptive Management Measures: blue whales/pygmy blue whales If higher than anticipated numbers of blue whales/pygmy blue whales are observed the Survey Vessel will relocate or cease operations during night-time or low visibility operations.	P = Yes E = Effective	In accordance with the EPBC Act Policy Statement, adaptive management procedures will be adopted for blue whales. If species identity is uncertain, a precautionary approach will be taken, and the unidentified whale will be assumed to be a blue whale/pygmy blue whale until identification is otherwise confirmed.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
		• If higher than anticipated numbers of blue whales/pygmy blue whales are observed (three or more blue whale/pygmy blue whale instigated shutdowns are made during the preceding 48 hour period) at any time or location during the survey, the following controls apply: a) the acoustic source will be shut down and the Seismic Vessel will relocate to an area at least 17 km away from the last blue whale/pygmy blue whale sighting, and outside of the blue whale migratory BIA or buffer, before commencing Pre Start-up Visual Observations and Soft-start Procedures; b) An Extended 10+ km Observation Zone will be adopted such that MMOs/MFOs observe for blue whales/pygmy blue whales as far as practicable, and to a minimum of 10 km from the acoustic source; c) The Extended 10+ km Observation Zone will be monitored using the Chase Vessel as an additional observation platform with two MMOs/MFOs onboard. During the adoption of these adaptive management measures, the Chase Vessel will travel approximately 5 km ahead of the Seismic Vessel and will conduct visual surveillance for marine mammals during daylight hours; d) While the Extended 10+ km Observation Zone is being implemented, all measures applicable to Observation Zones and relevant to blue whales/pygmy blue whales will adopt this distance; e) Night-time or low visibility operations shall cease and f) Normal operations may only resume after 48 hours of no blue whale/pygmy blue whale instigated shut-downs. • If a blue whale/pygmy blue whale mother and calf pair is observed during the Seismic Survey, the acoustic source will be immediately shut-down and the Seismic Vessel will relocate to another area at least 17 km away (and outside of the blue whale migratory BIA or buffer).	
EPBC Act Policy Statement 2.1: B.6 Adaptive Management Measures: other whales If higher than anticipated numbers of other baleen whales are observed the Survey Vessel will relocate.	P = Yes E = Effective	In accordance with the EPBC Act Policy Statement, adaptive management procedures will be adopted for other whales as described below. If species identity is uncertain, a precautionary approach will be taken, and the unidentified whale will be assumed to be a blue whale/pygmy blue whale until identification is otherwise confirmed (refer to control measure 'EPBC Act Policy Statement 2.1: B.6 Adaptive Management Measures: blue whales/pygmy blue whales') If higher than anticipated numbers of other whales are observed: • If three or more 'other whale' instigated shut-downs occur within a 24-hour period, the acoustic source will be shut-down and the Seismic Vessel will relocate to at least 10 km away before commencing Pre Start-up Visual Observations and Soft-start Procedures; and • If an 'other whale' mother and calf pair is observed during the Seismic Survey, the acoustic source will be immediately shut-down and the Seismic Vessel will relocate to another area at least 10 km away before commencing Pre Start-up Visual Observations and Soft-start Procedures. Environmental benefit gained outweighs the additional cost.	Yes
Additional Management Measures – Blue Whales/Pygmy Blue Whales to allow Biologically Important Behaviours to Continue: • Implementation of a 5+ km Observation Zone[AC]; • Additional MMO/MFO observation effort; • Implementation of an Extended 5+ km Shut-down Zone[AC]; and • No operation of the acoustic source within 17 km of a pygmy blue whale migration BIA during the migration period (mid [14th] – April to mid [14th] – January).	P = Yes E= Effective	In addition to the above-mentioned Standard and Adaptive Management Control Measures, the following control measures are proposed to afford a high level of protection to endangered blue whales/pygmy blue whales during the Seismic Survey. In particular, the Blue Whale Conservation Management Plan includes the following action: "*Anthropogenic noise in biologically important areas will be managed such that any blue whale continues to utilise the area without injury and is not displaced from a foraging area*". In addition, one of the CMPs interim objectives is that "*anthropogenic threats are demonstrably minimised*" and in particular "*Robust and adaptive management regimes leading to a reduction in anthropogenic threats to Australian blue whale are in place*". The proposed additional management procedures for blue whales/pygmy blue whales have been developed to ensure consistency with these requirements. The onset distance for 24 hour cumulative TTS is predicted to be 17 km for pygmy blue whales (see **Section 7.2.2.2.7**) and the predicted onset distance for behavioural impacts on all cetacean hearing groups is 14.3 km (see **Section 7.2.2.3.6**).	Yes

<table>
<tr><th>Control Measure</th><th>Practicability/ Effectiveness</th><th>Justification</th><th>Will it be adopted?</th></tr>
<tr><td></td><td></td><td>To mitigate the effects of the Seismic Survey on biologically important behaviours, the following additional management procedures are proposed to be implemented for blue whales/pygmy blue whales during the Seismic Survey:
• A 5+ km Observation Zone[AC] such that MMOs/MFOs observe for blue whales/pygmy blue whales as far as practicable at all times throughout the OA;
• Throughout the OA when the source is active during daylight hours, a minimum of two experienced MMOs/MFOs will be on-duty to increase the detection rate of blue whales/pygmy blue whales. To achieve this, at least one MMO/MFO will be on-duty on the Seismic Vessel and at least one MMO/MFO will be on-duty on the Chase Vessel;
• An Extended 5+ km Shut-down Zone[AC] for blue whales/pygmy blue whales will be implemented throughout the entire OA, where shut-downs will be triggered by a blue whale/pygmy blue whale sighting at any distance and to a minimum of 5 km from the acoustic source;
• A Start-up Delay will occur if a blue whale/pygmy blue whale enters or is detected in the 5+ km Extended Shut-down Zone[AC] during the soft-start. Blue whale/pygmy blue whale presence at any distance will trigger an immediate and complete shut-down, and Soft-start Procedures may only resume when 30 minutes have lapsed since the last blue whale/pygmy blue whale sighting
• If the species of whale observed cannot be identified, it will be assumed to be a blue whale/pygmy blue whale and the relevant control measures will be implemented; and
• To ensure consistency with the Blue Whale Conservation Management Plan and the purpose of the 'Australian Whale Sanctuary' the Seismic Vessel will not activate the acoustic source(s) within the blue whale migratory BIA or 17 km buffer from mid-April (14th) to mid-January (14th) which represents the period during which migrating blue whales/pygmy blue whales have historically been known to be present in and around the OA.
In light of the conservative approach taken by both the modelling and the EP (in relation to the extent of the pygmy blue whale migrating season), the proposed controls demonstrate consistency with the objective of the Blue Whale Conservation Management Plan and the purpose of the Australian Whale Sanctuary. On this basis, acoustic injury to blue whales/pygmy blue whales can be avoided throughout the OA; hence, anthropogenic threats (as they relate to impacts from underwater noise) are minimised through robust and adaptive management measures and biologically important behaviours can continue.
Environmental benefit gained outweighs the additional cost.</td><td></td></tr>
<tr><td>Additional Management Measures – other whales:
A 2 km Extended Shutdown Zone[AC] for 'other whales' will be implemented throughout the entire OA at all times. On this basis a low power zone is deemed unnecessary.</td><td>P = Yes
E= Effective</td><td>In addition to the above-mentioned Standard and Adaptive Management Control Measures, the following control measures are proposed to afford a high level of protection to all other whales during the Seismic Survey in accordance with the intention of the Australian Whale Sanctuary:
If three or more 'other whale' instigated shut-downs occur within a 24-hour period, the Seismic Vessel will relocate at least 10 km away before commencing Pre Start-up Visual Observations and Soft-start Procedures; and
If an 'other whale' mother and calf pair is observed during the Seismic Survey, the acoustic source will be immediately shut-down and the Seismic Vessel will relocate to another area at least 10 km away before commencing Pre Start-up Visual Observations and Soft-start Procedures.
Environmental benefit gained outweighs the additional cost.</td><td>Yes</td></tr>
</table>

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Night-time/Poor Visibility Procedures for marine turtles Consistent with EPBC Policy Statement 2.1 and existing procedures for marine turtles, night-time or low visibility operations may occur provided that there has not been three or more marine turtle instigated shut-down situations during the preceding 24-hour period.	P = Yes E= Effective	Visual observations and shut-down procedures for marine turtles are effective during daylight hours. However, observations for marine turtles cannot feasibly be undertaken under low visibility conditions or at nighttime. As long as there have not been three or more turtle instigated shut down within the preceding 24-hour period, the acoustic source can remain active during night time or periods of low visibility. This measure, therefore, provides practicable means to reduce the likelihood of exposing significant numbers of marine turtles to PTS/TTS effects and close-range behavioural effects if it was found that there were higher numbers of turtles in the area than was predicted. Environmental benefit gained outweighs the additional cost.	Yes
Adaptive Management Measures – Marine turtles If higher than anticipated numbers of marine turtles are observed, as determined by there being three or more marine turtle instigated shut-downs within a 24 hour period, the acoustic source will not be discharged within 8 km of the Carbonate bank and terrace system of the Sahul Shelf KEF.	P = Yes E= Effective	If higher than anticipated numbers of marine turtles are observed, as determined by there being three or more marine turtle instigated shut-downs within a 24 hour period, the acoustic source will not be discharged within 8 km of the Carbonate bank and terrace system of the Sahul Shelf KEF. As Thums *et al.,*2017 points out, flatback turtles nesting on the Lacepede Islands have been shown to migrate to areas of complex geomorphology, including the terraces, deep holes and valleys of the Sahul Shelf, to forage. These foraging grounds are associated with and intersect the carbonate bank and terrace system of the Sahul Shelf KEF and which, in part, overlaps the OA. This measure, therefore, provides practicable means to reduce the likelihood of exposing significant numbers of marine turtles to threshold levels which may elicit behavioural effects, if it was found that there were higher numbers of marine turtles in the area than was predicted. Environmental benefit gained outweighs the additional cost.	Yes
Night-time/Poor Visibility Procedures for whale sharks Consistent with EPBC Policy Statement 2.1 and existing procedures for whales, night-time or low visibility operations may occur provided that there has not been three or more whale shark instigated shut-down situations during the preceding 24-hour period.	P = Yes E= Effective	Visual observations and shutdown procedures for whale sharks are effective during daylight hours. However, observations for whale sharks cannot feasibly be undertaken under low visibility conditions or at night time. As long as there have not been three or more whale shark instigated shut down within the preceding 24 hour period, the acoustic source can remain active during night time or periods of low visibility. This measure, therefore, provides practicable means to reduce the likelihood of exposing significant numbers of whale sharks to PTS/TTS effects and close-range behavioural effects if it was found that there were higher numbers of whale sharks in the area than was predicted. Environmental benefit gained outweighs the additional cost.	Yes
No operation of the acoustic source within marine turtle nesting periods (October - May).	P = No E= Limited Effectiveness	In accordance with the Recovery Plan for Marine Turtles in Australia 2017 – 2027 (Commonwealth of Australia, 2017b), seismic surveys that are planned to occur inside important inter-nesting habitat should be scheduled outside the nesting season. Acquisition will occur during nesting and breeding season for a number of marine turtle species within the region. However, the closest nesting, inter-nesting, or habitat critical BIA from the OA is located near Ashmore Reef and Cartier Island, approximately 87 km west, beyond the predicted distances at which PTS, TTS, behavioural response and behavioural disturbance may occur. Therefore, the control measure is considered to provide limited effectiveness and costs are grossly disproportionate to the benefit gained from implementing the measure.	No
No operation of the acoustic source within Whale Shark foraging BIA during the reported migration period (September to November).	P = Yes E= Unknown/Limited Effectiveness	Approximately half of the OA overlaps with the whale shark foraging BIA. Whale shark foraging and migration within the BIA primarily occurs between September and November. The Seismic Survey is more likely to commence at the end of November; however, SLB have committed that there will be no active source within the whale shark BIA before 1 December 2022, which will reduce any overlap with the peak of the whale shark migration. Should whale sharks be present within the OA during the survey period it is expected that these mobile individuals would actively avoid the area of acoustic emissions should it be having a negative effect on an individual. Environmental benefit gained outweighs the additional cost.	Yes
Adaptive Management Measures – Whale Sharks.	P = No E= Unknown/Limited Effectiveness	In accordance with EPBC Act Policy Statement 2.1: B.6, the implementation of adaptive management measures is recommended to manage the potential increased likelihood of encountering whales. In response to feedback provided by relevant persons during the consultation process, SLB has also considered the protections which may be provided by the use of adaptive management measures if a higher than anticipated numbers of whale sharks are encountered within the OA.	No

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
		The current proposed shutdown procedures, soft-start procedures and night-time/low-visibility procedures are considered to be effective in reducing the risk of PTS/TTS and, to some degree, close range behavioural disturbance. Accordingly, SLB has considered whether the following adaptive management measures will provide effective protection against potential *behavioural* disturbance outside of the shutdown zone and whether they are practicable to implement: • Relocate the Seismic Vessel and acoustic source to another part of the OA; • Increase the shutdown zone; and • Cease and delay operation of the acoustic source upon consecutive whale shark instigated shutdowns The northernmost section of the whale shark migration and foraging BIA overlaps with the OA. Whale shark foraging and migration within the BIA primarily occurs between September and November. SLB have committed that there will be no active source within the whale shark BIA during this window of sensitivity, reducing the overlap with the peak of the whale shark migration period in the area. Should whale sharks be present within the OA during the survey period it is expected that these mobile individuals would actively avoid the area of acoustic emissions should it be having a negative effect on an individual. Given their limited sensitivity to sound and transient nature of the acoustic emissions, whereby a speed of 4.5 knots the Seismic Vessel will travel up to 200 km in 24 hours, behavioural disturbances to foraging whale sharks are predicted to be limited to short-term and one-off disturbances to individuals or discrete groups, should they occur. On this basis, elicitation of potential avoidance behaviours in response to the acoustic source are not expected to displace whale sharks from viable foraging grounds within the BIA or preclude the continuation of biologically important behaviours, noting that neither the whale shark Approved Conservation Advice (TSCC 2015), previously in force Whale Shark Recovery Plan 2005 – 2010 (DEH 2005a), or the North-west Marine Region (DSEWPaC 2012b) have identified seismic sound emissions as a threat to whale sharks. Consequently, the effectiveness of relocating the Seismic Vessel to another part of the OA (e.g., to an area outside the BIA) and/or the introduction of increased shutdown zones are unknown, but would result in loss of time and possibly extend the duration of the survey. Temporary cease and delay operation of the acoustic source in the event that higher than anticipated numbers of whale sharks are encountered (i.e., consecutive whale shark instigated shutdowns occur) has the potential to provide some environmental benefit; however, consistent with the reasoning described above, would result in loss of time. Increasing the shutdown zone distance is not considered effective due to visual limitations in sighting whale sharks at distances beyond 500 m and the redundancy in protection from behavioural impacts afforded between a 250 m and 500 m shut down zone. Cost is grossly disproportionate to the unknown/limited environmental benefit gained from implementing the control measure.	
No acquisition overlapping the Carbonate bank and terrace system of the Sahul Shelf KEF.	P = No E= Limited Effectiveness	This would result in the removal of 9,900 km² of area from the proposed survey area, equating to approximately 24% of the OA and SLB would not be able to obtain sufficient data for all hydrocarbon prospects being targeted.	No

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
		Shallow banks and terrace habitats are considered to be of particular importance to the ecological character of the KEF, supporting diverse benthic communities of hard and soft coral, sponge, whips, fans and bryozoans. Banks that rise to at least 45 m water depth are reported to support the greatest species diversity (Brewer *et al.*, 2007). The UAM outputs indicate the PK no effects threshold of 226 dB re 1 µPa for sponges and corals was not reached at seven of the eight water depths modelled within the OA, however, potential effects to sponges and coral could potentially occur in the immediate vicinity of the acoustic source (≤11 m) at depths of 40 m. Based on the proposed control measure limiting shallow water acquisition, the acoustic source will not be discharged over features ≤60 m and a corresponding buffer zone (421 m). The available bathymetry data indicates only two geomorphic features rising ≤60 m within the AA overlapping the KEF. The measure is, therefore, considered practicable to implement. The above measure is expected to protect the ecological character of the KEF, particularly with regard to benthic values, whilst ensuring the objectives of the Seismic Survey can be met. See also 'No Shallow Water Acquisition'. Environmental benefit gained outweighs the additional cost.	
Use of an additional vessel for the specific purpose of marine mammal monitoring.	P = No E = Limited Effectiveness	Having another vessel specifically dedicated to marine mammal monitoring (with MMOs/MFOs and a PAM system onboard) could provide additional capacity for detecting whales at greater distances than from the Seismic Vessel. In this respect a dedicated marine mammal monitoring vessel would provide a high level of support to the extended mitigation zones outlined in this EP. However, instead of using an additional vessel that is dedicated to marine mammal observations, the extended Observation Zone will be monitored using the Chase Vessel as an additional observation platform with two MMOs/MFOs onboard. Whenever practicable, the Chase Vessel will travel as far as practicable ahead of the Seismic Vessel and will conduct visual surveillance for marine mammals during daylight hours. On this basis, an additional and dedicated marine mammal monitoring vessel is not considered to be necessary as the proposed control measures that will be adopted sufficiently address the risks to marine mammals as quantified by underwater noise modelling. In addition, the adaptive management measures that will be implemented also serve to manage risk to marine mammals throughout the survey. Cost is grossly disproportionate to the environmental benefit gained from implementing the control measure.	No
Extended pre-start observation period.	P = Yes E = Limited Effectiveness	SLB recognises that by increasing the duration of pre-start visual observations, detectability rates of some marine fauna may increase. On this basis and due to the potential presence of deep/long diving cetacean species such as sperm whale and beaked whales, extending pre-start observations from 30 minutes to 60 minutes was considered. However, this control measure will not be implemented for the following reasons: a) the species identified as deep/long diving cetacean species are high frequency odontocete species for which modelling predicts that PTS will not occur from exposure to either a single pulse or cumulative exposure over 24 hours. For high-frequency species, TTS is also not predicted to occur from exposure to a single pulse and the onset distance for cumulative TTS is limited to within 80 m of the source; b) the acoustic source is moving continuously at a speed of ~8km/hr and therefore commencing observations earlier would include waters ~4 km further away from where acquisition is planned, meaning tangible benefits to individual species in the acquisition zone are limited; and c) For blue whales/pygmy blue whales, which are the species of primary conservation concern for the Seismic Survey, 30 minutes of pre-start observations is sufficient based on the following dive times as published by Owen *et al.* (2016) for pygmy blue whales off WA: - Feeding dives mean duration 7.6 min (max. 17.5 min) - Migratory dives mean duration 5.2 min (max. 26.7 min) - Exploratory dives mean duration 8.6 min (max 22.05 min)	No

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
		Cost is grossly disproportionate to the limited environmental benefit gained from implementing the control measure Additionally, effectiveness of the pre-observation period when applied to marine turtles and whale sharks was also evaluated and determined the following: - Reported dive times for relevant species can range between just a few minutes and over an hour. Immersion times may be variable across species, between behavioural modes (migrating, foraging, inter-nesting) and across environmental conditions. Where they are known, 'routine diving' for loggerhead, flatback, olive ridley, green and hawksbill turtles' are reported to range between 10 minutes and 40 minutes (Hays *et al.,* 2001; Iverson *et al.,* 2019; Thums *et al*., 2017). - Whale sharks may be present at the surface for brief periods when foraging, however, their vertical distribution when foraging is contingent upon the distribution of prey and, therefore, surfacing intervals are difficult to predict. Therefore, a 30-minute pre-start visual observation period provides a reasonable amount of time to account for the variable immersion times of multiple marine fauna, whilst being practicable to implement during operations. There is limited effectiveness in increasing the pre-start observation period and therefore costs are grossly disproportionate to the limited environmental benefit gained from implementing the control measure	
Use of PAM on-board the support vessels.	P = No E = Limited Effectiveness	PAM provides a useful detection method for high-frequency and very high-frequency cetacean species in addition to visual observations by MMOs/MFOs. For this reason, PAM will be adopted on board the Seismic Vessel. However, due to the limitations of PAM systems to detect baleen whales, the limited capacity for additional personnel on board the support vessels, and the significant costs associated with engaging dedicated, trained, and experienced PAM operators and equipment, the cost of this option is considered to outweigh the limited benefit that it would provide.	No
Acoustic source model validation.	P = No E = Limited effectiveness	UAM results are extensively used to inform suitable control measures for various receptors (including blue whales/pygmy blue whales) throughout this EP. While it is often considered best practise to undertake a programme of in-field noise measurements at relevant distances from the source to verify the accuracy of model predictions, in practise, this approach can be extremely challenging from both a scientific and logistical perspective. For the proposed Seismic Survey, the impact assessment has relied extensively upon UAM conducted by JASCO of the 3,000 in^3 acoustic source with a far-field source specification of 250.1 dB re 1 µPa m PK and 225.3 dB 1 $\mu Pa^2 m^2 s$ SEL (10 – 2,000 Hz) in the broadside direction (see **Appendix A** for the UAM report). Predictions from JASCO's Airgun Array Source Model (ASSM) and propagation models have been extensively validated by JASCO globally against underwater acoustic measurement programs in different marine environments from Australia, the United States, Canada, Greenland and Russia (e.g. Hannay & Racca 2005; Aerts *et al*. 2008; Funk *et al*. 2008; Ireland *et al*. 2009; O'Neill *et al*. 2010; Warner *et al*. 2010; Racca *et al*. 2012a, 2012b; Matthews & MacGillivray 2013; Martin *et al*. 2015; Racca *et al*. 2015; Martin *et al*. 2017a, 2017b; Warner *et al*. 2017; MacGillivray 2018; McPherson *et al*. 2018). These validation programs have been fundamental to JASCO's process of continual model improvement.	No

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
		The models used by JASCO to generate the predictions of underwater noise that underpin this EP are consistently found to be reliable and robust. This provides confidence in the impact assessment which was based on the acoustic modelling results. It is noteworthy that, a verification study for four different acoustic sources in Australian waters found that measured data showed good agreement with the modelling in all cases (McPherson *et al*. 2018). This validation study used fixed loggers on the seafloor which are far superior to streamer-based measurements that have been used previously for the collection of in-field measurements during seismic surveys. With regards to the acoustic array sound source specifications, there is little to no uncertainty in the source model when the acoustic array is a standard type (MacGillivray 2018; McPherson *et al.* 2018). JASCO has confirmed that the proposed acoustic source for the Seismic Survey fits this description. If the final acoustic source selected for the Seismic Survey differs to that which was modelled in **Appendix A**, then additional source modelling will be undertaken to confirm whether the sound levels are consistent with levels assessed as acceptable in this EP. Cost is grossly disproportionate to the limited environmental benefit gained from implementing the control measure	
Increase in line spacing.	P = No E = Effective	Wider line spacing would serve to reduce the survey duration and therefore reduce the overall amount of underwater noise generated. However, wider line spacing would not allow the objectives of the Seismic Survey to be achieved due to reduced data coverage.	No
Alternative line sequencing to a 'race track' design to avoid sequential lines.	P = No E = Effective	If an alternative line turn sequencing programme was implemented, it could double the line change time. This results in the duration of the survey would be for a lot longer, which has other implications with other marine users and peak-foraging season. With the duration of the survey increasing, this means that the crew are out on the vessel for longer, which can increase HSE exposure and potential conflict with other water users. In addition, increasing the duration of the survey increases the costs to the programme significantly. Cost is grossly disproportionate to the environmental benefit gained from implementing the control measure	No
Alternative methods for detecting marine mammals other than PAM and visual observations (i.e. Active Acoustic Monitoring, Thermal Imaging, and Radio Detection and Ranging (**RADAR**)).	P = No E = Limited/ Unknown Effectiveness	Visual sightings methods using MFOs/MMOs are restricted to daylight hours and relatively good weather conditions and can only detect whales at the sea surface. Therefore, any additional method for detecting marine mammals during poor sighting conditions would be beneficial, especially during night-time operations and detection of submerged animals. Alternative detection methods include PAM, Active Acoustic Monitoring, Thermal Imaging, and RADAR. SLB will utilise PAM on the Seismic Vessel during the Seismic Survey. PAM will be operational 24 hours per day while the acoustic source is active and will be continuously monitored by an experienced PAM Operator. Classification to species level from the acoustic detections can only be reliably achieved using PAM, as all other detection methods have not yet been commercially proven or validated (including for detection distance) (Verfuss *et al*., 2018). PAM provides the most cost effective and reliable method to complement visual sightings, despite its limitations for detecting some low frequency vocalisations. It is noteworthy that the reliability and accuracy of thermal imaging technologies are currently unproven, and the logistics associated with real-time acoustic monitoring for large scale seismic surveys are unfeasible. However, if this technology were to be available prior to the Seismic Survey commencing, SLB would look to assist with any trialling of thermal imaging methods. Cost is grossly disproportionate to the limited environmental benefit gained from implementing the control measure	No

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Prohibition of night-time operations.	P = No E= Effective	Modelling indicates that most whales exposed to a single acoustic pulse will not suffer PTS, but that TTS could occur from a single impulse out to c. 1 km. Cumulative effects of noise exposure over 24 hours would mean onset distances for TTS and PTS are larger; the potential for PTS in 'other baleen whales' due to cumulative exposure has been identified out to 7 km. While this is effect could theoretically occur beyond the 2 km Shut-down Zone for 'other baleen whales', TTS is unlikely to occur as: 1) individual animals are expected to move away from the active source and would not remain within this radius for 24 hours; and 2) the Seismic Vessel will travel up to 200 km within a 24-hour period. Under the standard management procedures for <u>all whales</u>, night-time operations may occur provided that there have not been three or more whale instigated power-down or shut-down situations during the preceding 24-hour period. Decisions on the requirement for this control will be made daily, i.e. at dusk each day, the MMO/MFO on-duty will advise whether the threshold of three whale instigated shut-downs was reached in the preceding 24 hours and will therefore confirm if night-time operations can occur. The same applies for low visibility operations where decisions on whether to continue operating will be made each time low visibility conditions arise. The standard night-time and low visibility management procedure for <u>all whales</u> has also been applied for the management of marine turtles and whale sharks. For blue whales/pygmy blue whales, a slightly more conservative approach is proposed; whereby if higher than anticipated numbers of blue whales/pygmy blue whales are observed (three or more blue whale/pygmy blue whale instigated shut-downs are made during the preceding 48 hour period) at any time or location during the survey then night-time or low visibility operations shall cease and may only resume after 48 hours of no blue whale/pygmy blue whale instigated shut-downs. The control measure of no night-time operations is not considered practicable, as it will result in extending the duration of the overall survey.	No
Use of drones or unmanned aerial vehicles (**UAV**).	P = No E = Limited	The capability of drones in offshore environments is limited by battery life, the distance they can travel and to low wind conditions (~<20 knots). The battery life of UAV's is longer, and they are capable of travelling longer distances, but are still limited to wind conditions of <25 knots. An experienced pilot is needed to operate an UAV and the costs associated with this in an offshore environment are likely to be c. $700/day, excluding the cost of drone hire. Therefore, the cost of having a pilot on a Seismic Vessel for c. 100 days would be approximately $70,000. It is considered that there would be limited benefit of using a drone/UAV over visual observation by MMOs/MFOs as both are best suited to optimal conditions. As such, the costs associated with using drones or UAVs to observe for whales are considered to be grossly disproportionate to the benefits.	No
No data acquisition during peak spawning periods for fish species within the OA.	P = No E = Fairly effective	Throughout the OA and EMBA there are no known specific spawning aggregation sites critical for the ongoing viability of fish species. Many fish species within the OA are widely distributed and have extended spawning periods in which they spawn multiple times. Spawning multiple times over an extended spawning period can offset potential risks and high inherent levels of mortality experienced by fish eggs and larvae. Fish eggs and larvae naturally experience high levels of mortality, the potential seismic survey related mortality over a limited spatial extent would be orders of magnitude smaller than regional scale environmental drivers that influence survival and recruitment of fish species. Moreover, the movement of fish out of an area following exposure to acoustic source emissions has not been widely reported and as such standing biomass of reproductively active individuals is no anticipated to be negatively affected. No changes to the population of commercially valuable fish species are expected through effects to fish spawning or recruitment success and thus avoiding the period of peak spawning for a limited number of fish species is not anticipated to have a material impact on the fish stocks or commercial fisheries. Given how limited the potential effect of seismic survey data acquisition on fish eggs and larvae is, restricting when the survey can be completed is not considered to be practicable particularly, cost effective or a measure to provide benefit to the populations of fish present.	No

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Seismic activities will be restricted to areas outside key commercial fishing areas/seasons.	P = No E = Effective	This would potentially avoid overlap with the commercial fishing operations identified during the consultation programme with relevant persons and the fisheries assessment undertaken. Best efforts have been made to avoid fisheries where possible; however, there will be some overlap, and this will be managed through control measures and ongoing communication for the duration of the survey to minimise conflict and disturbance.	No
A Before After Control Impact (**BACI**) study is implemented prior to the Seismic Survey commencing.	P = No E = Effective	Developing and completing a BACI study for the active fisheries within and surrounding the OA is a significant undertaking and would need to occur over a long period of time to assure that the methodology and results were robust, representative and consider the inherently high level of natural variability present. Many studies have been undertaken on the effects of fish and their response to seismic emissions, with many reporting that fish typically move away from a loud acoustic source if they are uncomfortable with the noise, thereby minimising their exposure and the potential for any deleterious effects. Most studies that are undertaken on fish are essentially represented as worst case scenarios, as the fish are not able to move away from the acoustic source like they can in the wild. The costs of such an extensive BACI study would be grossly disproportionate to the environmental benefit gained from implementing such a control measure.	No
Residual Risk of Impact (Receptor)	**Consequence**	**Likelihood**	**Residual Risk Ranking**
Physiological Effects			
Plankton	Negligible	Likely	Negligible
Benthic Invertebrates	Minor	Unlikely	Low
Fish	Minor	Likely	Low
Elasmobranchs	Minor	Rare	Low
Cephalopods	Minor	Unlikely	Low
Marine Turtles	Minor	Possible	Low
Sea snakes	Minor	Possible	Low
Baleen Whales	Minor	Unlikely	Low
High Frequency Cetaceans	Negligible	Rare	Negligible
Dugongs	Negligible	Rare	Negligible
Seabirds	Minor	Rare	Low
Behavioural Effects			
Benthic Invertebrates	Minor	Unlikely	Low
Fish	Minor	Likely	Low
Cephalopods	Minor	Unlikely	Low
Marine Turtles	Minor	Possible	Low
Sea snakes	Minor	Unlikely	Low
Baleen Whales	Minor	Certain	Moderate
High Frequency Cetaceans	Minor	Certain	Moderate
Dugongs	Minor	Certain	Moderate
Elasmobranchs	Minor	Unlikely	Low
Seabirds	Minor	Possible	Low

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Perceptual Effects			
Fish	Minor	Likely	Low
Mammals	Minor	Certain	Moderate
Effects to Relevant Persons			
Commercial Fisheries	Minor	Possible	Low
Divers	Moderate	Rare	Low
ALARP Statement			
The decision context has been assessed as Type B for all receptors. The corresponding residual risk rankings have been determined to range from Negligible to Moderate. SLB considers the adopted control measures appropriate to manage the impact from Acoustic Disturbance to the Marine Environment associated with the Seismic Survey. The proposed control measures have been developed in accordance with the legislative requirements, good industry practice, using professional experience and taking into account the specific environmental, social, economic and cultural characteristics of the OA and predicted impacts to other marine users. Alternative and additional control measures were considered, and implemented where effective and practicable, as part of the assessment process. No further additional or alternatively controls were identified. Therefore, the predicted impacts to receptors from Acoustic Disturbance to the Marine Environment are reduced to **ALARP.**			

7.2.7 Impact and Risk Acceptability

Table 71 Demonstration of General Impact and Risk Acceptability for Acoustic Disturbance to the Marine Environment

Context	Acceptability Summary
Residual Risk Ranking	The Residual Risk has been determined to range from **Negligible** to **Moderate**
Ecologically Sustainable Development	The management of risk associated with acoustic source emissions for the Seismic Survey shall comply with the five principles of ecologically sustainable development as defined within the EPBC Act. These principles have been considered as part of the development of this EP and risk assessment process, and the assessment has not identified any adverse impacts to the principles of ESD, namely: • No threats of serious or irreversible environmental damage; • Inter-generational equity will not be degraded for future generations as potential acoustic disturbance impacts will be localised and full recovery of all potential receptors is expected; • The decision-making process has integrated both long-term and short-term economic, environmental, social and equitable considerations and where necessary, appropriate control measures have been proposed; • Conservation of biological diversity and ecological integrity have been considered in the decision-making process following the Environmental Impact and Risk Assessment process outlined in **Section 6**; and • The control measures proposed have considered improved valuation, pricing and/or incentive mechanisms – control measures that had environmental benefits that outweighed the costs of their implementation were proposed to be undertaken.
SLB's Internal Context	The proposed management of the impact/risks from noise emissions are within **Acceptable Levels** of SLB's Environmental and QHSE Policy.
Existing Environmental Context	The OA overlaps or is near (<50 km) to BIAs for the following species: whale sharks, pygmy blue whales, flatback turtles, loggerhead turtles, olive ridley turtles, and lesser frigate birds. While numerous commercially valuable fish stocks occur in the region, in recent years fishing effort in the OA has been limited to the Northern Demersal Scalefish Managed Fishery and the Mackerel Managed Fishery, with by far the majority of fishing effort occurring inshore of the OA. Based on the UAM results, the residual risk ratings for all animal groups were assessed as **Low**, with the exception of marine mammals. A **Moderate** residual risk rating for behavioural effects and perceptual effects was reported for marine mammals. No Australian Marine Parks overlap with the OA, though the OA boundaries are contiguous with the Oceanic Shoals Marine Park Multiple Use Zone which is classified IUCN VI. The OA overlaps with one KEF being the Carbonate Bank and Terrace System of the Sahul Shelf. Environmental sensitivities within each AMP and KEF have been individually taken into consideration within the EP. In each case, primary environmental values include benthic-associated values. Based on results from the UAM, SLB will implement control measures whereby the acoustic source will not be active in waters 60 m depth or less, plus a 421 m buffer around these shallow water areas either by pausing the acquisition within this Acquisition Exclusion Zone (noting this would only occur during daylight hours and good visibility conditions) or deviating around the Acquisition Exclusion Zone. SLB will also not return to acquire any portion of any sail-line, or area, until at least 24-hours has passed. These measures will serve to protect benthic invertebrates from sub-lethal effects and mortality or mortal injury for site-attached fish (including those commercially targeted) from the Seismic Survey. Overall, it is considered that through the implementation of the proposed control measures (including precaution zones, MFOs/MMOs, temporal and spatial measures and adaptive management measures), and the associated operational procedures, the impacts from underwater noise emissions from the Seismic Survey will not have any serious, long-term or irreversible impacts to ecology or socio-economic values. The Seismic Vessel, and associated acoustic source, will be constantly moving at a speed of 4.5 knots during acquisition. The proposed acoustic source size of 3,000 in^3 is consistent with that used in contemporary seismic surveys for which there have been little, if any, reported deleterious effects. Therefore, the impacts to the existing environment and identified receptors are likely to be short-term, localised, and rapidly recoverable.
External Context – Management Plans, Species Recovery Plans and Conservation Advice	The residual risk of the acoustic disturbance to the marine environment has been determined to range between Negligible to Moderate and will not have a significant impact on a matter of national environmental significance in accordance with EPBC Act Policy Statement 1.1. The NOPSEMA guidance note for petroleum activities and Australian Marine Parks (NOPSEMA, 2020d) requires that an EP is developed for undertaking activities such as MSSs to evaluate how environmental impacts and risks will be of an **Acceptable Level** and reduced to **ALARP** and demonstrate that the MSS will not be inconsistent with the relevant marine park management plan. Even though the OA does not overlap with any marine parks, the Seismic Survey will be undertaken in accordance with the objectives of the North-west Marine Parks Network Management Plan and the North Marine Parks Network Management Plan. Each of the environmental sensitivities within the Australian Marine Parks have been assessed within this EP, where the management of the Seismic Survey is considered to be consistent with the objectives of the management plans. The relevant measures within the conservation advice and recovery plans have been considered during the development of the control measures that will be implemented during the Seismic Survey and are considered to be consistent with these recovery plans and Conservation Advice as described below. **Conservation Management Plan for the Blue Whale** Interim Objective 4 of the 'Conservation Management Plan for the Blue Whale' is to "*ensure anthropogenic threats are demonstrably minimised*" and is to be tested by Target 4-1; "*Robust and adaptive management regimes leading to a reduction in anthropogenic threats to Australian blue whales are in place*". This Conservation Management Plan listed seismic noise as a potential source of anthropogenic noise impacts, which was determined a threat with very high priority for pygmy blue whales. Listed conservation actions to ensure recovery targets are met that are applicable to the Seismic Survey include: • Assessing the effect of anthropogenic noise on blue whale behaviour; • Anthropogenic noise in BIAs will be managed such that any blue whale continues to utilise the area without injury, and is not displaced from a foraging area; and

Context	Acceptability Summary
	• EPBC Act Policy Statement 2.1 is applied to all MSSs. The effects of anthropogenic noise on pygmy blue whales have been assessed in this EP. Animat modelling was undertaken to understand the specific injury risk that the Seismic Survey poses to pygmy blue whales. This modelling incorporated pygmy blue whale movement data to predict exposure ranges that are significantly more realistic than those produced by UAM. Animat modelling predicted that the distance within which 95% of threshold exceedances would occur for pygmy blue whales is 1.4 km for PTS and 17 km for TTS. The 17 km onset distance for cumulative TTS has been used to define a buffer zone around the BIA. No acquisition will occur within the BIA or buffer during the blue whale/pygmy blue whale migration season (conservatively defined within the EP as mid-April to mid-January). This spatio-temporal measure has been designed to eliminate any physical or behavioural effects on migrating blue whales/pygmy blue whales; hence to comply with the requirement of the Blue Whale Conservation Management Plan that blue whales can continue to use biologically important areas without injury. In addition, an Extended 5+ km Shut-down Zone[AC] for blue whales/pygmy blue whales, will be adopted whereby shut-downs will be triggered by a blue whale/pygmy blue whale sighting at any distance (and to a minimum of 5 km from the acoustic source) and several adaptive management measures will also be implemented to manage vessel locations and night-time/low visibility operations when higher than anticipated numbers of blue whales/pygmy blue whales are detected (i.e. if three or more blue whale/pygmy blue whale instigated shut-downs are made during the preceding 48 hour period). . In summary, adoption of the EPBC Act Policy Statement 2.1 Part A measures and several Part B measures (as summarised above) including the implementation of additional control measures throughout the OA will ensure that blue whales will be able to utilise the BIA without injury or significant behavioural impacts whilst the survey takes place, and the control measures that SLB will implement are consistent with the conservation actions for the blue whale Based on the 1) proposed control measures (including the temporal and spatial mitigations to be implemented throughout the OA and several adaptive management measures), and the species specific Animat modelling to quantify potential impacts, the overall environmental risks from the Seismic Survey are considered to be reduced to **ALARP** and at **Acceptable Levels** with regard to pygmy blue whales and that management of the Seismic Survey aligns with the objective of the Blue Whale Conservation Management Plan. For all other species of baleen whale, conventional UAM results predicted that 24-hour cumulative PTS could occur out to a maximum of c. 7 km, but that exposure to a single pulse from the active acoustic source would not elicit PTS even if an animal was very close to the source (< 20 m). The maximum onset distance for 24-hour cumulative TTS is predicted to be 48 km while the single pulse onset distance for TTS is 80 m. On the basis that other baleen whales are probably only present in the OA at low or very low densities (see **Table 61**) and that UAM does not account for animal movement or the movement of the Seismic Vessel, the 24-hour cumulative UAM results were considered to be excessively conservative for defining the extent of observation or shutdown zones for other baleen whales. It is noteworthy that over a 24-hour period the Seismic Vessel could travel up to 200 km; hence 24-hour cumulative exposure over the 48 km TTS onset distance and the 7 km PTS onset distance is highly unlikely for baleen whales. As a precaution, an Extended 2 km Shut-down Zone for all other whales will be adopted throughout the OA and this will serve to provide complete protection from short-term exposure to underwater noise for these species. In addition, adaptive management measures will be implemented to provide further protection to these other species of whale. **Approved Conservation Advice for *Megaptera novaeanliae* (humpback whale):** Conservation and Management Actions for humpback whales have been outlined in the humpback whale Conservation Advice and include "*assessing and addressing anthropogenic noise: shipping, industrial and seismic surveys*". All mitigation measures listed within the Conservation Advice are included within the proposed control measures and will be implemented throughout the Seismic Survey, this also includes the adoption of all EPBC Act Policy Statement 2.1 Part A measures and certain Part B measures (including extended Precaution Zones, use of MFO/MMOs, spatial and temporal adaptive management procedures, such as limits on night-time/low visibility operations and vessel location in certain circumstances, and where appropriate and use of PAM), and the undertaking of UAM. The mitigation measures in place for the Seismic Survey will adhere to the requirements of the Conservation Advice and will assist with reducing potential noise impacts and risks to **ALARP** so that any potential impacts are managed to an **Acceptable Level** with regard to humpback whales and that the survey will be carried out in a way that will be consistent with the humpback whale Conservation Advice. **Conservation Advice for Sei and fin Whales** No further mitigation measures have been provided in the Conservation Advice for sei and fin whales to address anthropogenic noise; however, those mitigations adopted to address potential impacts on blue whales will be of substantial benefit to sei and fin whales as well. Adoption of the EPBC Act Policy Statement 2.1 Part A measures and several Part B measures will be implemented to reduce the potential noise impacts and risks to **ALARP** and **Acceptable Levels** with regard to sei and fin whales, and the survey will be consistent with the Conservation Advice for these species. **Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017)** Although the impact of anthropogenic activities, specifically anthropogenic noise, has been identified within the Recovery Plan for Marine Turtles in Australia, there are few specific requirements with regard to management actions which may address effects on marine turtles and ensure the continuation of biologically important behaviours, excluding the requirement to implement Soft-start Procedures in accordance with EPBC Act Policy Statement 2.1. Adoption of several control measures including a 500 m Observation Zone, pre-start observation procedures, Soft-start Procedures and a 250 m Shut-down Zone is considered sufficient to meet the requirements of, and undertake the activity consistent with, Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017). In addition, adaptive management measures will also be adopted for marine turtles, whereby if higher than anticipated numbers of marine turtles are observed, as determined by there being three or more marine turtle instigated shut-downs within a 24-hour period, the acoustic source will not be discharged within 8 km of the Carbonate bank and terrace system of the Sahul Shelf KEF. **Draft Wildlife Conservation Plan for Seabirds 2019** Under the Draft Wildlife Conservation Plan for Seabirds 2019, effects of anthropogenic disturbance to seabird breeding and roosting areas are to be managed. Given the open ocean nature of the Seismic Survey no disturbance effects from underwater noise are predicted for breeding or roosting sites therefor no specific additional measures are required to reduce potential noise impacts and risks to **ALARP** and **Acceptable Levels** for seabirds. **Conservation Advice for *Rhincodon typus* (Whale Shark)** The Whale Shark Approved Conservation Advice (TSCC, 2015) does not identify sound as a threat to the species. Seismic emissions impacts are not predicted on the whale shark and their behavioural response to avoid the sound source will further reduce injury, however, SLB will adopt several control measures for whale sharks including Pre-start Observation Procedures within a 500 m Observation Zone, Soft-start Procedures, and a 250 m Shut-Down Zone. Actions are considered consistent with the objective of facilitating recovery of whale sharks.

Context	Acceptability Summary
	<u>AMP Values, Management Prescriptions and IUCN Reserve Management Principles</u> No population level impacts or serious or irreversible ecological implications to AMPs within the EMBA are predicted to occur as a result of Acoustic Disturbance to the Marine Environment. Therefore, the biological diversity and sustainability of the AMPs are considered to be conserved. There are no predicted impacts to the ongoing sustainable use, where permitted, of the AMPs within the EMBA. The activity is consistent with the IUCN management prescriptions and permissible use of the AMPs. **<u>Conservation values and objectives of the North-west Marine Parks Management Plan (Commonwealth of Australia 2012)</u>** There are no predicted severe or long-term impacts to individual species or ecological populations as a result of the Acoustic Disturbance to the Marine Environment. Therefore, the biodiversity and ecosystem health of the NWMR is considered to be conserved. The predicted impacts are not inconsistent with the requirements of the Conservation Advice, Recovery Plans and Management Plans associated with the EPBC Act listed species identified. The activity is consistent with the goals and objectives of the North-west Marine Parks Management Plan(Commonwealth of Australia 2012)
Social Acceptance – Relevant Person Expectations	Some concerns were raised during the consultation programme with relevant persons, in regard to the effects from acoustic disturbance. The main concerns raised and what has been considered within the EP and environmental risk assessment process were: • Implement notification requirements, as a 48-hour operational look ahead plan; • Effects upon the values of protected receptors within the Oceanic Shoals Marine Park located adjacent to the OA; • Effects upon the values of the Carbonate banks and terrace system of the Sahul Shelf Key Ecological Feature; • Consideration of Adaptive Management Measures to mitigate the potential impacts to marine turtles; • Avoiding the foraging areas during migration periods for Whale Sharks or the use of shutdown zones; • Consideration of Adaptive Management Measures to mitigate the potential impacts to whale sharks; and • Implementing protocol to compensate fishers if they are displaced from their fishing grounds during the Seismic Survey. All concerns raised by relevant persons were considered as part of the EP process and responses were provided to all submissions with further information or feedback as necessary. All submissions and associated response are provided in **Appendix I**. Detailed literature reviews, UAM and revisions to the survey design and OA were included in the development of the EP and an extensive set of control measures to reduce the overall impacts from the Seismic Survey on the marine environment and those relevant persons that use the marine environment for their economic wellbeing, to **ALARP** and an **Acceptable Level**.
External Context – Commonwealth and State Legislative Criteria	The Seismic Survey will comply with all relevant legislative requirements, in particular the EPBC Policy Statement 2.1 Part A measures. Under Part B of the EPBC Act Policy Statement 2.1, various measures are recommended when the likelihood of encountering whales is moderate to high. Several control measures will be implemented for the duration of Seismic Survey in accordance with Part B of the EPBC Act Policy Statement 2.1.
Industry Best Practice	The proposed control measures follow industry best practice and best practice guidelines, including: • Adoption of the EPBC Policy Statement 2.1 which is considered Industry Best Practice for minimising the effects of MSSs on marine mammals. Control measures will be implemented for the duration of the Seismic Survey and these measures have been developed in accordance with the EPBC Act Policy Statement 2.1 (i.e. soft-starts, Precaution Zones, MMOs/MFOs). Where appropriate, SLB has provided increased protection for marine mammals above that which is required within the EPBA Act Policy Statement 2.1, for example through the use of Extended Observation and Shut-down Zones; • The IAGC Environmental Manual for Worldwide Geophysical Operations which includes recommended mitigation measures for cetaceans to minimise acoustic disturbance during geophysical operations. These measures include, but are not limited to: • Use of Soft-start Procedures; • Providing basic awareness training to the entire crew; have them immediately report any cetacean observation to the bridge; • Reporting immediately to local authorities any animals in distress, animal carcasses, etc.; and • The APPEA Code of Environmental Practice which includes objectives to reduce the impact on cetaceans and other marine life to ALARP and to an Acceptable Level by ensuring operations are in accordance with legislative requirements and demonstrate the implementation of appropriate management measures.
ALARP	The decision context has been assessed as Type B for all receptors. The corresponding residual risk rankings have been determined to range from Negligible to Moderate. SLB considers the adopted control measures appropriate to manage the impact from Acoustic Disturbance to the Marine Environment associated with the Seismic Survey. The proposed control measures have been developed in accordance with the legislative requirements, good industry practice, using professional experience and taking into account the specific environmental, social, economic and cultural characteristics of the OA and predicted impacts to relevant persons. Alternative and additional control measures were considered, and implemented where effective and practicable, as part of the assessment process. No further additional or alternatively controls were identified. Therefore, the predicted impacts to receptors from Acoustic Disturbance to the Marine Environment are reduced to **ALARP.**

Table 72 Demonstration of Specific Impact and Risk Acceptability for Acoustic Disturbance to the Marine Environment

Receptor	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact	Acceptable
Plankton	Principles of ESD, specifically no serious or irreversible environmental damage and the conservation of biological diversity and ecological integrity	Impacts to plankton communities are localised (within 100s of m from the acoustic source) and recoverable (< 1 week to recover). Note that the latter is considered sufficient to protect against population level impacts and impacts to the recruitment levels at surrounding habitats.	Overall, there is the potential for localised, short-term impacts to zooplankton as a result of the Seismic Survey; however, population recovery is expected within days after the Seismic Survey has ceased and no lasting ecosystem population impacts are expected.	Yes
Benthic Habitats (Banks, Shoals and Reef)	Principles of ESD, specifically no serious or irreversible environmental damage and the conservation of biological diversity and ecological integrity. Marine bioregional plan for the North-west Marine Region	No detectable impacts to habitat forming benthic primary producers, such as coral, as a result of the Seismic Survey.	The threshold value of 226 dB re 1 µPa PK was not reached at any of the modelled sites analysed within the UAM. Therefore, no detectable impacts to benthic habitat forming species such as sponges and corals, which colonise the banks, shoals and pinnacles within the OA, are expected.	Yes
Benthic Invertebrates	Principles of ESD, specifically no serious or irreversible environmental damage and the conservation of biological diversity and ecological integrity	Impacts to crustaceans and bivalves arising from the Seismic Survey will not result in mortality rates beyond the natural range of variation.	The UAM predicts sub-lethal effects to crustaceans could occur out to 421 m from the active acoustic source, wherein the threshold criteria of 202 dB re 1 µPa PK-PK was exceeded. Effects to molluscs are predicted to be highly localised and constrained to within 10.5 m of the active acoustic source. The investigations through which the adopted threshold criteria have been developed both concluded that mortality rates observed during exposure to treatment (i.e., seismic sound) were within the natural range of variation which may be expected to occur due to changes in environmental conditions and anthropogenic stressors. Where sub-lethal and lethal effects do occur, the natural cycle of death, recovery and recruitment of invertebrates from adjacent benthic habitats will occur in parallel over the same timescales and therefore, no net impacts to relative abundance, benthic community composition and structure are anticipated. Based on results from the UAM, SLB will implement control measures whereby the acoustic source will not be active in waters 60 m depth or less, plus a 421 m buffer around these shallow water areas. This will serve to protect benthic invertebrates from sub-lethal effects from the Seismic Survey. Any pause in seismic acquisition from this control measure would only occur during daylight hours and good visibility conditions so that it does not increase the impact and/or risk to marine mammals. SLB will also not return to acquire any portion of any sail-line, or area, until at least 24-hours has passed.	Yes

Receptor	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact	Acceptable
Non-Listed Marine Fauna (Cephalopods Fish, Sharks, Rays)	Principles of ESD, specifically no serious or irreversible environmental damage and the conservation of biological diversity and ecological integrity	No serious or irreversible damage to a population of any Non-listed marine fauna species as a result of the Seismic Survey.	**Cephalopods:** The evidence suggests that no serious physiological impacts to individuals or larvae will occur as a result of the survey. The life history traits of cephalopods mean they are well adapted to disturbance and appear to become habituated to acoustic release, displaying other behaviours which indicate rapid recovery. Therefore, no serious or irreversible risks to cephalopod populations are predicted. **Fish:** Consistent with the fisheries management principles, key indicator species have been considered representative of the full fish assemblage which may exist within the OA and relevant distances to thresholds. As described below, no serious or irreversible impacts to key indicator fish populations to the extent that sufficient spawning fish biomass and recruitment of stock may be compromised are predicted. **Sharks and Rays:** The controls adopted to reduce risk to protected elasmobranchs, afford similar protections to all elasmobranchs. Therefore, no serious or irreversible damage to shark and ray populations are expected.	Yes
EPBC Act Listed marine fauna (Whale Sharks, Marine Turtles, Marine Mammals, Seabirds)	**Marine Mammals** EPBC Act Part 3 (18A and 20A) EPBC Act Significant Impact Guidelines 1.1 Conservation Management Plan for the Blue Whale Approved Conservation Advice for Megaptera novaeangliae (humpback whale) Approved Conservation Advice for Balaenoptera borealis (sei whale) Approved Conservation Advice for Balaenoptera physalus (fin whale)	Impacts to EPBC Act Listed marine fauna are limited to minor, short term effects to individuals and ensure biologically important behaviours can continue, within and outside nominated BIAs.	The 17 km buffer zone around the blue whale/pygmy blue whale BIA, exclusion of seismic operations within the BIA and 17 km buffer during the migration season, the 5+ km Shut-down Zone, and the adaptive management controls for blue whales/pygmy blue whales have been designed to eliminate any physical or behavioural effects on migrating blue whales/pygmy blue whales, hence, to comply with the requirements of the Blue Whale Conservation Management Plan and to ensure that blue whales/pygmy blue whales can continue to use biologically important areas without injury. While the extended 2 km Shut-down Zone for all 'other whales' does not eliminate the risk of cumulative PTS or TTS, it provides protection from high intensity acoustic exposure. Single-pulse PTS is not predicted for baleen whales (of which some have an EPBC threatened listing) within the limits of the modelling resolution (20 m) and single pulse TTS would only occur if an animal was exposed within 80 m of the source. On this basis, significant injury effects (PTS or TTS) could only occur if a whale went undetected inside the 2 km Shut-down Zone or if they remained in the general vicinity of the active source for 24 hours; both vessel and animal movement will ensure that the likelihood of this occurring is low. On this basis effects will be limited to minor and short-term. Regarding the continuation of biologically important behaviours of 'other whales'; while avoidance behaviours are expected within 10 - 15 km of the acoustic source and serve to protect against hearing injury, other EPBC listed whales are probably only present in and around the OA at low or very low densities and the OA does not overlap with habitat identified as biologically important for these species; hence significant effects on biologically important behaviours are not expected.	Yes

Receptor	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact	Acceptable
	Marine Turtles EPBC Act Part 3 (18A and 20A) EPBC Act Significant Impact Guidelines 1.1 Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017)	Impacts to EPBC Act Listed marine fauna are limited to minor, short term effects to individuals and ensure biologically important behaviours can continue, within and outside nominated BIAs.	Industry practice seismic levels associated with PTS and TTS attributable to acoustic emissions in marine turtles is 232 dB_{peak} and 226 dB_{peak}, respectively. Based on JASCO AUM this threshold is expected to be experienced a maximum of 20 m. The current proposed 500 m Observation Zone, 250 m Shut-down Zone, Soft-start Procedures and Night-time/Low-visibility Procedures are considered to be effective and conservative in reducing the risk of PTS/TTS and, to some degree, close range behavioural disturbance. Therefore, PTS/TTS effects are predicted to be minor and short-term, should they occur at all. Based on the JASCO UAM (2022), sound pressure levels associated with behavioural response (166 dB re 1µPa) and disturbance (175 dB re 1µPa) were not detected at horizontal distances greater than 2.44 km and 7.68 km, respectively. Foraging BIAs have been identified for three species within the EMBA, including the flatback, olive ridley and loggerhead turtle, located approximately 9.0 km from the OA at their nearest point; whilst one foraging BIA for the flatback turtle has been identified within the OA. Based on the modelled R_{max} values, no impacts to biologically important behaviours within the three distal foraging BIAs are expected. Where they do occur, behavioural effects to turtles are predicted to be minor, short-term and affect a small number of individuals likely to be present within the OA. Due to the transient nature of the active acoustic source, whereby the Seismic Vessel will travel at a speed of 4.5 knots and based on the modelled ranges for behavioural response and disturbance, an individual turtle may respond the acoustic source for approximately one hour and exhibit stronger signs of disturbance for less than 30 minutes. In addition, SLB will implement adaptive management measures around marine turtles, whereby if higher than anticipated numbers of marine turtles are observed (i.e. three or more marine turtle instigated shut-downs within a 24-hour period), the acoustic source will not be discharged within 8 km of the Carbonate bank and terrace system of the Sahul Shelf KEF; and area which has been identified by Thums *et al.* (2017) as important for marine turtles.On this basis, acoustic emissions are not expected to displace marine turtles from viable foraging grounds or preclude the continuation of biologically important behaviours, including within the flatback turtle foraging BIA overlapping the OA. No population level impacts are predicted and the risk to turtles is already low.	Yes

Receptor	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact	Acceptable
	Whale Sharks EPBC Act Part 3 (18A and 20A) EPBC Act Significant Impact Guidelines 1.1 Conservation Advice for Rhincodon typus (Whale Shark)	Impacts to EPBC Act Listed marine fauna are limited to minor, short term effects to individuals and ensure biologically important behaviours can continue, within and outside nominated BIAs.	Industry practice seismic levels associated with mortality or mortal injury attributable to seismic emissions on fish with no swim bladders (applicable to whale sharks) is >213 dBpeak. Based on JASCO AUM this threshold is expected to be experienced a maximum of 80 m. The current proposed 500 m Observation Zone, 250 m Shut-down Zone, and Soft-start Procedures are considered to be effective and conservative in reducing the risk of PTS/TTS and, to some degree, close range behavioural disturbance. Therefore, PTS/TTS effects are predicted to be minor and short-term, should they occur at all. The northernmost section of the whale shark migration and foraging BIA overlaps with the OA. Whale shark foraging and migration within the BIA primarily occurs between September and November. The Seismic Survey is likely to commence at the end of November; however, SLB have committed that there will be no active source within the whale shark BIA before 1 December 2022, reducing the potential overlap with the peak period of whale shark migration. Should whale sharks be present within the OA during the survey period it is expected that these mobile individuals would actively avoid the area of acoustic emissions should it be having a negative effect on an individual. Given their limited sensitivity to sound and transient nature of the acoustic emissions, whereby the Seismic Vessel will move at a speed of 4.5 knots, behavioural disturbances to foraging whale sharks are predicted to be limited to short-term and one-off disturbances to individuals or discrete groups, should they occur. On this basis, elicitation of potential avoidance behaviours in response to the acoustic source are not expected to displace whale sharks from viable foraging grounds within the BIA or preclude the continuation of biologically important behaviours, noting that neither the whale shark Approved Conservation Advice (TSCC 2015), previously in force Whale Shark Recovery Plan 2005 – 2010 (DEH 2005a), or the North-west Marine Region (DSEWPaC 2012b) have identified seismic sound emissions as a threat to whale sharks.	Yes
	Seabirds Wildlife Conservation Plan for Seabirds (Commonwealth of Australia 2019)	Impacts to EPBC Act Listed marine fauna are limited to minor, short term effects to individuals and ensure biologically important behaviours can continue, within and outside nominated BIAs.	Birds on the sea surface are unlikely to suffer physiological effects as the Lloyd Mirror effect means that noise levels at the surface are lower than those deeper in the water column. However, studies suggest physiological damage might occur to those seabirds exhibit diving behaviours and which are in extremely close proximity to the acoustic source. Seabirds chase small bait fish as their prey, and it is likely that these small fish would be displaced from the immediate vicinity of the active acoustic source. Seabirds are expected to detect this change in fish distribution and cease any foraging, which would in turn reduce their exposure to any potential physiological effects. Therefore, any impacts to seabirds are predicted to be minor, short term and effect only a small number of individuals. The OA does not overlap any seabird BIAs and biologically important behaviours are predicted to continue, within and outside nominated BIAs.	Yes

Receptor	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact	Acceptable
Marine Protected Areas and Sensitive Areas	EPBC Act North-west Marine Park Management Plan 2018 Marine bioregional plan for the North-west Marine Region Australian IUCN Reserve Management Principles for Commonwealth Marine Protected Areas	• Meet the Oceanic Shoals Marine Park IUCN Category VI (Multiple Use Zone) objective to provide for ecologically sustainable use while conserving ecosystems, habitats and native species. • Meet the Ashmore Reef Marine Park and Cartier Island Marine Park IUCN Category Ia (Sanctuary Zone) objective to provide for the protection and conservation of ecosystems, habitats and native species in as natural and undisturbed a state as possible • The Seismic Survey is undertaken in a manner consistent with the requirements of the North-west Marine Parks Management Plan 2018 and with consideration to the Marine Bioregional Plan for the North-west Marine Region • The ecosystem function and integrity of Commonwealth Marine Areas are maintained.	There are no predicted severe or long-term impacts to individual listed species as a result of the Acoustic Disturbance to the Marine Environment and no impacts to ecological populations, habitat or functions are expected to occur. Furthermore, based on results from the UAM, SLB will implement control measures whereby the acoustic source will not be active in waters 60 m depth or less, plus a 421 m buffer around these shallow water areas. Any pause in seismic acquisition from this control measure would only occur during daylight hours and good visibility conditions so that it does not increase the impact and/or risk to marine mammals. SLB will also not return to acquire any portion of any sail-line, or area, until at least 24-hours has passed. These measures will serve to protect benthic invertebrates from sub-lethal effects and mortality or mortal injury for site-attached fish (including those commercially targeted) from the Seismic Survey. Therefore, the Seismic Survey meets the objectives to: • Provide for ecologically sustainable use while conserving ecosystems, habitats and native species within the Oceanic Shoals Marine Park. • Provide for the protection and conservation of ecosystems, habitats and native species in as natural and undisturbed a state as possible within the Ashmore Reef Marine Park and Cartier Island Marine Park. • Conserve the biodiversity and ecosystem health of the North-west Marine Region • Maintain the ecosystem function and integrity of Commonwealth Marine Areas, including Key Ecological Features.	Yes

Commercial Fisheries	The Offshore Petroleum and Greenhouse Gas Storage Act 2006
	Stakeholder Consultation, as guided by peak stakeholder representative WAFIC
	Commercial fisheries data and publications used to inform the impact assessment include:
	• Status Report of the Fisheries and Aquatic Resources of Western Australia 2019/2020: The State of the Fisheries (Gaughan and Santoro 2021)
	• Spatial and temporal patterns in fisheries catch and effort distribution (based on DPIRD 2015 – 2020 FishCube data)
	• North Coast Demersal Scalefish Resource Harvest Strategy 2017 – 2021 (DPIRD 2017), which describes the stock assessment and management approach (consistent with the principles of ESD), including annual fishing effort allocations, catch tolerance levels and sustainability (stock) status.
	• Global Fishing Watch website for VMS details on Indonesian commercial fishers.
		• No interference with other marine users to an extent greater than is necessary for the exercise of right conferred by the titles granted.
		• No change to the sustainability status of the fishery; the Seismic Survey is undertaken in a manner that does not result in serious, irreversible or long-term impacts to key indicator commercial fish populations and to the extent that sufficient spawning fish biomass and recruitment of the stocks may be maintained such that stocks continue to be assessed by DPIRD as sustainable.
		• There is no increased costs or loss of income for commercial fishing license holders.
			• The predicted level of interference to commercial fisheries is no greater than is necessary to exercise of right conferred by the titles granted to carry out exploration activities;
			• Based on the detailed evaluation undertaken in **Section 7.2.2.2.3, 7.2.2.3.2** and **7.2.2.4.1**, the predicted level of impact from acoustic emissions do not exceed the defined acceptable level, given that:
			  ◦ No significant changes in the diversity and abundance of fish species on various reef and non-reef habitats in western Australia have been reported to occur following exposure to seismic emissions. Studies include contemporary investigation of acoustic impacts on commercially important species such as snapper, emperor and groupers, on the North-west Shelf.
			  ◦ Despite the potential vulnerability of site attached fish with limited mobility to acoustic emissions, assemblages that have been exposed anthropogenic acoustic disturbances have been reported to exhibit high levels of resilience and quick recovery following exposure.
			  ◦ Commercially important pelagic species such as mackerels do not have a large swim bladder, if present at all, an as such mortality and mortal injury are predicted to occur within a maximum horizontal distance of 80 m from the acoustic source. Species that inhabit the pelagic environment can avoid areas that exceed current conservative industry practise levels. Moreover, as the seismic emission source is moving pelagic fishes would have a period as the source approaches to avoid the area and thus avoid exposure to levels that may cause mortality or mortal injury.
			  ◦ Under a 'worst-case' scenario, the reported mortality rates for fish (cod, saithe, herring, turbot and plaice) larvae and fry due to exposure to acoustic emissions did not approach or exceed natural rates of mortality.
			  ◦ The overall conclusion from the behavioural seismic acoustic exposure experiments was that there was minimal impact on fish behaviour and that any changes that were observed were short term and unlikely to have caused any significant biological or ecological impacts (Woodside, 2007).
			  ◦ Pelagic fish that target zooplankton as prey could be subject to indirect effects associated with changes to the abundance and distribution of zooplankton. These potential flow-on effects to marine food webs are expected to be spatially restricted to within a few kilometres of the Seismic Vessel with baseline conditions resuming relatively quickly after the survey line is complete. The energetic consequences of a small shift in foraging habitat will likely be negligible for pelagic fish.
			  ◦ Where they do occur, reported reductions in catch rates of fish following exposure to acoustic emissions are predicted to be temporary. Based on the available
				Yes

Receptor	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact	Acceptable
			evidence, fish are expected to return to normal behaviour and distributions within days of acoustic exposure. Likewise, catch rates have been observed to return to pre-survey levels following the cessation of acoustic emissions. • Overall, no serious, irreversible or long-term impacts to key indicator commercial fish populations to the extent that sufficient spawning fish biomass and recruitment of stock may be compromised are predicted to occur. On this basis, the sustainability status of the fishery is predicted to be conserved. • The NERA (2021) Commercial Fishing Industry Adjustment Protocol will be implemented to formally manage claims by commercial fishers for loss of catch, displacement and lost or damaged fishing gear as a consequence of the Seismic Survey.	
Divers	UK Diving Medical Advisory Committee (DMAC) Safe Diving Distance from Seismic Surveying Operations 2019	No health impacts to divers or underwater recreational activities as a result of the Seismic Survey.	Limited recreational and commercial diving activity are expected to occur within the EMBA. Recreational diving or underwater activities are likely to be constrained to natural features such as reefs, islands and cay, and where water depths permit. Within the EMBA, such sites include Ashmore Reef and Cartier Island. One commercial diving operation, to be led by Petrofac, was identified through the consultation process and is associated with the decommissioning of the Northern Endeavour. Though no known commercial diving operations have been reported for the Montara Venture, the installation has been precautionarily considered within the assessment of diving activities throughout this EP. Interrogating the JASCO UAM (2022) shows that divers at Ashmore Reef and Cartier Island (130 km from the OA), the Northern Endeavour (40 km from the OA) and the Montara Venture (12 km from the OA) will not be exposed to sound pressure levels greater than 145 dB re 1 µPa. Should new diving activities be identified, he adopted control measures regarding notification of survey commencement to diving operators and the need to conduct joint risk assessment where diving and seismic activities occur within 30 km of each other, ensure that no health impacts to divers will occur as a result of the Seismic Survey.	Yes

Acceptability Statement
Impacts and risks classified as 'Type B' or above are considered acceptable if the requirements in **Table 40** can be demonstrated and it can be determined that the predicted levels of impact and/or residual risk are at or below pre-defined Acceptable Levels for that impact or risk, including those described in **Table 41**. Based on the above evaluation, the potential impacts from Acoustic Disturbance to the Marine Environment meets the requirements of the risk acceptability criteria. The control measures that will be implemented throughout the Seismic Survey have been developed in accordance with these criteria and are considered appropriate to manage the impacts of Acoustic Disturbance to the Marine Environment on all receptors, including the associated disruption and interference with other marine users to an **Acceptable Level.**

7.2.8 Environmental Performance

Table 73 Environmental Performance Outcomes, Standards and Measurement Criteria for Acoustic Disturbance to the Marine Environment

Number	Environmental Performance Outcome	Environmental Performance Standard
EPO 4	Seismic acquisition is undertaken in a manner that limits impacts from underwater noise to individual listed threatened, listed migratory or listed marine fauna protected under the EPBC Act to minor, short term effects and do not preclude the continuation of biologically important behaviours.	**EPS 52** to **EPS 77**, **EPS 84**, **EPS 100** to **EPS 133**
EPO 5	Seismic acquisition is undertaken in a manner that prevents serious or irreversible damage to a population of marine fauna species not listed as threatened or migratory under the EPBC Act from underwater noise.	**EPS 52**, **EPS 53**, **EPS 74** to **EPS 77**, **EPS 100** to **EPS 105**
EPO 6	Seismic acquisition is undertaken in a manner such that any pygmy blue whales may continue to utilise the area without injury and are not displaced from a migration or foraging area.	**EPS 52**, **EPS 53**, **EPS 55**, **EPS 69** to **EPS 72**, **EPS 119**, **EPS 120**, **EPS 122**, **EPS 124**, **EPS 126**, **EPS 127**
EPO 7	Seismic acquisition is undertaken in a manner that preserves the sustainability status of the relevant fishery, as any impacts to stock, spawning or fishing activities will be minor, recoverable and short-term.	**EPS 52**, **EPS 53**, **EPS 74** to **EPS 77**, **EPS 100** to **EPS 105**
EPO 8	Seismic acquisition is undertaken in a manner that prevents any increased cost encumbrance or loss of income to commercial fishing license holders.	**EPS 52**, **EPS 53**, **EPS 74** to **EPS 81**, **EPS 84**, **EPS 87** to **EPS 105**
EPO 9	Seismic acquisition is undertaken in a manner that does not compromise the objectives of relevant recovery plans or wildlife conservation plans/advice that are in force for a marine fauna species.	**EPS 52** to **EPS 77**, **EPS 84**, **EPS 100** to **EPS 133**
EPO 10	Seismic acquisition is undertaken in a manner that does not impact the ecosystem function or integrity of Commonwealth marine areas	**EPS 52** to **EPS 77**, **EPS 84**, **EPS 100** to **EPS 133**
EPO 11	Seismic acquisition is undertaken in a manner that does not impact the ecosystem function or integrity of AMPs or the conservation status of native species within AMPs.	**EPS 52** to **EPS 77**, **EPS 84**, **EPS 100** to **EPS 133**
EPO 12	Seismic acquisition is undertaken in a manner that prevents widespread (>100s of m from the acoustic source) and long term (>1 week to recover) impacts to plankton communities.	**EPS 52**, **EPS 53**, **EPS 74** to **EPS 77**, **EPS 84**, **EPS 100** to **EPS 105**
EPO 13	Seismic acquisition is undertaken in a manner that prevents any detectable impacts to habitat forming primary producers, such as coral.	**EPS 52**, **EPS 53**, **EPS 74** to **EPS 77**, **EPS 84**, **EPS 100** to **EPS 105**
EPO 14	Seismic acquisition is undertaken in a manner that prevents lethal injury or mortality to crustaceans and bivalves at rates beyond the natural range of variation.	**EPS 52**, **EPS 53**, **EPS 74** to **EPS 77**, **EPS 84**, **EPS 100** to **EPS 105**
EPO 15	Seismic acquisition is undertaken in a manner that prevents any health impacts to divers or underwater recreational activities due to underwater seismic emissions.	**EPS 52**, **EPS 53**, **EPS 78** to **EPS 81**, **EPS 85** to **EPS 87**
EPO 16	Seismic acquisition is undertaken in a manner such that it does not interfere with other m s to a greater extent than is necessary for the exercise of right conferred by the titles granted to carry out exploration activities.	**EPS 52**, **EPS 53**, **EPS 74** to **EPS 87**

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
The Seismic Survey will be undertaken in accordance with the approved EP.	**EPS 52**: The Seismic Survey may only commence following acceptance of the EP by NOPSEMA.	Pre-mobilisation audit and inspection are completed prior to operations and confirm an accepted EP has been obtained. Audit records verify compliance with the requirements of the EP.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 53: The Seismic Survey will be undertaken in accordance with the accepted EP.	Bridge logs verify compliance with the requirements of the EP. Audit records verify compliance with the requirements of the EP.	Vessel Master SLB QC and HSE Representative Survey Environmental Advisor

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
Adherence to the EPBC Act Policy Statement 2.1 requirements, through the implementation of the following control measures with respect to all whales (baleen and toothed), throughout the entire OA for the duration of the Seismic Survey: • Observation Zone^AC: 5+ km horizontal radius from the acoustic source; • Shut-down Zone^AC: 2 km horizontal radius from the acoustic source; • Crew training: Crew are trained in the basic requirements of the EPBC Act Policy Statement 2.1 prior to the survey commencement • Pre-start-up Visual Observations (daylight hours): 30 minutes prior to the commencement of Soft-start Procedure; • Soft-start Procedure: Commences only when no whales have been sighted within the relevant Shut-down Zone over a 30-minute Pre-start up Visual Observation period; • Start-up Delay Procedures: Will be implemented if a whale enters the Shut-down Zone during the Soft-start Procedures; • Stop Work Procedures: Will be implemented whenever a whale is detected in the relevant Shut-down Zone; • Night-time and Low Visibility Procedures: Will be implemented throughout periods of low visibility, including night-time, under rough seas or fog; • Compliance and Sighting Reports.	**EPS 54**: Operations will comply with the EPBC Act Policy Statement 2.1. Part A requirements at all times, to mitigate potential impacts to whales. • During daylight hours at least one MMO/MFO will be on duty at all times from the Seismic Vessel and one MMO/MFO will be on duty at all times from the Chase Vessel to undertake continuous visual observations for marine mammals; • Throughout the OA, MMOs/MFOs will implement a 5+ km Observation Zone^AC from the acoustic source. In practise this means that MMOs/MFOs will be required to scan as far as possible towards the horizon given the prevailing sightings conditions. The minimum Observation Zone permissible will be 5 km; • During daylight hours, pre-start-up visual observations for the presence of whales will be undertaken for at least 30 minutes before the commencement of the Soft-start Procedure; • If no whales have been sighted within the relevant Shut-down Zones, Soft-start Procedures will commence over a 30-minute period; • A 2 km Extended Shut-down Zone^AC for all whales will be implemented throughout the entire OA at all times. • A start-up Delay will occur if a whale enters or is detected in the relevant Shut-down Zone during Soft-start Procedures. Whale presence within the Shut-down Zone will trigger an immediate and complete shut-down, and Soft-start Procedures may only resume after the whale has been observed to move outside the relevant Shut-down Zone, or when 30 minutes have lapsed since the last whale sighting; • If a whale is detected within any nominated observation zone during the Seismic Survey, an additional MMO/MFO will be stationed on the bridge of the vessel from which the detection was made to assist with observations. The only permissible exception to this is when the off-duty MMO/MFO is on a meal or toilet break or is standing-down having reached maximum shift duration for that particular working day. In these instances a trained crew member will assist with marine mammal observations; • Stop Work Procedures will be implemented for the entire duration in which operations are underway as follows: the acoustic source will shut-down whenever a whale is detected in the relevant Shut-down Zone. Soft-start Procedures may only resume after the whale has been observed to move outside the relevant Shut-down Zone, or when 30 minutes has lapsed snice the last whale sighting; • Low visibility or night-time operations may occur provided that there have not been three or more whale instigated power-down or shut-down situations during the preceding 24-hour period; and • When species identification is uncertain, a precautionary approach will be taken, and the additional management procedures for blue whales/pygmy blue whales will be followed until identification is otherwise confirmed.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of these procedures.	Survey Environmental Advisor MFOs/MMOs Vessel Master SLB QC and HSE Representative
EPBC Act Policy Statement 2.1: Precaution Zones: • Observation Zone^AC: 5+ km horizontal radius from the acoustic source; • Shut-down Zone^AC: 2 km horizontal radius from the acoustic source; • An Extended 5+ km Shut-down Zone^AC for blue whales/pygmy blue whales.	**EPS 55**: The following Precaution Zones will be implemented throughout the duration of the survey: • Observation Zone – 5+ km horizontal radius from the acoustic source using the Seismic Vessel as the observation platform; • Extended (5+ km) Shut-down Zone^AC – 5+ km for blue whales/pygmy blue whales, whereby shut-downs will be triggered by a blue whale/pygmy blue whale sighting at any distance, and to a minimum of 5 km from the acoustic source; • Extended (2 km) Shut-down Zone^AC – 2 km horizontal radius from the acoustic source for all 'other whales'.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. MFO/MMO daily and weekly logs confirm the Precaution Zones were implemented.	Survey Environmental Advisor MFOs/MMOs Party Chief SLB QC and HSE Representative
	EPS 56: MFOs/MMOs and PAM operators onboard will have the primary responsibility for whale observation and compliance of the Precautionary Zones.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. MFO/MMO daily and weekly logs confirm the Precaution Zones were implemented. PAM daily and weekly logs confirm the Precaution Zones were implemented.	Survey Environmental Advisor MFOs/MMOs SLB QC and HSE Representative

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
EPBC Act Policy Statement 2.1: A.2 – Crew training (General crew).	**EPS 57**: All vessel crew will be trained to understand the basic requirements of the EPBC Act Policy Statement 2.1 and the specific Precaution Zones that will be implemented as part of the Seismic Survey.	Induction records outline the content of vessel inductions and crew present. A copy of these records will be kept onboard the Seismic Vessel and the SLB Project Manager will also have a copy.	SLR Environmental Consultant SLB QC and HSE Representative Survey Environmental Advisor Vessel crew
	EPS 58: Vessel crews, MFOs/MMOs and PAM Operators will be briefed on the EP controls and EP reporting requirements.	Induction records outline the content of vessel inductions and crew present. A copy of these records will be kept onboard the Seismic Vessel and the SLB Project Manager will also have a copy.	SLR Environmental Consultant SLB QC and HSE Representative Survey Environmental Advisor Vessel crew MFO/MMOs PAM Operators Trained Crew Vessel Master
	EPS 59: Trained crew will act in a supporting role to the MFO/MMOs by immediately reporting any opportunistic marine mammal sighting (from either the Seismic Vessel or any of the support vessels) to the on-duty MFO/MMOs.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. Bridge logs record opportunistic sightings by trained crew and confirms they were reported to the MFO/MMO. MFO/MMO daily and weekly logs record opportunistic sightings by trained crew.	SLB QC and HSE Representative Survey Environmental Advisor MFOs/MMOs Vessel Crew Vessel Master
	EPS 60: MFOs/MMOs and PAM operators will be inducted in their responsibilities regarding environmental matters (including the EPBC Act Policy Statement 2.1 and all additional management procedures specific to this Seismic Survey), whale identification, and the environmental legal obligations for companies operating in Australian waters.	Induction records outline the content of MFOs/MMOs and PAM operator inductions and personnel present.	SLR Environmental Consultant SLB QC and HSE Representative Vessel Master's. Survey Environmental Advisor MFOs/MMOs PAM Operators.
	EPS 61: Reference material will be available onboard all vessels, with available materials including the EPBC Act Policy Statement 2.1, the Department's whale and dolphin sighting report form, and the APPEA CD Guide Search Australian Whales and Dolphins, and a copy of this EP.	Audit/inspection records verify the presence of reference materials on board the vessel.	SLB QC and HSE Representative Survey Environmental Advisor
	EPS 62: Appropriate visual aids such as binoculars will be available on board the vessel to aid in the identification and reporting of any whales sighted.	Audit/inspection records verify the presence of suitable visual ais on board the vessel.	SLB QC and HSE Representative Survey Environmental Advisor MFOs/MMOs
EPBC Act Policy Statement 2.1: A.3.1 – Pre-start-up visual observation procedures. The 5+ km Observation Zone[AC] will be monitored for the presence of whales for at least 30 minutes before the commencement of a Soft-start procedure.	**EPS 63**: During daylight hours, visual observations for the presence of whales will be undertaken by the on-duty MFO/MMOs onboard the Seismic Vessel in the 5+ km Observation Zone[AC] for at least 30 minutes before the commencement of Soft-start Procedures.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. MFO/MMO daily and weekly logs confirm Pre-start-up procedures were implemented.	Survey Environmental Advisor MFOs/MMOs Vessel Master SLB QC and HSE Representative
	EPS 64: Softstart Procedures may only commence if conditions allow for visual inspection of the 5+ km Observation Zone.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. MFO/MMO daily and weekly logs.	Party Chief MFOs/MMOs Survey Environmental Advisor SLB QC and HSE Representative

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
EPBC Act Policy Statement 2.1: A.3.2 – Soft start procedures. Soft-start Procedures will be limited to starting up in conditions that allow visual inspection of the 5+ km Observation Zone[AC] and so that no soft starts will occur within 15 km of the boundaries of the Oceanic Shoals AMP.	**EPS 65**: Soft-start Procedures may only commence if no whales have been sighted within the relevant Shut-down Zones during the pre-start observation period. In addition, soft-start procedures may only commence if the Seismic Vessel and acoustic source is at least 15 km from the boundaries of the Oceanic Shoals AMP. Shape files will be loaded onto the survey vessels' navigation system outlining the 15 km buffer area within which soft starts cannot commence.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. MFO/MMO daily and weekly logs confirm soft-start procedures were implemented. Buffer area polygons on survey vessels' navigation system.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative
EPBC Act Policy Statement 2.1: A.3.3 – Start-up delay procedures.	**EPS 66**: If a whale is sighted within any Observation Zone during Soft-start Procedures, an additional MFO/MMO will be brought to the bridge of the vessel from which the detection was made to assist with observations. The only permissible exception to this is when the off-duty MFO/MMO is on a meal or toilet break or is standing down having reached maximum shift duration for that particular working day. In these instances, a trained crew member will assist with marine mammal observations.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. MFO/MMO daily and weekly logs confirm start-up delay procedures were implemented.	MFOs/MMOs Survey Environmental Advisor SLB QC and HSE Representative
	EPS 67: If any 'other whale' is sighted within or about to enter the 2 km Extended Shut-down Zone[AC], the acoustic source will shut-down completely. A Soft-start Procedure will resume only after the whale has been observed to move outside the 2 km Extended Shut-down Zone[AC], or when 30 minutes has lapsed since the whale was last sighted.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. Bridge logs. MFO/MMO daily and weekly logs confirm start-up delay procedures were implemented.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative
	EPS 68: If a blue whale/pygmy blue whale is sighted within or about to enter the 5+ km Extended Shut-down Zone, the acoustic source will shut-down completely. A Soft-start Procedure will resume when 30 minutes has lapsed since the last blue whale/pygmy blue whale sighting. This effectively means that Shut-down and Start-up Delay Procedures will be implemented for any sighting of a blue whale/pygmy blue whale.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. Bridge logs. MFO/MMO daily and weekly logs confirm start-up delay procedures were implemented.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative
EPBC Act Policy Statement 2.1: A.3.5 – Stop work procedures. Stop work procedures will be implemented when: • A blue whale/pygmy blue whale is detected within the Extended (5+ km) Shut-down Zone[AC]; and • Any 'other whale' enters the Extended (2 km) Shut-down Zone[AC].	**EPS 69**: If a whale is detected within any Observation Zone during daylight hours, an additional MFO/MMO will be stationed on the bridge of the vessel from which the detection was made to assist with observations. The only permissible exception to this is when the off-duty MFO/MMO is on a meal or toilet break or is standing-down having reached maximum shift duration for that particular working day. In these instances, a trained crew member will assist with marine mammal observations.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. MFO/MMO daily and weekly logs confirm stop work delay procedures were implemented.	MFOs/MMOs Survey Environmental Advisor SLB QC and HSE Representative
	EPS 70: EPBC Act Policy Statement 2.1: A.3.5 – Stop work procedures and additional controls will be applied, including: If a blue whale/pygmy blue whale is detected within the 5+ km Extended Shut-down Zone[AC] the acoustic source will be shut-down immediately. If an 'other whale' is detected within/about to enter the 2 km Extended Shut-down Zone[AC], the acoustic source will be shut-down immediately.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. MFOs/MMOs daily and weekly logs confirm stop work delay procedures were implemented.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative
	EPS 71: Power-up of the acoustic source will only occur after the whale has been observed to more outside the relevant Shut-down Zone, or when 30 minutes has lapsed since the last sighting. Power-up will follow the Soft-start Procedure.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. MFOs/MMOs daily and weekly logs confirm stop work delay procedures were implemented.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
EPBC Act Policy Statement 2.1: A.3.6 – Night-time and low visibility procedures. During these periods, operations may proceed provided there have not been three or more whale instigated power-down or shut-downs during the preceding 24-hour period. If conditions prohibit visual inspection of the Observation Zones, Soft-start Procedures and activation of the acoustic source will not occur until such a time where pre-start observation procedures can be effectively undertaken. This control also addresses EPBC Act Policy Statement 2.1: B.2 – Night-time/Poor Visibility and B.6 Adaptive Management Measures.	**EPS 72**: Low/poor visibility or night-time operations may occur provided that there have not been three or more whale instigated power-down or shut-down situations during the preceding 24-hour period; However, if higher than anticipated numbers of blue whales/pygmy blue whales are observed (three or more blue whale/pygmy blue whale instigated shut-downs are made during the preceding 48 hour period) at any time or location during the survey, night-time or low visibility operations shall cease and may only resume after 48 hours of no blue whale/pygmy blue whale instigated shut-downs.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. MFOs/MMOs daily and weekly logs confirm night-time and low visibility procedures were implemented.	Survey Environmental Advisor MFOs/MMOs Vessel Master SLB QC and HSE Representative
EPBC Act Policy Statement 2.1: A.4 – Compliance and Sighting Reports. All cetacean sightings will be recorded in the 'Cetacean Sightings Application' software.	**EPS 73**: Whale sightings will be reported in accordance with the EPBC Act Policy Statement 2.1 Part A.4 Compliance and Sighting Reports requirements, including submission of a report to the DoEE within two months of the survey completion.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4. Whale Observation Report confirms compliance.	Survey Environmental Advisor MFOs/MMOs Vessel Master SLB QC and HSE Representative
The minimum source size to acquire the survey data and meet the geophysical objectives of the survey has been selected.	**EPS 74**: The acoustic source will have a maximum source output no greater than 3,000 in^3, with a maximum zero to peak SPL of 256.3 dB re 1 µPa @ 1 m, as this has been determined to be the minimum source size required to acquire the survey data and meet the geophysical objectives of the survey.	MFOs/MMOs will record source volumes as part of their daily observations each swing. MFOs/MMOs daily and weekly logs confirm compliance.	Party Chief Vessel Master Survey Environmental Advisor MFOs/MMOs SLB QC and HSE Representative
The acoustic source size used will not exceed that which has been modelled (3,000 in^3) and for which the predicted impacts and risks have been assessed. If the source used for the Seismic Survey differs to that modelled in the EP, additional modelling will be undertaken.	**EPS 75**: The acoustic source will have a maximum source output no greater than 3,000 in^3, with a maximum zero to peak SPL of 256.3 dB re 1 µPa @ 1 m. Care will be taken to ensure spare acoustic sources are not discharged as part of the active source array. If the source used for the Seismic Survey differs to that modelled within this EP, additional modelling will be undertaken to confirm that the far-field horizontal source level specifications of the seismic source selected for the activity are consistent with those assessed in this EP, and the control measures and EPSs reviewed as appropriate to confirm they continue to manage impacts to ALARP and Acceptable Levels. Changes will be documented as per the Management of Change requirements.	MFOs/MMOs will record source volumes as part of their daily observations each swing. MFOs/MMOs daily and weekly logs confirm compliance. Documentation of modelling report and review of control measures/EPSs as per the Management of Change requirements.	Party Chief Vessel Master Survey Environmental Advisor MFOs/MMOs SLB QC and HSE Representative
The acoustic source will not be activated outside of the OA. The acoustic source will only be activated outside of the AA for the purpose of soft starts.	**EPS 76**: The acoustic source is only activated under full power within the boundaries of the Seismic Survey AA that is clearly defined as part of the EP application. The source may be active within the OA, but only for the purposes of soft-starts.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 show no breach in operations. Bridge logs. MFOs/MMOs daily and weekly logs confirm compliance.	Party Chief Vessel Master Survey Environmental Advisor MFOs/MMOs SLB QC and HSE Representative
	EPS 77: Shape files will be loaded onto the survey vessels' navigation system outlining the areas within which the acoustic source may be activated, against the boundary extents of the OA and AA.	Exclusion polygons on survey vessel's navigation system.	Vessel Master SLB QC and HSE Representative Survey Environmental Advisor
Publication of a Notice to Mariners of survey presence and towed array, no less than four weeks before operations commence.	**EPS 78**: A Notice to Mariners will be published and distributed by the AHO under the Navigation Act 2012, informing other marine users of the Seismic Survey, no less than four weeks before operations commence.	Record of Notice to Mariners.	SLB Project Manager Vessel Master
A communications protocol will be in place between the survey vessels and relevant persons (e.g., commercial fishers known to utilise the OA) to actively manage concurrent activities.	**EPS 79**: Pre-survey consultation will be undertake with all identified relevant persons, confirming the Seismic Survey will proceed, no less than four weeks before operations commence.	Documentation of consultation, consultation log demonstrates compliance.	SLB Project Manager
	EPS 80: Onshore personnel (SLB Project Manager) will communicate any updates determined through the ongoing consultation process to the Vessel Master, where they have the potential to impact the Seismic Survey and/or other marine users.	Documentation of consultation, consultation log demonstrates compliance. Forms part of ongoing consultation strategy.	SLB Project Manager Vessel Master SLB QC and HSE Representative

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
		Any complaints received will be documented within the complaints register.	
	EPS 81: Relevant persons will be notified following the conclusion of the survey as per the following Post-Activity Notifications: • All relevant persons – relevant time post completion; • AMSA – relevant time post completion; • NOPSEMA – 10 days post completion advising the completion of the Seismic Survey; and • NOPSEMA – As soon as practicable advising that all of the activities and obligations covered under the EP have been completed.	Documentation of consultation, consultation log and notification demonstrate compliance.	SLB Project Manager
Where the potential for concurrent MSSs to occur is identified, SLB will engage with proponents prior to commencing the Seismic Survey and develop a SIMOPS plan. SIMOPS planning will include the implementation of a 40 km spatial separation between the Seismic Vessel and any other operating Seismic Vessel in the Bonaparte Basin area.	**EPS 82**: The NOPSEMA database of activity status and summaries has been searched to identify the potential for temporal and spatial overlap with other MSSs in the Bonaparte Basin, in the development of this EP and will be searched immediately prior to the survey commencing for completeness.	Search of the NOPSEMA activity status and summaries website, looking in particular for EP submissions or decisions in the surrounding areas to the OA is completed and documented within the EP. This will be completed, again, immediately prior the survey and documented within SIMOPS plan.	SLB Project Manager SLB QC and HSE Representative
	EPS 83: A SIMOPS plan is developed and implemented where concurrent MSSs are identified to occur.	SIMOPS Plan documents the following: • Communications protocols • Work programming • Hazard management • Emergency Response Bridge logs confirm implementation and compliance.	SLB Project Manager SLB QC and HSE Representative Survey Environmental Advisor Vessel Master
	EPS 84: SLB will maintain at least 40 km separation distance with any concurrent MSS at all times to avoid cumulative impacts to marine fauna.	Vessel track records as well as AIS track records demonstrate compliance. Communication records between the title holders and survey vessels.	Vessel Master SLB QC and HSE Representative Survey Environmental Advisor
Notification of MSS commencement to diving operators (diving charters, dive schools, dive equipment stores and oil and gas operators) undertaking diving activities within 45 km of the acoustic source.	**EPS 85**: A Notification of MSS commencement will be provided to diving (diving charters, dive schools, dive equipment and oil and gas operators) undertaking any diving activities within 45 km of the acoustic source, no less than four weeks before operations commence.	Documentation of consultation, consultation log demonstrates compliance.	SLB Project Manager SLB QC and HSE Representative
Where diving and seismic activities occur within 30 km of each other, a joint risk assessment will be conducted.	**EPS 86**: Where diving and seismic activities occur within 30 km of each other, a joint risk assessment between SLB and the proponent undertaking diving activities will be conducted prior to either operator commencing activity.	Documentation of consultation, consultation log demonstrates compliance. Records confirm a joint risk assessment has been developed, where diving and seismic activities occur within 30 km of each other. Bridge logs confirm implementation and compliance	SLB Project Manager SLB QC and HSE Representative Vessel Master
Daily look-ahead reports will be provided to relevant persons (e.g. commercial fishers known to utilise the OA or have indicated they could use the area (i.e. WTBF concession owners) and those who registered for the service (Petrofac)), detailing the current vessel location and proposed timing and location of operations within the next 48 hour period.	**EPS 87**: A 48-hour 'look-ahead plan' will be provided to relevant persons identified throughout the relevant persons consultation process, detailing the survey activities over the next 48 hours. The 48-hour look-ahead plans will be updated and issued every 24 hours and distributed to relevant persons via email.	Documentation of consultation, consultation log and issuing of weekly and 48-hour look-ahead plans demonstrate compliance. Forms part of ongoing consultation strategy.	SLB Project Manager SLB QC and HSE Representative Vessel Master

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
Compensation to fishers and vessel crews (i.e., the claimant) is demonstrated to have occurred for the following circumstances: • Interaction resulting in loss or damage to fishing equipment; • A temporary loss of fish landed catch due to damaged or lost fishing equipment; • Where displacement from fishing grounds results in additional costs incurred due to relocating; or • A temporary reduction in fish landed catch ('loss of catch') due to the impacts associated with acoustic disturbance or due to displacement from fishing grounds. Displacement from fishing grounds can be as a result of seismic operational activities or as a result of avoiding contaminated waters following a fuel oil spill. Claims received from fishers in any circumstances other than those outlined above will not be assessed. Claims will be considered provided the interaction/displacement/loss of catch took place in the Adjustment Area where the Seismic Survey took place (plus any additional area of avoidance requested around the survey vessel/s and towed equipment, and during the period of seismic operations only. For loss of catch due to the impacts associated with acoustic disturbance, claims can be made for the period of seismic operations, plus a period of six months following completion of the survey, and in accordance with the Adjustment Protocol Timeframes set out in NERA (2021). Note that for damaged or lost equipment claims, the interaction can have taken place in the Operational Area (not just Adjustment Area), plus any additional area of avoidance requested around the survey vessels and towed equipment. The adoption of the NERA (2021) protocol is an agreement reached between SLB and WAFIC over the course of consultation. If any changes are required as a result, these will be made through the management of change process.	**EPS 88:** NERA (2021) Commercial Fishing Industry Adjustment Protocol is adopted for the Seismic Survey. If any changes to the fisheries protocol are required as a result of this process, changes will be made through the management of change process.	Documentation of consultation demonstrates SLB has agreed to adopt the NERA (2021) Commercial Fishing Industry Adjustment Protocol, endorsed by WAFIC. Any changes suggested by WAFIC have been considered through the management of change process.	SLB Project Manager.
	EPS 89: Pre-survey consultation with commercial fishers known to utilise the OA, notifying them in writing of the Commercial Fisheries Compensation Protocol in place for the Seismic Survey, no less than 28 days before operations commence. Notification is to be provided in the form of a map, showing the Operational Area and associated Adjustment Area, plus digital files in formats such as shapefiles and a copy of the Protocol in full.	Documentation of consultation demonstrates the NERA (2021) Commercial Fishing Industry Adjustment Protocol, is in place for the Seismic Survey and was provided to commercial fishers known to utilise the OA no less than 28 days before operations commence. Information provided is demonstrated to include a copy of the Protocol in full, a map showing the Operational Area and Adjustment Area, plus digital files in formats such as shapefiles.	SLB Project Manager
	EPS 90: Eligible Commercial Fishers have been provided relevant application forms as listed in the attachments in NERA (2021) Commercial Fishing Industry Adjustment Protocol and a contact point to relevant commercial fishers relating to lodging a claim or notification regarding loss of catch, displacement, or fishing gear loss of damage. Contact information will also be provided to WAFIC.	Documentation of consultation demonstrates the NERA (2021) Commercial Fishing Industry Adjustment Protocol has been adopted. This protocol incudes the relevant compensation claims application forms. Relevant information was attached to the pre-survey consultation with commercial fishers known to utilise the OA, and that contact point has been provided to commercial fishers and WAFIC.	SLB Project Manager
	EPS 91: Subject to a claim being lodged, a suitably experienced/qualified independent person/organisation will be engaged as the assessor of the claim, in consultation with the claimant. Suitably experienced and qualified is defined as a person or organisation with proven demonstrated experience in data analysis and data auditing processes and procedures within the industry.	Documentation of consultation with claimant around engagement of independent assessor, appropriate experience/qualifications of independent assessor, and agreements in place between SLB and independent assessor to engage their services for assessing the claim.	SLB Project Manager
	EPS 92: SLB will provide the assessor with a letter of instruction/project brief, which is to also be provided to the claimant as part of the assessment report.	Documentation of communications with assessor and claimant including provision of letter of instruction/project brief.	SLB Project Manager
	EPS 93: All compensation claims made by commercial fishing license holders or vessel crews for equipment damage/loss, displacement and loss of catch will be assessed for merit in accordance with the processes outlined in NERA (2021) Commercial Fishing Industry Adjustment Protocol (**Appendix M**), in accordance with the Adjustment Protocol Timeframes (NERA 2021).	Records demonstrate that claims made by commercial fishery license holders and vessel crew were assessed in accordance with the processes outlined in NERA (2021) Commercial Fishing Industry Adjustment Protocol (**Appendix M**).	SLB Project Manager
	EPS 94: Where a commercial fishing licence holder has been involved in an interaction leading to loss or damage to the licence holder's equipment or displacement from usual fishing grounds, all interactions between the commercial fishing licence holder and the survey vessels will be recorded by the MSS operator. Details to be recorded should include, but not be limited to: the time, date and location coordinates of where the gear interaction occurred or the fishing was aborted and where it recommended, the name of the vessel, the licence holder number on the fishing gear, and any details of communications between the commercial fishing licence holder and the vessel/s.	Records demonstrate documentation of interactions with commercial fishing licence holder leading to loss or damage of the licence holder's equipment or displacement from usual fishing grounds.	Vessel Master
	EPS 95: Where possible and safe to do so, the Vessel Master shall make attempts to recover any fishing equipment. Photos will be provided to SLB by the Vessel Master.	Records demonstrate attempts to retrieved fishing equipment and photos of retrieved equipment.	Vessel Master.
	EPS 96: The independent assessor is to provide SLB with an assessment report which is to include the following information: - A copy of the letter of instruction/project brief;	Records demonstrate receipt of assessment report and consultation with claimant.	SLB Project Manager

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
	- Confirmation (or otherwise) that the information provided in the claim is sufficient to conduct a meaningful assessment; - A summary of the claim details (survey, applicant, vessel, month/s); - For a loss of catch claim, monthly CPUE assessments as outlined in the Commercial Fisheries Compensation Protocol for the Bonaparte MC3D Marine Seismic Survey, including an estimation of any loss of catch and its market price; and - Any other information, comments, or views relevant to the assessment that the assessor may wish to include. Upon receiving and considering the assessment report, SLB will provide a copy of the report to the claimant and offer to meet with the claimant to discuss/address the claim.		
	EPS 97: All claimants will be notified of the outcome of the claim (or request clarification/additional information from the claimant) as soon as practicable and in accordance with the timeframes set out in the NERA (2021) Commercial Fishing Industry Adjustment Protocol (**Appendix M**).	Records demonstrate claimants were notified of the outcome of the claim or request for clarification/additional information, in accordance with NERA (2021) Commercial Fishing Industry Adjustment Protocol (**Appendix M**).	SLB Project Manager
	EPS 98: All claimants considered to have a claim of merit will receive compensation, in accordance with NERA (2021) Commercial Fishing Industry Adjustment Protocol **(Appendix M**), within 60 days of the claim determination. Claimants will be contacted via the email addressed provided within the claim application, unless requested otherwise. Compensation value paid will calculated based on the measures provided in NERA (2021) Commercial Fishing Industry Adjustment Protocol (e.g. reduced kg caught per species multiplied by the market price per kg at the time the catch would have been sold for catch reduction claims).	Records demonstrate all claimants considered to have a claim of merit received compensation in accordance with NERA (2021) Commercial Fishing Industry Adjustment Protocol (**Appendix M**), within 60 days of the claim determination.	SLB Project Manager
	EPS 99: In the event that a claimant disagrees with a claim assessment outcome, and an agreement cannot be reached between SLB and the claimant, the claimant opt to request that a suitably experienced/qualified independent third-party is engaged to review and determine the outcome of the claim. The appointment of the independent third party will be agreed mutually between SLB and the claimant. The dispute will be resolved within the timeframes set out in NERA (2021), with the costs of engaging the independent third-party assessor covered by SLB.	Records demonstrate that a claimant's dispute has been assessed by a suitable experience/qualified independent third-party, where requested, and that costs of engaging the independent third-party assessor have been covered by SLB Records document outcome of the independent third-party assessor's assessment and that the dispute has been resolved within the timeframes set out in NERA (2021)..	SLB Project Manager
No operation of the acoustic source in water depths less than 60 m plus a 421 m horizontal buffer from this depth – henceforth referred to as the Acquisition Exclusion Zone.	**EPS 100**: There will be no active acoustic source within water depths less than 60 m and the associated 421 m horizontal buffer (the Acquisition Exclusion Zone) associated with shallow water shoal features.	Bridge logs confirm the acoustic source was not operated in depths less than 60 m or the 421 m horizontal exclusion buffer around the 60 m contour line.	Party Chief Vessel Master SLB QC and HSE Representative Survey Environmental Advisor
	EPS 101: Shape files will be loaded onto the survey vessels' navigation system outlining the Acquisition Exclusion Zone within which the acoustic source cannot be activated.	Acquisition Exclusion Zone polygons on survey vessels' navigation system.	Vessel Master SKB QC and HSE Representative Survey Environmental Advisor
	EPS 102: Before entering the Acquisition Exclusion Zone, either A) the acoustic source will be stopped before it enters the Acquisition Exclusion Zone and then reactivate once it exits the Acquisition Exclusion Zone, or B) the vessel will deviate around the Acquisition Exclusion Zone and ensure the acoustic source is not activated within the Acquisition Exclusion Zone.	Bridge logs confirm the acoustic source was not operated within the boundaries of the Acquisition Exclusion Zone.	Party Chief Vessel Master SLB QC and HSE Representative Survey Environmental Advisor

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
	EPS 103: In the event that scenario A is implemented the acoustic source will only be re-activated outside the boundaries of the Acquisition Exclusion Zone during daylight hours and in good visibility conditions to ensure the detection of whales using the Soft-start Procedures whereby the acoustic source's power will be gradually increased, starting with the lowest capacity acoustic source and progressively added to until operating level is achieved over a minimum period of at least 30 minutes, and no longer than 40 minutes. Soft-starts will be delayed in the event that marine fauna (i.e. whales, whale sharks, and marine turtles) are sighted within the relevant Shut-down Zones during Pre-start Observations.	Bridge logs and MMO/MFO daily and weekly logs confirm action taken (Scenario A or B) and implementation of Soft-start Procedures if required.	Party Chief Vessel Master MMO/MFO SLB QC and HSE Representative Survey Environmental Advisor
	EPS 104: In the event that scenario B is implemented, the Seismic Vessel will not deviate around the Acquisition Exclusion Zone with the acoustic source activated unless at least 24-hours has passed since the adjacent line was acquired.	Bridge logs and MMO/MFO daily and weekly logs confirm action taken (Scenario A or B) and acoustic source was not active unless at least 24-hours have passed since the adjacent sail line was acquired.	Party Chief Vessel Master MMO/MFO SLB QC and HSE Representative Survey Environmental Advisor
The Seismic Vessel will not return to acquire any portion of any sail line , or area, until at least 24 hours has passed.	**EPS 105**: The Seismic Vessel will not return to acquire any portion of any sail line , or area, until at least 24-hours has passed.	Bridge logs confirm the acoustic source was not operated over any portion of any sail line, or area, within 24-hours of the initial sail line.	Party Chief Vessel Master SLB QC and HSE Representative Survey Environmental Advisor
A 500 m Observation Zone for marine turtles and whale sharks will be implemented and, once the source is active, a 250 m Shut-down Zone from the operating source will be applied to marine turtles and whale sharks.	**EPS 106**: Visual observations include observations for marine turtles and whale sharks within a 500 m radius of the acoustic source. Any sightings within the 500 m Observation Zone, and beyond the 250 m Shut-down Zone, will trigger the use of Soft-start Procedures.	MFOs/MMOs daily and weekly logs confirm marine turtle or whale shark sightings, where they occurred, within the 500 m Observation Zone trigger the use of Soft-start Procedures.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative
	EPS 107: The acoustic source will be immediately shut-down if a marine turtle or whale shark is observed within a 250 m radius from the active acoustic source.	MFOs/MMOs daily and weekly logs confirm that the acoustic source was shut-down if a marine turtle or whale shark was sighted within the 250 m Shut-down Zone.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative
The 500 m Observation Zone will be monitored for marine turtles and whale sharks for at least 30 minutes prior to Soft-start Procedures.	**EPS 108**: Pre-start visual observations will be made for marine turtles and whale sharks for at least 30 minutes. Soft-start Procedures may only commence if conditions allow for visual inspection of the 500 m pre-start visual Observation Zone.	MFOs/MMOs daily and weekly logs confirm that pre-start visual observations included observations for marine turtles and whale sharks within a 500 m radius for a minimum period of at least 30 minutes.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative
Soft-start Procedures may only commence if no marine turtles or whale sharks have been sighted within the relevant Shut-down Zones during the relevant pre-start observation period.	**EPS 109:** Soft-start Procedures may only commence if no marine turtles or whale sharks have been sighted within the 250 m Shut-down Zone during the 30-minute pre-start observation period.	MFOs/MMOs daily and weekly logs confirm that Soft-start Procedures only commenced if no marine turtles or whale sharks have been sighted within the 250 m Shut-down Zones during the 30 minute pre-start observation period.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative
Start-up will be delayed for 30 minutes if a marine turtle or whale shark is observed within the 250 m Shut-down Zone.	**EPS 110:** Activation of the acoustic source following a start-up delay will only resume via soft-start, and only if 30 minutes has lapsed since the turtle or whale shark sighting, or the turtle or whale shark has been observed to move outside the 250 m Shut-down Zone, or the vessel has proceeded more than 250 m from the location of the last turtle or whale shark sighting.	MFOs/MMOs daily and weekly logs confirm that soft-starts were used after a marine turtle or whale shark instigated shut-down and only when the marine turtle, whale shark or vessel had proceeded more than 250 m from the location of the last marine turtle sighting or 30 minutes had elapsed since the last turtle sighting.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
EPBC Act Policy Statement 2.1: Part B.1 – Marine Mammal Observers. The use of suitably trained, dedicated and experienced MMOs/MFOs to undertake visual observations for whales and ensure that the appropriate mitigation measures outlined in this EP are implemented.	**EPS 111**: Marine mammal observations made during the Seismic Survey will be undertaken by dedicated, trained and experienced MFO/MMOs. MMOs/MFOs must: • Have logged a minimum of 20 weeks' relevant sea-time engaged in marine seismic survey operations in Australian waters as an MMO or marine fauna observer (**MFO**); • Have proven 'at sea' experience in whale identification and behaviour, and distance estimation; and • Be confident in the identification of those species that the EP predicts will be present in the OA.	Procurement process for engaging MFOs/MMOs includes the provision of compliant CVs. Induction records outline qualifications/training of each MFOs/MMOs.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative MFOs/MMOs Vessel Master
	EPS 112: A minimum of two dedicated, trained, and experienced MFOs/MMOs will be onboard the Seismic Vessel at all times, with at least one MFO/MMO on the bridge of the Seismic Vessel during daylight hours for the visual detection of marine mammals.	Induction records outline qualifications/training of each MFOs/MMOs. MFOs/MMOs daily and weekly logs confirm two MFOs/MMOs were on board the Seismic Vessel to complete daylight visual observations.	SLB QC and HSE Representative Survey Environmental Advisor MFOs/MMOs Vessel Master
	EPS 113: Two dedicated, trained, and experienced MFOs/MMOs will be onboard the Chase Vessel at all times, with at least one MFOs/MMO on the bridge of the Seismic Vessel during daylight hours for the visual detection of marine mammals	MFOs/MMOs daily and weekly logs confirm two MFOs/MMOs were on board the Chase Vessel to complete daylight visual observations.	SLB QC and HSE Representative Survey Environmental Advisor MFOs/MMOs Vessel Master
EPBC Act Policy Statement 2.1: B.4 – Increased Precaution Zones. Increased Observation Zones and Shut-down Zones will be in place for all whales during the Seismic Survey.	**EPS 114**: The following Precaution Zones apply throughout the full duration of the Seismic Survey: • 5+ km Observation Zone[AC] – MMOs/MFOs will be required to scan as far as possible towards the horizon given the prevailing sightings conditions. The minimum Observation Zone permissible will be 5 km; • Extended (5+ km) Shut-down Zone[AC] – 5+km for blue whales/pygmy blue whales, whereby shut-downs will be triggered by a blue whale/pygmy blue whale sighting at any distance, and to a minimum of 5 km from the acoustic source; and; • Extended (2 km) Shut-down Zone[AC] – 2 km horizontal radius from the acoustic source for all 'other whales'.	MFOs/MMOs daily and weekly logs confirm that Extended Precaution Zones were implemented, if required.	Survey Environmental Advisor MFOs/MMOs Vessel Master SLB QC and HSE Representative
	EPS 115: Where species identification is uncertain, Extended Precaution Zones applicable to blue whales/pygmy blue whales will be applied.	MFOs/MMOs daily and weekly logs confirm that Extended Precaution Zones for blue whales/pygmy blue whales were implemented if required and where species identification was uncertain.	Survey Environmental Advisor MFOs/MMOs Vessel Master SLB QC and HSE Representative
EPBC Act Policy Statement 2.1: B.5 – Passive Acoustic Monitoring The use of a Passive Acoustic Monitoring system to detect the presence of vocalising cetaceans, for the duration of the Seismic Survey. PAM is to be implemented by two (as a minimum) trained, dedicated and experienced PAM Operators, with at least one PAM Operator maintaining 'acoustic watch' at all times.	**EPS 116**: PAM will be implemented on the Seismic Vessel and will operate 24-hours per day on the Seismic Vessel for the duration of the Seismic Survey while the acoustic source is in the water and during the 30 minutes before the commencement of any Soft-start Procedure.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4. PAM daily and weekly logs confirm PAM is operational while the acoustic source is in the water and at least one PAM Operator maintains 'acoustic watch' at all times.	Survey Environmental Advisor PAM Operators Vessel Master SLB QC and HSE Representative
	EPS 117: Two trained and experienced PAM Operators will be onboard the Seismic Vessel for the duration of the survey. At least one PAM Operator will maintain 'acoustic watch' at all times while the acoustic source is in the water and during the 30 minutes before the commencement of any Soft-start Procedure.	Induction records outline qualifications/training of each PAM Operator. PAM daily and weekly logs confirm two PAM Operators were on board the Seismic Vessel, with at least one PAM Operator maintaining 'acoustic watch' at all times.	Survey Environmental Advisor SLB QC and HSE Representative PAM Operators Vessel Master
	EPS 118: PAM Operators must have logged a minimum of 20 weeks' relevant sea-time engaged in MSS operations in Australian waters as a PAM Operator. PAM operators will need to be able to demonstrate competency in the acoustic identification of the species that are likely to be present during the Seismic Survey, and in interpreting acoustic software and estimating distance to any detected whale calls.	Procurement process for engaging PAM Operators includes the provision of compliant CVs. Induction records outline qualifications/training of each PAM Operator.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
	EPS 119: The PAM system will be programmed to receive/recognise vocalisations of whales within the frequencies 10 Hz to 200 kHz. The frequency range will theoretically be tuned to detect both low frequency vocalisations of baleen whales and the high frequency echolocations of sperm whales.	Compliance and sighting reports as per the EPBC Act Policy Statement 2.1 Part A.4 verify the implementation of this procedure. PAM daily and weekly logs confirm compliance	Survey Environmental Advisor PAM Operators Vessel Master SLB QC and HSE Representative
	EPS 120: PAMGuard software will be incorporated into the PAM system to assist with locating and classifying the vocalisations of marine mammals, and the PAM operators will be suitably trained in using the PAMGuard software.	Procurement process for engaging PAM Operators includes the provision of compliant CVs. Induction records outline qualifications/training of each PAM Operator. PAM daily and weekly logs confirm PAMGuard software is operational an implemented.	Survey Environmental Advisor PAM Operators Vessel Master SLB QC and HSE Representative
	EPS 121: A full replacement PAM system will be kept onboard the Seismic Vessel and will be used as a back-up if the PAM system malfunctions and is unable to be repaired. PAM Operators will be competent to firstly assess whether there is an issue, and if not possible to repair, must be able to swap out the PAM system that is not working with the replacement PAM system.	Audit/inspection records verify the presence of a replacement PAM system.	Survey Environmental Advisor PAM Operators Vessel Master SLB QC and HSE Representative
EPBC Act Policy Statement 2.1: B.6 Adaptive Management Measures: blue whales/pygmy blue whales If higher than anticipated numbers of blue whales/pygmy blue whales are observed the Survey Vessel will relocate or cease operations during night-time or low visibility operations.	**EPS 122**: If higher than anticipated numbers of blue whales/pygmy blue whales are observed (three or more blue whale/pygmy blue whale instigated shut-downs are made during the preceding 48 hour period) at any time or location during the survey, the following adaptive management controls will apply: • The acoustic source will be shut-down and the Seismic Vessel will relocate to another area at least 17 km away from the last blue whale/pygmy blue whale sighting, and outside of the blue whale migratory BIA or buffer, before commencing Pre Start-up Visual Observations and Soft Start Procedures. • An Extended 10+km Observation Zone will be adopted such that MMOs observe for blue whales/pygmy blue whales as far as practicable, and to a minimum of 10 km form the source. • The Extended 10+km Observation Zone will be monitored using the Chase Vessel as an additional observation platform with two MMOs onboard. During the adoption of these adaptive management measures, the Chase Vessel will travel approximately 5 km ahead of the Seismic Vessel and will conduct visual surveillance for marine mammals during daylight hours. • While the Extended 10+ km Observation Zone is being implemented, all measures applicable to Observation Zones and relevant to blue whales/pygmy blue whales will adopt this distance; • Night-time and low visibility operations shall cease; and • Normal operations may only resume after 48 hours of no blue whale/pygmy blue whale instigated shut-downs.	MFOs/MMOs daily and weekly logs confirm that Adaptive Management Measures for blue whales/pygmy blue whales were implemented if required.	Survey Environmental Advisor MFOs/MMOs Seismic Operator Party Chief Vessel Master SLB QC and HSE Representative
	EPS 123: If a blue whale/pygmy blue whale mother and calf pair is observed during the Seismic Survey, the acoustic source will be immediately shut-down and the Seismic Vessel will relocate to another area at least 17 km away (and outside of the blue whale migratory BIA or buffer) before commencing Pre Start-up Visual Observations and Soft Start Procedures.	MFOs/MMOs daily and weekly logs confirm that Adaptive Management Measures for blue whales/pygmy blue whales were implemented if required.	Survey Environmental Advisor MFOs/MMOs Seismic Operator Party Chief Vessel Master SLB QC and HSE Representative

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
	EPS 124: Where species identification is uncertain, a precautionary approach will be taken, and the additional management procedures for blue whales/pygmy blue whales will be followed until identification is otherwise confirmed.	MFOs/MMOs daily and weekly logs confirm that Adaptive Management Measures for blue whales/pygmy blue whales were implemented if required and where species identification was uncertain.	Survey Environmental Advisor MFOs/MMOs Vessel Master SLB QC and HSE Representative
EPBC Act Policy Statement 2.1: B.6 Adaptive Management Measures: other whales If higher than anticipated numbers of other whales are observed the Survey Vessel will relocate.	**EPS 125**: EPBC Act Policy Statement 2.1: B.6 Adaptive Management Measures will be applied to reduce the risk of potential impacts to 'other whales', including: • If three or more 'other whale' instigated shut-downs are made during the preceding 24 hour period, the Seismic Vessel will relocate at least 10 km away before commencing Pre Start-up Visual Observations and Soft-start Procedures • If an 'other whale' mother and calf pair is observed during the Seismic Survey, the acoustic source will be immediately shut-down and the Seismic Vessel will relocate to another area at least 10 km away before commencing Pre Start-up Visual Observations and Soft-start Procedures.	MFOs/MMOs daily and weekly logs confirm that Adaptive Management Measures for 'other whales' were implemented if required.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative
Additional Management Measures – Blue Whales/Pygmy Blue Whales to allow Biologically Important Behaviours to Continue: • Implementation of a 5+ km Observation Zone • Additional MMO/MFO observation effort • Implementation of an Extended 5+ km Shut-down Zone • No operation of the acoustic source within 17 km of a pygmy blue whale migration BIA during the migration period (mid [14th] – April to mid [14th] – January).	**EPS 126**: Consistent with the requirements of the Blue Whale Conservation Management Plan, Additional Management Measures will be applied to ensure biologically important behaviours can continue, including: • A 5+km Observation Zone such that MMOs observe for blue whales/pygmy blue whales at all times throughout the OA; • Throughout the OA when the source is active during daylight hours, a minimum of two trained, dedicated, and experienced MMOs/MFOs will be on-duty to increase the detection rate of blue whales/pygmy blue whales. To achieve this, at least one MMO will be on-duty on the Seismic Vessel and at least one MMO/MFO will be on-duty on the Chase Vessel; • An Extended 5+ km Shut-down Zone for blue whales/pygmy blue whales will be implemented throughout the entire OA, where shut-downs will be triggered by a blue whale/pygmy blue whale sighting at any distance, and to a minimum of 5 km from the acoustic source; • A 17 km buffer will be established around the blue whale migratory BIA where it overlaps with the OA; • The Seismic Vessel will not activate the acoustic source(s) within the blue whale migratory BIA or buffer from mid-April (14th) to mid-January (14th) which represents the period during which migrating blue whales/pygmy blue whales have historically been known to be present in and around the OA.	MFOs/MMOs daily and weekly logs confirm that Additional Management Measures for blue whales/pygmy blue whales were implemented when required.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative
	EPS 127: Shape files will be loaded onto the survey vessels' navigation system outlining the blue whale BIA and 17 km buffer, against the boundary extents of the OA and AA.	Exclusion polygons on survey vessel's navigation system.	Vessel Master SLB QC and HSE Representative Survey Environmental Advisor
Additional Management Measures – other whales: A 2 km Extended Shut-down Zone for 'other whales' will be implemented throughout the entire OA at all times. On this basis a low power zone is deemed unnecessary.	**EPS 128**: A 2 km Extended Shut-down Zone for 'other whales' will be implemented throughout the entire OA at all times.	MFOs/MMOs daily and weekly logs confirm the Additional Management Measure for 'other whales' and toothed whales was implemented.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative
Night-time/Poor Visibility Procedures for marine turtles. Consistent with EPBC Policy Statement 2.1 and existing procedures for whales, night-time or low visibility operations may occur provided that there has not been three or more marine turtle instigated power-down or shut-down situations during the preceding 24-hour period.	**EPS 129**: Where three or more marine turtle instigated shut-downs are made during the preceding 24 hour period, night time or low visibility operations shall cease and may only resume after 24 hours of no marine turtle instigated shut-downs.	MFOs/MMOs daily and weekly logs confirm that Night-time/Poor Visibility Procedures for marine turtles were implemented if required.	Survey Environmental Advisor MFOs/MMOs Vessel Master SLB QC and HSE Representative

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
Adaptive Management Measures – Marine turtles If higher than anticipated numbers of marine turtles are observed, as determined by there being three or more marine turtle instigated shut-downs within a 24 hour period, the acoustic source will not be discharged within 8 km of the Carbonate bank and terrace system of the Sahul Shelf KEF.	**EPS 130:** Where three or more marine turtle instigated shut-downs occur during the preceding 24 hour period, no operation of the acoustic source will take place within 8 km of the Carbonate bank and terrace system of the Sahul Shelf KEF. Operation of the acoustic source within the Carbonate bank and terrace system of the Sahul Shelf KEF may only resume after 24 hours has lapsed since the last marine turtle instigated shut-down.	MFOs/MMOs daily and weekly logs confirm that the acoustic source was not discharged within 8 km of the Carbonate bank and terrace system of the Sahul Shelf KEF if three or more marine turtle instigated shut-downs are made during the preceding 24 hour period	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative
	EPS 131: Shape files will be loaded onto the survey vessels' navigation system outlining areas the extent of the Carbonate bank and terrace system of the Sahul Shelf KEF and the associated 8 km buffer within which the acoustic source cannot be activated following more than three or more marine turtle instigate shut-downs during the preceding 24 hour period.	Exclusion polygons on survey vessels' navigation system.	Vessel Master SLB QC and HSE Representative Survey Environmental Advisor
Night-time/Poor Visibility Procedures for whale sharks Consistent with EPBC Policy Statement 2.1 and existing procedures for whales, night-time or low visibility operations may occur provided that there has not been three or more whale shark instigated power-down or shut-down situations during the preceding 24-hour period.	**EPS 132**: Where three or more whale shark instigated shut-downs are made during the preceding 24 hour period, night time or low visibility operations shall cease and may only resume after 24 hours of no whale shark instigated shut-downs.	MFOs/MMOs daily and weekly logs confirm that Night-time/Poor Visibility Procedures for whale sharks were implemented if required.	Survey Environmental Advisor MFOs/MMOs Vessel Master SLB QC and HSE Representative
No operation of the acoustic source within Whale Shark foraging BIA during the reported migration period (September to November).	**EPS 133**: No operation of the acoustic source within Whale Shark foraging BIA during the reported migration period (September to November).	MFOs/MMOs daily and weekly logs confirm that the acoustic source was not operated within the whale shark BIA during the reported migration period (September to November) Vessel track records as well as AIS tracks and bridge logs confirm this.	Survey Environmental Advisor MFOs/MMOs Party Chief Vessel Master SLB QC and HSE Representative

7.2.9 Acoustic Disturbance Impact and Risk Summary

Based on the findings of this EP, with the implementation of the control measures, underwater noise emitted from the acoustic source is considered to have (at most) a **Moderate** residual risk to the identified receptors (i.e., environmental and other marine users). Consequences of predicted effects will generally be minor and short-term with regards to displacement of marine mammals, marine turtles and fish away from the acoustic source.

The suite of control measures determined to be adopted have been developed in accordance with industry best practice and relevant legislation. In accordance with the Risk Ranking Descriptions in **Table 34**, where risk cannot be reduced to '**Low**', additional control measures must be evaluated to determine whether the risk is reduced to **ALARP**.

Additional controls have also been evaluated to determine whether they are effective and practicable to implement in **Table 42**. Where they are determined to effectively reduce the environmental impact and risk, and are practicable to implement, they have been adopted. Consequently, it is considered that the environmental impacts and risks on the identified receptors arising from the Acoustic Disturbance to the Marine Environment arising from the Seismic Survey, are reduced to **ALARP**.

In accordance with the acceptability requirements prescribed in **Section 6.4,** the suite of control measures, are considered appropriate to manage the impacts arising from the Acoustic Disturbance to the Marine Environment on all receptors, specifically marine fauna, commercial fishers and divers, to an **Acceptable Level.**

7.3 Routine Permissible Waste Discharges

7.3.1 Description of Source of the Impact and Risk

The source of routine permissible waste discharges falls into three categories:

- Biodegradable waste (sewage, greywater and galley waste such as putrescible food waste);
- Deck drainage; and
- Bilge water.

The primary forms of biodegradable wastes produced during the Seismic Survey are sewage, greywater and galley wastes, with these wastes originating from processes such as ablution, laundry, and galley activities. A typical Seismic Vessel is likely to have a maximum daily sewage discharge capacity of approximately 15 m^3, and the typical discharge capacity for the Support Vessel and Chase Vessel is approximately 4.2 m^3. The actual daily volumes of sewage and greywater generated during the Seismic Survey will be directly related to the number of personnel onboard (0.45 m^3 of sewage/greywater per day[32] (NERA, 2017)). Based on the maximum capacities provided in **Table 8** for the Seismic Vessel and support vessels respectively, the Seismic Vessel (maximum 70 persons) will discharge approximately 31.5 m^3 per day, the Chase Vessel (maximum 50 persons) approximately 20 m^3 per day, and the Supply Vessel (maximum 14 persons) approximately 6.3 m^3 per day. Putrescible waste discharges are in the order of 1 – 2 kg per person per day (NERA, 2017).

The composition of sewage, putrescible wastes and grey water may Ie (NERA, 2017):

- Physical particulate matter such as solids composed of floating, settleable, colloidal and dissolved matter;
- Chemicals including nutrients, organics, and inorganics; and
- Biological pathogens (e.g. bacteria, viruses, protozoa, parasites, etc.).

The other source of permissible waste discharges are deck drainage and bilge water. Ongoing cleaning and maintenance operations around the vessels, as well as deck drainage from rain or spray will generate deck waters which may contain remnants of spilt materials, detergents, oils and smaller solid materials (garbage). Larger chemical spills would be contained and/or cleaned up prior to entering the deck drainage systems as per the vessels emergency spill/pollution plans. Bilge water is drainage water and other fluids captured in a closed system, often from engine or machinery spaces within the vessel, for treatment prior to discharge at sea, or stored for discharge at port – as per requirements of MARPOL Annex 1. The contaminant profile of bilge water may comprise cleaning chemicals, hydrocarbons and heavy metals.

[32] This volume has been taken as a worst-case from the NERA '*Planned discharge of sewage, putrescible waste and grey water*' Environment Plan Reference Case which estimates the total volume generated to range from 0.04 – 0.45 m^3 per person per day. The worst case of 0.45 m^3 has been used for these calculations.

Dilution of discharges from moving vessels, such as will be the case for the Seismic Survey, occurs immediately. Moving ships displace a volume of water that is immediately refilled as the ship passes, resulting in mixing within the wake astern of the ship. Dilution factors behind a moving vessel have been estimated to be in the order of 200,000 – 640,000 (Loehr *et al*., 2006). NERA (2017) states that a 150 m^3 discharge of sewage and greywater from a fixed-point discharge will be at background levels within 500 m from the point of discharge. Due to the movement of the seismic vessels, mechanical mixing of the vessel wake, and significantly less volumes of sewage and greywater that may be discharged per day from the vessels, background levels will be observed considerably closer to the point of discharge than 500 m.

Non-biodegradable wastes, such as garbage, will also be generated during routine operations onboard the seismic vessels. The discharge to sea of all types of garbage is prohibited under MARPOL Annex V unless explicitly permitted under the Annex. Garbage onboard the survey vessels such as plastics, synthetic ropes, cooking oils, paper and cardboards, rags, packaging materials, polystyrenes/foam and wood are prohibited from being discharged into the marine environment, and these materials will be retained onboard the vessels and stored for later disposal onshore at suitable waste facilities.

7.3.2 Evaluation of Known and Potential Impacts and Risks to Environmental Receptors

Using the information presented in **Section 2** to **Section 5**, the impact and risk assessment has been undertaken for those receptors determined to be relevant to the activity as listed in **Table 75.**

Table 74 Environmental Receptors Assessed

Receptor	Section reference
Marine Environmental Quality	**Section 7.3.2**
Plankton	
Benthic Habitats	
Benthic Invertebrates	
Non-listed Marine Fauna	
Listed Marine Fauna	

Any marine receptor that resides in the water column and which could uptake contaminants through a dissolved, particulate, or dietary exposure pathway may be affected by discharges. Impacts from discharges may include (NERA, 2017):

- Ecosystem health values being compromised in the vicinity of the waste discharge;
    - Eutrophication and associated changes in the abundance and biomass of biota (e.g. enhanced growth of phytoplankton in the water column), change in patterns of biological diversity (reduced species diversity with shifts towards fewer well adapted species), and/or increased biological and chemical oxygen demand; and
    - Direct and indirect toxicity to marine flora and fauna (including acute lethal and/or chronic sub-lethal effects) for example through exposure to chemicals used to treat wastewater and waste systems.
- Primary industry values may be impacted, for example, seafood caught within the immediate vicinity of the discharge may not be sage for human consumption; and
- Recreation and aesthetic values may be affected such as contamination of water with human pathogens making swimming areas unsuitable.

The level of impact will be directly related to the volume of the contaminant and the volume of water it is discharged within, their toxicity, the types of organisms present, and the receiving environment itself. Discharged contaminants can cause damage to organisms across all trophic levels. Immediate impacts would mostly affect organisms within the water column but pollutants adsorbing onto particles/sediments within the water column settle to the seabed where benthic organisms may be exposed.

The main environmental impacts associated with the discharge of routine permissible wastes is eutrophication (NERA, 2017). Biodegradable waste disposed at sea is decomposed by bacteria either in the water column or on the seabed. This decomposition process increases the biochemical oxygen demand (**BOD**) in the surrounding area which can potentially limit dissolved oxygen for other marine organisms (particularly in low flow areas where water circulates slowly). Disposal of biodegradable wastes at sea can also lead to areas of artificial nutrient enrichment (particularly phosphorus and nitrogen) which in extreme cases can trigger excessive algae growth (Perić, 2016; Wilewska-Bien *et al.*, 2016). Plankton communities have developed to rapidly respond to favourable conditions such as an influx of nutrients; however, once the favourable conditions cease, plankton populations collapse and/or return to previous conditions (NERA, 2017). Any potential change to phytoplankton or zooplankton abundance will be localised, returning to background conditions within tens to a few hundred meters of the discharge location (Parnell, 2003).

The discharge of food wastes can also lead to increased scavenging behaviour around the vessels by seabirds and fish, sometimes leading to animals following the vessel for significant distances.

Marine pollution has been identified as a pressure in North-west Marine Parks, including marine debris and the discharge of oils, chemicals or wastes. Habitat, key ecological features, and species vulnerable to marine pollution include island, reef, and other shallow-water habitats, Ashmore Reef and Cartier Island and surrounding Commonwealth waters and species of sawfish, dolphin, whale, dugong, marine turtle and seabird (DNP, 2018). The disposal of waste from normal operations of vessels is permitted within Australian Marine Parks as long as the disposal is compliant with MARPOL requirements (DNP, 2018). Although all discharges from the survey vessels will be compliant with the requirements of MARPOL, there will be no discharge of routine permissible wastes within the boundaries of any Australian Marine Park and therefore no impacts on the sensitivities and values of these areas.

Discharges from vessels are most problematic when they occur within enclosed inland waters and/or semi-enclosed coastal waters with minimal flushing (Koboevic *et al.*, 2022), or within areas with high conservation values such as marine parks (Byrnes and Dunn, 2020). Receiving waters with high flushing capacities are able to dilute or eliminate most pollutants associated with waste discharges (Koboevic *et al*., 2022). The wind, waves and currents present in the offshore marine waters of the OA (**Section 4.3.4**) will ensure that any discharges are rapidly mixed. As a result of the highly dispersive environment within the OA, nutrients from the discharge of sewage will not accumulate or lead to eutrophication of waters surrounding the discharge point. As the majority (approximately 55%) of the OA is within waters >100 m, discharges are unlikely to settle on the seabed and affect benthic organisms.

Based on the control measures that will be implemented during the Seismic Survey (**Section 7.3.4**), it is considered that the consequence of impact is *Negligible*, with a likelihood of seeing a measurable impact being *Unlikely* which results in an overall risk ranking of **Negligible**.

7.3.3 Decision Context

The decision context for Routine Permissible Waste Discharges has been assessed as Type A for all receptors, given the predicted impacts and risks are well understood and uncertainty is minimal, with little or no interest from relevant persons.

7.3.4 Identification of Control Measures, Residual Risk Assessment and Demonstration of ALARP

The control measures that will be implemented during the Seismic Survey to manage the impacts from routine permissible waste discharges to **ALARP** have been included in **Table 76**. SLB has considered a number of control measures to determine the benefits of their implementation towards risk reduction (**Table 76**), based on a Hierarchy of Controls methodology (**Table 75**). The control measures that will be adopted are those that have been assessed and characterised as effective and practicable to implement.

Table 75 Hierarchy of Control Measures for Routine Permissible Waste Discharges

Eliminate	As discussed within **Table 76**, the vessels are required to be manned at all times which means the generation of sewage, greywater and galley waste cannot be eliminated. Alternatively, waste could be stored onboard the vessels and transported to for disposal. This would add significant operational costs, time, and additional health and safety risks. Therefore, it was considered that elimination of permissible waste discharge was not practicable.
Substitute	Limited practicable substitutes for discharge of this waste are available.
Reduce	The impact from the discharge of routine permissible wastes will be reduced by the implementation of the adopted control measures, as described within **Table 76.** For example, the oil content within oily water discharge will be reduced to 15 ppm through an approved oily water separator, an approved comminuting and disinfecting system will be used to treat sewage and a grinder/comminuter will be utilised where required to reduce the potential impacts from the discharge of food waste on the marine environment.
Mitigate	To mitigate the effects of routine permissible waste discharges, separation distances have been defined for sensitive receptors, in accordance with the legislative requirements and good industry practice. For example, no untreated sewage and putrescible wastes will be discharged within 12 NM from land and no treated sewage and putrescible wastes will be discharged within 3 NM from land to protect nearshore coastal margins from potential nutrient enrichment.

Table 76 Assessment of Control Measures for Routine Permissible Waste Discharges

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Legislative Requirements:			
The Seismic Survey will be undertaken in accordance with the approved EP.	P = Yes E = Effective	All vessels undertaking an offshore activity in waters between 3 and 200 NM must undertake that activity in line with an approved EP. The approved EP outlines the measures that will be taken to ensure that environmental effects from the activity will be reduced to **ALARP** and **Acceptable Levels**, including the management of routine permissible waste discharges.	Yes
All survey vessels will comply with the requirements of MARPOL Annex I (Regulations for the Prevention of Pollution by Oil), Marine Order 91 (Marine Pollution Prevention – Oil) and *Protection of the Sea* (Prevention of Pollution from Ships) *Act 1983,* including*:* • In accordance with MARPOL Annex I and Marine Order 91, vessels ≥ 400 gross tonnes will: • Have an oil discharge monitoring and control system and oil filtering equipment on-board. • The oil discharge monitoring and control system will be maintained and operated to the 15 ppm standard. • Hold a current International Oil Pollution Prevention (IOPP) Certificate. • Maintain and oil usage management logbook. • Treated bilge water will only be discharged when the vessel is moving and the oil discharge monitoring and control system and oil filtering equipment is operating. If oil discharge monitoring and control system and oil filtering equipment is unavailable, bilge water mixtures will be retained onboard for onshore disposal.	P = Yes E = Effective	It is a legislative requirement to meet the relevant aspects of MARPOL Annex I, Marine Order 91 and the PSPPS Act.	Yes
All survey vessels will comply with the requirements of MARPOL Annex IV (Regulations for the Prevention of Pollution by Sewage from Ships) and Marine Order 96 (Marine Pollution Prevention – Sewage), including: • A valid international Sewage Pollution Prevention (ISPP) Certificate, as required by vessel class; • Sewage will only be discharged via an IMO-approved sewage treatment plant; or • Comminuted/disinfected sewage via an IMO-approved system will only be discharged when ≥3 nm from land and when the vessel is moving at ≥4 knots; or • Sewage that has not been comminuted/disinfected via an IMO-approved system will only be discharged when ≥12 nm from land and when the vessel is moving at ≥4 knots.	P = Yes E = Effective	It is a legislative requirement to meet the relevant aspects of MARPOL Annex IV and Marine Order 96.	Yes
All survey vessels will comply with the requirements of MARPOL Annex V (Regulations for the Prevention of Pollution by Garbage from Ships) and Marine Order 95 (Marine Pollution Prevention – Garbage), including: • Putrescible waste will be discharged while the vessel is moving and ≥12 nm from the nearest land; or • Putrescible waste will pass through a comminuter or grinder capable of passing through a screen with no opening wider than 25 mm in diameter prior to discharge and discharged while the vessel is moving and ≥3nm from the nearest land.	P = Yes E = Effective	It is a legislative requirement to meet the relevant aspects of MARPOL Annex V and Marine Order 95.	Yes
Good Industry Practice			
Equipment/machinery involved in the treatment of wastes, such as oil discharge monitoring and control systems, oil filters and comminuters, will be routinely maintained and calibrated as per the manufacturers guidelines to ensure they operate effectively.	P = Yes E = Effective	Routine maintenance ensures that the requirements of MARPOL are able to be met. Good industry practice, environmental benefit outweighs additional cost.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Equipment/machinery involved in the treatment of wastes will be operated by trained crew who will be instructed at the pre-mobilisation environmental induction on how to comply with the requirements of this EP.	P = Yes E = Effective	It is a standard industry practice to hold inductions for all onboard the vessels, with participation in induction meetings compulsory. During inductions, crew will be made aware of their responsibilities with regard to the management of routine permissible waste discharges to the marine environment. Good industry practice, environmental benefit outweighs additional cost.	Yes
The vessel crew will be made aware of their crew will be made aware of their responsibilities with regard to the management of routine permissible waste discharges to the marine environment during the environmental induction.	P = Yes E = Effective	Environmental inductions are standard industry practice to ensure the health and safety of those onboard and the protection of the environment. During inductions, crew will be made aware of their responsibilities with regard to effects of the discharge of wastes to the marine environment and restrictions around the overboard discharge of waste materials. Participation in inductions is compulsory. Good industry practice, safety benefit outweighs additional cost.	Yes
All storage areas for hazardous substances will be designed and maintained to support some form of containment/bunding.	P = Yes E = Effective	Containment/bunding will be in place around all locations where hazardous substances/materials are stored onboard the vessels to capture any spilled substances/materials and prevent them from entering the marine environment. Good industry practice, environmental benefit outweighs additional cost.	Yes
Deck scupper plugs will be available beside all deck drainage points that lead overboard.	P = Yes E = Effective	Deck scupper plugs allow for drainage to be blocked off, stopping wastes (including hazardous wastes) from entering the marine environment through deck drainage systems. Good industry practice, environmental benefit outweighs additional cost.	Yes
Display of signage notifying vessel crew of disposal requirements.	P = Yes E = Effective	The display of signage notifying crew of disposal requirements is good industry practice and reminds crew of waste disposal requirements/separation etc. Good industry practice, environmental benefit outweighs additional cost.	Yes
Alternatives/Substitutes Controls Considered:			
Eliminate the discharge of sewage, greywater and galley waste to the marine environment through the retention of all liquid wastes on board and, ultimately, transfer to a licensed onshore disposal site.	P = No E = Very Effective	As the vessels is required to be manned, the generation of sewage, greywater and galley waste is unavoidable. Although this would reduce the impact of discharges, the storage of this waste on board the vessels and subsequent transfer to shore will require additional supply journeys to be made throughout the survey, adding significant operational costs (e.g., fuel) and also increasing the environmental and navigational impact and risk associated with the Seismic Survey. Given the control measures to be adopted commit to the routine discharge of permissible wastes in accordance with MARPOL and associated Marine Orders, the environmental risks associated with this activity are considered low. On this basis, the cost associated with this control measure are considered disproportionate to the benefits gained.	No
Eliminate the discharge deck drainage and bilge water to the marine environment through the retention of all liquid wastes on board and, ultimately, transfer to a licensed onshore disposal site.	P = No E = Very Effective	Maintenance and cleaning required for the safe operation of survey vessels generate water requiring treatment and are unavoidable. Deck drainage arising from rain or spray cannot be eliminated. Although this would reduce the impact of discharges, the storage of this waste on board the vessels and subsequent transfer to shore will require additional supply journeys to be made throughout the survey, adding significant operational costs (e.g., fuel) and also increasing the environmental and navigational impact and risk associated with the Seismic Survey. Given the control measures to be adopted commit to the routine discharge of permissible wastes in accordance with MARPOL and associated Marine Orders, the environmental risks associated with this activity are considered low. On this basis, the cost associated with this control measure are considered disproportionate to the benefits gained.	No
Additional Controls Considered:			

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
There will be no planned discharge of routine permissible wastes within the boundaries of any Australian Marine Park.	P = Yes E = Limited Effectiveness	Whilst no Australian Marine Parks exist within the OA, the Oceanic Shoals Marine Parks is situated immediately beyond the eastern boundary of the OA. Restricting release of discharges within the Australian Marine Parks will avoid any potential adverse effects on the sensitivities within the parks, though none are anticipated. Any routine permissible discharges are expected to be rapidly mixed and diluted by the wind, waves and currents which characterise the offshore marine waters of the OA, before dispersion occurs. As a result of the highly dispersive environment within the OA, toxicants and nutrients from the discharge of sewage will not accumulate or lead to eutrophication of waters surrounding the discharge point or nearby receiving environments such as the Oceanic Shoals Marine Park. Though no management plan specific to the Oceanic Shoals Marine Park currently exists, water quality is not a value cited within the Australian Marine Parks North Marine Parks Network Management Plan (DNP 2018). The disposal of waste from normal operations of vessels is permitted within Australian Marine Parks as long as the disposal is compliant with MARPOL requirements (DNP, 2018). Although all discharges from the survey vessels will be compliant with the requirements of MARPOL and are not anticipated to cause any potential adverse effects, SLB has committed to not discharge routine permissible wastes within the boundaries of any Australian Marine Park. Given there are no Australian Marine Parks within the OA, this measure was considered practicable to implement. Limited environmental benefit outweighs additional cost.	Yes
There will be no discharge of routine permissible wastes within the boundaries of any Key Ecological Feature.	P = No E = Limited Effectiveness	The Carbonate bank and terrace system of the Sahul Shelf KEF overlaps the OA. The Carbonate bank and terrace system of the Sahul Shelf KEF is considered ecological important due to it's role in enhancing local productivity, relative to the surrounding environment. Emerging banks and shoals rise steeply, creating channels in between elevated features which support localised high primary productivity. To this end, water quality is considered a value of the Carbonate bank and terrace system of the Sahul Shelf KEF to be protected. Restricting release of discharges within the Carbonate bank and terrace system of the Sahul Shelf KEF will avoid any potential adverse effects on the sensitivities within the KEF, though none are anticipated. Any routine permissible discharges are expected to be rapidly mixed and diluted by the wind, waves and currents which characterise the offshore marine waters of the OA, before dispersion occurs. As a result of the highly dispersive environment within the OA, toxicants and nutrients from the discharge of sewage will not accumulate or lead to eutrophication of waters surrounding the discharge point or nearby receiving environments such as The Carbonate bank and terrace system of the Sahul Shelf. Given the Carbonate bank and terrace system of the Sahul Shelf KEF overlaps with 9,900 km² (38%) of the OA, it is not considered practicable to limit routine permissible discharges within the boundaries of the KEF. Given no adverse effects on the sensitivities within the KEF are predicted, the cost to operations associated with storage of wastes or additional journeys to areas of the OA located outside of the KEF are considered grossly disproportionate to the limited environmental benefit gained from implementing the control measure.	No
Residual Risk of Impact (Receptor)	**Consequence**	**Likelihood**	**Residual Risk Ranking**
Marine Environmental Quality	Negligible	Unlikely	Negligible
Plankton	Negligible	Unlikely	Negligible
Benthic Habitats	Negligible	Unlikely	Negligible
Benthic Invertebrates	Negligible	Unlikely	Negligible
Non-listed Marine Fauna	Negligible	Unlikely	Negligible
EPBC Act Listed Marine Fauna	Negligible	Unlikely	Negligible
ALARP Statement			
The decision context has been assessed as Type A and the overall residual risk has been determined to be Negligible. SLB considers the adopted control measures are appropriate to manage the impacts of Routine Permissible Waste Discharges during the survey. The proposed control measures have been developed in accordance with the legislative requirements and good industry practice and taking into account the specific environmental, social, economic and cultural characteristics of the OA. No effective and practicable alternative or additional control measures were identified as part of the assessment process. Therefore, the predicted impacts to receptors from Routine Permissible Waste Discharges are reduced to **ALARP.**			

7.3.5 Impact and Risk Acceptability

Table 77 Demonstration of Impact and Risk Acceptability for Routine Permissible Waste Discharges

Criteria for Acceptance	Acceptability Summary
Residual Risk Ranking	The Residual Risk has been determined to be Negligible
Ecologically Sustainable Development	The management of the impacts associated with the Seismic Survey as a result of the discharge of routine permissible discharges can be carried out in compliance with the five principles of ecologically sustainable development as defined within the EPBC Act. The assessment has not identified any adverse impacts to the principles of ESD, with no threats of serious or irreversible damage, no impacts to biological diversity and ecological integrity, no degradation of inter-generational equity, or negative effects on the social and economic integrity in the short or long-term.
SLB's Internal Context	The proposed management of routine permissible waste discharges is consistent with SLB's QHSE Policy.
Existing Environmental Context	It is considered that the routine discharge of permissible wastes will not result in any significant impact on environmental values or sensitivities within the OA, including protected and non-protected species which inhabit the water column, such as pelagic fish, sharks, marine mammals, marine turtles and seabirds. Given the expected mixing and dispersion of discharged waste, it is unlikely that routine permissible waste discharges will impact upon benthic species. By extension, the discharge of routine permissible wastes are not expected to impact significantly on the environmental values and sensitivities, including significant benthic habitats and communities, which comprise the KEF (Carbonate bank and terrace system of the Sahul Shelf) within the OA or the adjacent Oceanic Shoals Marine Park. No impacts to other marine users are predicted to occur as a result of the discharge of routine permissible wastes. It is considered that the proposed control measures provide appropriate protection to marine fauna and other marine users from the potential effects associated with the routine discharge of permissible waste. A number of control measures were considered as part of the assessment process and it was concluded that the addition of any further control measures not already considered would provide little or no additional protection.
External Context – Management Plans, Species Recovery Plans and Conservation Advice	The residual risk of the routine permissible waste discharges has been determined to be Negligible and will not have a significant impact on a matter of national environmental significance in accordance with EPBC Act Policy Statement 1.1. **<u>Species Recovery Plans and Conservation Advices</u>** Routine permissible waste discharges are not considered as a threat requiring additional management under the relevant Management Plans, Species Recovery Plans or Conservation Advices. **<u>AMP Values, Management Prescriptions and IUCN Reserve Management Principles</u>** Routine permissible waste discharges are not expected to impact significantly on environmental values or sensitivities at a local or regional level. No population-level impacts or serious irreversible ecological implications are predicted to the values of AMPs. Management of routine permissible discharges in accordance with the MARPOL requirements meet the management prescriptions for Multiple Use Zones. **<u>Conservation values and objectives of the North-west Marine Parks Management Plan</u>** Routine permissible waste discharges are not expected to impact significantly on environmental values or sensitivities of the North-west Marine Region at a local or regional level.
Social Acceptance – Relevant Person Expectations	No concerns were raised in regard to possible impacts from routine permissible waste discharges, and as such no additional control/mitigation measures were expected or put in place following consultation with relevant persons. The environmental impacts relating to routine permissible waste discharges from the survey vessels in accordance with industry best practice were considered to be at a socially **Acceptable Level**.
External Context – Commonwealth and State Legislative Criteria	SLB will ensure that the routine permissible waste discharges (i.e. sewage, food waste, deck drainage and bilge water) will be undertaken in accordance with international conventions and relevant legislation, including: • MARPOL Annex I, Annex IV and Annex V; • Protection of the Sea (Prevention of Pollution from Ships) Act 1983; • Marine Order 91 (Marine Pollution Prevention – Oil), 2014; • Marine Order 95 (Marine Pollution Prevention – Garbage), 2013; • Marine Order 96 (Marine Pollution Prevention – Sewage), 2013
Industry Best Practice	The proposed control measures follow industry best practice and best practice guidelines, including: • The IAGC Environmental Manual for Worldwide Geophysical Operations which provides guidance on waste management, including, but not limited to: • Vessels having a Waste or Garbage Management Plan to effectively manage waste in line with MARPOL regulations as well as local legislation; • Waste that cannot be incinerated will be segregated and stored for disposal ashore; • Prior to discharge, oily water is processed to remove oil to less than 15 ppm; • Greywater and sewage are dealt with according to MARPOL; and

Criteria for Acceptance	Acceptability Summary
	• The APPEA Code of Environmental Practice includes an objective to reduce the impact of routine waste discharges on the marine environment to **ALARP** and to an **Acceptable Level** by ensuring discharges are in accordance with legislative requirements and predicted levels.
ALARP	Total elimination of all impacts associated with routine permissible waste discharges cannot be achieved, as the generation of sewage, greywater and galley waste is unavoidable and will be discharged to sea daily in relatively small volumes, with no practicable alternatives. However, these discharges will be in accordance with the requirements of the MARPOL 73/78 Convention (as implemented in Commonwealth waters by the Protection of the Sea (Prevention of Pollution from Ships) Act 1983). Additionally, the survey vessels may have to discharge bilge water and deck drainage during the survey if required. There are no predicted long-term effects at a population level on any species identified in this EP, and no adverse effects on the environmental values of protected areas or KEFs as a result of permissible waste discharges are expected. Based on the discussions above, including the potential impacts on the environment and the associated control measures to be implemented, the residual risk from routine permissible waste discharges from the survey vessels is considered **Negligible** and to **ALARP**. Therefore, the impacts from this activity associated with the Seismic Survey are considered to be at an **Acceptable Level**.

Acceptability Statement
Impacts and risks classified as 'Type A' or above are considered acceptable if the requirements in **Table 40** can be demonstrated and if the level of residual impact and risk are determined to be Moderate or less. Based on the above evaluation, the potential impacts from Routine Permissible Waste Discharges meets the requirements of the impact and risk acceptability criteria. The control measures that will be implemented throughout the Seismic Survey have been developed in accordance with these criteria and are considered appropriate to manage the impacts of Routine Permissible Waste Discharges on all identified receptors to an **Acceptable Level.**

7.3.6 Environmental Performance

Table 78 Environmental Performance Outcomes, Standards and Measurement Criteria for Routine Permissible Waste Discharges

Number	Environmental Performance Outcome		Environmental Performance Standard
EPO 17	No release of unplanned objects, emissions or discharges to sea or air		**EPS 134** to **EPS 155**
EPO 18	All routine permissible waste discharges will meet or exceed the requirements of MARPOL Annex I, IV, V and Marine Orders 91, 95 and 96		**EPS 134** to **EPS 146**
Control Measure	**Environmental Performance Standard**	**Measurement Criteria**	**Responsible Party**
The Seismic Survey will be undertaken in accordance with the approved EP.	**EPS 134**: The Seismic Survey may only commence following acceptance of the EP by NOPSEMA.	Pre-mobilisation audit and inspection are completed prior to operations and confirm an accepted EP has been obtained. Audit records verify compliance with the requirements of the EP.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 135: The Seismic Survey will be undertaken in accordance with the accepted EP.	Bridge logs verify compliance with the requirements of the EP. Audit records verify compliance with the requirements of the EP.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
All survey vessels will comply with the requirements of MARPOL Annex I (Regulations for the Prevention of Pollution by Oil), Marine Order 91 (Marine Pollution Prevention – Oil) and *Protection of the Sea* (Prevention of Pollution from Ships) *Act 1983,* including: • In accordance with MARPOL Annex I and Marine Order 91, vessels ≥ 400 gross tonnes will: • Have an oil discharge monitoring and control system and oil filtering equipment on-board. • The oil discharge monitoring and control system will be maintained and operated to the 15-ppm standard. • Hold a current International Oil Pollution Prevention (IOPP) Certificate. • Maintain an oil usage management logbook. • Treated bilge water will only be discharged when the vessel is moving, and the oil discharge monitoring and control system and oil filtering equipment is operating. If oil discharge monitoring and control system and oil filtering equipment is unavailable, bilge water mixtures will be retained onboard for onshore disposal	**EPS 136**: An International Oil Pollution Prevention Certificate (**IOPP Certificate**) will be held by every ship of 400 gross tonnage and above involved in the Seismic Survey as per division 3 of Marine Order 91, and MARPOL Annex I. The IOPP Certificate will be drawn up in the form corresponding to the model given in Appendix II of MARPOL Annex I and shall be at least in English, French or Spanish.	A pre-mobilisation vessel audit and inspection confirms IOPP Certificate has been issued and is valid.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 137: The survey vessels will maintain an Oil Usage Management Logbook.	A pre-mobilisation vessel audit and inspection confirms Oil Usage Management Logbook for each survey vessel.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 138: Oil filtering equipment (of an approved design) processes oily water to meet the 15-ppm requirement of MARPOL Annex I, Marine Order 91 and the PSPPS Act. Any discharge of processed oily water will be monitored and undertaken while the vessel is underway in accordance with the above concentration requirements. Any separated oil will be retained/stored onboard and transported to shore for disposal at an approved facility.	Pre-mobilisation vessel audit and inspection confirms approved oil filtering equipment is onboard and equipment is operational. Discharge logs confirm that any discharges of processed oily water are compliant with MARPOL Annex I, Marine Order 91 and the PSPPS Act.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
All survey vessels will comply with the requirements of MARPOL Annex IV (Regulations for the Prevention of Pollution by Sewage from Ships) and Marine Order 96 (Marine Pollution Prevention – Sewage), including:	**EPS 139**: An International Sewage Pollution Prevention Certificate (**ISPP Certificate**) will be held by every ship of 400 gross tonnage and above involved in the Seismic Survey, and any vessel certified to carry more than 15 persons as per division 3 of Marine Order 96, and Regulation 4 of MARPOL Annex IV.	A pre-mobilisation vessel audit and inspection confirms ISPP Certificate is valid.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
• A valid international Sewage Pollution Prevention (ISPP) Certificate, as required by vessel class; • Sewage will only be discharged via an IMO-approved sewage treatment plant; or • Comminuted/disinfected sewage via an IMO-approved system will only be discharged when ≥3 nm from land and when the vessel is moving at ≥4 knots; or • Sewage that has not been comminuted/disinfected via an IMO-approved system will only be discharged when ≥12 nm from land and when the vessel is moving at ≥4 knots	**EPS 140**: When sewage is comminuted and disinfected using an approved system (as per Marine Order 96), the discharge to sea will only occur at a moderate rate when the vessel is travelling at greater than 4 knots, and when further than 3 NM from the nearest land as per MARPOL Annex IV.	Pre-mobilisation vessel audit and inspection confirms approved sewage communiter and disinfection system is onboard, and equipment is operational. Discharge logs confirm that any discharges of processed sewage are compliant with MARPOL Annex IV and Marine Order 96.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 141: When sewage is not comminuted or disinfected using an approved system, the discharge to sea will only occur at a moderate rate when the vessel is travelling at greater than 4 knots, and when further than 12 NM from the nearest land as per MARPOL Annex IV.	Discharge logs confirm that any discharges of unprocessed sewage are compliant with MARPOL Annex IV and Marine Order 96.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 142: When operating vessels within 12 NM of the coast, any sewage that is not comminuted or disinfected through an approved system will be stored within holding tanks. This sewage will then either: be transferred ashore for appropriate treatment; or, discharged to sea once further than 12 NM from the coast as per the standards above.	Where they occur, discharge logs confirm that any discharges of processed sewage are compliant with MARPOL Annex IV and Marine Order 96. Where waste is stored for onshore disposal, Waste Transfer Certificate issued by licensed facility or carrier are obtained and records kept on file in accordance with record management procedures.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
All survey vessels will comply with the requirements of MARPOL Annex V (Regulations for the Prevention of Pollution by Garbage from Ships) and Marine Order 95 (Marine Pollution Prevention – Garbage), including: • Putrescible waste will be discharged while the vessel is moving and ≥12 nm from the nearest land; or • Putrescible waste will pass through a comminuter or grinder capable of passing through a screen with no opening wider than 25 mm in diameter prior to discharge and discharged while the vessel is moving and ≥3nm from the nearest land.	**EPS 143**: When food wastes have been comminuted or ground down to less than 25 mm, the discharge of this waste can occur when further than 3 NM from the nearest land as per MARPOL Annex V.	Pre-mobilisation vessel audit and inspection records confirm that macerator is onboard, functional and in use. Discharge logs confirm that any discharges of processed food wastes are compliant with MARPOL Annex V and Marine Order 95.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 144: When food wastes have not been comminuted or ground down to less than 25 mm, the discharge of this waste can occur when further than 12 NM from the nearest land as per MARPOL Annex V.	Discharge logs confirm that any discharges of unprocessed food wastes are compliant with MARPOL Annex V and Marine Order 95.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 145: Any vessel used for the Seismic Survey over 100 gross tonnes or certified to carry 15 or more persons will hold and maintain a Garbage Management Plan for minimising, collecting, storing, processing and disposing of garbage, including the use of equipment on board, as per MARPOL Annex V and Marine Order 95.	A pre-mobilisation vessel audit and inspection confirms a valid Garbage Management Plan is in place, in accordance with MARPOL Annex V and Marine Order 95.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 146: All permissible waste discharges will be recorded within the vessel's discharge log.	Discharge logs confirm that any planned discharges of processed and unprocessed oil, sewage and waste have been recorded.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
Equipment/machinery involved in the treatment of wastes, such as oil discharge monitoring and control systems, oil filters and communiters, will be routinely maintained and calibrated, as per the manufacturers guidelines, to ensure they operate effectively.	**EPS 147**: Equipment/machinery involved in the treatment of wastes, such as oil discharge monitoring and control systems, oil filters and communiters, will be maintained and calibrated, as per the manufacturers guidelines, to ensure they operate effectively.	Maintenance logs confirm appropriate maintenance. A pre-survey vessel audit and inspection confirms that equipment involved in the treatment of wastes has undergone appropriate maintenance.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
Equipment/machinery involved in the treatment of wastes will be operated by trained crew who will be instructed at the pre-survey environmental induction on how to comply with the requirements of this EP.	**EPS 148**: Equipment/machinery involved in the treatment of wastes will be operated by trained crew who will be instructed at the pre-survey environmental induction on how to comply with the requirements of this EP.	Induction records show Environmental Induction includes instruction on the operation of waste treatment equipment/machinery and meeting the requirements of this EP. Induction records confirm vessel crew attended and Environmental Induction.	Vessel crew SLR Environmental Consultant SLB QC and HSE Representative Survey Environmental Advisor Vessel Master

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
The vessel crew will be made aware of their crew will be made aware of their responsibilities with regard to the management of routine permissible waste discharges to the marine environment during the environmental induction.	**EPS 149**: The vessel crew will be made aware of their crew will be made aware of their responsibilities with regard to the management of routine permissible waste discharges to the marine environment during the environmental induction.	Induction records show Environmental Induction includes instruction on the operation of waste treatment equipment/machinery and meeting the requirements of this EP. Induction records confirm vessel crew attended and Environmental Induction.	Vessel crew SLR Environmental Consultant SLB QC and HSE Representative Survey Environmental Advisor Vessel Master
All storage areas for hazardous substances will be designed and maintained to support some form of containment/bunding.	**EPS 150**: Hazardous materials (e.g., hydrocarbons and cleaning chemicals) storage areas will be fully contained/bunded.	A pre-mobilisation vessel audit and inspection confirms that hazardous materials storage areas are fully contained/bunded/	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 151: Spill response kits will be stored nearby the storage location of hazardous substances to support effective clean-up if a spill does occur.	A pre-mobilisation vessel audit and inspection confirms the availability and location of spill response kits.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
Deck scupper plugs will be available beside all deck drainage points that lead overboard.	**EPS 152**: Scupper plugs, or equivalent drainage control measures, will be readily available to allow drains to be blocked in the event of a hydrocarbon or cleaning chemicals spill to deck (i.e., outside bunded area).	A pre-mobilisation vessel audit and inspection confirms the availability and location of scupper plugs.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
Display of signage notifying vessel crew of disposal requirements.	**EPS 153**: Display of signage notifying vessel crew of disposal requirements.	A pre-mobilisation vessel audit and inspection confirms signage consistent with the requirements of this EP has been developed.	Vessel crew Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
There will be no planned discharge of routine permissible wastes within the boundaries of any Australian Marine Park.	**EPS 154**: Planned routine permissible discharges will not occur within Australian Marine Parks.	Discharge logs confirm that discharges have not occurred within the boundaries of Australian Marine Parks.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master.
	EPS 155: Shape files will be loaded onto the survey vessels' navigation system outlining exclusion areas within which permissible wastes cannot be discharged, against the boundary extents of the OA and AA.	Discharge logs confirm that discharges have occurred outside of the boundaries of Australian Marine Parks. Vessel track records. Exclusion polygons on survey vessel's navigation system.	SLB Project Manager SLB QC and HSE Manager Vessel Master Survey Environmental Advisor

7.3.7 Routine Permissible Waste Discharge Impact and Risk Summary

Based on the assessment above, including the identification of potential impacts on the environment and the associated control measures to be implemented, the residual risk of routine permissible waste discharges during the Seismic Survey is considered to be **Negligible**.

The suite of control measures to be implemented have been developed in accordance with Industry Best Practice and relevant legislation. Consequently, it is considered that the environmental impacts and risks on the marine environment and receptors arising from routine permissible waste discharges are reduced to **ALARP**.

In accordance with the acceptability requirements prescribed in **Section 6.4**, the suite of control measures are considered appropriate to manage the risks and impacts arising from routine permissible waste discharges during the Seismic Survey on all receptors to an **Acceptable Level**.

7.4 Atmospheric Emissions

7.4.1 Description of Source of the Impact and Risk

The combustion of exhaust gasses from mechanical equipment (engines, generators, winches, power-units, plant machinery etc.) and incineration of wastes represent the principal sources of potential atmospheric emissions during the Seismic Survey. Most of these gaseous emissions will be in the form of carbon dioxide (**CO_2**) and carbon monoxide (**CO**); however, smaller quantities of other gasses such as methane (**CH_4**), nitric oxide (**NO**), nitrogen dioxide (**NO_2**) and sulphur dioxide (**SO_2**) may be emitted particularly during any incomplete combustion.

Fugitive gas emissions comprise both greenhouse gases (**GHG**) such as CO_2 and CH_4 and non-GHG such as CO, NO, NO_2, SO_2.

Vessels used during the Seismic Survey may have Ozone Depleting Substances (**ODS**) onboard. However, if these ODSs are onboard the vessel, they will be within closed loop systems, such as rechargeable refrigeration systems, and will not be discharged deliberately.

7.4.2 Evaluation of Known and Potential Impacts and Risks to Environmental Receptors

Using the information presented in **Section 2** to **Section 5**, the impact and risk assessment has been undertaken for those receptors determined to be relevant to the activity as listed in **Table 79.**

Table 79 Environmental Receptors Assessed

Receptor	Section reference
Marine Environmental Quality	**Section 7.4.2**
Seabirds	

The known and potential impacts on air quality from atmospheric emissions will be a minor deterioration of local air quality due to the emissions of pollutants from the burning of hydrocarbons. Atmospheric emissions from the vessels, onboard equipment and incineration of wastes can cause a reduction in air quality in the localised area around the vessels. GHG emissions such as these are linked to climate change, and atmospheric emissions are also related to a reduction in ambient air quality; leading to human health issues in populated areas such as pulmonary disease, cardiovascular disease and cancer (Steiner *et al*., 2016).

The volume of the emissions associated with this Seismic Survey will centre around the vessels and be relatively small in terms of the wider environment (which could be up to 30 m^3 per day of fuel usage as per **Section 3.4.4**). Due to the open ocean nature of the OA and the variable, moderate wind conditions the emissions from the vessels are likely to be quickly dispersed into the atmosphere and will not impact on the onshore/nearshore interests/communities. In addition, the constant movement of the vessels will ensure that the discharge is not occurring in a single location for any significant period of time.

Potential receptors therefore include seabirds and migratory shorebirds which may traverse the OA whilst foraging or on route between staging sites and foraging grounds, and humans in the immediate vicinity of the vessel during discharge events.

The main control measures (detailed below in **Section 7.4.3**) relate to the compliance with MARPOL Annex VI, and the use of MGO instead of Heavy Fuel Oil (**HFO**). It is considered that the consequence of this activity occurring is *Negligible*, with the likelihood of this consequence occurring being *Likely*. This results in a residual risk of **Negligible**.

7.4.3 Decision Context

The decision context for Atmospheric Emissions has been assessed as Type A for all receptors, given the predicted impacts and risks are well understood and uncertainty is minimal, with little or no interest from relevant persons.

7.4.4 Identification of Control Measures, Residual Risk Assessment and Demonstration of ALARP

The control measures that will be implemented during the Seismic Survey to manage the impacts from atmospheric emissions to **ALARP** have been included in **Table 81**. SLB has considered a number of control measures to determine the benefits of their implementation towards risk reduction (**Table 81**), based on a Hierarchy of Controls methodology (**Table 80**). The control measures that will be adopted are those that have been assessed and characterised as effective and practicable to implement.

Table 80 Hierarchy of Control Measures for Atmospheric Emissions

Eliminate	Fuel use and its associated atmospheric emissions cannot be eliminated as fuel is a fundamental requirement for the operation of the survey vessels. Deliberate discharge of ODS will be eliminated during the Seismic Survey as outlined in **Table 81**.
Substitute	As outlined within **Table 81**, the survey vessels will use MGO to power their engines, rather than other fuels such as HFO. Although the cost of using MGO is higher than that of HFO, the reduction in sulphur content is considered an important step in managing impacts to **ALARP**. No other alternative fuel sources are currently commercially viable for larger vessels.
Reduce	Similar to the discussion around substitution above, the use of MGO will reduce the contaminants discharged from the combustion engines on the vessels in order to meet the requirements of Marine Order 97, the PSPPS Act and MARPOL Annex VI.
Mitigate	The control measures within **Table 81** have been assessed to ensure that they mitigate the impacts from atmospheric emissions to **ALARP**. This is primarily done through the implementation of measures required under Marine Order 97, the PSPPS Act and MARPOL Annex VI.

Table 81 Assessment of Control Measures for Atmospheric Emissions

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Legislative Requirements:			
The Seismic Survey will be undertaken in accordance with the approved EP.	P = Yes E = Effective	All vessels undertaking an offshore activity in waters between 3 and 200 NM must undertake that activity in line with an approved EP. The approved EP outlines the measures that will be taken to ensure that environmental effects from the activity will be reduced to **ALARP** and **Acceptable Levels**, including the management of atmospheric emissions.	Yes
Compliance with: MARPOL Annex VI (Regulations for the Prevention of Air Pollution from Ships). Protection of the Sea (Prevention of Pollution from Ships) Act 1983. Marine Order 97 (Air Pollution): • Vessels >400 tonnes require a certificate to demonstrate that they comply with the requirement to prevent unnecessary air pollution; • The vessel engines do not emit excess Nox emissions; • Incinerators used are of an approved standard and it is operated correctly; • Vessels must comply with a plan for energy efficiency and implement a Ship Energy Efficiency Management Plan (**SEEMP**); • Vessels shall not emit excess sulphur emissions; • Noxious and toxic substances shall not be emitted through combustion of illegal substances; and • ODS shall not be deliberately released.	P = Yes E = Effective	It is a legislative requirement to meet the relevant aspects of MARPOL Annex VI, the PSPPS Act and Marine Order 97.	Yes
Good Industry Practice			
Vessels will use MGO grade fuel during the survey.	P = Yes E = Effective	The vessels associated with the Seismic Survey will be utilising MGO grade fuel in order to reduce the pollutants from the combustion engines. AS of 1 January 2020, the new limit for sulphur in fuel oil used on-board vessels is 0.50% m/m. MGO usually has less than 0.2% sulphur which aids in meeting the requirements of the legislation outlined in the control measure above. Good industry practice, environmental benefit outweighs additional cost.	Yes
Fuel consumption will be recorded and monitored for abnormal consumption, with corrective action taken if necessary.	P = Yes E = Effective	While fuel consumption throughout the Seismic Survey is inevitable, abnormal consumption results in additional atmospheric emissions as well as additional costs. Good industry practice, environmental benefit outweighs additional cost.	Yes
All combustion and incineration machinery will be appropriately maintained as per the manufacturer's guidelines.	P = Yes E = Effective	Routine maintenance ensures that machinery is running in accordance with the manufacturer's specifications, reducing excess emissions. Good industry practice, environmental benefit outweighs additional cost.	Yes
Only wastes approved by the vessel's Garbage Management Plan will be incinerated and no oil or other noxious substances will be incinerated.	P = Yes E = Effective	Incineration of materials not approved by the Garbage Management Plan may lead to the release of toxic emissions and will not be compliant with MARPOL. Good industry practice, environmental benefit outweighs additional cost.	Yes
Incineration will only occur when the vessel is a distance greater than 12 NM from shore.	P = Yes E = Effective	Incineration of wastes beyond 12 NM from shore will not result in any emissions that will make their way to shore, nor will any emissions be visible from shore. Good industry practice, environmental benefit outweighs additional cost.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Alternatives/Substitutes Controls Considered:			
No incineration on vessels.	P = No E = Effective	Incineration of wastes on vessels is a standard industry practice and negates the need for additional visits from supply vessels to remove waste. The storage of wastes onboard the survey vessels have added risks to human health.	No
Use of alternative fuels to power vessels.	P = No E = Effective	Alternative fuel sources include solar, wind, and biofuels. Such fuel sources have not been commercially proven for vessels and helicopters such as those that will be used during the Seismic Survey.	No
Use of incinerators and engines with higher environmental efficiency.	P = No E = Effective	There are significant costs associated with modifying vessel equipment such as incinerators and engines. The costs are grossly disproportionate to the low environmental benefit gained from limited improvements in air quality that may result.	No
Additional Controls Considered:			
Non-essential machinery will be routinely shut-down on survey vessels.	P = Yes E = Limited	Due to the limited benefit gained from shutting-down non-essential machinery, and the limited risk associated with atmospheric emissions, this control was determined to be unnecessary.	No
Eliminate atmospheric emissions during operation.	P = No E = Effective	Vessels are required for the Seismic Survey to collect data. Without vessels, the survey would not be able to occur.	No
Residual Risk of Impact (Receptor)	**Consequence**	**Likelihood**	**Residual Risk Ranking**
Marine Environmental Quality	Negligible	Likely	Negligible
Seabirds	Negligible	Likely	Negligible
ALARP Statement			
The decision context has been assessed as Type A and the overall residual risk has been determined to be Negligible. SLB considers the adopted control measures are appropriate to manage the impacts of Atmospheric Emissions during the Seismic Survey. The proposed control measures have been developed in accordance with the legislative requirements and good industry practice and taking into account the specific environmental, social, economic and cultural characteristics of the OA. No effective and practicable alternative or additional control measures were identified as part of the assessment process. Therefore, the predicted impacts to receptors from Atmospheric Emissions are reduced to **ALARP.**			

7.4.5 Impact and Risk Acceptability

Table 82 Demonstration of General Impact and Risk Acceptability for Atmospheric Emissions

Criteria for Acceptance	Acceptability Summary
Residual Risk Ranking	The Residual Risk has been determined to be Negligible
Ecologically Sustainable Development	The management of the Impacts and risks associated with atmospheric emissions proposed by SLB can be carried out in compliance with the five principles of ecologically sustainable development as defined within the EPBC Act. These principles have been considered as part of the development of this EP and risk assessment process. The assessment has not identified any adverse impacts to the principles of ESD, with no threats of serious or irreversible damage, no impacts to biological diversity and ecological integrity, no degradation of inter-generational equity, or negative effects on the social and economic integrity in the short or long-term.
SLB's Internal Context	The proposed management of atmospheric emissions is consistent with SLB's QHSE Policy.
Existing Environmental Context	Based on the proposed control measures to be implemented, it is considered that atmospheric emissions will not result in a significant impact on environmental values or sensitivities within the OA, including seabird species and migratory shorebirds which may traverse the OA and be temporarily exposed to atmospheric emissions. It is considered that the proposed control measures provide appropriate protection to marine fauna and other marine users from the potential effects associated with atmospheric emissions. A number of control measures were considered as part of the assessment process, and it was concluded that the addition of any further control measures not already considered would provide little or no additional protection.
External Context – Management Plans, Species Recovery Plans and Conservation Advice	The residual risk of the atmospheric emissions has been determined to be Negligible, and will not have a significant impact on a matter of national environmental significance in accordance with EPBC Act Policy Statement 1.1. **Draft Wildlife Conservation Plan for Seabirds** Point source atmospheric emissions as a result of the Seismic Survey are predicted to cause negligible effects to seabirds which may traverse the OA. The Draft Wildlife Conservation Plan for Seabirds does not identify, short-term, point source atmospheric emissions as a threat to seabird populations. The activity is, therefore, considered consistent with the objective of facilitating conservation of seabird populations. Consideration to the effects of chronic atmospheric emissions will be achieved through the implementation of the SEEMP. AMP Values, Management Prescriptions and IUCN Reserve Management Principles The management prescriptions for AMPs do not include information on atmospheric emissions from commercial vessels. **Conservation values and objectives of the North-west Marine Parks Management Plan** Atmospheric Emissions are not expected to impact significantly on the environmental values or sensitivities of the North-west Marine Region at a local or regional level.
Social Acceptance – Relevant Person Expectations	During consultation with relevant persons no concerns were raised in regard to possible impacts from atmospheric emissions, and as such no additional control/mitigation measures were expected or put in place as a result. Consequently, the environmental impacts relating to atmospheric emissions from the survey vessels were considered to be at a socially **Acceptable Level**.
External Context – Commonwealth and State Legislative Criteria	SLB will ensure the Seismic Survey air emissions will comply with the relevant legislative requirements and applicable international conventions, including: • MARPOL 73/78 Annex VI Prevention of Air Pollution by Ships; • PSPPS Act, 1983 (Part IIID Prevention of Air Pollution); • Maritime Legislation Amendment (Prevention of Air Pollution from Ships) Act 2007; • Marine Orders Part 97 (Marine Pollution Prevention – air pollution); • Marine Notice 11/2015 Measure to Reduce Greenhouse Gas Emissions from International Shipping; and • Marine Notice 05/2017 Regulations for Air Emissions from Ships.

Criteria for Acceptance	Acceptability Summary
Industry Best Practice	The control measures are based on industry best practice and best practice guidelines, including: • The IAGC Environmental Manual for Worldwide Geophysical Operations which provides guidance on engine emissions, including: • Ensuring vessels are fitted with appropriate emission monitoring and control systems to meet applicable flag state and vessel design class requirements; • Servicing of exhaust systems occurs on a regular basis to ensure that noise and emissions are kept to appropriate levels (no unburned fuels and exhaust gases to create localised pollution); • Require low-sulphur MGO; and • The APPEA Code of Environmental Practice includes an objective to reduce greenhouse gas emissions to an **Acceptable Level** and reduce the risk of impacts to **ALARP**.
ALARP	Total elimination of all impacts associated with atmospheric emissions cannot be achieved, as engines must be used onboard the vessel and there are no practicable alternatives. Following the implementation of the control measures the potential impacts to the environment from atmospheric emissions are likely to be localised in nature and short-term given the relative spatial extent of the vessel's trajectory across the total OA and the duration of the Seismic Survey. Based on the discussions within the EP, including the potential impacts on the environment and the associated control measures to be implemented, the residual risk from atmospheric emissions from the survey vessels is considered **Negligible** and to **ALARP**. Therefore, the impacts and residual risk from this activity associated with the Seismic Survey are considered to be at an **Acceptable Level**.

Acceptability Statement
Impacts and risks classified as 'Type A' or above are considered acceptable if the requirements in **Table 40** can be demonstrated and if the level of residual impact and risk are determined to be Moderate or less. Based on the above evaluation, the potential impacts from Atmospheric Emissions meets the requirements of the impact and risk acceptability criteria. The control measures that will be implemented throughout the Seismic Survey have been developed in accordance with these criteria and are considered appropriate to manage the impacts of Atmospheric Emissions on all identified receptors to an **Acceptable Level.**

7.4.6 Environmental Performance

Table 83 Environmental Performance Outcomes, Standards and Measurement Criteria for for Atmospheric Emissions

Number	Environmental Performance Outcome	Environmental Performance Standard
EPO 19	No release of unplanned objects, emissions or discharges to sea or air	**EPS 156** to **EPS 168**
EPO 20	All unplanned atmospheric emissions produced during the survey (including GHF, NO_X,SO_X, CO, CO_2 and particulates) meet or exceed the requirements MARPOL Annex VI and Marine Order 97.	**EPS 156** to **EPS 163**

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
The Seismic Survey will be undertaken in accordance with the approved EP.	**EPS 156**: The Seismic Survey may only commence following acceptance of the EP by NOPSEMA.	Pre-mobilisation audit and inspection are completed prior to operations and confirm an accepted EP has been obtained. Audit records verify compliance with the requirements of the EP.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 157: The Seismic Survey will be undertaken in accordance with the accepted EP.	Bridge logs verify compliance with the requirements of the EP. Audit records verify compliance with the requirements of the EP.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
Compliance with: MARPOL Annex VI (Regulations for the Prevention of Air Pollution from Ships). Protection of the Sea (Prevention of Pollution from Ships) Act 1983. Marine Order 97 (Air Pollution): • Vessels >400 tonnes require a certificate to demonstrate that they comply with the requirement to prevent unnecessary air pollution; • The vessel engines do not emit excess Nox emissions; • Incinerators used are of an approved standard and it is operated correctly; • Vessels must comply with a plan for energy efficiency and implement a Ship Energy Efficiency Management Plan (**SEEMP**); • Vessels shall not emit excess sulphur emissions; • Noxious and toxic substances shall not be emitted through combustion of illegal substances; and • ODS shall not be deliberately released	**EPS 158**: All vessels used in the Seismic Survey over 400 gross tonnage will hold an International Air Pollution Prevention Certificate (**IAPP Certificate**) as per the requirements of Marine Order 97 and MARPOL Annex VI.	A pre-mobilisation vessel audit and inspection confirms IAPP Certificate is valid.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 159: The engines in the vessels used for the Seismic Survey will meet the prescribed Nox emission levels set within Marine Order 97 and MARPOL Annex VI.	A pre- mobilisation vessel audit and inspection confirms the vessel engines meet the specifications required to operate in accordance with the Marine Order 97 and MARPOL Annex VI.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 160: The Sox content of the fuel used within the survey vessels will not exceed the limits set within Marine Order 97, the PSPSS Act and MARPOL Annex VI.	Fuel data sheet confirms low sulphur content. A pre-mobilisation vessel audit and inspection confirms the Sox content of fuel used within the survey vessels is compliant with Marine Order 97, the PSPSS Act and MARPOL Annex VI.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 161: All vessels used during the Seismic Survey over 400 gross tonnage will have, and comply with, a SEEMP as per Marine Order 97 and MARPOL Annex VI.	A pre-mobilisation vessel audit and inspection confirms a SEEMP is in place. Monitoring in accordance with the SEEMP demonstrates compliance with the SEEMP. Bridge logs demonstrate compliance with the SEEMP.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 162: Any Incineration onboard the vessels will be undertaken in accordance with Marine Order 97 and MARPOL Annex VI, including the prohibition of incinerating noxious and hazardous substances.	Incineration Logs demonstrate compliance with Marine Order 97 and MARPOL Annex VI	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 163: An ODS Record Book will be maintained if the Seismic Vessel has a rechargeable system that contains ODS as per the PSPPS Act and confirms no planned ODS discharges have occurred.	Where required, A pre-survey vessel audit and inspection confirms an ODS Record Book is available and confirms no planned ODS discharges have occurred.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
Vessels will use MGO grade fuel during the survey.	**EPS 164**: MGO is the primary fuel for vessels associated with the Seismic Survey.	The Bunker Note confirms MGO is the primary fuel for use within survey vessels. Oil usage records show MGO fuel is used.	SLB Project Manager SLB QC and HSE Representative Survey Environmental Advisor Vessel Master
Fuel consumption will be recorded and monitored for abnormal consumption, with corrective action taken if necessary.	**EPS 165**: Fuel use will be recorded and monitored for excessive fuel consumption, with corrective action taken if necessary.	Bridge log confirms fuel use is consistent with the SEEMP. Where excessive fuel consumption is identified, records show the processes for Management of Non-Conformances are followed.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
All combustion and incineration machinery will be appropriately maintained as per the manufacturer's guidelines.	**EPS 166**: All combustion and incineration machinery will be appropriately maintained as per the manufacturer's guidelines.	Maintenance logs confirm appropriate maintenance. A pre-mobilisation vessel audit and inspection confirms that combustion and incineration machinery has undergone appropriate maintenance.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
Only wastes approved by the vessel's Garbage Management Plan will be incinerated and no oil or other noxious substances will be incinerated.	**EPS 167**: Only wastes approved by the vessel's Garbage Management Plan will be incinerated and no oil or other noxious substances will be incinerated.	Incineration Log demonstrate compliance with the Garbage Management Plan.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
Incineration will only occur when the vessel is a distance greater than 12 NM from shore.	**EPS 168**: Incineration will only occur when the vessel is a distance greater than 12 NM from shore.	Incineration Logs (and where required AIS tracking data) demonstrate compliance.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master

7.4.7 Atmospheric Emissions Impact and Risk Summary

Based on the discussions above, including the potential impacts on the environment and the associated control measures to be implemented, the residual risk from atmospheric emissions generated from the survey vessels and on-board waste incineration is considered **Negligible.**

The suite of control measures to be implemented have been developed in accordance with Industry Best Practice and relevant legislation. Consequently, it is considered that the environmental impacts and risks on the marine environment and receptors arising from atmospheric emissions are reduced to **ALARP**.

In accordance with the acceptability requirements prescribed in **Section 6.4**, the suite of control measures are considered appropriate to manage the risks and impacts arising from atmospheric emissions during the Seismic Survey on all receptors to an **Acceptable Level**.

7.5 Artificial Light Emissions

7.5.1 Description of Source of the Impact and Risk

Artificial lighting is required on the survey vessels for the health and safety of crew onboard (e.g. deck lighting for night operations) and for safe navigation of vessels underway at sea at night and in poor weather conditions. Different navigation lights are required specific to that particular vessel and size, as well as whether the vessel is engaged in towing and restricted in its ability to manoeuvre.

The primary sources of artificial lighting in the offshore marine environment during the Seismic Survey will result from the deck and navigational lights onboard the survey vessels. Deck areas need to be lit at all times for personnel safety, with deck lighting typically consisting of bright white lights focused on working areas. Spot lighting may be required for in-sea inspection, deployment, and retrieval of survey equipment. Navigational lights are typically elevated on the vessel, outwards facing, and of lesser intensity than deck lighting.

7.5.2 Evaluation of Known and Potential Impacts and Risks to Environmental Receptors

Using the information presented in **Section 2** to **Section 5**, the impact and risk assessment has been undertaken for those receptors determined to be relevant to the activity as listed in **Table 84**.

Table 84 Environmental Receptors Assessed

Receptor	Section reference
Fish, Sharks, Rays	**Section 7.5.2.1**
Marine Mammals	**Section 7.5.2.2**
Marine Reptiles	**Section 7.5.2.3**
Seabirds	**Section 7.5.2.4**

Artificial light at night (**ALAN**) is a recently acknowledged form of anthropogenic pollution which is rapidly expanding in the marine environment (Davies *et al.,* 2014; Gaston *et al.,* 2021; Tidau *et al*., 2021). ALAN affects marine organisms as it introduces light in places, times and at intensities which it does not naturally occur, and is introducing light with a spectrum that is different from that of natural sources (i.e. sunlight, moonlight or starlight) (Gaston *et al*., 2015). Artificial light can disrupt critical behaviour (e.g. migrations) and cause physiological changes in wildlife, potentially stalling the recovery of a threatened species (Commonwealth of Australia, 2020). Disorientation and behaviour modifications are the two main modes through which ALAN is known to affect marine fauna and are the focus of this EP; however physiological changes are discussed for fish and benthic communities.

Artificial lighting on vessels at sea can attract and disorientate marine animals and affect their physiology (Davies *et al.,* 2014; Poot *et al*., 2008). The effects of artificial light can be particularly high for juvenile animals such as turtles and fledgling seabirds/novice flyers in coastal locations (Telfer *et al*., 1987), and artificial lighting has been linked to an increased risk of bird collision with vessels (particularly their rigging) (Black, 2005).

The combination of colour, intensity, closeness, direction, and persistence of light source are key factors in determining the magnitude of environmental impacts (WA EPA, 2010; Commonwealth of Australia, 2020). For example, artificial lights that are fixed or stationary in the marine environment have been shown to attract aggregations of zooplankton and then baitfish and/or squid, which are prey for higher trophic order species that take advantage of these aggregations for feeding (Golder, 2007). Increased amounts of light at night in the marine environment can also possibly be detrimental to marine mammals by allowing predators to see the mammals more easily during normally dark night times.

The potential adverse impacts on marine fauna associated with artificial light emissions is well understood, as is reflected in the development of State and Commonwealth guidelines designed to mitigate the effects from these activities (WA EPA 2010; Commonwealth of Australia 2020). The National Light Pollution Guidelines for Wildlife recommends using Best Practice Lighting Design to reduce light pollution and minimise the effect on wildlife and undertaking an ERA for effects on listed species for which artificial light has been demonstrated to affect behaviour, survivorship or reproduction, and where there is important habitat within 20 km of a project (Commonwealth of Australia, 2020).

According to the National Light Pollution Guidelines for Wildlife (Commonwealth of Australia 2020), a 20 km distance threshold provides a precautionary limit based on observed effects of sky glow on marine turtle hatchlings demonstrated to occur at 15 – 18 km and grounding behaviour of fledgling seabirds in response to artificial light 15 km away. Although, the effect of light glow may occur at distances greater than 20 km for some species and under certain environmental conditions (Commonwealth of Australia, 2020).

Potential receptors therefore include fish, sharks and rays, marine turtles, seabirds and migratory shorebirds. As cetaceans predominantly utilise acoustic senses to monitor and navigate their environment, impacts are considered to be unlikely. However, an assessment of potential impacts to marine mammals has been undertaken in **Section 7.5.2.2**, below.

7.5.2.1 Bony Fish and Elasmobranchs

The response of fish to artificial light varies according to species and habitat; for example, it can throw off fine-tuned nocturnal behaviours such as navigation, hunting patterns or the ability to forage while evading predators (Milicich *et al*., 1992; Meekan *et al*., 2001). Lindquist *et al*. (2005) concluded from a study that artificial lighting associated with offshore oil and gas activities resulted in an increased abundance of clupeids (herring and sardines) and engraulids (anchovies) around lighted structures; these species are known to be highly photopositive. Attraction of fish to light may result in an increase in predation from larger fish and sharks on prey species, or exclusion of nocturnal foragers/predators aggregating in the immediate vicinity of the vessels at night (Marchesan *et al*., 2006). These aggregations are generally considered to be localised and not associated with long-term changes to fish abundances or distributions.

Light emissions within the OA will be highly localised, short term and not stationary limiting the ability to result in a behavioural response by fishes in the area. Moreover, the sound emissions from the survey vessel and support vessels would be expected to provide a deterrent to bony fish and elasmobranchs (see **Section 7.2.2**)

It is considered that the consequence of artificial lights on bony fish and elasmobranchs within the OA (including for commercially important species retained as part of the NDSF, MMF and Indonesian Commercial Fisheries) is minor; with any effects to be localised, short-term ceasing when the activity ceases and no detectable adverse effects to the population expected.

Based on available evidence, it is considered unlikely (uncommon but has been known to occur elsewhere) artificial lights o may impact bony fish and elasmobranchs.

As such, the residual risk of negative impacts to bony fish and elasmobranchs due to artificial lights associated with the MSS has been assessed as **Low** (*Minor x Unlikely*) (**Table 38**).

7.5.2.2 Marine Mammals

Many marine mammals have evolved specialised sight or acoustic techniques to enable successful hunting/prey capture in low light, while others are reliant on suitable levels of light and clear water to enable capture. Cetaceans for example use echolocation as their primary sense for locating and hunting prey, followed by visual means at close range (Simmonds *et al.*, 2004). Artificial lights that are fixed or stationary in the marine environment often attract aggregations of zooplankton and then baitfish and/or squid which are prey for species of pinnipeds and dolphins that take advantage of these aggregations for feeding (Golder, 2007). Increased amounts of light at night in the marine environment can also possibly be detrimental to marine mammals by allowing predators to see the mammals more easily during normally dark night times. However, a number of studies have been undertaken on the effects of artificial lighting from oil and gas exploration activities in the Great Australian Bight Marine Park on sea lions and cetaceans and concluded that any impacts would be insignificant (Pidcock *et al*., 2003), and similar studies in NW Australia and Canada have found no evidence that cetacean feeding and breeding was being impacted from offshore installations (BHP Billiton, 2005).

The residual risk of artificial light emissions on marine mammals from vessels associated with the Seismic Survey has been assessed as **Negligible** (*Negligible* x U*nlikely*).

7.5.2.3 Marine Reptiles

As discussed in **Section 4.5.5**, the flatback turtle, green turtle, hawksbill turtle, olive ridley turtle and loggerhead turtle are known to occur within the NWMR, each of which are listed species under the EPBC Act as either endangered or vulnerable. Of these species, two are known to nest along emergent land within the EMBA. The nearest marine turtle nesting habitat, and therefore critical habitat, includes Cartier Island and Ashmore Reef Island, located between 100 and 140 km to the west of the OA. Here, green turtles' nest year-round but predominantly between November to March (**Section 4.5.5**).

Light cues from natural sources are used by both juvenile and adult turtles for navigation. Adult turtles prefer to nest in areas well away from human habitation, where the beaches are darkened, thus artificial lighting can deter turtles from approaching an area where they may have previously nested reducing the number of nests (Davies *et al*., 2014; Deda *et al.*, 2007; EPA, 2010) and beyond this the number of juveniles in such areas. Post hatching juvenile turtles need to make their way to the ocean and use visual cues to do so.

Artificial lighting can disorientate the juveniles sending them in the wrong direction which could lead to delays or even failure to reach the water, risking greater chances of predation or desiccation (Davies *et al*., 2014; Deda *et al*., 2007). However, offshore light sources will influence newly hatched juvenile turtles less than sources onshore, as offshore sources will attract the juveniles towards the ocean post hatching (Pendoley, 2005). Once at sea, juveniles continue to follow visual clues to navigate away from land and remain in the surface waters. Here, artificial light emissions can distract/disorientate the juveniles and lead them to follow false clues that limit dispersion, and the same artificial lighting can make them more visible to predators in the water (Salmon *et al.*, 1992).

The Environmental Protection Authority (**EPA**) *Environmental Assessment Guide No. 5 – Protecting Marine Turtles from Light Impacts* (EPA, 2010); the *Recovery Plan for Marine Turtles in Australia 2017-2027* (Commonwealth of Australia, 2017b), and the DoEE Species Profile and Threats Database have been considered as part of the preparation of this EP, and do not identify artificial light from vessels underway in the offshore marine environment as creating a risk for turtles. However, the EPA recommends that a darkness zone of at least 1.5 km from all significant rookeries be maintained in order to mitigate against any potential effects from lighting.

The National Light Pollution Guidelines for Wildlife (Commonwealth of Australia 2020) recommends a 20 km nominal distance from light source to important habitat be applied to protect the conservation value of natural darkness and mitigate potential impacts to marine turtles, as the observed effects of sky glow on marine turtle hatchlings have been demonstrated to occur at 15-18 km (Commonwealth of Australia 2020). The 20 km threshold provides a nominal distance at which artificial light impacts should be considered through an Environmental Impact Assessment (EIA) process, noting that the effects of light glow may occur at distances greater than previously reported.

Given the closest known breeding/nesting areas for marine turtles are located at Ashmore Reef and Cartier Island, situated approximately 100 – 140 km from the OA at their nearest point, there is limited propensity for artificial light to impact marine turtle breeding/nesting behaviour, including for more sensitive juveniles.

The residual risk of artificial light emissions on marine reptiles from the vessels associated with the Seismic Survey has been assessed as **Low** (*Minor* x *Unlikely*).

7.5.2.4 Seabirds

There are ten seabird species with BIAs reported to overlap the EMBA; however, none of which are located within the OA (see **Section 4.5.7**). Seabirds are known to commonly strike vessels lit with artificial light at night, particularly vessels with significant exposed rigging/lines. Artificially lit installations, vessels or structures also act to attract seabirds, particularly in otherwise dark areas and for migratory birds travelling at night (Poot *et al.*, 2008). From SLB's previous offshore MSSs in New Zealand and Australia, there have been no bird strikes during night-time.

As stated in the previous section on marine mammals, marine organisms such as zooplankton and small fish are often attracted to artificial light sources and these aggregations can create an enhanced food source for seabirds (Rich and Longcore, 2006). However, as the vessels will be continuously moving during the survey the attraction of zooplankton and baitfish will be highly unlikely to occur, particularly in comparison to fixed lighting sources (e.g., lighthouse, platforms, bridges, etc.).

Seabirds are vulnerable to artificial lighting during nocturnal activities which comprise the annual breeding cycle, through increased predation when leaving and returning to the nesting colony. Cianchetti-Benedetti *et al*., 2018 found artificial light disrupted adult nest attendance, affecting weight gain in chicks. Fledglings are considered more vulnerable to the impacts of artificial light than adults due to unfamiliarity, the immature development of ganglions in the eye at fledging and the potential connection between light and food (Montevecchi 2006 and Mitkus *et al*., 2018).

The National Light Pollution Guidelines for Wildlife (Commonwealth of Australia, 2020) recommends a 20 km nominal distance from light source to important habitat be applied to protect the conservation value of natural darkness and mitigate potential impacts to listed seabirds. Although a combined breeding and foraging BIA for the Lesser Frigatebird is located immediately south of the OA, it is anticipated that habitat important to the continuation of breeding/nesting behaviours is largely constrained to coastal and island environments upon which seabirds can nest. Therefore, the closest known breeding/nesting areas for seabirds are reported to be Ashmore Reef and Cartier Island, situated approximately 100 – 140 km from the OA at their nearest point. At this distance, there is limited propensity for artificial light to impact seabird breeding/nesting behaviours.

The Draft Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2019) characterised light pollution as a moderate risk to seabirds, having a minor impact on individuals but no effect at a population level. The guidance recommends mitigating against impacts of light pollution by boats at sea and around breeding colonies, though no specific management actions are prescribed.

The residual risk of artificial light emissions on seabirds from vessels associated with the Seismic Survey has been assessed as **Low** (*Minor* x *Unlikely*).

7.5.3 Decision Context

The decision context for Artificial Light Emissions has been assessed as Type A for all receptors, given the predicted impacts and risks are well understood and uncertainty is minimal, with little or no interest from relevant persons.

7.5.4 Identification of Control Measures, Residual Risk Assessment and Demonstration of ALARP

The control measures that will be implemented during the Seismic Survey to manage the impacts from atmospheric emissions to **ALARP** have been included in (**Table 86**). SLB has considered a number of control measures to determine the benefits of their implementation towards risk reduction (**Table 85**), based on a Hierarchy of Controls methodology (**Table 85**). The control measures that will be adopted are those that have been assessed and characterised as effective and practicable to implement.

Table 85 Hierarchy of Control Measures for Artificial Light Emissions

Eliminate	Collision prevention and maritime regulations require specific navigation lighting to be implemented. Likewise, provision of safe working conditions at night achieved through employing suitable deck lighting is required to minimise any health and safety incidents. As a result, artificial light emissions cannot be completely eliminated.
Substitute	Navigation lighting cannot be substituted given the requirements cited within the COLGREGs, Marine Order 21 and Marine order 30. Sufficient work lighting cannot be substituted either.
Reduce	Work lighting will be extinguished wherever possible when not required, and as far as practicable work lighting will be focused inwards.
Mitigate	Control measures have been assessed within **Table 86** in order to mitigate the impacts from artificial light emissions to **ALARP** levels. Those which are appropriate and are not impracticable or unfeasible due to disproportionately large costs will be implemented during the Seismic Survey. Likewise, those which do not diminish the safety of on-board operations and navigation will be implemented during the Seismic Survey.

Table 86 Assessment of Control Measures for Artificial Light Emissions

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Legislative Requirements:			
The Seismic Survey will be undertaken in accordance with the approved EP.	P = Yes E = Effective	All vessels undertaking an offshore activity in waters between 3 and 200 NM must undertake that activity in line with an approved EP. The approved EP outlines the measures that will be taken to ensure that environmental effects from the activity will be reduced to **ALARP** and **Acceptable Levels**, including the management of routine permissible waste discharges.	Yes
Adherence to the requirements of the national and international legislation, including the International Regulations for Preventing Collisions at Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the *Navigation Act 2012* and associated Marine Orders 21 and 30, including: • Appropriate use of lighting, navigation and radio communication at sea; • 24-hour bridge and radar watch by qualified watch-keepers.	P = Yes E = Effective	It is a legislative requirement to meet the relevant aspects of COLREGs, Marine Order 21 and Marine Order 30 as listed below: • COLREGs Part A (General) • COLREGs Part B (Sound and Light Signals) • COLREGs Part C (Lights and Shapes) • COLREGS Annex I (Positioning and technical details of lights and shapes) • Marine Order 21 (Safety of Navigation and Emergency Procedures) • Marine Order 30 (Prevention of Collisions)	Yes
Good Industry Practice:			
Artificial lighting is reduced to minimum levels, wherever practicable, whilst maintaining safe working conditions and navigation. Specifically, outwards facing lighting will reduced to minimum levels, wherever practicable.	P = Yes E = Effective	Outward facing lighting is required for navigation/safety/visibility at sea. Work lighting (e.g., in deck areas) will be directed inward as much as possible whilst still supplying the minimum adequate lighting required to maintain safe working conditions for all areas where crew are operating on deck. Navigation lighting to be compliant with relevant guidance for safe passage at sea and specific to each vessel and the activities it is conducting. Good industry practice, environmental benefit outweighs additional cost.	Yes
Development and implementation of Marine Fauna Mitigation Plan.	P = Yes E = Effective	One of the roles of the MFO/MMOs onboard the Seismic Vessel is to develop a Marine Fauna Mitigation Plan, to be submitted to SLB prior to the pre-mobilisation survey and audit commencing. This plan will demonstrate the following, at a minimum: • MFOs/MMOs are trained, dedicated and experienced • Responsibilities and authorities of MFOs/MMOs to ensure the plan is communicated and available to those roles that are required to implement the controls; • Communications protocols for relaying marine fauna observations to the Seismic Operator, Vessel Master and vessel crew as required. • Survey Plan – describes the proposed activity including location and timing, acoustic source and streamer configuration, equipment (vessels) and key geographic locations such as BIAs and nominated exclusion zones. • Implementation Plan – details how the marine fauna management controls within the EP will be implemented; • Handling procedures for the retrieval of marine fauna entangled in towed equipment or seabirds on the vessels' deck. Good industry practice, environmental benefit outweighs additional cost.	Yes
Seabird collisions (both fatal and non-fatal) with the survey vessels will be recorded.	P = Yes E = Partial	The National Light Pollution Guidelines recommends that bird strikes are recorded. All crew will be instructed to remain vigilant for seabird collisions with the survey vessels (such as grounding on the vessels deck) and any observed/discovered incidents will be recorded and reported within the final survey report. Good industry practice, environmental benefit outweighs additional cost.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Alternatives/Substitutes Controls Considered:			
Use of lighting sources with wavelengths that are less disruptive to marine organisms, as listed in the National Light Pollution Guidelines for Wildlife.	P = No E = No	Given the large variety of marine organisms that may be present, and that their varying sensitives to different light wavelengths, this control measure is not regarded as being practical and is likely to be of minimal overall benefit. The costs of replacing lighting are also considered disproportionate to any benefit gained.	No
Eliminate lighting.	P = No E = Very Effective	Adequate lighting is required for safe work of all crew onboard the vessels and navigation lighting is required for collision avoidance and visibility at sea. Safety costs are disproportionate to benefits.	No
Additional Controls:			
Inward/downward facing lighting only.	P = No E = Effective	Outward facing lighting is required for navigation/safety/visibility at sea, in accordance with the COLREGS, Marine Order 21 and Marine Order 30. It is a regulatory requirement to have appropriate navigation lighting on all vessels from sunset to sun rise. However, there are benefits to ensuring deck/workspace lighting is inward/downward facing to reduce light spill as far as reasonably practicable, see directional lighting control measure above.	No
Use of non-reflective, dark-colour surfaces.	P = No E = Effective	As the survey vessels have already been built, changes to the ship materials to follow all design principles of Best Practice Lighting Design would require a re-fit of the vessels. The costs of doing this would are considered disproportionate to any benefit gained	Yes
No acquisition during hours of darkness.	P = No E = Effective	This measure would effectively double the time to acquire the Seismic Survey. By extension, this would extend the duration of disturbance to sensitive environmental receptors and would increase potential conflict and displacement with commercial and recreational fishers. Additionally, vessels would remain at sea necessitating they display navigation lighting and provide safe amounts of deck lighting for crew even if not acquiring data (e.g., during darkness hours). Consequently, costs are considered disproportionate to benefits.	No
Data acquisition will only occurring outside of turtle nesting periods.	P = No E = Limited Effectiveness	As outlined in **Section 7.5.2.3**, the OA is located 80 km from any known turtle nesting or mating areas. Therefore, whilst the wider NWMR is an important breeding and foraging area for flatback turtles, green turtles, hawksbill turtles, olive ridley turtles, and loggerhead turtles, it is considered that any individuals encountered are likely to be transiting the area and should not be significantly affected from the survey given the relatively short duration and localised nature of acquisition across a given survey line and the transient nature of the Seismic Vessel as it moves throughout the OA. As discussed within **Section 7.5.1**, the light source will constantly be moving; any attraction, distraction or disorientation of marine organisms would be highly unlikely, particularly in comparison to a fixed light source. Therefore, any minor environmental gains from limiting data acquisition periods to outside of key nesting periods are considered to be at a disproportionally increased cost to the survey.	No
Use of filters over existing lighting.	P = No E = Partial	Filters can be fitted over lights to eliminate shorter light wavelengths. This control measure is not regarded as being practical and is likely to be of minimal overall benefit. The costs of fitting filters to ship lights are considered disproportionate to any benefit gained.	No

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Data acquisition will only occurring outside of seabird breeding/nesting periods.	P = No E = Limited Effectiveness	The constraints associated with and potential impacts of artificial lighting on seabird breeding/nesting are broadly comparable to those described above for marine turtles. Additionally, seabird breeding at sites such as Ashmore Reef occurs throughout the calendar year with species such as the Wedge-tailed shearwater breeding during spring and summer whereas the White-tailed Tropicbird has been reported to breed during May and October (DoEE, 2022). Therefore, this control measure is considered to provide limited overall benefit.	No
Residual Risk of Impact (Receptor)	**Consequence**	**Likelihood**	**Residual Risk Ranking**
Fish, Sharks, Rays	Minor	Unlikely	Low
Marine Mammals	Negligible	Unlikely	Negligible
Marine Reptiles	Minor	Unlikely	Low
Seabirds	Minor	Unlikely	Low
ALARP Statement			
The decision context has been assessed as Type A and the overall residual risk has been determined to range from Negligible to Low for the identified receptors. SLB considers the adopted control measures are appropriate to manage the impacts of Artificial Light Emissions during the Seismic Survey. The proposed control measures have been developed in accordance with the legislative requirements and good industry practice and taking into account the specific environmental, social, economic and cultural characteristics of the OA. No effective and practicable alternative or additional control measures were identified as part of the assessment process. Therefore, the predicted impacts to receptors from Artificial Light Emissions are reduced to **ALARP.**			

7.5.5 Impact and Risk and Acceptability

Table 87 Demonstration of General Impact and Risk Acceptability for Artificial Light Emissions

Criteria for Acceptance	Acceptability Summary
Residual Risk Ranking	The Residual Risk has been determined to range from Negligible to Low.
Ecologically Sustainable Development	The management of the impact and risks associated with artificial light emissions proposed by SLB can be carried out in compliance with the five principles of ecologically sustainable development as defined within the EPBC Act. These principles have been considered as part of the development of this EP and risk assessment process. The assessment has not identified any adverse impacts to the principles of ESD, with no threats of serious or irreversible damage, no impacts to biological diversity and ecological integrity, no degradation of inter-generational equity, or negative effects on the social and economic integrity in the short or long-term.
SLB's Internal Context	The proposed management of artificial light emissions is consistent with SLB's QHSE Policy.
Existing Environmental Context	Given that the survey vessels, and ultimately artificial light source, involved in the Seismic Survey will be constantly moving and the relatively low amounts of artificial light that will be emitted from the vessels, the impacts to the marine environment from artificial light emissions are likely to be short term, highly localised, and quickly recoverable. While the OA is located close to BIAs of several important marine turtle and seabird species, the levels of artificial light emission will be similar or less (with mitigation measures in place) to those generated from maritime traffic in the area associated with coastal shipping and fishing activity. The proposed control measures provide appropriate protection to the marine environment from artificial light emissions. Further/alternative control measures (such as no night-time acquisition) are considered to provide little or no further protection from artificial light emissions, while greatly increasing the duration and cost of the survey. Increases to the duration of the survey are particularly prohibitive as the increase the time environmental receptors are exposed to disturbance and also increase the potential for conflict and displacement with the fishing industry. As a result, no further/alternative control measures have been adopted.
External Context – Management Plans, Species Recovery Plans and Conservation Advice	The residual risk of the artificial light emissions has been determined to range between Negligible to Low and will not have a significant impact on a matter of national environmental significance in accordance with EPBC Act Policy Statement 1.1. The following Management Plans, Species Recovery Plans and Conservation Advices have been taken into consideration when determining the acceptability of effects of artificial light emissions: **Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017)** The recovery plan for marine turtles recommends that best practice light management is undertaken to minimise light impacts to marine turtles, so their behaviours are not changed, and they do not become displaced from important habitats. The closest marine turtle breeding/nesting BIA is Cartier Island, located approximately 100 km west of the OA. The lighting control measures proposed herein, and transient nature of the light source generated from the moving Seismic Vessel means that the planned survey approach is compliant with the objectives of the marine turtle recovery plan. The proximity of the OA to marine turtle foraging BIAs is not of concern, given that foraging is constrained to daylight hours when artificial light generated by the Seismic Vessel will be minimal. A darkness zone of at least 1.5 km from all significant rookeries is stated within the EPA Guideline #5 – Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts (EPA, 2010). Additionally, a 20 km distance threshold between light source and important sites is recommended to be maintained, according to the National Light Pollution Guidelines for Wildlife (Commonwealth of Australia 2020). Given that the closest marine turtle breeding/nesting BIA is Cartier Island, located approximately 100 km west of the OA, the Seismic Survey is compliant with the relevant EPA guidelines and Commonwealth Guidelines. The proposed activities are considered consistent with the objective of facilitating recovery of marine turtles. Draft Wildlife Conservation Plan for Seabirds 2019 The Draft Wildlife Conservation Plan for Seabirds objectives seek to manage and minimise the adverse impacts of anthropogenic disturbance to breeding and roosting seabirds and enhance contingency plans to prevent, respond to or remediate environmental emergencies that have an impact on seabirds and their habitats. Given there is no emergent land within the OA and the closest known seabird breeding/nesting site is Ashmore Reef, approximately 140 km west of the OA, the lighting control measures proposed herein, and transient nature of the light source generated from the moving Seismic Vessel means that the planned survey approach is compliant with the objectives of the conservation plan. The proximity of the OA to seabird foraging BIAs is not of concern, given that foraging is constrained to daylight hours when artificial light generated by the Seismic Vessel will be minimal. As is the case for marine turtles, a 20 km distance threshold between light source and important seabird habitat is recommended to be maintained, according to the National Light Pollution Guidelines for Wildlife (Commonwealth of Australia 2020). Given that the closest seabird breeding/nesting site is Ashmore Reef, located approximately 140 km west of the OA, the Seismic Survey is compliant with the relevant Commonwealth guidelines. The proposed activities are considered consistent with the objective of facilitating conservation of seabird populations. • Conservation Management Plan for the Blue Whale; • Approved Conservation Advice for *Megaptera novaeanliae* (humpback whale); and • Conservation Advice for Sei and fin Whales The conservation and management guidance does not identify artificial light pollution as a threat to relevant species and no management actions are prescribed. Artificial light emissions generated during the Seismic Survey are not predicted to impact blue whale, humpback whale, Sei or fin whales. The proposed activities are considered consistent with the conservation and recovery of relevant species. AMP Values, Management Prescriptions and IUCN Reserve Management Principles

Criteria for Acceptance	Acceptability Summary
	The management prescriptions for AMPs do not include information on artificial light emissions from commercial vessels. **Conservation values and objectives of the North-west Marine Parks Management Plan** Artificial Light Emissions are not expected to impact significantly on the environmental values or sensitivities of the North-west Marine Region at a local or regional level.
Social Acceptance – Relevant Person Expectations	No concerns were raised in regard to possible impacts from artificial light emissions, and, therefore, no additional control/mitigation measures were expected or put in place. As such the environmental impacts relating to light emissions from survey vessels were considered to be at a socially **Acceptable Level**.
External Context – Commonwealth and State Legislative Criteria	Lighting requirements for the Seismic Survey are determined by relevant legislative requirements (i.e., COLREGS, SOLAS, Marine Order 21 and Marine Order 30). Legislated requirements for safe working conditions and safe navigation will be met.
Industry Best Practice	The control measures to decrease artificial light emissions are based on industry best practice and best practice guidelines, including: • The IAGC Environmental Manual for Worldwide Geophysical Operations. Geophysical vessels must ensure that their emissions are kept to appropriate levels; and • The APPEA Code of Environmental Practice. Details within this document relate mainly to offshore operations such and offshore exploration/drilling and production facilities where light emissions are recommended to be reduced to **ALARP** and **Acceptable Levels**. A similar approach could feasibly be expected of survey vessels operating in offshore areas.
ALARP	Total elimination of all impacts associated with artificial lighting emissions cannot be achieved, as lighting must be used onboard the vessels to maintain safe operations and navigation and there are no practicable alternatives. Following the implementation of the control measures, the potential impacts to the marine environment and associated receptors from artificial light emissions are likely to be short term and localised. Based on the assessment within this EP, including the potential impacts on the environment and the associated controls measures to be implemented, the impact of artificial light emitted from the survey vessels is considered to be **Low** and reduced to **ALARP**. Therefore, the impacts and associated residual risk from this activity are considered to be at an **Acceptable Level**.

Acceptability Statement
Impacts and risks classified as 'Type A' or above are considered acceptable if the requirements in **Table 40** can be demonstrated and if the level of residual impact and risk are determined to be Moderate or less. Based on the above evaluation, the potential impacts from Artificial Light Emissions meets the requirements of the impact and risk acceptability criteria. The control measures that will be implemented throughout the Seismic Survey have been developed in accordance with these criteria and are considered appropriate to manage the impacts of Artificial Light Emissions on all identified receptors to an **Acceptable Level.**

7.5.6 Environmental Performance

Table 88 Environmental Performance Outcomes, Standards and Measurement Criteria for Artificial Light Emissions

Number	Environmental Performance Outcome	Environmental Performance Standard
EPO 21	Lighting is reduced to levels required to support safe navigation and on-board operations, so as to limit impacts from artificial light to individual non-listed, listed threatened, listed migratory or listed marine fauna protected under the EPBC Act to minor, short term effects and ensure biologically important behaviours can continue.	**EPS 169** to **EPS 176**

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
The Seismic Survey will be undertaken in accordance with the approved EP.	**EPS 169**: The Seismic Survey may only commence following acceptance of the EP by NOPSEMA.	Pre-mobilisation audit and inspection are completed prior to operations and confirm an accepted EP has been obtained. Audit records verify compliance with the requirements of the EP.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 170: The Seismic Survey will be undertaken in accordance with the accepted EP.	Bridge logs verify compliance with the requirements of the EP. Audit records verify compliance with the requirements of the EP.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
Adherence to the requirements of the national and international legislation, including the International Regulations for Preventing Collisions at Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the *Navigation Act 2012* and associated Marine Orders 21 and 30, including: • Appropriate use of lighting, navigation and radio communication at sea; • 24-hour bridge and radar watch by qualified watch-keepers.	**EPS 171**: Vessel navigational lighting and equipment is compliant with COLREGs, SOLAS and Marine Orders 21 and 30.	Vessel certification confirms compliance with applicable Regulations.	SLB Project Manager Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
Artificial lighting is reduced to minimum levels, wherever practicable, whilst maintaining safe working conditions and navigation. Specifically, outwards facing lighting will reduced to minimum levels, wherever practicable.	**EPS 172**: Vessel crews are instructed to reduce artificial lighting levels, wherever practicable, whilst maintaining safe working conditions and navigation during an Environmental Induction.	Induction records show Environmental Induction includes instruction on the measures to reduce artificial lighting levels, whilst maintaining safe working conditions and navigation in accordance with the COLREGS, Marine Order 21 and Marine Order 30. Induction records confirm vessel crew attended an Environmental Induction.	Vessel crew Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 173: Non-essential lighting will be switched off when not in use.	Pre-mobilisation audit and inspection prior to operations beginning identifies any non-essential lighting, along with vessel crew inductions.	Vessel crew Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 174: External lighting will be directed inboard and onto the deck where practicable.	Pre-mobilisation audit and inspection prior to operations beginning identifies the opportunity to direct external lighting inward, along with vessel crew inductions.	Vessel crew Survey Environmental Advisor SLB QC and HSE Representative Vessel Master

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
	EPS 175: Essential navigation lighting to maintain compliance with COLREGS, Marine Order 21 and Marine Order 30 is required.	Vessel certification confirms compliance with applicable Regulations Induction records show Environmental Induction includes instruction on the measures to reduce artificial lighting levels, whilst maintaining safe working conditions and navigation in accordance with the COLREGS, Marine Order 21 and Marine Order 30.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
Development and implementation of Marine Fauna Management Plan.	**EPS 176:** One of the roles of the MFO/MMOs onboard the Seismic Vessel is to develop a Marine Fauna Mitigation Plan, to be submitted to SLB prior to the pre-mobilisation survey and audit commencing. This plan will demonstrate the following, at a minimum: • MFOs/MMOs are trained, dedicated and experienced • Responsibilities and authorities of MFOs/MMOs to ensure the plan is communicated and available to those roles that are required to implement the controls; • Communications Plan – details the protocols for relaying marine fauna observations to the Seismic Operator, Vessel Master and vessel crew as required. • Survey Plan – describes the proposed activity including location and timing, acoustic source and streamer configuration, equipment (vessels) and key geographic locations such as BIAs and nominated exclusion zones. • Implementation Plan – details how the marine fauna management controls within the EP will be implemented; and • Handling procedures for the retrieval of marine fauna entangled in towed equipment or seabirds on the vessels' deck.	Pre-mobilisation audit and inspection confirms the Marine Fauna Management Plan has been developed Induction records outline the content of inductions and personnel present. MFOs/MMOs daily and weekly logs and Bridge logs confirm the Marine Fauna Mitigation Plan is being implemented.	SLB QC and HSE Representative Survey Environmental Advisor MFOs/MMOs SLB Project Manager

7.5.7 Artificial Light Emission Impact and Risk Summary

Based on the assessment above, including the identification of potential impacts on the environment and the associated controls measures to be implemented, the impact of artificial lights emissions generated from the survey vessels is considered to be **Low.**

The suite of control measures to be implemented have been developed in accordance with Industry Best Practice and relevant legislation. Consequently, it is considered that the environmental impacts and risks on the marine environment and receptors arising from artificial light emissions are reduced to **ALARP**.

In accordance with the acceptability requirements prescribed in **Section 6.4**, the suite of control measures are considered appropriate to manage the risks and impacts arising from artificial light emissions during the Seismic Survey on all receptors to an **Acceptable Level**.

8 Environmental Impacts and Risks from Unplanned Activities

Unplanned activities are those that are non-routine and are rare during MSS operations. However, the potential impacts and risks associated with any unplanned events must be given serious consideration as their consequences can be severe. The impact and risk assessment has been undertaken for each unplanned activity listed in **Table 42**.

Table 89 Unplanned Activities Assessed

Unplanned activity	Section reference	Residual risk
Introduction of invasive marine species	**Section 8.1**	Low
Streamer loss	**Section 8.2**	Low
Vessel collision, sinking or bunkering incident and associated hydrocarbon spill	**Section 8.3**	Low
Hydrocarbon spill response	**Section 8.4**	Low
Accidental release of hazardous and non-hazardous materials	**Section 8.5**	Low

This section of the EP goes through the impact and risk evaluation for each of the unplanned activities listed above that could potentially be associated with the Seismic Survey, for each of the receptors of relevance within the OA and wider environment should such an incident occur, using the methodology described within **Section 6**. This evaluation will demonstrate that the impacts and risks associated with the Seismic Survey will be reduced to **ALARP** and will be of an **Acceptable Level**. This will be achieved largely through the implementation of control measures, operational procedures and operating to Good Practice.

8.1 Introduction of Invasive Marine Species

8.1.1 Description of Source of the Impact and Risk

Invasive marine species (**IMS**) are foreign marine aquatic plants and animals that have managed to colonise and establish new populations in areas beyond their natural range. IMS are typically carried as larvae or juveniles on international vessels, either in niche areas on vessel hulls or in their ballast and/or bilge water. Not all introduced species successfully colonise new environments since most species have well defined tolerances to environmental conditions, such as water temperature, salinity and light. However, if the source environment and the destination environment are sufficiently similar, larvae may successfully establish new colonies which may outcompete and/or predate on native species, causing environmental impacts that are often difficult to control. Likewise, incursions of highly adaptable species, able to successfully proliferate under dynamic environmental constraints, pose similar risk to native species ecology and persistence.

Importantly, an introduced species is only considered ‘invasive’ once it begins to cause negative consequences on its new environment (Bax *et al.*, 2003) and once established, marine pests are usually difficult to manage or eradicate (Fletcher *et al.*, 2017).

For an IMS to become established, there are various conditions which must be met, including surviving the introduction process, ability to overcome abiotic factors and adapt to a new trophic niche and the ability of the recipient environment to facilitate survival and establishment (Streftaris *et al.*, 2005). Gebuzri and McCarthy (2018) suggest that there are several ecological and life-history traits which regularly occur in IMS from different taxa and can, therefore, be associated with their success and many of which are associated with reproduction. These include having the ability to form resting stages, a life-history strategy consisting of pelagic larval dispersal or direct development, having a high reproductive rate and plasticity in resource utilisation (Gebuzri and McCarthy 2018).

The introduction and spread of marine pests or invasive species to Australian waters during MSSs could occur due to international movements of the Seismic Vessel and/or the Support Vessel, and inter-regionally when the vessels operate between different Australian ports or marine regions. Consequently, shallow coastal marine environments surrounding key maritime infrastructure are particularly susceptible to the colonisation of IMS.

The '*National Biofouling Management Guidance for the Petroleum Production and Exploration Industry*' states that immersible equipment associated with MSSs do not normally pose a threat for biofouling accumulation and translocation as most components are generally free of biofouling, except for the streamers which may accumulate biofouling organisms in the joints. The most likely biofouling organisms in open, deep waters growing on the streamers are goose barnacles and green filamentous seaweed which are not considered marine pests (DAWR, 2018a).

The NOPSEMA information paper '*Reducing marine pest biosecurity risks through good practice biofouling management*' (NOPSEMA, 2020h) states that, at a minimum, NOPSEMA expects titleholders, and their contracted vessels apply relevant guidance from the IMO Biofouling Guidelines. These guidelines provide an internationally consistent approach to biofouling management and record keeping, with the key recommendation being the development and implementation of a Biofouling Management Plan and Biofouling Record Book.

8.1.2 Evaluation of Known and Potential Impacts and Risks to Environmental Receptors

Using the information presented in **Section 2** to **Section 5**, the impact and risk assessment has been undertaken for those receptors determined to be relevant to the activity as listed in **Table 90**.

Table 90 Environmental Receptors Assessed

Receptor	Section reference
Plankton	**Section 8.1.2**
Benthic habitats (banks, shoals and reefs)	
Benthic invertebrates	
Marine fauna	
EPBC Act listed marine fauna	
Marine protected areas and sensitive areas	

Once introduced, IMS can have significant and irreversible impacts on the marine ecosystem. Due to a lack of natural competitors or predators, the following adverse effects on the receiving environment may occur:

- Out-competing and/or displacing native species;
- Increase in predation and possible depletion of native flora and fauna; and

- Changing the nature of the environment through altering the abundance and diversity of native species, resulting in a change to the functioning of the communities.

The establishment of IMS can have consequences which cascade through the trophic structure, affect commercially important species and aquaculture, or which impact other marine users, as discussed in **Section 8.1.1**.

Should an IMS population establish, the management options available to regulatory agencies are limited primarily to continual monitoring and control of the IMS population, or to mitigating the impacts from its establishment. These measures are commonly associated with a high economic or labour encumbrance. Due to this, and the high social and environmental impacts resulting from the introduction of an IMS, regulatory agencies, such as the WA Department of Primary Industries and Regional Development (**DPIRD**) have implemented increased management requirements.

The risk of an IMS establishing itself as result of the Seismic Survey is no different than the various shipping operations (e.g., commercial shipping and cruise ships) that occur within the wider Bonaparte Basin. The biosecurity of these vessel movements is regulated by a number of legislative requirements which are considered to be industry best practice. These requirements have been utilised to form the basis of the control measures outlined in **Section 8.1.3**, below.

Based on the control measures that will be implemented, it is considered that the risk of introducing IMS as part of this proposal is **Low** (*severe x remote).*

8.1.3 Evaluation of Known and Potential Impacts and Risk to Other Marine Users

Using the information presented in **Section 2** to **Section 5**, the impact and risk assessment has been undertaken for those receptors determined to be relevant to the activity as listed in **Table 91**.

Table 91 Relevant Persons and Other Marine Users Assessed

Receptor	Section reference
Commercial fisheries	**Section 8.1.3**
Commercial shipping	
Tourism and recreation	
Divers (commercial and recreational)	
Petroleum exploration and production activities	

Potential risks from the establishment of an IMS to relevant persons and other marine users include:

- Impacts on human health through presence and/or release of toxins or toxic tissues;
- Predation (leading to depletion) of and competition with commercial stocks, including wild fisheries and aquaculture, and/or impacts to their associated habitats;
- Nuisance biofouling causing damage to and/or smothering of industrial marine equipment or local infrastructure;
- Impacts to shipping logistics, efficiency and feasibility; and
- Reduction of aesthetics in coastal environment and/or water column.

A number of identified relevant persons associated with the OA rely on the presence and use of healthy native flora and fauna and ecologically sustainable populations. As outlined above, in the unlikely event of the establishment of an IMS, these native flora and fauna could be displaced either through direct establishment of the IMS, through increased predation and competition or as a result of changes in environmental conditions driven by the IMS ecology.

The residual risk of introducing IMS during the Seismic Survey has been assessed as **Low** (*severe* x *remote*).

8.1.4 Decision Context

The decision context for the introduction of IMS has been assessed as Type A given the predicted impacts and risks are well understood and uncertainty is minimal, with little or no interest from relevant persons.

8.1.5 Identification of Control Measures, Residual Risk Assessment and Demonstration of ALARP

Control measures that will be put in place during the Seismic Survey to manage the potential risks associated with IMS to **ALARP** have been listed in **Table 93**. SLB has considered a number of control measures to determine the benefits of their implementation towards risk reduction (**Table 92**), based on a Hierarchy of Controls methodology (**Table 92**). The control measures that will be adopted are those that have been assessed and characterised as effective and practicable to implement.

Table 92 Hierarchy of Control Measures for the Introduction of Invasive Marine Species

Eliminate	To completely eliminate the risk of the establishment of any IMS, the transport of vessels into Australian waters would need to be eliminated. However, the Seismic Survey cannot be conducted without the use of a Seismic Vessel.
Substitute	As per the above, and at this point in time, there are no validated approaches which could be adopted to gather information on geologic formations below the seabed at the required resolution. Therefore, there is no substitute to the Seismic Vessel undertaking the Seismic Survey.
Reduce	Control measures to reduce the risk of the establishment of IMS have been detailed within **Table 93**. These include restriction to the discharge of ballast water, maintenance of adequate anti-fouling systems and cleanliness of the vessels undertaking the Seismic Survey.
Mitigate	Control measures have been assessed within **Table 93** in order to mitigate the risks of an IMS establishing within the OA or connected marine environments. Generally speaking, the risks of unplanned activities should be eliminated, substituted or reduced, with mitigation primarily used for those activities in which impacts will occur. However, SLB will report any sighting or suspicion of IMS as per the measure outlined in **Table 93** in order to mitigate the potential impacts to **ALARP**.

Table 93 Assessment of Control Measures for the Introduction of Invasive Marine Species

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Legislative Requirements:			
The Seismic Survey will be undertaken in accordance with the approved EP.	P = Yes E = Effective	All vessels undertaking an offshore activity in waters between 3 and 200 NM must undertake that activity in line with an approved EP. The approved EP outlines the measures that will be taken to ensure that environmental effects from the activity will be reduced to **ALARP** and **Acceptable Levels**, including the management of routine permissible waste discharges.	Yes
Adherence to the Ballast Water Management Requirements (Version 8). Vessels will manage ballast water exchange/discharge using one of the following approved methods of management: • An approved ballast water management system; • Ballast water exchange conducted in an acceptable area (as defined in the Ballast Water Management Requirements (Version8)); • Use of low-risk ballast water (such as fresh potable water, high seas water or fresh water from an on-board fresh water production facility); • Retention of high-risk ballast water on board the vessel; or • Discharge to an approved ballast water reception facility.	P = Yes E = Effective	Compliance with these requirements will reduce the risk of potential IMS from establishing within the Bonaparte Basin from the discharge of ballast water. It is a legislative requirement for vessels to comply with the Biosecurity Act 2015.	Yes
In accordance with the Ballast Water Management Requirements (Version 8), vessels will not exchange ballast water within 12 NM from the nearest land and in water depths of less than 50 m unless sourced from Australian waters.	P = Yes E = Effective	Compliance with these requirements will reduce the risk of potential IMS establishing through the discharge of ballast water. It is a legislative requirement for vessels to comply with the Biosecurity Act 2015.	Yes
Vessels will have a Ballast Water Management Plan in place and valid Ballast Water Management Certificate (unless an exemption applies or is obtained from (DoCCEEW).	P = Yes E = Effective	As each ship is different, so are ballast water management practices. As such, having a Ballast Water Management Plan and Ballast Water Management Certificate appropriately maintained for each relevant vessel is important so that the potential for the introduction and establishment of IMS is reduced to **ALARP**. This control measure is in accordance with the Australian Ballast Water Management Requirements and is a legislative requirement for vessels to comply with the Biosecurity Act 2015.	Yes
All vessels will maintain a complete and accurate Ballast Water Record System that is consistent with the Ballast Water Management Requirements (Version 8).	P = Yes E = Effective	This Ballast Water Record System will contain a complete and current record of all ballast water movements and will be used to confirm that ballast water management is undertaken in accordance with the Australian Ballast Water Management Requirements. It is a legislative requirement for vessels to comply with the Biosecurity Act 2015.	Yes
Vessels entering Australian territorial waters will obtain all the necessary DoCCEEW biosecurity approvals, prior to mobilisation.	P = Yes E = Effective	Operators of all vessels utilised during the Seismic Survey will provide information on how biofouling has been managed prior to arriving in Australian territorial seas through DAWEs Pre-Arrival Report. This will confirm that the vessel does not present a high risk to the marine environment in Australian waters and therefore reduces the likelihood of IMS being introduced. It is a legislative requirement for vessels to comply with the Biosecurity Act 2015.	Yes
All vessels utilised for the Seismic Survey will demonstrate proactive management of biofouling prior to entering Australian territorial waters by implementing one of the following three accepted proactive biofouling management options: • Implementation of an effective biofouling management plan; • Cleaned all biofouling within 30 days prior to arriving in Australian territory; • Implementation of an alternative biofouling management method pre-approved by DoCCEEW.	P = Yes E = Effective	This control measure aligns with the Australian Biofouling Management Requirements (Version 1) which provide guidance for vessel operators on best practice measures to avoid the introduction of IMS into Australia. It is a legislative requirement for vessels to comply with the Biosecurity Act 2015.	
Effective anti-fouling systems and management practices are adopted for each vessel that complies with the requirements of Annex 1 of the International Convention on the Control of Harmful Anti-Fouling Systems on Ships and the requirements of the Protection of the Sea (Harmful Antifouling Systems) Act 2006.	P = Yes E = Effective	Annex 1 of the International Convention on the Control of Harmful Anti-Fouling Systems on Ships and the Protection of the Sea (Harmful Antifouling Systems) Act 2006 prohibit ships from bearing or applying organotin compounds which act as biocides in anti-fouling systems and require vessels to carry a current international anti-fouling system certificate. Anti-foul systems used on the vessel will not	Yes

<table>
<tr><th>Control Measure</th><th>Practicability/ Effectiveness</th><th>Justification</th><th>Will it be adopted?</th></tr>
<tr><td>Anti-foul systems used on the vessel will not consist of harmful anti-fouling compounds (i.e. an organotin compound that acts as a biocide in an anti-fouling system, or cybutryne) or each harmful anti-fouling compound that is applied on external surfaces has a coating that forms a barrier to the compound leaching into the water, or, for a ship that has cybutryne applied on a designated external surface, neither of the following has occurred; i) the first scheduled renewal of the ships' anti-fouling system after 1 January 2023, ii) the day that is 60 months after the last application of cybutryne to the ship before 1 January 2023.</td><td></td><td>consist of harmful anti-fouling compounds (i.e. an organotin compound that acts as a biocide in an anti-fouling system, or cybutryne) or each harmful anti-fouling compound that is applied on external surfaces has a coating that forms a barrier to the compound leaching into the water, or, for a ship that has cybutryne applied on a designated external surface, neither of the following has occurred; i) the first scheduled renewal of the ships' anti-fouling system after 1 January 2023, ii) the day that is 60 months after the last application of cybutryne to the ship before 1 January 2023.
Anti-fouling paint systems are one of the primary methods for preventing the establishment and translocation of fouling species. Therefore, having an effective anti-fouling system in place onboard the survey vessels will reduce the potential for IMS to attach to the vessels, and subsequently establish in new areas.
Each vessel is to have documented anti-fouling management procedures, involving periodic in-water and/or dry-dock inspections. A current international anti-fouling system certificate will be carried by each vessel associated with the Seismic Survey.
It is a legislative requirement for vessels to comply with the Protection of the Sea (Harmful Antifouling Systems) Act 2006.</td><td></td></tr>
<tr><td colspan="4">Good Industry Practice</td></tr>
<tr><td>All vessels will have 'clean' hull and niche areas upon arrival with a written report from a qualified marine biologist on the biofouling inspection. A Marine Biofouling Inspector will be contracted in accordance with the requirements set out in Section 10.3.1 to ensure this.</td><td>P = Yes
E = Effective</td><td>Checking or evidence of recent inspection that the vessel hulls and niche areas are clean prior to arrival within the OA will reduce the likelihood of any IMS travelling with the vessel en-route to the area. Due to this fact, the ability for an IMS to establish itself due to the proposed activities will be reduced to ALARP.
A Marine Biofouling Inspector will be contracted in accordance with the requirements set out in Section 10.3.1 to evaluate the risk profile of the survey vessel/s. When assessing the risk profile of the survey vessel/s, the Marine Biofouling Inspector will take into consideration the following (note that this is not an exhaustive list):
The age, type and condition of the vessel and anti-fouling coating;
Previous biofouling cleaning and inspections that have been undertaken on the vessel/s and the outcomes of these previous inspections;
An assessment of internal niches with potential to harbour IMS and presence and condition of internal seawater treatment systems;
The vessel's history since the last inspection, including the origin of the vessel and its potential for exposure to IMS and subsequent translocation risk;
An assessment of the vessel's Biofouling Management Plan and record book against the IMO Biofouling Guidelines; and
In water specifications where appropriate.
Environmental benefit outweighs additional cost.</td><td>Yes</td></tr>
<tr><td>Survey equipment to be cleaned and dried prior to use in the OA.</td><td>P = Yes
E = Effective</td><td>As per the above, checking that equipment proposed to be used for the Seismic Survey is clean prior to use will reduce the potential for IMS to be transferred into the area and ensure the management of these risks are ALARP.
Environmental benefit outweighs additional cost.</td><td>Yes</td></tr>
<tr><td>Implementing a Biofouling Risk Assessment tool (similar to that required by Western Australia Department of Primary Industries and Regional Development (DPIRD).</td><td>P = Yes
E = Effective</td><td>Similar MSSs conducted in WA used the DPIRD biofouling risk assessment tool (https://vesselcheck.fish.wa.gov.au/) to demonstrate that all reasonable measures to minimise IMS transfer had been undertaken. The costs associated with developing and implementing such a tool is low, particularly compared to cost of a potential IMS introduction/establishment.
Environmental benefit outweighs additional cost.</td><td>Yes</td></tr>
</table>

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Reporting sighting or suspicion of any IMS on vessel(s), in niche areas or in ports/harbours.	P = Yes E = Effective	Reporting of any sighted or suspected IMS will allow an effective response to the presence of IMS and reduce the risk of further establishment of that species. Therefore, if an IMS is sighted or suspected, SLB will report via FishWatch within 24 hours by email (aquatic.biosecurity@dpird.wa.gov.au) or telephone (1800 815 507). This report will include photos of any sighted or suspected IMS. Environmental benefit outweighs additional cost.	Yes
Vessels to maintain a Biofouling Record Book.	P = Yes E = Effective	The National Biofouling Management Guidance for the Petroleum Production and Exploration Industry recommends vessels operators maintain a Biofouling Record Book to record details of all inspections and biofouling management measures undertaken on the vessel. Environmental benefit outweighs additional cost.	Yes
Reassessment of risks in the event of a change to contracted vessels.	P = Yes E = Effective	Under the NOPSEMA Information Paper 'Reducing marine pest biosecurity risks through good practice biofouling management', any change in risk profile as a result of new information or changes to the offshore activity should trigger a risk review process. In the event that there is a change to the vessels contracted for the Seismic Survey, a risk review process will be triggered to determine whether new or modified control measures should be adopted. Any new vessel contracted for the Seismic Survey will comply with the appropriate Control Measures for minimising the risk of IMS. Environmental benefit outweighs additional cost.	Yes
Alternative/Substitute Controls Considered:			
No discharge of ballast water.	P = No Effective = Partly effective	The possibility of needing to discharge ballast water cannot be ruled out completely and exchange and uptake may be required in unexpected circumstances. This control measure is not practicable to implement and is disproportionate to any reduction in risk.	No
Additional Control Measures Considered:			
Mandatory dry docking of the Seismic Vessel prior to entering the OA.	P = No E = Effective	Although this control measure would eliminate IMS, the substantial costs associated with this occurring, in addition to the significant delays in the scheduling, make this control measure unsustainable; especially considering the other controls in place are expected to effectively reduce the risks associated with IMS. The cost associated with this measure would outweigh the reduction in risk.	No
Ballast the vessel using only finely filtered water or freshwater.	P = No E = Partly Effective	Ballast water requirements change frequently and supplying the required large volumes of finely filtered seawater, or freshwater is either not possible quickly enough, or would require large redesign of vessel(s) to create enough storage. Making freshwater, and/or filtering seawater requires a large amount of energy, decreasing efficiency and sustainability. Therefore, the costs are disproportionate to benefits. Additionally, the allocation of freshwater, which likely has many other beneficial uses, to a commercial industrial application is not sustainable and should be minimised wherever possible. Using 'local' water as ballast provides an effective means of reducing IMS introductions to **ALARP**.	No
Treatment of ballast water, either through heat treatment or chemical dosage.	P = No E = Partly Effective	This control measure would reduce the potential for IMS to establish within the ballast water; however, the high cost involved in completing this control outweighs the reduction in risk, considering the other controls in place already reducing the risks associated with IMS. This type of control also includes detrimental effects to the marine environment, either through additional chemicals being released which are toxic to marine species, or high temperature water being added to the marine environment that may cause death of native marine species.	No
Source Seismic Vessel within Australia.	P = No E = Partly Effective	There is still a risk of an undetected IMS being present on/near the vessel at its Australian Port, as ports and marinas within the coastal nearshore marine environment are highly susceptible to IMS incursion and establishment. Additional time and resources would be required to find and assess suitable vessels within Australia, if any are present and available. Therefore, the costs are disproportionate to benefits.	No
Niche areas and deployed equipment built/redesigned to reduce IMS attachment or stowage.	P = No E = Effective	Design of vessels, niche areas and the seismic equipment make them as efficient as possible at their task. Additional redesign adds significant cost and may decrease the efficiency of equipment for its intended purpose, such as affecting the performance of sensitive equipment. Therefore, costs are disproportionate to benefits.	No

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Residual Risk of Impact (Receptor)	**Consequence**	**Likelihood**	**Risk Ranking**
All receptors (outlined in **Section 8.1.2** and **8.1.3**).	Severe	Remote	Low
ALARP Statement:			
The decision context has been assessed as Type A and the overall residual risk has been determined to Low. SLB considers the adopted control measures minimise the risk of impacts from the introduction of IMS and are appropriate to the localised nature and small scale of the predicted environmental impacts associated with the Seismic Survey. The proposed control measures have been developed in accordance with the legislative requirements, good industry practice, using professional experience and taking into account the specific environmental, social, economic and cultural characteristics of the OA and predicted impacts to other marine users. Additional control measures were considered as part of the assessment process; however, it was considered that they did not provide any further environmental benefit or were not reasonably practicable to implement. Therefore, the predicted impacts to receptors from the introduction of IMS are reduced to **ALARP.**			

8.1.6 Impact and Risk Acceptability

Table 94 Demonstration of General Impact and Risk Acceptability for the Introduction of Invasive Marine Species

Criteria for Acceptance	Acceptability Summary
Residual Risk Ranking	The residual risk has been determined to be Low.
Ecologically Sustainable Development	The management of the risks and impacts proposed by SLB associated with the introduction of IMS can be carried out in compliance with the five principles of ecologically sustainable development as defined within the EPBC Act. These principles have been considered as part of the development of this EP and risk assessment process. The assessment has not identified any adverse impacts to the principles of ESD, with no threats of serious or irreversible damage, no impacts to biological diversity and ecological integrity, no degradation of inter-generational equity, or negative effects on the social and economic integrity in the short or long-term. Therefore, the impact and risks are considered to be consistent with the principles of ESD.
SLB's Internal Context	The proposed management of the risks associated with the establishment of IMS is consistent with SLB's QHSE Policy.
Existing Environmental Context	As described in **Section 8.1.2**, the greatest potential for an IMS introduction occurs due the movement and docking of vessels, transporting material between contrasting source and receiving environments. With regard to the Seismic Survey, this would be limited to occurrences when the survey vessels visit ports/harbours at the beginning and conclusion of the campaign (noting that refuelling and re-supply will be conducted at sea). During acquisition of the survey, the vessels will be continually moving in offshore areas which make the potential attachment or translocation of IMS less likely. It is considered that the control measures in place will provide appropriate protection to the existing marine environment, and that the potential for any impacts and associated risks from the introduction of IMS are at an **Acceptable Level**.
External Context – Management Plans, Species Recovery Plans and Conservation Advice	The residual risk of the introduction of IMS has been determined to be Low and will not have a significant impact on a matter of national environmental significance in accordance with EPBC Act Policy Statement 1.1. The North-west Marine Parks Management Plan allows for ballast water to be discharged or exchanged, except for within areas characterised as Sanctuary Zone (1A), subject to compliance with: • The Australian ballast water management requirements and relevant state ballast water management arrangements; and • Relevant Commonwealth and state legislation or international agreements (if any) relating to ballast water management. The control measures that will be implemented during the Seismic Survey are consistent with the North-west Marine Parks Management Plan. Review and assessment of the species recovery plans, and conservation advice did not identify threats associated with the establishment of IMS for the species of relevance to the OA (**Section 4.5.8**). As such, no additional control measures are required with regard to the introduction of IMS.
Social Acceptance – Relevant Persons Expectations	No concerns were raised in regard to the introduction of IMS, therefore no additional control/mitigation measures were expected or put in place. As such the environmental impacts relating to IMS and biosecurity during the Seismic Survey were considered to be at a socially **Acceptable Level**.
External Context – Commonwealth and State Legislative Criteria	The proposed control measures for IMS introduction and establishment during the Seismic Survey are consistent with the following relevant standards/documents: • Biosecurity Act 2015; • Australian Ballast Water Management Requirements (Version 8); • Australian Biofouling Management Requirements (Version 1); and • Protection of Sea (Harmful Anti-Fouling Systems) Act 2006.
Industry Best Practice	The control measures are based on industry best practice to decrease the risk of IMS introduction/establishment, including: • The IAGC Environmental Manual for Worldwide Geophysical Operations. This manual recommends ballast water management plans need to be in place and followed to ensure IMS are not translocated between regions/countries, including recommendations to regularly exchange ballast water, clean ballast tanks, etc.;

Criteria for Acceptance	Acceptability Summary
	• The APPEA Code of Environmental Practice, which recommends that geophysical surveys should have an environmental objective to reduce the risk of IMS introduction to **ALARP** and **Acceptable Levels**, including having evidence of appropriate quarantine management measures; • The National Biofouling Management Guidance for the Petroleum Production and Exploration Industry including the completion of an IMS risk assessment prior to the vessels entering Australian waters and in-water survey equipment being cleaned and dried prior to use in the OA; • IMO Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species; and • Anti-fouling and In-Water Cleaning Guidelines.
ALARP	Complete elimination of the risk of IMS is not possible as the Seismic Survey will require the use of vessels and deployed equipment which could be subject to biofouling, and ballast water will be required for each vessel to operate safely and efficiently. Following the implementation of the control measures detailed in this assessment, the residual risks and impacts to the marine environment and associated receptors from establishment of IMS is **Low**. In accordance with the Risk Ranking descriptions, the predicted magnitude of impact is acceptable without further reduction measures being required, the control measures are consistent with good industry practice have been applied and have been assumed in the design process. No further development of control measures is required if ALARP. It is considered that through the implementation of control measures, the potential for impacts and associated risks from the introduction of IMS, as a result of the Seismic Survey, are at an **Acceptable Level**.

Acceptability Statement
Impacts and risks classified as 'Type A' are considered acceptable if the requirements in **Table 40** can be demonstrated and it can be determined that the predicted levels of impact and/or residual risk are at or below pre-defined Acceptable Levels for that impact or risk, including those described in **Table 41.** Based on the above evaluation, the potential impacts and risk from the introduction of IMS meets the requirements of the risk acceptability criteria. The control measures that will be implemented throughout the Seismic Survey have been developed in accordance with these criteria and are considered appropriate to manage the impacts of the introduction of IMS on all receptors to an **Acceptable Level.**

8.1.7 Environmental Performance

Table 95 Environmental Performance Outcomes, Standards and Measurement Criteria for Invasive Marine Species

Number	Environmental Performance Outcome	Environmental Performance Standard(s)
EPO 22	No introduction or establishment of any Invasive Marine Species	**EPS 177** to **EPS 197**

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
The Seismic Survey will be undertaken in accordance with the approved EP.	**EPS 177**: The Seismic Survey may only commence following acceptance of the EP by NOPSEMA.	Pre-mobilisation audit and inspection are completed prior to operations and confirm an accepted EP has been obtained. Audit records verify compliance with the requirements of the EP.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
	EPS 178: The Seismic Survey will be undertaken in accordance with the accepted EP.	Bridge logs verify compliance with the requirements of the EP. Audit records verify compliance with the requirements of the EP.	Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
Adherence to the Ballast Water Management Requirements (Version 8). Vessels will manage ballast water exchange/discharge using one of the approved methods of management.	**EPS 179**: Compliant with the Australian Ballast Water Management Requirements (Version 8) by following at least one of the approved methods of management, including: • An approved ballast water management system; • Ballast water exchange conducted in an acceptable area (as defined in the Ballast Water Management Requirements (Version8)); • Use of low-risk ballast water (such as fresh potable water, high seas water or fresh water from an on-board fresh water production facility); • Retention of high-risk ballast water on board the vessel; or • Discharge to an approved ballast water reception facility.	Pre-mobilisation inspection/audit confirms at least one approved method is in place.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
In accordance with the Ballast Water Management Requirements (Version 8), vessels will not exchange ballast water within 12 NM from the nearest land and in water depths of less than 50 m unless sourced from Australian waters.	**EPS 180**: Ballast water discharges must comply with the relevant requirements of the Biosecurity Act 2015 and Australian Ballast Water Management Requirements (Version 8).	All Ballast Water exchanges recorded in Ballast Water Logbook. Biosecurity Clearance attained following Pre-Arrival Report process.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
	EPS 181: Internationally sourced ballast water will not be discharged within 12 NM of the nearest land or in water <50 m deep and preferably beyond 200 NM from nearest land in water >200 m deep.		
	EPS 182: Ballast waters sourced from Australian waters may be discharged within 12 NM of emergent land or in water <50 m deep (including ports/harbours).		
Vessels will have a Ballast Water Management Plan in place and valid Ballast Water Management Certificate (unless an exemption applies or is obtained from DAWE).	**EPS 183**: A Ballast Water Management Plan will be maintained in accordance with Regulation B-1 of the International Convention for the Control and Management of Ships' Ballast Water and Sediments	Pre-mobilisation inspection/audit confirms each vessel holds an approved Ballast Water Management Plan.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
	EPS 184: Vessels undertaking the Seismic Survey will hold valid Ballast Water Management Certificates.	Pre-mobilisation inspection/audit confirms each vessel holds a valid Ballast Water Management Certificate.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
All vessels will maintain a complete and accurate Ballast Water Record System that is consistent with the Ballast Water Management Requirements (Version8).	**EPS 185**: A complete and current record of all ballast water movements will be maintained in the Ballast Water Record System to confirm ballast water management is undertaken in accordance with the Australian Ballast Water Management Requirements (Version 8).	Accurate and complete Ballast Water Record System kept onboard the vessel and maintained throughout the Seismic Survey. Pre-mobilisation inspection/audit confirms each vessel has a Ballast Water Record System consistent with the Ballast Water Management Requirements (Version 8).	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
Vessels entering Australian territorial waters obtaining all necessary DAWE biosecurity approvals.	**EPS 186**: Operators of all vessels utilised during the Seismic Survey will provide information on how biofouling has been managed prior to arriving in Australian territorial seas through DAWEs Pre-Arrival Report.	Pre-mobilisation inspection/audit confirms each vessel has a copy of Biosecurity Status Document onboard each vessel following Pre-Arrival Report process	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
All vessels utilised for the Seismic Survey will demonstrate proactive management of biofouling prior to entering Australian territorial waters by implementing one of the three accepted proactive biofouling management options.	**EPS 187:** As part of the Pre-Arrival Report referenced in **EPS 186**, each vessel will demonstrate proactive management of biofouling in accordance with the Australian Biofouling Management Requirements (Version 1). This can be achieved by implementing one of the following three accepted proactive biofouling management options: • Implementation of an effective biofouling management plan; • Cleaned all biofouling within 30 days prior to arriving in Australian territory; • Implementation of an alternative biofouling management method pre-approved by DAWE.	Each vessel used for the Seismic Survey will demonstrate proactive management of biofouling through the Pre-Arrival Report. Pre-mobilisation inspection/audit confirms each vessel proactively manages biofouling by ensuring a copy of Biosecurity Status Document is onboard each vessel following Pre-Arrival Report process.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
Effective anti-fouling systems and management practices are adopted for each vessel that complies with the requirements of Annex 1 of the International Convention on the Control of Harmful Anti-Fouling Systems on Ships and the requirements of the protection of the Sea (Harmful Antifouling Systems) Act 2006. Anti-foul systems used on the vessel will not consist of harmful anti-fouling compounds (i.e. an organotin compound that acts as a biocide in an anti-fouling system, or cybutryne) or each harmful anti-fouling compound that is applied on external surfaces has a coating that forms a barrier to the compound leaching into the water, or, for a ship that has cybutryne applied on a designated external surface, neither of the following has occurred; i) the first scheduled renewal of the ships' anti-fouling system after 1 January 2023, ii) the day that is 60 months after the last application of cybutryne to the ship before 1 January 2023.	**EPS 188**: A current international anti-fouling system certificate will be carried by each vessel associated with the Seismic Survey which shows that the vessel anti-fouling systems are maintained in accordance with the Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 and Anti-fouling and In-Water Cleaning Guidelines which implements the International Convention on the Control of Harmful Anti-fouling Systems on Ships.	Pre-mobilisation inspection/audit confirms the Seismic Vessels are carrying a current International Anti-fouling System Certificate.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
	EPS 189: All vessels will comply with the requirements of the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia, 2009) which requires: • Maintenance of biofouling electronic records outlining marine fouling management actions • Completion of an IMS risk assessment prior to vessel entry into Australian waters and which concludes a low risk of IMS presence • In-water equipment free of marine fouling prior to the commencement of the survey	Pre-mobilisation inspection/audit confirms records are available to verify the following has occurred: • Marine fouling management actions are recorded electronically; • An IMS risk assessment has been completed prior to each vessel entry into Australian waters and concludes a low risk of IMS presence; and • In-water equipment is free of marine fouling prior to the commencement of the Seismic Survey.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
	EPS 190: Vessel will have had recent dry-docking or IMS hull inspection with appropriate certification and have a written report from a qualified marine biologist on the biofouling inspection.	Pre-mobilisation inspection/audit for IMS inspection certificate, dry-dock and/or anti-fouling application certification and written report from qualified marine biologist on the biofouling inspection.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
All vessels will have 'clean' hull and niche areas upon arrival with a written report from a qualified marine biologist on the biofouling inspection. A Marine Biofouling Inspector will be contracted in accordance with the requirements set out in **Section 10.3.1** to ensure this.	**EPS 191:** A Marine Biofouling Inspector will be contracted in accordance with the requirements set out in **Section 10.3.1** to evaluate the risk profile of the survey vessel/s. When assessing the risk profile of the survey vessel/s, the Marine Biofouling Inspector will take into consideration the following (note that this is not an exhaustive list): • The age, type and condition of the vessel and anti-fouling coating; • Previous biofouling cleaning and inspections that have been undertaken on the vessel/s and the outcomes of these previous inspections; • An assessment of internal niches with potential to harbour IMS and presence and condition of internal seawater treatment systems; • The vessel's history since the last inspection, including the origin of the vessel and its potential for exposure to IMS and subsequent translocation risk; • An assessment of the vessel's Biofouling Management Plan and record book against the IMO Biofouling Guidelines; and • In-water inspections where appropriate.	Pre-mobilisation inspection/audit confirms a Marine Biofouling Inspector has been contracted for a biofouling assessment on vessels entering Australian territorial waters. Pre-mobilisation inspection/audit confirms documentation of biofouling assessment carried out on vessels entering Australian territorial waters.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
Survey equipment to be cleaned and dried prior to use in the OA.	**EPS 192**: All equipment deployed from vessel (e.g. streamers, birds, tail-floats, etc.) must be thoroughly cleaned, and then dried for at least 24 hours prior to being deployed in the OA for the first time. This is consistent with the requirements of the National Biofouling Guidelines for the Petroleum Production and Exploration Industry.	Onboard records of equipment maintenance and cleaning.	Vessel Master. Seismic Operator(s).
Implementing a Biofouling Risk Assessment tool (similar to that required by Western Australia DPIRD.	**EPS 193**: Completion of the Western Australian DPIRD Biofouling Risk Assessment Tool: https://www.vessel-check.com with any actions required from this assessment being completed.	Biofouling Risk Assessment Report received once Vessel Check completed.	Vessel Master. Survey Environmental Advisor. SLB QC and HSE Representative
Report sighting or suspicion of any IMS on vessel(s), in niche areas, and in ports/harbours.	**EPS 194**: Suspected or confirmed presence of any marine pests or disease must be reported to authorities via FishWatch within 24 hours of sighting by email (aquatic.biosecurity@dpird.wa.gov.au) or telephone (1800 815 507), including photos of the suspected or confirmed marine pests or disease.	Incident reporting form identifying sighting or suspicion of any IMS. Records of communication show report of suspected or confirmed presence within 24 hours by email or telephone.	Vessel Master. Party Chief. General Vessel Crew.
Vessels to maintain a Biofouling Record Book.	**EPS 195**: Each survey vessel shall maintain a Biofouling Record Book detailing all inspections and biofouling management measures undertaken on that vessel.	Biofouling Record Book maintained on each vessel. Pre-mobilisation inspection/audit confirms Biofouling Record Book is in place	Vessel Master. Survey Environmental Advisor. SLB QC and HSE Representative
	EPS 196: Biofouling Record Book will follow the format provided in Appendix B of the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry.	Biofouling Record Book maintained on each vessel. Pre-mobilisation inspection/audit confirms Biofouling Record Book is in place	Vessel Master. Survey Environmental Advisor. SLB QC and HSE Representative
Reassessment of risks in the event of a change to contracted vessels.	**EPS 197**: A risk assessment will be carried out as per the Management of Change process in the event that there is a change in vessels part way through the Seismic Survey.	Management of Change records show changed contracted vessel complies with biosecurity requirements listed in the EPSs above.	Vessel Master. Survey Environmental Advisor. SLB QC and HSE Representative

8.1.8 Introduction of Invasive Marine Species Impact and Risk Summary

Based on the assessment above, including the identification of potential impacts on the environment and the associated controls measures to be implemented, the residual risk of the introduction/establishment of an IMS from the Seismic Survey is considered to be **Low**.

The suite of control measures to be implemented have been developed in accordance with industry best practice, and all relevant legislation. Consequently, it is considered that the environmental impacts and risks on the marine environment and receptors arising from the introduction/establishment of an IMS from the Seismic Survey, are reduced to **ALARP**.

In accordance with the acceptability requirements prescribed in **Section 6.4,** the suite of control measures is considered appropriate to manage the risks and impacts arising from the introduction/establishment of an IMS from the Seismic Survey on all receptors to an **Acceptable Level.**

8.2 Streamer Loss

8.2.1 Description of Source of the Impacts and Risks

There are a number of ways in which potential damage to and resultant loss of streamers could occur; these include snagging with floating debris, rupture from abrasions or shark bites, or loss from severance during a collision (e.g. if another vessel were to accidentally cross the streamer). Solid streamers, such as those proposed to be used during the Seismic Survey, are negatively buoyant and would sink if severed.

8.2.2 Evaluation of Known and Potential Impacts and Risks to Environmental Receptors

Using the information presented in **Section 2** to **Section 5**, the impact and risk assessment has been undertaken for those receptors determined to be relevant to the activity as listed in Table 96.

Table 96 Environmental Receptors Assessed

Receptor	Section reference
Benthic habitats (banks, shoals and reefs)	**Section 8.2.2**
Benthic invertebrates	

Direct contact between the streamer and the seabed as a result of damage or loss would result in physical damage to the benthic habitat and any sensitive communities in the area. Should this equipment be irretrievably lost and persist on the seabed as debris, it has the potential to entangle with marine fauna or fishing equipment.

A number of control measures will be implemented during the Seismic Survey (**Table 98**), including, but not limited to, the utilisation of solid streamers, integration of self-recovery devices and recording real-time positioning of the streamers, all of which are implemented to prevent the loss of streamer should it break free and stop it from reaching the seabed for recovery. The 'streamer recovery devices' are pressure activated self-inflating buoys, that activate if a streamer is severed and sinks to a certain depth. This system provides sufficient positive buoyancy to return the damaged streamer to the sea surface, enabling recovery by the Support Vessel. Only solid streamers will be used during the MSS. In contrast to oil-filled streamers and other alternatives, solid streamers do not contain fluids which could leak into the marine environment following damage or loss.

In the unlikely event that a streamer does make contact with the seabed, it is useful to note that areas of archaeological interest or cultural significance are typically associated with intertidal and shallow subtidal environments of the nearshore and costal marine environment. The nature of the OA, which is located offshore, affords low potential for impacts on such values. Additionally, it is considered that should the control measures fail, and a streamer is lost to the seabed, it would sink relatively quickly, before travelling any great distance. Therefore, if a streamer reached the seabed, it would be unlikely to drift beyond the boundary of the OA.

The seabed is composed of soft sediments comprising varying proportions of silt and sand, and sparse areas of hard substrate inhabited by sponges, soft corals and filter feeders. A lost streamer is likely to marginally disturb the seabed as it lands, through direct physical damage or driving potential resuspension of fine-grained sediments. Therefore, benthic faunal communities may be affected in the landing area and immediate surrounds. Where possible, recovery would occur over time as the disturbed sediments naturally settle and redistribute under the local conditions. These impacts, both direct and indirect, would be spatially constrained and relative to the size of one or, in the worst-case, all streamers. Such habitats are also well represented throughout the region. Consequently, no lasting impacts are expected.

The residual risk to environmental receptors arising from the use of streamers during the Seismic Survey has been assessed as **Low** (*Minor x Remote*).

8.2.3 Decision Context

The decision context for streamer loss has been assessed as Type A given the predicted impacts and risks are well understood and uncertainty is minimal, with little or no interest from relevant persons.

8.2.4 Identification of Control Measures, Residual Risk Assessment and Demonstration of ALARP

The control measures that have been considered during the Seismic Survey to manage any potential impacts from the loss of a seismic streamer to **ALARP** have been included in **Table 98**. SLB has considered a number of control measures to assess the benefits of their implementation towards risk reduction (**Table 98**), based on a Hierarchy of Controls methodology (**Table 97**). The control measures that will be adopted are those that have been assessed and characterised as effective and practicable to implement.

Table 97 Hierarchy of Control Measures for Streamer Loss

Eliminate	The survey cannot be conducted without the use of streamers.
Substitute	There are no practicable substitutes for using streamers on the Seismic Vessel.
Reduce	Streamer recovery devices will float a lost/broken streamer, or section of streamer, to facilitate recovery by either of the survey vessels before it can make contact with the seabed. The streamer and associated towing equipment will be regularly inspected and maintained for wear-and-tear and any worn or 'tired' parts replaced.
Mitigate	Control measures have been assessed within **Table 98** in order to mitigate the impacts from loss of a streamer to **ALARP** levels. Those which are appropriate and are not impracticable or unfeasible due to disproportionately large costs will be implemented during the Seismic Survey.

Table 98 Assessment of Control Measures for Streamer Loss

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Legislative Requirements:			
The Seismic Survey will be undertaken in accordance with the approved EP.	P = Yes E = Effective	All vessels undertaking an offshore activity in waters between 3 and 200 NM must undertake that activity in line with an approved EP. The approved EP outlines the measures that will be taken to ensure that environmental effects from the activity will be reduced to **ALARP** and **Acceptable Levels**, including the management of routine permissible waste discharges.	Yes
Good Industry Practice:			
Solid streamers utilised.	P = Yes E = Effective	The utilisation of solid streamers which contain no fluids eliminates the risk that release of hazardous substances into the marine environment following damage or loss. Environmental benefit outweighs additional cost.	Yes
Streamer-recovery devices fitted to the streamers.	P = Yes E = Effective	Streamer recovery devices will be fitted at nominated intervals along the streamer and programmed to automatically deploy at water depths that are shallower than the depth of the ocean where seismic data acquisition is occurring. Under typical conditions, this will allow a damaged and/or severed streamer to return to the sea surface, and be retrieved, before impacting the seabed. Environmental benefit outweighs additional cost.	Yes
Use of redundant attachment points to Seismic Vessel.	P = Yes E = Effective	Streamers will be attached to the Seismic Vessel via the main attachment point as well as a redundant attachment point. Redundant attachment points are a secondary attachment point that act as back-up in the event that the primary attachment point fails. Good industry practice, environmental benefit outweighs additional cost.	Yes
Presence of Support Vessels.	P = Yes E = Effective	A Chase Vessel and Support Vessel will accompany the Seismic Vessel for the duration of the Seismic Survey. These vessels will aim to intercept any other marine users that may interact with the Seismic Vessel and towed equipment, identify and remove any fishing equipment that may be in the path of the Seismic Vessel, and be involved in the retrieval of lost equipment if required and safe to do so. Good industry practice, safety benefit outweighs additional cost.	Yes
Streamer depth controlled using depth control ‘birds’.	P = Yes E = Effective	Depth control birds will allow the Seismic Vessel to control the depth of the streamers. This will ensure streamers do not sink too low in the water column and potentially impact the seabed, or migrate too deep and activate streamer recovery devices, which could add additional strain on the streamer while underway and making way. Environmental benefit outweighs additional cost.	Yes
Real time positioning of streamers.	P = Yes E = Effective	The exact position of the streamers will be monitored at all times utilising Intrinsic Ranging by Modulated Acoustics, allowing their positions to be seen relative to any potential hazards, such as shallow water. Environmental benefit outweighs additional cost.	Yes
Adherence to vessel Standard Operation Procedure (**SOP**) for streamer deployment and retrieval.	P = Yes E = Effective	All crew will be suitably familiar with and adhere to SOP documents relating to the preparation, deployment, operation and recovery of the seismic equipment to reduce risk of streamer damage and potential loss. Environmental benefit outweighs additional cost.	Yes
Inspections and maintenance of streamers and associated equipment.	P = Yes E = Effective	Inspections and maintenance of streamers and associated equipment (e.g., cables and attachment points) ensures that any ‘wear-and-tear’ is identified and fixed, reducing the potential for the breaking (and subsequent loss) of equipment. All in-sea equipment will be electronically monitored for performance and integrity during the course of the survey. Visual inspections will be carried out on any occasion the equipment is deployed or retrieved. Preventative maintenance will be carried out as per the vessels’ Preventative Maintenance System. Environmental benefit outweighs additional cost.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Recovery of lost streamer.	P = Partially E = Somewhat effective	Lost equipment will be located and recovered where safe and practicable to do so, in accordance with SLB's Non-Routine Equipment Recovery Procedures. Environmental benefit outweighs additional cost.	Yes
No streamers will be towed within any water depths less than 40 m..	P = Yes E = Effective	The minimum depth to seabed in the area of the proposed survey lines is 20 m, though approximately 95% of the survey will be completed in water depths greater than 60 m. The source will not be active in waters where shallow water features (i.e. shoals) are present in water depths less than 60 m, plus a 421 m horizontal buffer around this depth contour. In addition, the vessel will not have the streamers deployed in water depths less than 40 m. There will be ample separation distance given the proposed tow depth (10-20 m below sea surface) to ensure that the streamer does not contact the seabed. Environmental benefit outweighs additional cost.	Yes
Reporting of all incidents of lost equipment.	P = Yes E = Effective	The recording and reporting of incidents, including those associated with lost equipment is standard in the industry. Environmental benefit outweighs additional cost.	Yes
Alternatives/Substitutes Controls Considered:			
Alternative data acquisition method.	P = No E = Effective	The Seismic Survey cannot acquire seismic data without the use of streamers and its associated equipment. Implementation of this control measure would render the survey inoperable.	No
Additional Control Measures Considered:			
Laying the streamers on the sea floor, also known as ocean bottom cable, as opposed to towing the streamers.	P = No E = Effective	Using this methodology for the Seismic Survey would effectively eliminate the risk associated with the potential loss of a streamer, but it still requires an acoustic source to be towed behind a Seismic Vessel. The towed recording device will not pose a significant risk to marine life within the water column and would require less source locations to deliver an equivalent data set and achieve the survey objectives. Deploying the recording array on the seabed takes significantly more time and will introduce additional health and safety risks. It will also cause temporary disturbance to the seabed. The costs would be prohibitively expensive and impracticable for a survey of this size. The proposed methodology is the most efficient way of conducting the survey in the shortest amount of time and will reduce the time that the Seismic Vessel is in the area.	No
Residual Risk of Impact (Receptor)	**Consequence**	**Likelihood**	**Risk Ranking**
Benthic habitats (banks, shoals and reefs)	Minor	Remote	Low
Benthic invertebrates	Minor	Remote	Low
ALARP Statement			
The decision context has been assessed as Type A and the overall residual risk has been determined to Low. SLB considers the adopted control measures minimise the risk of impacts from streamer loss and are appropriate to the localised nature and small scale of the predicted environmental impacts associated with the Seismic Survey. The proposed control measures have been developed in accordance with good industry practice, using professional experience and taking into account the specific environmental, social, economic and cultural characteristics of the OA and predicted impacts to other marine users. Additional control measures were considered as part of the assessment process; however, it was considered that they did not provide any further environmental benefit or were not reasonably practicable to implement. Therefore, the predicted impacts to receptors from streamer loss are reduced to **ALARP.**			

8.2.5 Impact and Risk Acceptability

Table 99 Demonstration of General Impact and Risk Acceptability for Streamer Loss

Criteria for Acceptance	Acceptability Summary
Residual Risk Ranking	The residual risk has been determined to be Low.
Ecologically Sustainable Development	The management of the risk associated with streamer loss can be carried out in compliance with the five principles of ecologically sustainable development as defined within the EPBC Act. These principles have been considered as part of the development of this EP and risk assessment process. The assessment has not identified any adverse impacts to the principles of ESD, with no threats of serious or irreversible damage, no impacts to biological diversity and ecological integrity, no degradation of inter-generational equity, or negative effects on the social and economic integrity in the short or long-term.
SLB's Internal Context	The proposed management of the risks of streamer loss and its associated impacts will be informed by SLB's Non-Routine Equipment Recovery Procedures and Environmental and QHSE Policy.
Existing Environmental Context	Of relevance, are the maintenance of management objectives and values for protected areas such as the adjacent Oceanic Shoals Marine Park and the Carbonate bank and terrace system of the Sahul Shelf KEF which overlaps OA. While it is possible that a lost streamer reaching the seabed could cause physical damage to benthic habitats and communities comprising the KEF and Oceanic Shoals Marine Park, the implementation of the proposed control measures ensure that the risks and potential impacts associated with the loss of a streamer do not impede the maintenance of management objective or values for protected areas. As a result, the risks and potential impacts associated with the loss of a streamer to these sensitivities is considered Low. It is considered that the proposed control measures provide appropriate protection to the existing marine environment from the risk of a lost streamer and that any associated effects (e.g., physical seabed damage) are at an **Acceptable Level**.
External Context – Management Plans, Species Recovery Plans and Conservation Advice	The residual risk of streamer loss has been determined to be Low and will not have a significant impact on a matter of national environmental significance in accordance with EPBC Act Policy Statement 1.1. **Section 4.5.8** provides an outline of the EPBC Act Conservation Management Plans, Recovery Plans and Conservation Advice relevant to the Seismic Survey. Within these documents, the risk of marine debris impacting those relevant species is highlighted, with the actions required including supporting the implementation of the EPBC Act in accordance with the *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life* (Commonwealth of Australia 2018). The control measures in place during the Seismic Survey will support the implementation of this threat abatement plan. The NOPSEMA guidance note for petroleum activities and Australian Marine Parks (NOPSEMA, 2020d) requires that an EP is developed for undertaking activities such as MSSs. The EP evaluates how environmental impacts and risks will be of an **Acceptable Level** and reduced to **ALARP** and demonstrates that the Seismic Survey will not be inconsistent with the relevant marine park management plan. Operations within the park must ensure the long-term maintenance of biodiversity and other natural values within the reserve. Although the OA is not located within any AMP, the proposed control measures in place to reduce the risk of streamer loss and subsequent environmental impact to adjacent AMP and will ensure that the integrity of the IUCN reserve management principles will be maintained throughout the survey.
Social Acceptance – Relevant Person Expectations	No concerns were raised in regard to possible impacts associated with the loss of a streamer, and as such no additional control/mitigation measures were expected or put in place as a result. The environmental impacts relating to the loss of a streamer from the Seismic Survey are considered to be at a socially **Acceptable Level**.
External Context – Commonwealth and State Legislative Criteria	There are no relevant legislative requirements identified for the management of the risks and impacts from the potential loss of equipment (i.e. a streamer). However, implementation of control measures will be used to mitigate potential risks and impacts wherever practicable.
Industry Best Practice	The control measures to decrease the risk of streamer loss follow industry best practice and best practice guidelines and include: • The IAGC Environmental Manual for Worldwide Geophysical Operations, which recommends that operators: - Document and communicate their contingency plans for retrieving any equipment to help mitigate environmental impacts associated with the loss of that equipment; - Notify appropriate regulatory agencies in event of equipment loss; and - Make a reasonable effort to retrieve lost equipment as soon as possible after loss occurs. • The APPEA Code of Environmental Practice, which recommends that geophysical surveys should have an environmental objective to reduce the impacts from loss of equipment to **ALARP** and **Acceptable Levels**, including having evidence of appropriate management procedures and an emergency response plan.
ALARP	Total elimination of all impacts associated with the loss of a streamer cannot be achieved, as a streamer must be towed to acquire the seismic data and there are no practicable alternatives. Following the implementation of control measures, the potential impacts to the marine environment and associated receptors from loss of a streamer are likely to be highly localised and short-term. Therefore, based on the assessment within the EP, the residual impact and risk of the loss of a streamer from the Seismic Survey Vessel is considered to be **Low** and to **ALARP**. Therefore, the potential impact and risk from a lost streamer during the Seismic Survey is considered to be at an **Acceptable Level**.

Acceptability Statement
Impacts and risks classified as 'Type A' are considered acceptable if the requirements in **Table 40** can be demonstrated and it can be determined that the predicted levels of impact and/or residual risk are at or below pre-defined Acceptable Levels for that impact or risk, including those described in **Table 41.** Based on the above evaluation, the potential impacts from streamer loss meets the requirements of the risk acceptability criteria. The control measures that will be implemented throughout the Seismic Survey have been developed in accordance with these criteria and are considered appropriate to manage the impacts of streamer loss to an **Acceptable Level.**

8.2.6 Environmental Performance

Table 100 Environmental Performance Outcomes Standards and Measurement Criteria for Streamer Loss

Number	Environmental Performance Outcome	Environmental Performance Standard(s)
EPO 23:	No loss of equipment to the marine environment.	**EPS 198** to **EPS 214**

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
The Seismic Survey will be undertaken in accordance with the approved EP.	**EPS 198**: The Seismic Survey may only commence following acceptance of the EP by NOPSEMA.	Pre-mobilisation audit and inspection are completed prior to operations and confirm an accepted EP has been obtained. Audit records verify compliance with the requirements of the EP.	SLB Project Manager Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
	EPS 199: The Seismic Survey will be undertaken in accordance with the accepted EP.	Bridge logs verify compliance with the requirements of the EP. Audit records verify compliance with the requirements of the EP.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
Solid streamers utilised.	**EPS 200**: The Seismic Survey will be carried out using solid streamers.	Pre-mobilisation audit and inspection confirms solid streamers are to be used.	Seismic Operator(s). Survey Environmental Advisor. SLB QC and HSE Representative
Streamer recovery devices fitted to the streamers.	**EPS 201**: The streamers will be fitted with Pressure Activated Streamer Recovery Devices at intervals along its length.	Pre-mobilisation audit and inspection confirms presence and operative capability of Pressure Activated Streamer Recovery Devices.	Seismic Operator(s). Survey Environmental Advisor. SLB QC and HSE Representative
Use of redundant attachment points to Seismic Vessel.	**EPS 202**: Streamers will be attached to the Seismic Vessel via a primary attachment point and secondary redundant attachment point.	Pre-mobilisation audit and inspection confirms presence of redundant attachment points.	Seismic Operator(s). Survey Environmental Advisor SLB QC and HSE Representative
Presence of Support Vessels.	**EPS 203**: Support vessels will be present around the Seismic Vessel at all times and will act to intercept marine users, identify and remove fishing equipment in the path of the Seismic Vessel, and retrieve equipment in the event that a loss occurs.	Bridge logs and vessel incident report/record	Seismic Operator(s). Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
Streamer depth controlled using depth control 'birds'.	**EPS 204**: The streamer will be fitted with depth control birds to control streamer depth.	Pre-mobilisation audit and inspection confirms presence and capability of 'birds'.	Seismic Operator(s). Survey Environmental Advisor. SLB QC and HSE Representative
	EPS 205: Streamer depth will be maintained between 10 m and 20 m depth.	Bridge logs records tow depth of the streamers.	Seismic Operator(s).
Real time positioning of streamers.	**EPS 206**: Intrinsic ranging by modulated acoustics (**irMA**) will be utilised for the real time positioning of the streamers.	Bridge logs and irMA data shows streamer positions.	Seismic Operator(s).
Adherence to vessel SOP's for streamer deployment and retrieval.	**EPS 207**: Survey equipment will be prepared, deployed, used and retrieved in accordance with relevant vessel SOPs for each equipment type.	Audit/inspection records and maintenance logs show checks have been completed and operating checklists in the SOP are filled and signed.	Seismic Operator(s).
Inspections and maintenance of streamers and associated equipment.	**EPS 208**: All in-sea equipment will be electronically monitored for performance and integrity during the course of the survey. Visual inspections will be carried out on any occasion the equipment is deployed or retrieved. Preventative maintenance will be carried out as per the vessels' Preventative Maintenance System.	Inspection records confirm equipment is fit-for-purpose and records any maintenance work that is required/carried out. Audit/inspection confirms Preventative Maintenance System in place on vessel.	Seismic Operator(s).

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
Recovery of lost streamer.	**EPS 209**: Lost streamer will be located and recovered, if safe and practicable to do so, by either of the survey vessels, in accordance with SLB's Non-Routine Equipment Recovery Procedures.	Incident report/record confirms loss of streamer and details recovery actions undertaken.	SLB Project Manager. Vessel Master(s). Party Chief.
No streamers will be towed within any water depths less than 40 m.	**EPS 210**: The streamers will not be towed within water depths less than 40 m.	Pre-mobilisation audit and inspection confirms exclusion polygons on survey vessel's navigation system have been developed and are available for use Bridge logs verify vessel track records to show no breach of these requirements.	Vessel Master. Survey Environmental Advisor. SLB QC and HSE Representative
Reporting of all incidents of lost equipment.	**EPS 211**: Loss of streamer and associated equipment (including in the event that lost equipment is successfully retrieved) will be recorded in an incident report.	Incident report/record shows the loss of the streamer and if the equipment is successfully retrieved.	SLB Project Manager Vessel Master. Party Chief.
	EPS 212: If the streamer cannot be retrieved, all relevant persons will be notified as soon as practicable through the communication pathways that will be in place. Communications will include GPS coordinates and all other relevant information.	Incident report/record shows the loss of the streamer and communications sent to relevant persons on the location of the equipment.	SLB Project Manager. Vessel Master. Party Chief.
	EPS 213: AMSA will be notified of any lost equipment as soon as practicable, as a potential navigation hazard.	Incident report/record shows the loss of the streamer and communications sent to AMSA on the location of the equipment.	SLB Project Manager. Vessel Master. Party Chief.
	EPS 214: Any complaints received regarding loss of equipment will be recorded in a complaint register.	Complaints register will outline any complaints received.	SLB Project Manager.

8.2.7 Streamer Loss Impact and Risk Summary

Based on the discussions above, including the potential impacts on the environment and the associated controls measures to be implemented, the residual risk of the loss of a streamer from the Seismic Vessel is considered to be **Low**.

The suite of control measures to be implemented have been developed in accordance with industry best practice. Consequently, it is considered that the environmental impacts and risks on the marine environment and receptors arising from streamer loss during the Seismic Survey, are reduced to **ALARP**.

In accordance with the acceptability requirements prescribed in **Section 6.4,** the suite of control measures is considered appropriate to manage the risks and impacts arising from the loss of a streamer during the Seismic Survey on all receptors to an **Acceptable Level**.

8.3 Vessel Collision, Sinking, and Bunkering and Associated Hydrocarbon Spills

8.3.1 Description of Source of the Impacts and Risks

In 2011 AMSA commissioned a study to estimate the risk of pollution from marine oil spills in Australian ports and waters (DNV, 2011). Part of this study assessed the breakdown of spills by accident type as a frequency per year; this assessment found that spill frequencies are dominated by drift grounding (21.6%), transfer spill (19.9%) and powered grounding (19.1%); whereas the frequency of a collision causing a spill is 11.6%.

The Seismic Vessel will be operating in deep offshore waters, with the vast majority of the survey lines being in waters 20- 200 m, or beyond the shelf edge. As outlined in **Section 3.4.5**, bunkering of the vessels will be undertaken at sea. Whilst this activity is recognised as a potential source of risk for a hydrocarbon spill during the Seismic Survey, the control measures and mitigating factors ensure that this risk, and magnitude of potential adverse effects, are small and any effects are restricted to well within the footprint of the OA. Given it is a source of risk, however, this is assessed alongside the risk of vessel collision for the purpose of this EP. The most catastrophic and hence 'worst-case' scenario for a spill occurrence is that associated with a vessel collision/sinking.

A collision between the survey vessels and another vessel (e.g. passing merchant vessels, fishing vessels, passenger vessels, etc.) has the potential to cause widespread environmental impacts. The most significant potential environmental impact associated with vessel collision is related to the vessel(s) sinking and making contact with the sea floor, or damage to the vessel(s) and associated release of on-board hazardous substances, specifically the oil, fuel and lubricants, and the effects of these substances on the marine and coastal environment. A surface release of hydrocarbons from a vessel collision or sinking has the potential to result in ecological impacts on various environmental receptors through surface, dissolved and entrained hydrocarbon exposure.

The very worst-case scenario for a hydrocarbon spill would likely arise where the entire contents of either of the survey vessel's fuel tanks (approximately 2,500 m^3 at 95% full) were released into the surrounding ocean. However, compartmentalised fuel storage systems will be on the vessels to be utilised during the Seismic Survey, which effectively reduced the volume of a spill that could occur if the vessel was damaged (complete rupture of the largest fuel tank at 100% full would result in the release of 257.4 m^3). In addition, onboard emergency procedures include transferring contents of a ruptured tank into other tanks, where possible.

However, a collision at sea is unlikely due to routine seagoing procedures undertaken by the crew and master (in accordance with COLREGs), the slow speeds at which the survey vessels will be operating (4 – 5 knots), notifications issued to other marine users (i.e. Notice to Mariners), as well as state of the art navigational systems (i.e. transmitting and receiving AIS and radar) which are typically found on Seismic Vessels, and which support the seismic data acquisition.

For bunkering of marine diesel between the support vessel(s) and the Seismic Vessel within the OA, two scenarios for a hydrocarbon spill include:

- Loss of containment of marine diesel during bunkering operations, such as a partial or total failure of a bulk transfer hose or fittings during bunkering. This failure may be caused by mechanical stress/ integrity issues that could spill marine diesel to the deck and/or into the marine environment. This is estimated to be in the order of less than 200 L, based on the likely volume of a bulk transfer hose (assuming a failure of the dry break and complete loss of hose volume); and

- Partial or total failure of a bulk transfer hose or fittings during bunkering, combined with a failure in procedure to shutoff fuel pumps, for a period of up to five minutes, resulting in approximately 8 m^3 marine diesel loss to the deck and/or into the marine environment.

8.3.1.1 Oil Spill Trajectory Modelling

SLB has commissioned an assessment of the oceanic dispersal and beaching potential in the unlikely event of a spill event resulting from vessel collision during the Seismic Survey (Calypso Science, 2022, see full report in **Appendix B**). In the assessment, a stochastic approach has been adopted to define the statistical probabilities related to oil trajectory, dispersion, diffusion, weathering, and beaching patterns. This was achieved by simulating the occurrence of 100 realistic spill events of MGO from three locations within the OA, randomly distributed over the previous decade with a continuous release of 1000 m^3 of MGO over six hours at sea level.

For this EP, the scenario of a hydrocarbon spill associated with bunkering was not included in the modelling outputs, however information from other EPs is presented to provide an indication of the likely extent of effects that could occur from such spills. The relatively small volume of any spill associated with a bunkering operation is small by comparison to the worst-case scenarios adopted for the trajectory modelling for vessel collision. Any spill associated with bunkering would be small, contained within the OA, and based on the fate and transport of MGO in the offshore environment, effects would be very localised around the site of the spill and would not persist for very long.

8.3.1.1.1 Methodology

To guide the site selection, AIS vessel traffic data from 2019 was plotted over the OA, highlighting the regions with highest traffic. On the basis of AIS density and geographic spread, three hypothetical spill locations (A, B, and C) were selected – allowing for maximum distance between the spill locations in order to capture the effect of variation in environmental factors on the spill outcomes (see **Figure 54**).

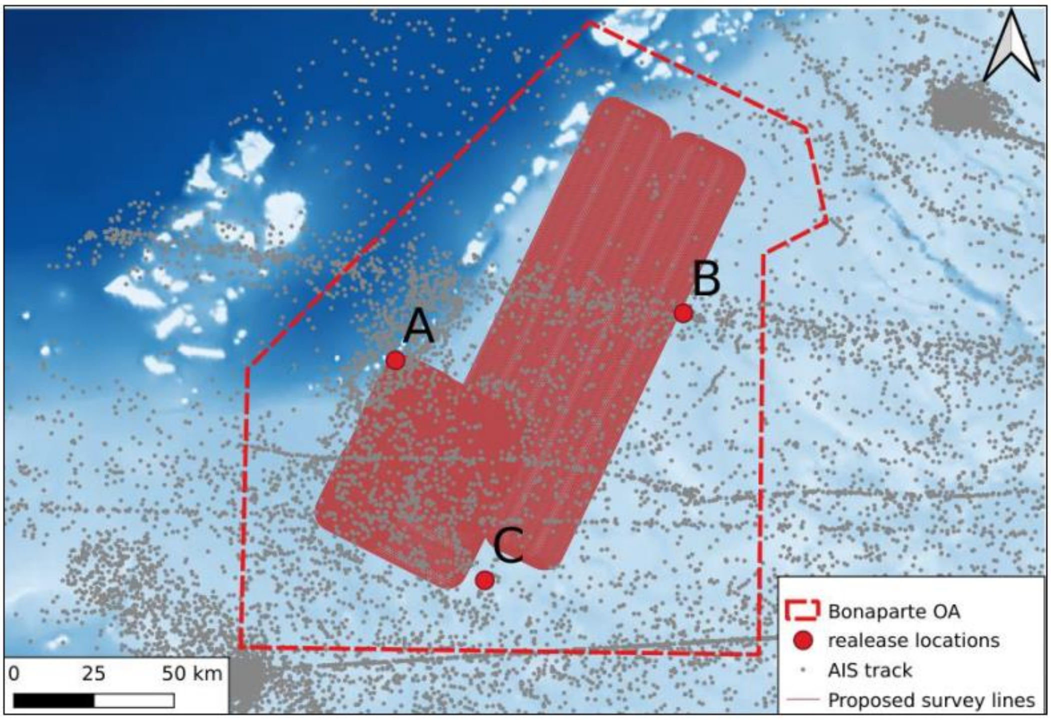


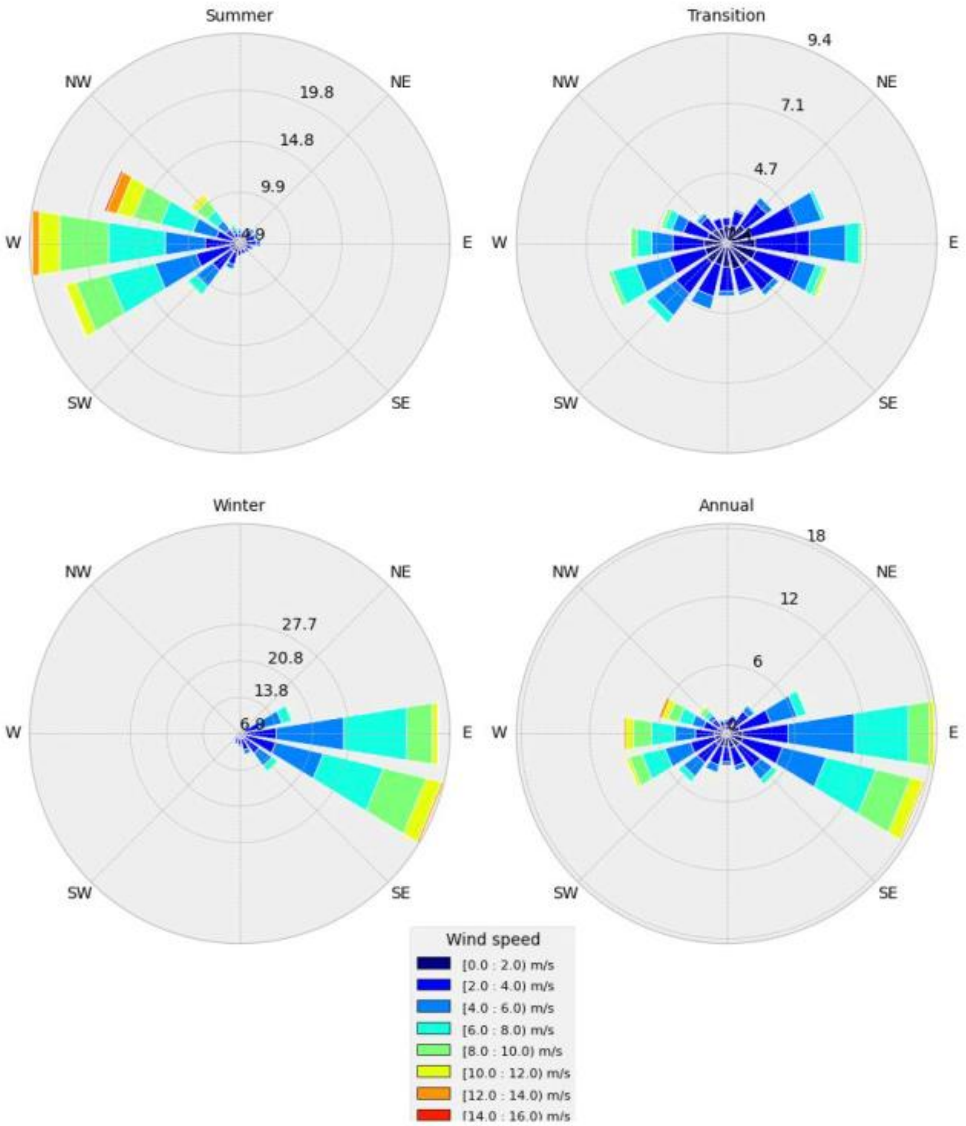
Figure 54 Position of the Three Spill Locations (A-C) Chosen within the Bonaparte OA

The fuel for the Seismic Vessel will either be marine diesel oil or MGO, with the latter having greater environmental persistence following a spill. Accordingly, the more conservative approach has been adopted for the study, with MGO being selected as the spill product. MGO has specific and well documented characteristics which influence its persistence in the marine environment after a spill event. The characteristics of the MGO is presented below.

- Density of 852 kg/m^3 and a kinematic viscosity of 3 cP at 15°C;
- Total wax content of 0.8% by mass with no significant emulsifying properties;
- Low pour point for both fresh oil and 250°C+ residue (<-36 °C);
- Low viscosity for both fresh oil and 250°C+ residue (< 20 mPa·s at 2 °C);
- Intermediate evaporative loss (30.6 vol. % at 250 °C); and
- Relatively high natural dispersion in breaking wave conditions and poor natural dispersion in non-breaking wave (swell) conditions.

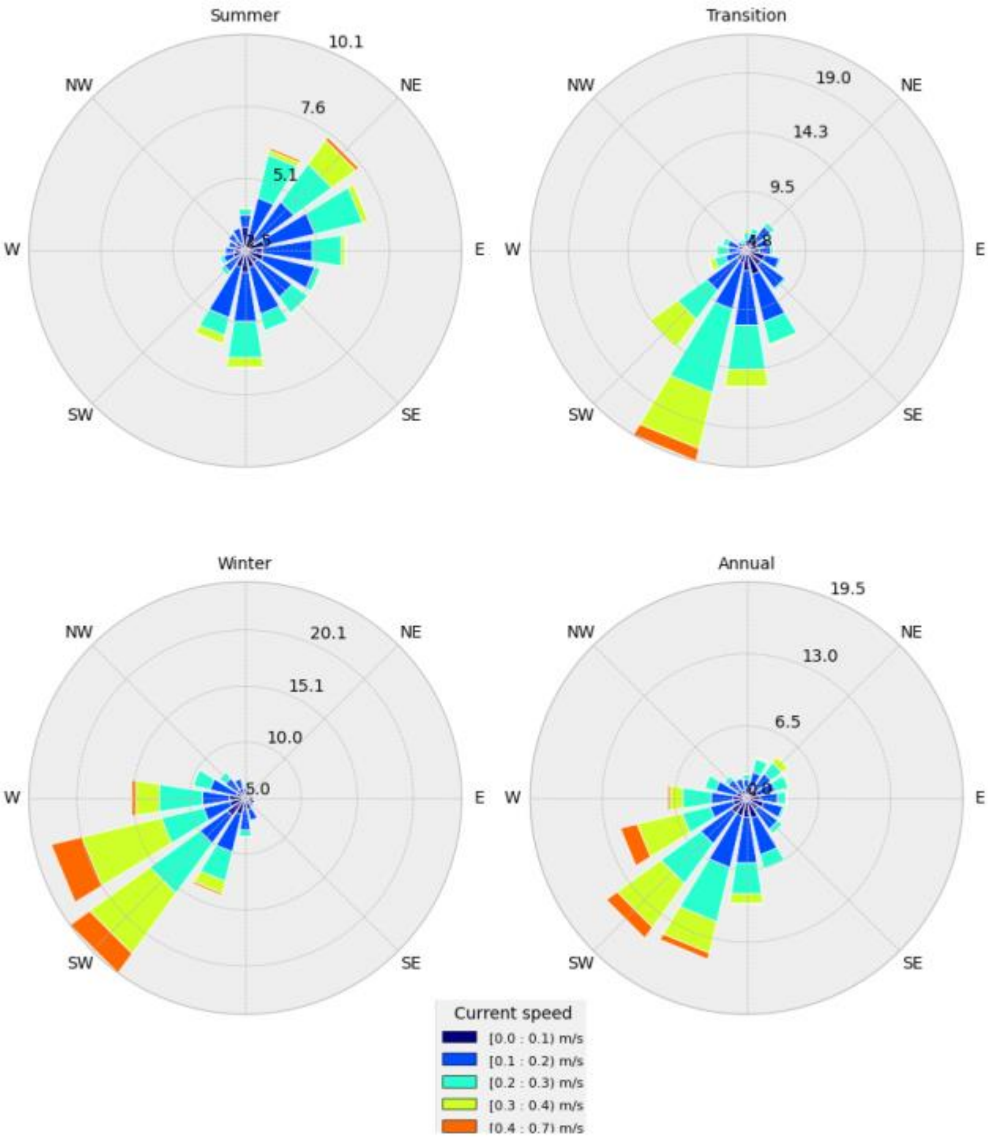
The simulated spill scenario was a surface release of 1,000 m^3 of MGO over a 6-hour period. Each spill was tracked by the model for 90 days, and the results used to form a database of 100 events which were analysed to derive statistics on the fate and mass budgets, plus the probability of occurrence for specific impacts. The OpenOil simulation framework was used to model the weathering dispersal and trajectory of the spill for a maximum exposure of hydrocarbons on the surface, entrained at water depths of 0-10 m and 10 to 20 m, dissolved in depths of 0-10 m and beaching.

Records of historical hindcasts of the wave, wind, and ocean current conditions from 2008-2017 were used to drive the numerical model. Rose plots for the seasonal and annual conditions for winds and surface currents are presented in **Figure 55** and **Figure 56**. Modelling was conducted at any time of year to ensure weather and hydrodynamic conditions provide the worst-case extent of the hydrocarbon release scenario, ensuring conservatism in the modelling.



Note: The wind directional convention is 'coming from'.

Figure 55 Annual and Seasonal Wind Roses at the Centre of the OA, from Hindcast Data 2008-2017



Note: The wind directional convention is 'coming from'.

Figure 56 Annual and Seasonal Current Roses for the Sea Surface (Tidal and Non-tidal) at the Centre of the OA, from Hindcast Data 2008-2017

8.3.1.1.2 Exposure Values

The outputs of the hydrocarbon spill modelling are used to assess the environmental risk, if a credible hydrocarbon spill scenario occurred, by defining which areas of the marine environment could be exposed to hydrocarbon levels exceeding exposure values that may result in impact to sensitive receptors. The degree of impact will depend on the sensitivity of the biota contacted, the duration of the contact (exposure) and the toxicity of the hydrocarbon mixture making the contact. The toxicity of a hydrocarbon will change over time, due to weathering processes altering the composition of the hydrocarbon.

The modelling considered four key physical or chemical phases of hydrocarbons that pose differing environmental and socioeconomic risks: surface, entrained, dissolved and shoreline accumulated hydrocarbons. The modelling used defined hydrocarbon exposure values, as relevant for risk assessment and oil spill planning, for the various hydrocarbon phases.

Applied exposure values used in the modelling study are summarised in **Table 101**. The adopted exposure values are based primarily on the instantaneous exposure values defined in NOPSEMA Bulletin #1 Oil Spill Modelling (April 2019).

Table 101 Summary of the Hydrocarbon Exposure Thresholds

Exposure Type	Potential Level of Exposure	Hydrocarbon Concentration	Description
Surface hydrocarbons (floating) (g/m^2)	Low	1	This value represents the area where a visible sheen may be present on the surface but is below concentrations at which ecological impacts are expected to occur. It is indicative of perceived impacts and areas that may be temporarily closed as a precautionary measure. It predicts the potential for some socio-economic impact (visual/aesthetic).
	Moderate	10	This represents the minimum oil thickness at which ecological impacts (e.g. to birds and marine mammals) are expected to occur. It is the lowest “actionable” level where spill response may be possible.
	High	50	This value is the estimated minimum floating hydrocarbon threshold for containment and recovery and informs response planning.
Total submerged hydrocarbons (entrained) (ppb)	Low	10	This value establishes the planning area for scientific monitoring based on potential for exceedance of water quality triggers.
	Moderate	100	This represents potential toxic effects, particularly sublethal effects to sensitive species and life stages.
	High	1000	This value represents lethal effects to sensitive species.
Dissolved hydrocarbons (ppb)	Low	10	This value establishes the planning area for scientific monitoring based on potential for exceedance of water quality triggers.
	Moderate	50	This represents potential toxic effects, particularly sublethal effects to highly sensitive species and life stages of fish and invertebrates (e.g. larvae, plankton).
	High	400	This value represents toxic effects including lethal effects to sensitive species.
Accumulated hydrocarbons (shoreline) (g/m^2)	Low	10	This value represents light oiling (equivalent to 2 teaspoons of oil per m2). It is indicative of perceived impacts and shorelines that may be temporarily closed as a precautionary measure and predicts the potential for some socio-economic impact (visual/aesthetic).
	Moderate	100	This represents the minimum oil thickness at which potential lethal ecological impacts (e.g. to intertidal invertebrates, shorebirds, mammals and reptiles) may occur. It also predicts areas likely to require clean-up effort.
	High	1000	This value predicts areas likely to require intensive clean-up effort. Potential significant impacts to coastal vegetation including mangroves and marshes.

8.3.1.1.3 Oil Spill Modelling Results

The set of 100 randomly selected spills over an historical decade provides a robust dataset to define the statistics of spill trajectory, beaching along the shore, and expected mass budgets of any spilled MGO.

The characteristics of MGO is that oil will quickly disperse under wave action but tends to persist as a surface slick during calm weather. On the sea surface, strong winds will increase the rate of evaporation, while the wave conditions associated with these winds also act to mix and disperse the oil into the upper layers of the ocean. Consequently, the day-to-day weather conditions strongly influence the mass budget of MGO throughout the simulations.

A summary of the oil spill modelling results is provided below, with a tabulated summary of the results for annual conditions provided in **Table 102**. The EMBA exhibits a southwest/northeast axis with an extension toward the JBG. Some 79% of the runs exceed 1 g/m^2 on the surface and 100% of the runs exceed the 10-ppb threshold in the water column. However, no concentration was found to exceed the highest thresholds. The modelled oil spill EMBA for surface, total submerged (entrained) and dissolved hydrocarbons for relevant Marine Parks, Shoals and banks and BIAs in addition to beaching is presented in **Figure 57, Figure 58, Figure 59** and **Figure 60**.

The results show that the fate of spilled MGO in the Bonaparte Basin is highly dependent on the wind and wave climate. During the transitional months (March, September, October and November) winds and waves are relatively calm and the fuel persists on sea surface for a longer time period than other seasons. There is less dispersion within the water column and more surface trajectory toward JBG. During the winter months (April, May, June, July and August) the plume tends to spread toward the southwest (i.e., Ashmore reef and Cartier Island), whereas during the summer months (December, January, February) the plume trajectory is predominantly directed toward the northeast.

On average, around 1.7% of the spilled volume can be expected to beach during an event at location B and less than 1% at locations A and C. The worst-case outcome from the simulations resulted in 13% of the spilled volume beaching on the North Kimberley Coast. Overall, on an annual basis, the location with the highest chance of oil beaching is JBG (6%), followed by the Ashmore Reef and Cartier Island area (5%) and North Kimberley coast (3%). The minimum times for the beaching concentration to reach 10 g/m^2 is 40 days for the Kimberley coast and 18 days for Ashmore Reef.

A review of available EPs identified that the potential extent of several small marine diesel spills has been modelled, including surface spill volumes of 8 m^3 in offshore waters of northwest Western Australia (Woodside, 2022; Woodside, 2021). This modelling showed elevated hydrocarbon concentrations are limited to the immediate vicinity of the spill site, with exposure to surface hydrocarbon concentrations above 10 g/m^2 predicted to occur within 1 km of the release point, with little potential to exceed this threshold beyond this distance. The 10 g/m^2 threshold representing concentration above which ecological impacts are expected to occur (being the ‘moderate’ threshold listed in **Table 101**).

Table 102 Annual Maximum Probability (in %) of Potential Sensitive Receptors reaching specific Concentration Thresholds due to a 1,000 m^3 MGO Spill at Location A-C

Potential Sensitive Receptor	Location A						Location B						Location C					
	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved
Hydrocarbon Concentration	1 g/m^2	10 ppb	100 ppb	10 ppb	100 ppb	10 ppb	1 g.m^2	10 ppb	100 ppb	10 ppb	100 ppb	10 ppb	1 g.m^2	10 ppb	100 ppb	10 ppb	100 ppb	10 ppb
Heywood Shoal		1																
Eugene McDermott Shoal								1					2	3	1	1		1
Vulcan Shoal	1													3		3		
Barracouta Shoal		5											1	4	2	2		
Woodbine Bank		2												3		1		
Hibernia Reef		1																
Fantome Shoal	10	18	5	7				2						3				
Sahul Bank	76	97	88	67	15	7	7	15	4	8				4				
Margaret Harries Bank								2										
Gale Bank	1	2				1	2	6	2			2	8	9	1			2
Van Cloon Shoal													4	5				2

Potential Sensitive Receptor	Location A						Location B						Location C					
	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved
Hydrocarbon Concentration	1 g/m^2	10 ppb	100 ppb	10 ppb	100 ppb	10 ppb	1 g.m^2	10 ppb	100 ppb	10 ppb	100 ppb	10 ppb	1 g.m^2	10 ppb	100 ppb	10 ppb	100 ppb	10 ppb
Flat Top Bank								1										
Penguin Shoal	1	1				1							2	1				1
Bassett-Smith Shoal													1	2				1
Holothuria Bank	1					1								1				
Long Reef																		
Johnson Bank		2												3		2		
Kimberley MP (Multiple Use Zone VI)	1	2						2					2	4				1
Cartier Island MP (Sanctuary Zone Ia)		1												3				
Ashmore Reef MP (Recreational Use Zone IV)														2				
Ashmore Reef MP (Sanctuary Zone Ia)		1												2		2		

Potential Sensitive Receptor	Location A						Location B						Location C					
	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved
Hydrocarbon Concentration	1 g/m²	10 ppb	100 ppb	10 ppb	100 ppb	10 ppb	1 g.m²	10 ppb	100 ppb	10 ppb	100 ppb	10 ppb	1 g.m²	10 ppb	100 ppb	10 ppb	100 ppb	10 ppb
Oceanic Shoals MP (Multiple Use Zone VI)	1	6		2		1	37	58	39	35		10	17	25	8	9		6
Joseph Bonaparte Gulf MP (Special Purpose Zone VI)								1						1				
Joseph Bonaparte Gulf MP (Multiple Use Zone VI)		1						2						3				1
Pinnacles of the Bonaparte Basin KEF							5	8	2	1		4	2	5		2		2
Carbonate bank and terrace system of the Sahul Shelf KEF	16	31	13	15		4	79	100	89	74	8	12	78	99	91	73	6	9
Ashmore Reef, Cartier Island and surrounding Commonwealth waters KEF		3		1										4		2		

Potential Sensitive Receptor	Location A						Location B						Location C					
	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved
Hydrocarbon Concentration	1 g/m²	10 ppb	100 ppb	10 ppb	100 ppb	10 ppb	1 g.m²	10 ppb	100 ppb	10 ppb	100 ppb	10 ppb	1 g.m²	10 ppb	100 ppb	10 ppb	100 ppb	10 ppb
Continental Slope Demersal Fish Communities KEF		5												4		2		
Ancient coastline at 125 m depth contour KEF		2											1	2				
Dolphin BIAs														2				
Pygmy Blue Whale BIA	44	55	37	35	1	1	3	9	2	6				8		3		
Seabird BIAs	3	15	1	2		1	2	11		2		1	12	26	3	5		4
Marine Reptile BIAs	1	9		1		1	37	55	32	29		8	14	27	5	9		6
Dugong BIAs														2		2		
Whale Shark BIA	46	71	48	44	4	7	77	91	77	69	8	4	78	99	93	76	6	4
North Kimberley Marine Park								1						2				
Joseph Bonaparte Gulf SE Coastline																		

Note: blank cell is the same as 0 % probability).

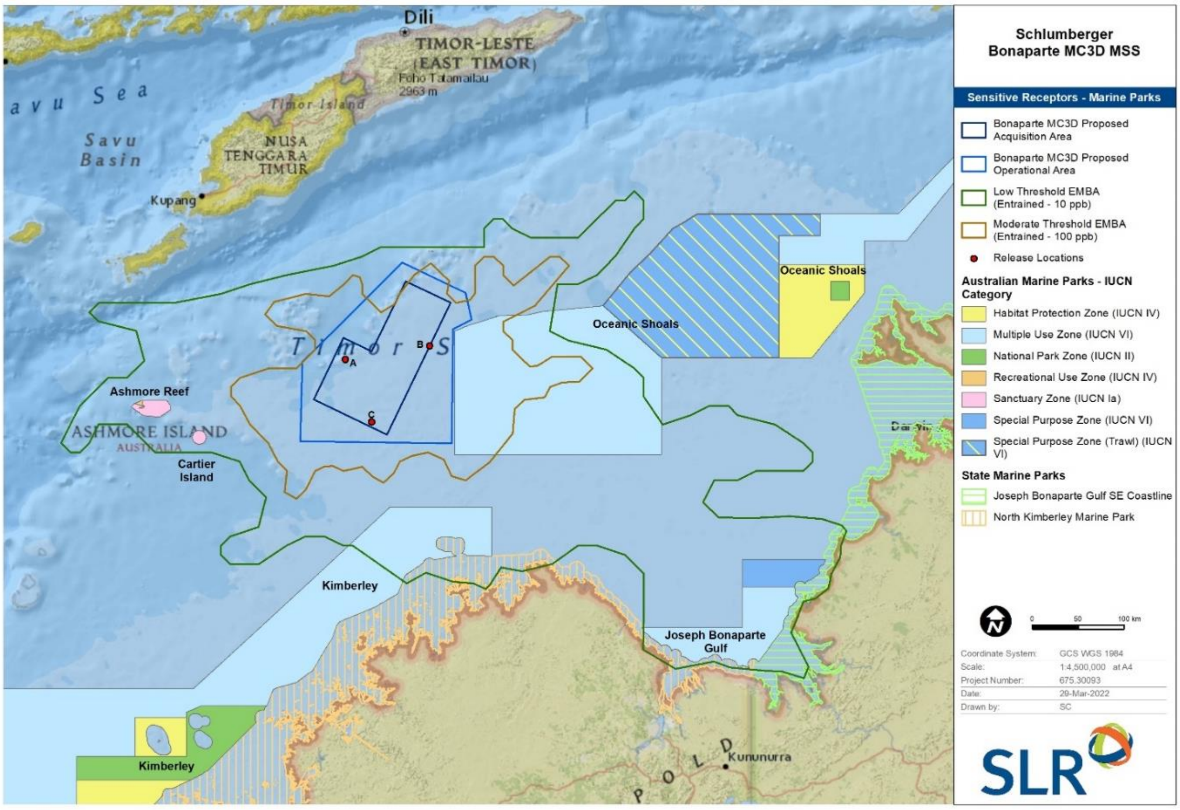


Figure 57 Hydrocarbon Spill Scenario from Release Location A-C for a 1,000 m^3 MGO spill – Marine Parks

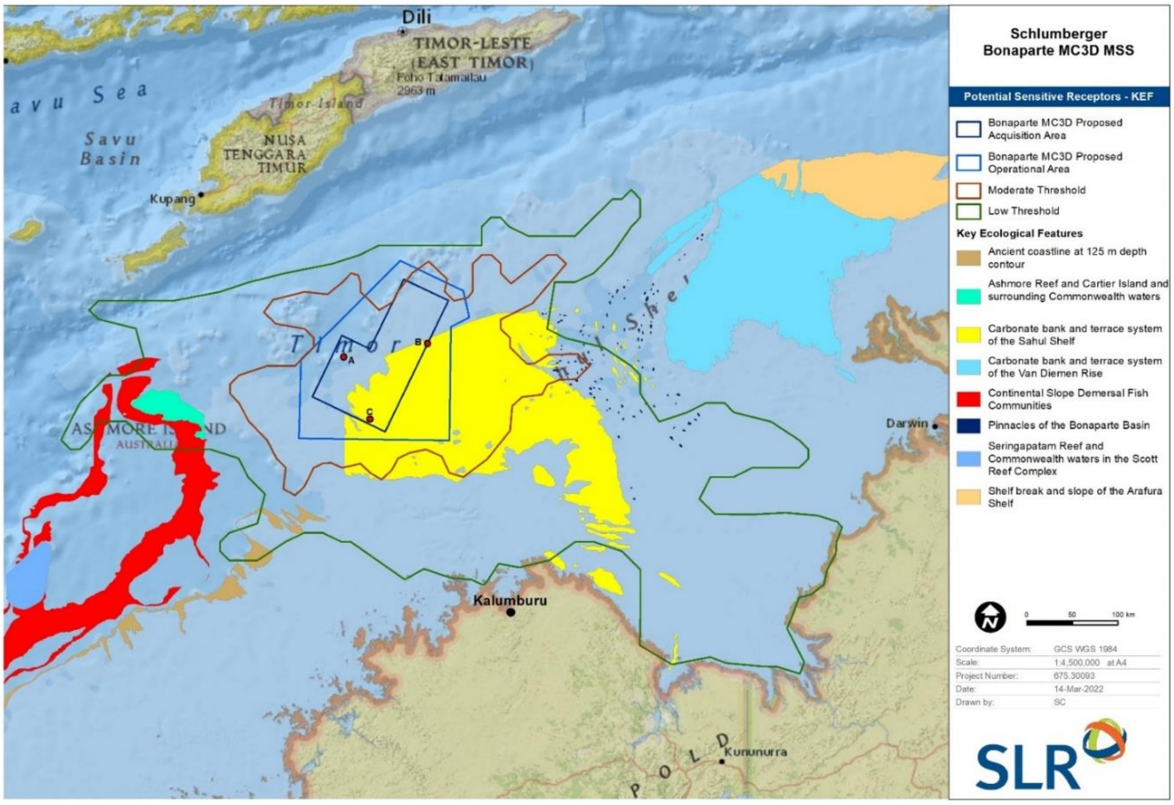


Figure 58 Hydrocarbon Spill Scenario from Release Location A-C for a 1,000 m^3 MGO spill – Key Environmental Features

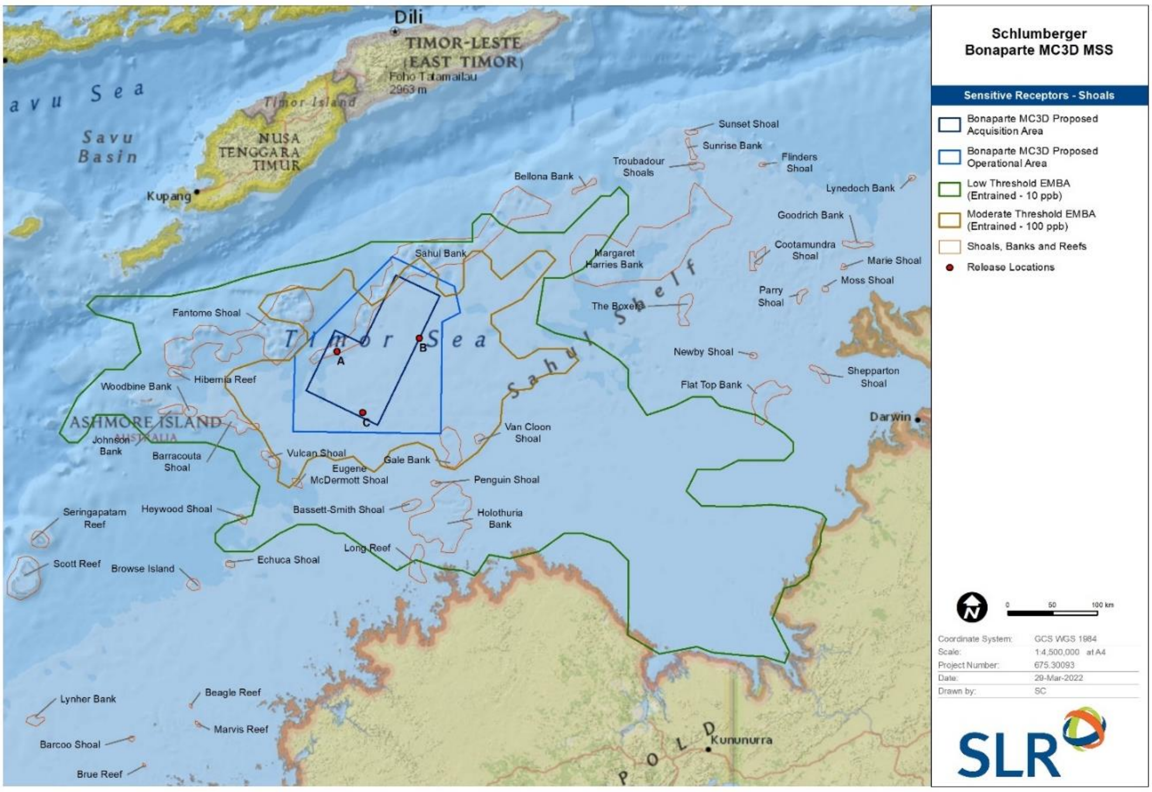


Figure 59 Hydrocarbon Spill Scenario from Release Location A-C for a 1,000 m^3 MGO spill – Shoals and Banks

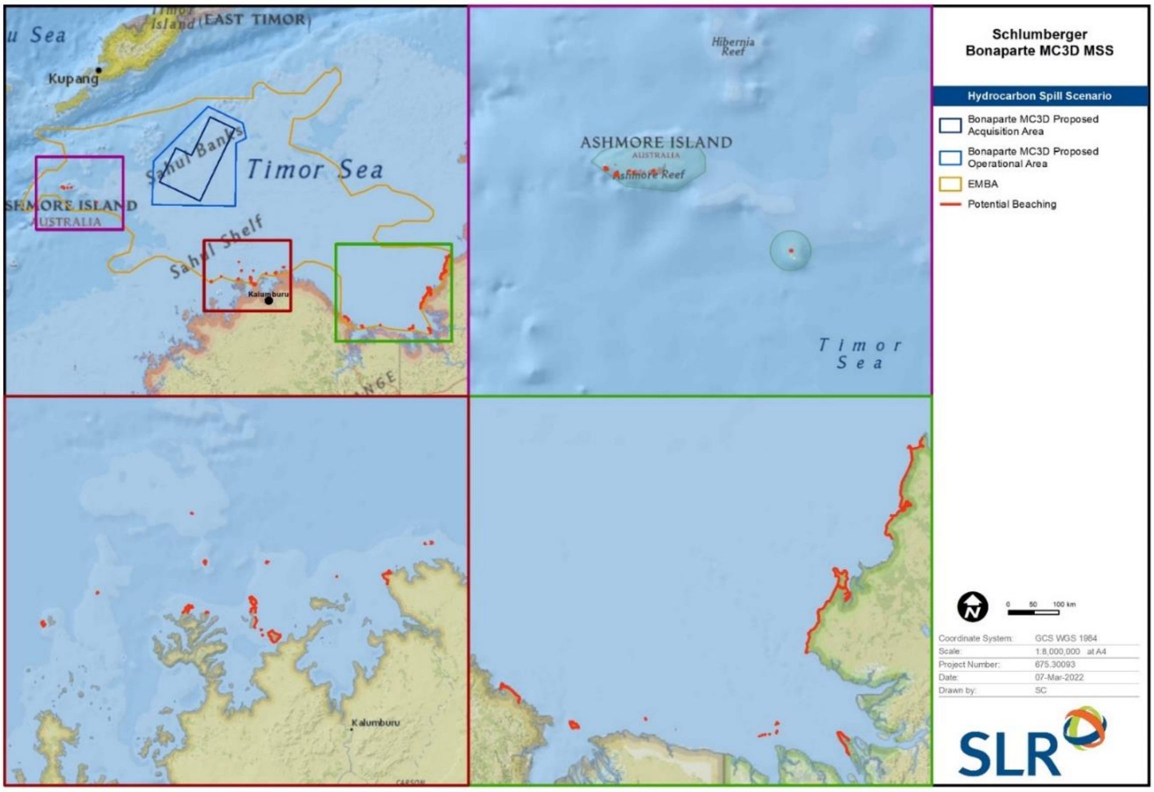


Figure 60 Hydrocarbon Spill Scenario from Release Location A-C for a 1,000 m^3 MGO spill – Potential Beaching

8.3.2 Evaluation of Known and Potential Impacts and Risk to Environmental Receptors

Using the information presented in **Section 2** to **Section 5**, the impact and risk assessment has been undertaken for those receptors determined to be relevant to the activity as listed in **Table 103**.

Table 103 Environmental Receptors Assessed

Receptor	Section reference
Marine environment quality (water and air quality)	**Section 8.3.2.1**
Benthic invertebrates	**Section 8.3.2.2.1**
Zooplankton, fish eggs and larvae	**Section 8.3.2.2.2**
Bony fish and elasmobranchs	**Section 8.3.2.2.3**
Marine reptiles	**Section 8.3.2.2.4**
Cetaceans	**Section 8.3.2.2.5**
Seabirds and migratory shorebirds	**Section 8.3.2.2.6**
Cultural and heritage sites	**Section 8.3.2.3**
Coastal marine environment	**Section 8.3.2.4**

Potential effects of a hydrocarbon spill on the marine environment will be influenced by factors such as the weather and sea conditions at the time (**Section 8.3.1.1**), the specific characteristics of the hydrocarbon fuel type, effectiveness of clean-up/response measures (**Table 106**) and the sensitivity of the environment and organisms that exist in the affected area (**Section 4.5**). Hydrocarbon spills will affect the water quality in the upper surface waters of the water column and can cause immediate/acute chemical and physical impacts to marine species, as well as longer term/chronic impacts such as bioaccumulation in the food chain and behavioural changes (e.g., predator/prey interactions).

The known effects of hydrocarbon spills on the marine environment are well documented and include, but are not limited to:

- Direct and indirect toxicity effects (e.g. Alonso-Alvarez *et al.,* 2007; Almeida *et al*., 2012; Schwacke *et al*., 2013);
- Removal and damage to, or exclusion from habitats and other important areas (Lee and Page, 1997);
- Bioaccumulation in the food chain, disruption of food chains and predator/prey interactions (e.g. Abbriano *et al.,* 2011; Ansari *et al.,* 2012; Wise *et al*., 2014);
- Loss of waterproofing, buoyancy, swimming ability, filtering capabilities, and thermoregulatory abilities from external oiling (especially in pinnipeds and seabirds) (e.g. Jenssen, 1994; O'Hara and Morandin, 2010); and
- Exclusion of users of the marine environment due to contamination/tainting of edible species or altered perception (e.g., Law and Hellou, 1999; McCrea-Strub *et al.,* 2011; Balcioglu, 2016).

Different hydrocarbon fuel types have different chemical characteristics which influence the fate if released into the receiving environment. Combined with the location of potential release, and prevailing weather conditions, the rate of other processes (dispersion, dilution, partitioning, beaching, biodegradation and photo-oxidation) will be affected.

The modelled fate and exposure probabilities to sensitive receptors of MGO spilled into the marine environment is summarised in **Table 102**. The bulk of MGO spilled into the marine receiving environment will, over time, become dispersed, and undergo physical evaporation, with a component expected to become gradually submerged, and a low proportion potentially beached (depending on location and prevalent weather conditions). These characteristics significant impacts to

Marine fauna in the open ocean areas of the Bonaparte Basin is described as relatively mobile and are expected to be able to display avoidance behaviours in the event of any hydrocarbon release. By contrast, fauna (and flora) with less mobility that would not exhibit immediate behavioural response (e.g. plankton/primary producers, benthic species, early life stages (juvenile) of cephalopods and some vertebrate species) , as well as benthic environments and coastal ecosystems could be at risk of being contacted by a hydrocarbon spill if a release event were to occur during a more sensitive life stage for the animal (i.e., seasonally depended), or on the southern extent of the OA whereby a higher probability of oil beaching may be incurred.

8.3.2.1 Potential Marine Environment Quality Impacts and Risks

A vessel collision has the potential to affect the local marine environment by impacting the surrounding water and air quality in the vicinity of the incident. In the highly unlikely event of a vessel collision/sinking these effects are predicted to be localised and temporary, and conditions will quickly return to background levels on account of weathering of spilled hydrocarbons, on-site response actions (if required), and in-water dilution effects.

Similarly, any release of hydrocarbon as a result of refuelling incident is, by comparison to a vessel collision, regarded as small and there will be negligible impacts on the physical marine environment. Given the small volume of release expected, any acute effects of a spill entering the marine waters are expected to be rapidly mitigated by immediate dilution and dispersion. On board control measures and operational contingencies are expected to minimise further release into the marine receiving environment.

A worst-case larger spill scenario at a southern location in the OA could pose potentially longer-term impacts, given the increased likelihood of oil beaching. Oil beaching has the potential to interfere with sensitive receptors on near shore/ intertidal areas, through habitat modification, or through the physical smothering/impairment of the animal itself (e.g., impairment of their feeding, respiratory and/or locomotory structures). Given the OA is located a significant distance offshore, any potential hydrocarbon release is expected to undergo significant physical dispersion and dissolution, prior to any amount being beached.

Localised seabed damage and disturbance could occur in the event that vessel debris makes contact with the seabed. Across much of the OA the seabed is likely to be composed of gravelly muddy sand and sinking debris would marginally disturb the seabed as it lands, with potential resuspension of fine-grained sediments.

Where possible, damaged vessels resulting from collision would be salvaged and returned to a suitable facility for repair or disposal, and smaller items of debris would be recovered.

Based on the above, the residual risk of a vessel collision and associated hydrocarbon spill on the physical marine environment has been assessed as **Low** (*minor* x *remote*).

The residual risk associated with refuelling and associated hydrocarbon release on the physical marine environment has been assessed as **Negligible** (*negligible* x *remote*).

8.3.2.2 Potential Biological Environment Impacts

Potential adverse effects on the marine environment from marine debris released during a sinking event include entanglement and ingestion. Entangled individuals may drown, suffer from injury, or be subject to reduced foraging efficacy and/or predator avoidance. Ingestion of foreign debris is also a possibility which could lead to blocked digestive tracts, internal injury, and suppressed appetite (Laist, 1987). However, the majority of marine debris released through a vessel collision/sinking event would not be of the nature that would cause such effects (i.e. entanglement and ingestion is particularly problematic for plastics and discarded fishing gear), and the majority of such debris would likely remain contained within their collection receptacles onboard the vessel.

In the event of a vessel collision/sinking, the greatest impact to the biological environment will be associated with the release of hydrocarbons. Light oils, such as MGO, are significantly more toxic to marine organisms than heavy crude oils (NOAA, 2022), although lighter oils are less persistent in the marine environment due to evaporation of volatile components. Environmental impacts from a spill following vessel collision/sinking in the marine environment will primarily be restricted to those species that inhabits the sea surface, mainly marine mammals, seabirds and marine reptiles, although fish, cephalopods and zooplankton may also be impacted (at a chronic level) following dispersion and partitioning.

Any release of hydrocarbon as a result of refuelling incident is, by comparison to a vessel collision, regarded as small. The small volume of potential discharge would possibly impact the immediate surrounding water in the vicinity of the spill. Given the small volume of release expected, any acute effects of a spill entering the marine waters are expected to be rapidly mitigated by immediate dilution and dispersion – concentrations of concern would not be expected beyond a distance of around 1 km (discussed in **Section 8.3.2.3**). On board control measures and operational contingencies are expected to minimise further release into the marine receiving environment. To reduce risks to shallow water features and the more sensitive ecological values that inhabit them, SLB will not undertake refuelling at sea within 5 km of: 1) any shallow water feature which rises to within 40 m of the sea surface; 2) the Oceanic Shoals Marine Park; or 3) the Carbonate Bank and Terrace System of the Sahul Shelf KEF – these buffer areas are shown in **Figure 61**. The 5 km buffer distance from these sensitive receptors is considered to be very conservative as the available literature suggests concentrations of concern are likely to be restricted to within 1 km of any likely spill during refuelling.

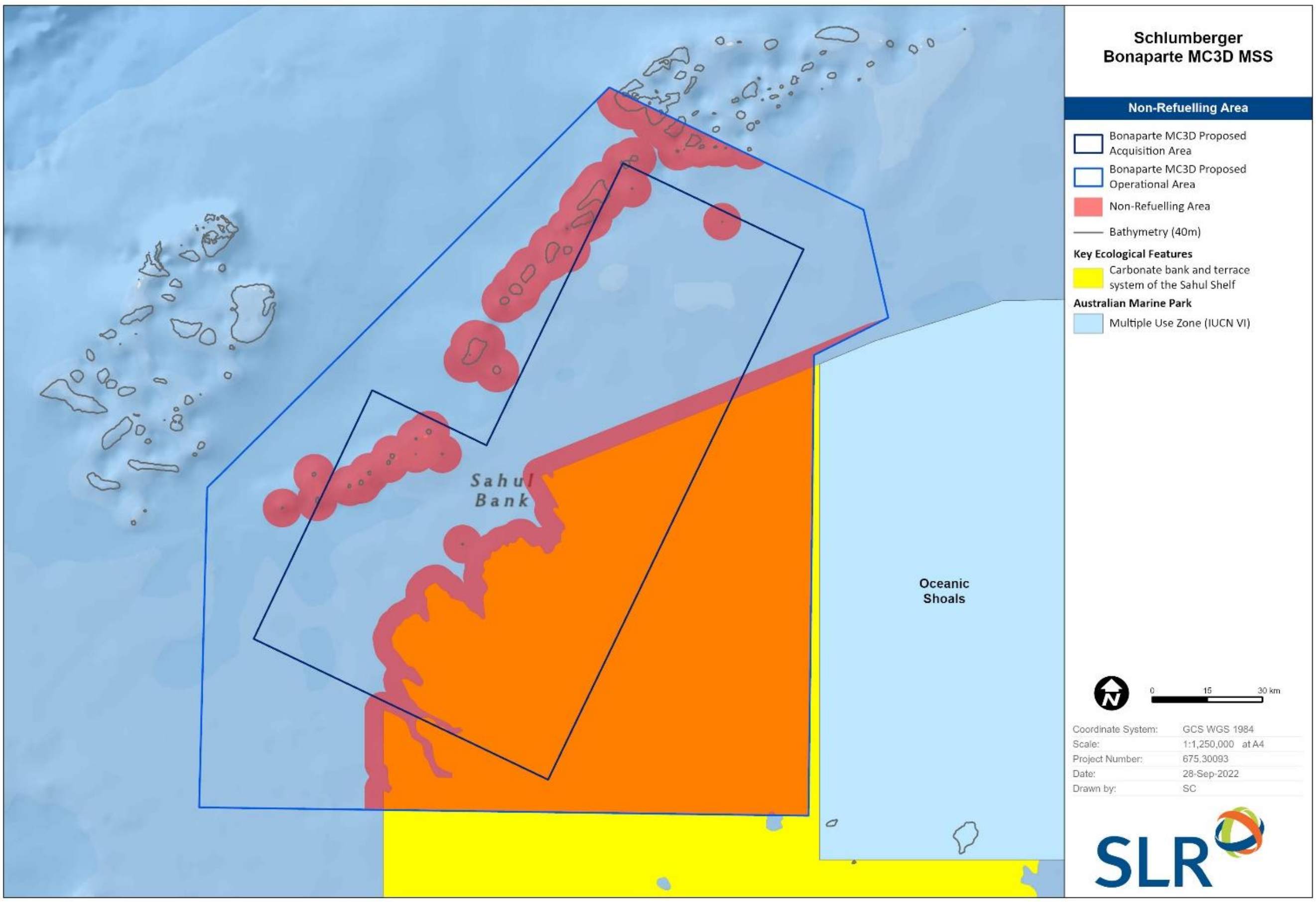


Figure 61 Proposed Non-Refuelling Areas

8.3.2.2.1 Benthic Invertebrates

A release of hydrocarbons under a worst-case scenario may impact benthic species under certain weather/spill conditions. Benthic invertebrate species (e.g., molluscs, echinoderms) occurring on more shallow areas such as shoals (which are shown to occur within the EMBA) may be more vulnerable adverse effects of hydrocarbon pollution than vertebrate species. Potential impacts can be acute effects (i.e., mortality, significant impairment of behaviour, feeding, motility), or longer-term chronic effects (e.g., impaired growth and reduced fecundity).

Sessile invertebrates (e.g., coralline reef assemblages, occurring between shoals, see **Section 4.5.2.1**) and species with low mobility (soft-sediment benthic invertebrates including taxa listed in **Section 4.5.2.2**) may be susceptible to physical effects of vessel collision/sinking. Risk of exposure to any hydrocarbon release, however, is expected to be low given the depth and expected dispersion/evaporation/dissolution of any spilled MGO into the marine receiving environment. Life history strategies (e.g., high fecundity, high recruitment) for many benthic invertebrates also ensures that if any adverse impacts are incurred, localised population resilience and recovery will be rapid.

The Seismic Survey will be undertaken in waters ranging from 20-200 m in depth. This depth physically mitigates and attenuates any potential for direct oiling impacts on the benthic environment from a spill within the OA, including shoals, given and spill plume will largely be buoyant in the surrounding ocean. Any oil beaching is more likely to incur potential direct acute and chronic effects to near shore/intertidal invertebrates if they come into direct contact with any beached MGO. This scenario is highly unlikely, and any effects are expected to be highly localised.

Based on the parameters of the proposed Seismic Survey, the control measures in place and the physical properties of the MGO if it is released in the marine environment, the potential for long-term impacts to benthic invertebrates from an MGO spill are very unlikely. The residual risk to benthic invertebrates arising from an accidental release of MGO as a result of a vessel collision/refuelling incident during the Seismic Survey has been assessed as **Low** (*minor x remote*).

8.3.2.2.2 Zooplankton, Fish Eggs and Larvae

During and after an oil spill event, marine zooplankton, phytoplankton, eggs and larvae may exposed to dissolved oil fractions and dispersed oil droplets. Several studies have demonstrated that plankton may take up dissolved petroleum hydrocarbons by passive mechanisms or consuming contaminated phytoplankton, as well as ingestion of oil droplets (Almeda *et al*., 2016). If dissolved fractions are high, acute toxicity thresholds may be incurred.

A hydrocarbon spill within the EMBA has the potential to overlap with spawning of some fish species (**Section 4.5.3.1**). Depending on the time of year, larval stages of commercially targeted fish species of *Serranidae* sp. (cods) and *Lutjanidae* sp. (snappers), and *Scombridae* sp. (mackerel) may be affected. Other important planktonic species such as krill, and macro-zooplankton assemblages may be impacted.

Any hydrocarbon spill has the potential to reduce the water quality by increasing toxicity due to the presence of entrained/dissolved hydrocarbons, resulting in localised mortality of plankton due to potentially acute thresholds. Acute toxicity thresholds will be highest in areas close to the spill source. However, MGO is expected to rapidly evaporate and disperse/partition the offshore environment, reducing the acute toxicity of the spill. Whilst localised mortality for zoo- phytoplankton species may occur; this is expected to be localised and short term. Due to their vertical stratification within the water column (eggs and larvae are generally not at the sea surface), eggs and larvae are less likely to come into direct contact with the bulk of any spill.

Planktonic communities impacted by a spill are expected to recover quickly (weeks/months) due to rapid fecundity and recruitment (ITOPF, 2011). The residual risk to plankton arising from an accidental release of MGO as a result of a vessel collision/refuelling incident during the Seismic Survey has been assessed as **Low** (*minor x remote*).

8.3.2.2.3 Bony Fish and Elasmobranchs

The primary pathways to exposure for fish from a hydrocarbon spill are through direct dermal contact such as oiling of gills/smothering (Hook *et al*., 2016), and/or ingestion of contaminated prey.

Fish are also at risk from an MGO spill due to partitioning of dissolved hydrocarbons and any entrainment of hydrocarbons within the water column (leading to exposure through ingestion or dermal contact). This risk is reduced by the fact that adult fish have chemoreceptors – sensitive for detecting taste and smell, which can enable them to avoid the areas of a spill where there are hydrocarbons within the water column (NERA, 2018).

Due to their mobility, it is unlikely that pelagic fish would be exposed to acutely toxic concentrations of spilled hydrocarbons for the extended periods of time required to result in acute toxicity to be incurred. NOAA (2012) and ITOPF (2011) have reported that deaths of adult fish are rarely observed from hydrocarbon spills in the open ocean due to the rapid dilution and evaporation.

The Bonaparte Basin supports a diverse assemblage of fish and thirteen threatened and/or migratory species of sharks and rays identified by the EPBC Protected Matters search may be present within the EMBA (refer to **Section 4.5.3**). Given the absence of critical habitat for most of these species, significant numbers are not expected to be impacted; however, the southern part of the OA overlaps with a whale shark foraging BIA (See **Figure 18**). This BIA represents waters where solitary whale sharks may forage during the migration from Ningaloo, which occurs primarily in Spring (September to November). Oil spill modelling predicted that should a spill occur; the BIA could be exposed to moderate concentrations of entrained hydrocarbons (100 ppb) (refer to **Section 8.3.1**). Information on the possible effects on whale sharks of an oil spill are largely unknown, but could have serious implications; for example, if a spill were to occur, the health of individual whale sharks, or the group as a whole, could be affected both directly through ingestion of oil and indirectly through disruption to food sources (DPAW, 2013). The risk for this to happen is however particularly higher for an oil spill containing crude oil than MGO that rapidly dilutes and evaporates in the water column.

Other species of sharks and rays could be present at low densities all year round within the OA and EMBA; however, the absence of any known feeding, resting or breeding areas means significant numbers are unlikely to be impacted if an unplanned release were to occur.

As the fish populations within the OA and EMBA are highly mobile pelagic species, it is unlikely that fish populations would be subjected to sufficient hydrocarbon contamination for periods long enough to result in mortality. Fish populations are likely to be distributed over a wide geographical area so impacts on populations or species level are considered to be negligible. Combined with these factors and the rapid dispersion of marine diesel, the residual risk to fish species arising from an accidental release of MGO as a result of a vessel collision/refuelling incident during the Seismic Survey has been assessed as **Low** (*minor x remote*).

8.3.2.2.4 Marine Reptiles

Marine reptiles are particularly at risk from a hydrocarbon spill as they need to surface for breathing, and may be exposed to ingestion, inhalation and/or skin contact with hydrocarbons on the ocean surface. MGO has a low stickiness so it is unlikely to stick to turtles in large amounts and would likely wash of skin surfaces; however, MGO may cause skin irritation to sensitive organs such as eyes. If hydrocarbons from the spill reached the shoreline in large amounts which coincided with turtle hatchlings going to sea, then this could have an impact on the survival of those turtles.

Ten species of threatened marine reptile and/or migratory species has been identified as possibly being present within the EMBA (**Section 4.5.5**). In the unlikely event of a hydrocarbon spill occurring, individuals traversing open water may come into contact with water column (submerged/dissolved) or surface MGO. The EMBA overlaps or are located close to several foraging and three nesting/internesting BIAs (refer to **Section 4.5.5**). Oil spill modelling predicted that the foraging BIAs may be partially exposed to low concentrations of sea surface hydrocarbons (1 g/m^3), low concentrations of dissolved hydrocarbons (10 ppb) and moderate concentrations of entrained hydrocarbons (100 ppb) should a spill occur (see **Table 102**).

A hydrocarbon spill within the OA may result in impacts to individual marine turtles and a potential disruption to a portion of the foraging/internesting habitat; however, this is not expected to result in a threat to the overall population viability due to the rapid dispersion of MGO. The residual risk to marine reptiles arising from an accidental release of MGO as a result of a vessel collision/refuelling incident during the Seismic Survey has been assessed as **Low** (*minor x remote*).

8.3.2.2.5 Cetaceans

Marine mammals in the area could potentially ingest MGO when feeding in open water, or they could get coated with MGO when they surfaced to breath. However, given MGO has a low stickiness, it is likely that it would wash off the dorsal surfaces of cetaceans as they dived into deeper waters. MGO contact with sensitive body parts such as eyes may cause injury or damage and when cetaceans surface to breath, and there is the potential for volatile hydrocarbons to be inhaled. Hydrocarbons are fat-soluble and therefore tend to bioaccumulate before being eliminated by metabolism and excretion (Troisi *et al*., 2007). Physiological effects from internal contamination include dehydration, anaemia, organ damage, intestinal ulceration, immunosuppression, irritations and burns to mucous membranes (Balsiero *et al*., 2005). Cetaceans that spend extended periods of time at the sea surface will be particularly at risk to the effects of an MGO spill.

Eleven migratory marine mammal species were identified by the EPBC Protected Matters search within the EMBA (See **Section 4.5.6**). Of these, one is listed as endangered (blue whale (considered to be the pygmy blue whale sub-species) and two as vulnerable (fin whale and sei whale). The hydrocarbon spill EMBA overlaps breeding and foraging BIAs for Australian snubfin dolphins, Indo-Pacific humpback dolphins, spotted bottlenose dolphins, and dugong. The EMBA also overlaps the migration BIA for pygmy blue whales. However, the BIAs (except for pygmy blue whales) are all located south of the area predicted to be affected by surface hydrocarbons from an oil spill **(Section 8.3.1.1**).

These species are expected to be present in the EMBA in low numbers and limited to isolated individuals or small pods and in the unlikely event of a spill occurring, they are not expected to remain in the vicinity of spilled hydrocarbons for extended periods. Although surface feeding cetaceans would be sensitive to a hydrocarbon spill, the residual risk of a vessel collision/refuelling incident and associated MGO spill on cetaceans has been assessed as **Low** (*minor x remote*) on account of their ability to metabolise hydrocarbons, low degree of adhesiveness of the MGO, and the fast dispersion and weathering of volatile hydrocarbons.

8.3.2.2.6 Seabirds and Migratory Shorebirds

Seabirds are susceptible to potential impacts at various exposure levels for surface oil through pathways such as a reduction in insulation and waterproofing, ingestion, impaired flight and navigation (AMSA, 2017). Depending on the length of time of exposure, especially in the case of areas of heavy oiling, direct contact with surface hydrocarbons can result in irritation of the skin and eyes and some individuals may die as a result of exposure.

Oiling, or external contamination of seabirds is particularly problematic and can lead to a loss of insulation, buoyancy, and the ability to fly or swim (as observed for penguins but noting there are no penguin colonies in the EMBA). Seabirds will groom/preen themselves in an attempt to remove any contamination, leading to ingestion and further toxicity effects from any MGO which might have adhered to their fur/feathers. However, MGO has a dispersive nature, and the majority of seabirds are highly mobile so if any hydrocarbon was spilt, a significant/acute impact is unlikely.

Sixteen threatened bird species, as identified by the EPBC Protected Matters database search may be encountered during the Seismic Survey (refer to **Section 4.5.7**). Four of the threatened bird species may occur in the OA, with the remaining species potentially present within the EMBA. The EMBA overlaps breeding BIAs for 10 bird species, none of which are located within the OA. The maximum probability of an oil spill reaching specific concentration thresholds at the surface close to BIAs are relatively low, 2-12%, slightly higher (up to 26%) for entrained oil 0-10 m (see **Table 102**). This is unlikely to have any major impact on nesting or egg laying individuals in colonies, since the closest breeding BIA are located at a minimum of 50 km from the OA, however, it is possible that individuals could come into contact with surface or entrained MGO while foraging (diving and skim feeding) closer to the OA. Although oceanic seabird species can travel long distances to forage in offshore waters, most breeding seabirds tend to forage in nearshore waters near their breeding colony, resulting in intensive feeding by higher seabird densities in these areas during the breeding season and making these areas particularly sensitive in the event of a spill.

Shorebirds foraging for food in intertidal areas or along the high-tide mark may encounter weathered hydrocarbons, subsequently returning to the next and/or ingested. However, by the time this may occur, the hydrocarbons are expected to be heavily weathered and likely to permeate through the sandy areas, limiting the potential accumulation on adult birds. Potential toxicity effects from ingestion of weathered hydrocarbons are not expected due to the properties of MGO, with the volatile aromatics evaporating rapidly after a spill event.

The residual risk to seabirds arising from an accidental release of MGO as a result of a vessel collision/refuelling incident during the Seismic Survey has been assessed as **Low** (*minor x remote*).

8.3.2.3 Potential Impacts and Risks to Cultural and Heritage Sites

Sections 4.6.1.1 and **4.6.1.2** detail the southern extent of the EMBA that overlaps with the Western Australia Native Title Determination Area, namely areas on Uungugu Indigenous Protection Area, and Balanggarra Region. Traditional fishing is also recognised to occur across the EMBA (in particular, across the Ashmore Islands, but not expected to be within the OA) (see **Section 4.6.1.2**). There are no protected shipwrecks within the OA, and nine submerged shipwrecks across the outer margins of the EMBA.

Predicted probabilities of any released MGO impacting on the waters around Ashmore Reef (overlapping with cultural fishing grounds) and the waters of the North Kimberly Marine Park (partially overlapping with Uungugu Indigenous Protection Area) were low (range 1-4% Ashmore Ref, 1-2% North Kimberly Marine Park, **Table 102**). For any potential oil beaching, the worst-case scenario for oil beaching identifies isolated coastal margins located in both the Uungugu and Balanggarra areas, as well as isolated sections on Ashmore Island, as potential sites that may be subject to the beaching of oil.

Given the OA is located a significant distance offshore, any potential hydrocarbon release is expected to undergo significant physical dispersion and dissolution, prior to any amount being beached. Any potential beached amount is expected to be low and restricted to minor outcrops rather than the mainland. Natural weathering/attenuation processes are anticipated to adequately mitigate any residual risk of beached oil droplets at these remote locations. Submerged shipwrecks on the outer edge of the EMBA are not anticipated to be exposed to surface oil plumes and predicted low concentrations of dispersed/entrained oil to these will not be expected to incur any adverse effects.

The residual risk to cultural/heritage areas arising from an accidental release of MGO as a result of a vessel collision/refuelling incident during the Seismic Survey has been assessed as **Low** (*minor x remote*).

8.3.2.4 Potential Impacts and Risks to Coastal Marine Environment

Calculations for beaching of a MGO spill (**Section 8.3.2**), indicates that most of the spilt substance will have weathered or dispersed before the spill reaches coastal areas. On average, around 1.7% of the spilled volume can be expected to beach during an event at location B and less than 1% at locations A and C. The worst-case outcome from the simulations resulted in 13% of the spilled volume beaching on the North Kimberley Coast.

Due to the low density and viscosity of MGO (i.e., the spilt hydrocarbon would float and rapidly disperse, evaporate and reduce in toxicity), combined with high wave energy within the OA coastal habitats and communities are unlikely to be impacted by an MGO spill. Hydrocarbons that contact soft-sediment habitats such as estuaries and sandy beaches may become entrained within the fine grains of the substrate. Results of the modelling demonstrate (on an annual average across scenarios) rapid dispersion and evaporation of MGO, which also significantly reduces the volume reaching any shoreline locations. For any shoreline environments, it is expected that given the significantly reduced amount coming into contact, coupled with natural attenuation and weathering, toxicity and persistence of its parent form will be reduced. The highest concentrations, and therefore likely impacts, of hydrocarbons that may be deposited in the coastal environment will be along the high-water mark or strandline. Wave-exposed sandy shores are often considered to have a low vulnerability and sensitivity due to the natural cleaning of the waves (Law *et al*., 2011).

On the other hand, low energy intertidal habitats may potentially be more affected by an MGO spill. Due to the low-energy nature of these environments (and increased accumulation/depositional zones), any beached MGO will not be re-suspended by wave action. Accumulation of MGO will, however, breakdown on the shoreline by natural weathering and biodegradation processes, which is considered the most appropriate response method due to these habitats being easily damaged by clean-up techniques (Hook *et al*., 2016).

The OA overlaps with one KEF, the Carbonate bank and terrace system of the Sahul Shelf. There are six other KEFs within the EMBA or close to it:

- Ashmore Reef and Cartier Island and surrounding Commonwealth Waters;
- Continental Slope Demersal Fish Communities;
- Ancient Coastline at 125 m Depth Contour;
- Pinnacles of the Bonaparte Basins;
- Carbonate bank and terrace system of the Van Diemen Rise; and
- Shelf break and slope of the Arafura Shelf.

A summary of the relevant KEFs in each area is described in **Section 4.4.3**.

The carbonate bank and terrace system of the Sahul Shelf KEF is the only KEF predicted to be exposed to concentrations of surface and entrained hydrocarbons at moderate exposure values. As discussed in **Section 8.3.3.2,** no refuelling will occur within 5 km of the Carbonate Bank and Terrace System of the Sahul Shelf KEF (as shown **Figure 61**) to provide a buffer between any spills and the sensitive environmental values of this KEF.

The other KEFs have a low probability of contact with entrained hydrocarbons above the low exposure value only. The values and sensitivities of the KEFs are generally related to benthic habitats and communities which support areas of enhanced diversity and productivity. A release of MGO to the marine environment would result in a localised reduction in water quality in the upper surface waters of the water column and therefore impacts to the habitats of the KEFs is not considered likely.

Marine Protected Areas are described in **Section 4.4.1**. The OA does not overlap with any MP boundaries; however, the EMBA overlaps with five Marine Parks:

- Oceanic Shoals Marine Park;
- Ashmore Reef Marine Park;
- Cartier Island Marine Park;
- Kimberley Marine Park; and
- Joseph Bonaparte Gulf Marine Park.

The Oceanic Shoals Marine Park is the only marine park predicted to be exposed to concentrations of entrained hydrocarbons at moderate exposure values. As discussed in **Section 8.3.2.2**, no refuelling is proposed to occur within 5 km of the Oceanic Shoals Marine Park (as shown **Figure 61**) to provide a buffer between any spills and the sensitive environmental values of this marine park. The other MPs have a low probability (0-4%) of contact with entrained and dissolved hydrocarbons above the low exposure value only.

The EMBA partially overlaps with the Multiple Use Zone (IUCN VI) of the Oceanic Shoals Marine Park. The designated natural values of the Oceanic Shoals Marine Park include a range of species (including species listed as threatened, migratory, marine or cetacean under the EPBC Act), and foraging and internesting habitat for marine turtles. Potential impacts to these values and commercial fishing from a worst-case marine diesel spill within the OA are assessed in the sub-sections above.

Based on the above and including numerous control measure (**Section 8.3.5**) to be implemented, the residual risk to the coastal marine environment from an accidental release of MGO as a result of a vessel collision/refuelling incident during the Seismic Survey has been assessed as **Low** (*minor x remote*).

8.3.3 Evaluation of Known and Potential Impacts and Risks to Relevant Persons

Using the information presented in **Section 2** to **Section 5**, the impact and risk assessment has been undertaken for those receptors determined to be relevant to the activity as listed in **Table 104**.

Table 104 Relevant Persons Assessed

Receptor	Section reference
Commercial fisheries	**Section 8.3.3.1**
Commercial shipping	**Section 8.3.3.2**
Tourism and recreation	**Section 8.3.3.3**

Commercial fisheries and coastal shipping operations are considered the most at risk of vessel collisions due to their presence in, or transiting through, the OA. Due to the low potential volumes of an MGO spill that could result from a collision/sinking event, socio-economic impacts on existing interests are likely to be low.

There may be some temporary disruption to fishing activities if a spill occurred and entrained or surface hydrocarbon plume moved through a fishing ground, where it could have potential to coat the buoys and ropes of fish or rock lobster pots. In the worst-case would be if nursery habitats in intertidal margins for commercial fish species were impacted by a spill; however, through the literature no specific locations were identified as standing out as being important such as this. Given the distance offshore of the OA, it is expected if a spill occurred, by the time any MGO made it to shore, it would not be at the volumes or concentrations that would decimate an intertidal community.

The most obvious effect from a vessel collision/sinking to existing interests in/around the OA is the potential for casualties and injury. Released debris may float, either at the surface or partially submerged, creating a navigation hazard to other users of the marine environment, while MGO released from the vessel(s) will likely disperse and weather with time, unless making landfall where risks to the public could occur.

8.3.3.1 Potential Impacts and Risks to Commercial Fishing

Following a collision/sinking large debris that settles on the seabed, such as a vessel itself, pose a risk to commercial trawl fisheries. Trawling would not be safe around such debris as trawl gear may become entangled.

Potential effects of a hydrocarbon spill (such as MGO) on fisheries include effects on fish populations, contamination of equipment (e.g., nets, and boats), displacement from fishing grounds, contamination of catch, loss of revenue from disruption, and negative public perception of fish quality and safety. Given the low volume of MGO that might potentially escape in the event of a collision/sinking, the likely impacts to commercial fisheries would be relatively short-lived, and reasonably localised around the vessel collision/sinking location.

Any fishing equipment such as nets and lines that contacts a spill may become fouled by hydrocarbons, for example fishing nets towed through spill areas or lifted through surface slicks. However, it is highly unlikely that fishermen will knowingly enter into a spill area, making fouling of equipment unlikely. A more likely effect comes from displacement of fishing vessels from regular fishing grounds, possibly reducing the potential of a vessel to catch their quota or increasing the time and fuel consumption costs by having to travel to other unaffected fishing areas.

Economic impacts from loss of revenue and profit due to inability to fish in certain areas following a hydrocarbon spill will initially impact the fishing companies. However, trickle-down effects also occur, with the potential for employees to suffer from loss of wages and job cuts (McCrea-Strub *et al*., 2011), as well as sub-contractors and supply companies becoming effected.

Under the '*Commercial Fisheries Compensation Protocol for the Bonaparte MC3D Marine Seismic Survey*', commercial fishers may lodge a claim for compensation to be paid as a result of economic losses due to displacement from 'usual fishing grounds' as a result of avoiding contaminated waters following a fuel oil spill. Further details on the commercial fisheries protocol are provided in **Section 7.2.3.1.**

The residual risk to commercial fisheries arising from an accidental release of MDO as a result of a vessel collision/refuelling incident during the Seismic Survey has been assessed as **Low** (*Minor x Remote*).

8.3.3.2 Potential Impacts and Risks to Commercial Shipping

Heavy vessel traffic directly South of the OA is expected, due to vessels heading in and out of Darwin (refer to **Section 4.7.4**). Traffic within the OA itself is relatively low (in comparison to other locations along WA).

In the event of a vessel collision and significant marine diesel spill, the AMSA Joint Rescue Coordination Centre may issue a warning to shipping traffic in the area to avoid the incident location. Exclusion zones surrounding a spill will reduce access for shipping vessels for the duration of the response undertaken for spill clean-up (if applicable); vessel may have to take detours leading to potential delays and increased costs.

Debris left floating in the ocean following a vessel collision/sinking provides a hazard to marine shipping traffic and may force vessels to reduce speed in the known area of a debris field, or alter courses to avoid the area, reducing efficiency. This would be advised via safety communications and Notices to Mariners to alter regular routes to avoid movement through contaminated areas and areas involving clean-up activities. This impact would apply to both offshore and coastal routes.

Due to advance communications and vessel's ability to alter course to avoid floating debris and/or hydrocarbon spills, the environmental risk and subsequent effect of a vessel collision/sinking on commercial shipping would be **Low** (*minor x remote*).

8.3.3.3 Potential Impacts and Risks to Tourism and Recreation

Tourism and recreational activities in the region occur predominantly in State/Territory waters adjacent to population centres, such as Broome and Darwin. Charter vessels may occasionally transit through the EMBA between Darwin and the northern Kimberley coastline, however interactions with the Seismic Survey are considered unlikely due to the remoteness of the OA. No whale watching activity is known or expected to occur within the OA or the EMBA and recreational diving is not anticipated to occur within the OA (see **Section 4.7.2**).

Debris released from a collision/sinking may pose a temporary and localised navigational risk to recreational and tourism vessels plying the coastal waters and drifting or washed-up debris could have negative effects on the aesthetic qualities of the area for tourists. Effects of a hydrocarbon spill on tourism and recreational activities include lost abilities to carry out activities due to loss of habitats, displacement of tourism/recreational vessels from areas (e.g. within oil slicks and during clean-up activities), displacement of marine organisms (which may have attracted tourists) by presence of slicks, and loss of revenue from changes in public perception including reduced aesthetic qualities of coastal environments where hydrocarbons land or persist. As a result of these potential impacts to tourism and recreational activities if a spill occurred, the impacts are considered to be **Low** (*minor x remote*).

8.3.4 Decision Context

The decision context for vessel collision, sinking and bunkering and any associated hydrocarbon spill has been assessed as Type A given the predicted impacts and risks are well understood and uncertainty is minimal, with little or no interest from relevant persons.

8.3.5 Identification of Control Measures, Residual Risk Assessment and Demonstration of ALARP

The potential control measures implemented during the Seismic Survey to manage any potential impacts and risks from vessel collision, sinking, bunkering incidents and associated hydrocarbon spill to **ALARP** have been included in **Table 106**. SLB has considered a number of control measures to determine the benefits of their implementation towards risk reduction (**Table 106**), based on a Hierarchy of Controls methodology (**Table 105**). These control measures have been assessed to consider the environmental benefits gained through implementing the controls and characterised as effective and practicable to implement.

Table 105 Hierarchy of Control Measures for Vessel Collision, Sinking, Bunkering and Associated Hydrocarbon Spill

Eliminate	The use of vessels cannot be eliminated as a Seismic Vessel and Support Vessel have to be used to undertake the required data collection. The OA is also an open ocean area where other vessels (fishing, shipping, cargo, recreational) are not restricted from entering and may pass through any part of the area (within reason) at any time thus other vessels cannot be eliminated either. A Support Vessel is also needed for a number of reasons and cannot be removed from the operations. Refuelling at sea cannot been eliminated from the Seismic Survey, thus this source of risk cannot be eliminated. Refuelling at port would incur more frequent vessel movement and increase the risk of vessel collision. The consequence of vessel collision and associated hydrocarbon spill are higher than those associated with potential hydrocarbon loss associated with refuelling at sea.
Substitute	There are no suitable substitutes for use of a Seismic Vessel to undertake the survey in the required location.
Reduce	SLB aims to reduce the amount of time the vessels are in the OA by working 24/7 whenever possible. Reducing the number of vessels by removing the presence of a Support Vessel could reduce the risk of a collision/sinking. But at the same time this reduction could increase the risk of a collision between other vessels and the Seismic Vessel and/or its towed equipment. Thus, a reduction in the number of vessels isn't a practicably feasible option. Refuelling is expected to occur every five weeks, undertaken within the OA, and to be kept to a minimum to reduce vessel traffic.
Mitigate	Control measures have been assessed within **Table 106** in order to mitigate the impacts from a possible vessel collision/sinking to **ALARP** levels. Those which are appropriate and are not impracticable or unfeasible due to disproportionately large costs will be implemented during the Seismic Survey.

Table 106 Assessment of Control Measures for Vessel Collision, Sinking, and Bunkering and Associated Hydrocarbon Spills

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Legislative Requirements:			
The Seismic Survey will be undertaken in accordance with the approved EP.	P = Yes E = Effective	All vessels undertaking an offshore activity in waters between 3 and 200 NM must undertake that activity in line with an approved EP. The approved EP outlines the measures that will be taken to ensure that environmental effects from the activity will be reduced to **ALARP** and **Acceptable Levels**, including the management of vessel collision, sinking and bunkering and associated hydrocarbon spills.	Yes
All survey vessels will adhere to the requirements of the national and international legislation, including the International Regulations for Preventing Collisions at Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the Navigation Act 2012 and associated Marine Orders 21, 30, 91 and the STCW Convention. The requirements give effect, but are not limited to, the following: • Appropriate lighting, navigation and communication to inform other marine users; and • Use of radar and 24/7 watch.	P = Yes E = Effective	At all times during the survey the crew of the survey vessels will comply with COLREGS, including maintaining a visual watch and undertaking a full radar scanning watch for the presence of any other vessels in close proximity or any vessel on a course heading towards them or the other vessel involved in the survey. Early detection of approaching vessels will allow the survey vessels to attempt to communicate with approaching vessels to avoid chances of collision. The slow speed of the vessels during the operational phase of the survey (4 – 5 knots) will then also allow the vessels plenty of time to attempt communication following early detection and if required make appropriate evasive manoeuvres. In addition to the above, having navigational lighting and day-shapes compliant with COLREGS for safe passage at sea and specific to each vessel and its activities will provide further means in reducing the chance of vessel collisions. In accordance with Marine Order 91, if a MGO spill does occur following a vessel collision/sinking SLB will implement the response strategy in accordance with the SOPEP, and also in line with relevant legislation and industry standards. SLB will also undertake all required notification and reporting during planning stages of mobilisation phase of survey. In the event of a vessel collision/sinking and there is a resultant MGO release, notification will be provided to AMSA and regulatory agencies in accordance with the Implementation Strategy – Reporting **Section 10.6**.	Yes
Vessels over 400 gross registered tonnage hold and approved and tested SOPEP, with crew trained in its implementation.	P = Yes E = Effective	This control measure meets the requirements of Annex I of MARPOL which requires vessels over a certain size to have a SOPEP. Having crew trained in the implementation of the SOPEP will reduce the likelihood of a spill response option being required, by reducing the likelihood of a spill occurring in the first place. It is a legislative requirement for vessels to comply with MARPOL.	Yes
In the event of a spill to the marine environment, the OPEP will be implemented.	P = Yes E = Effective	In accordance with the requirements of the Environment Regulations, an OPEP accompanies this EP, which details the spill preparedness and response arrangements that will be implemented in the event of a spill. The OPEP includes arrangements for notifying AMSA and engaging the National Plan resources.	Yes
Good Industry Practice:			
Vessel will only utilise MGO.	P = Yes E = Not Effective	Utilising a certain type of fuel is not effective in reducing the risks of a vessel collision and hydrocarbon spill, but it is important for considering the types of responses required for clean-up. Utilising MGO would have less impacts on the marine environment should a spill occur compared to other heavier oils and the same level of response would not be required for the clean-up. Finally, this fuel type is consistent with that which for which the impacts have been modelled. Good industry practice, environmental benefit outweighs additional cost.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Refuelling will occur away from shallow water features, Oceanic Shoals Marine Park and Sahul Shelf KEF.	P = Yes E = Effective	Refuelling will not occur within 5 km of: 1) any shallow water feature which is less than 40 m below the sea surface; 2); the Carbonate Bank and Terrace System of the Sahul Shelf KEF; or 3) the Oceanic Shoals Marine Park as shown in **Figure 61**. These separation distances will minimise the risk of adverse effects occurring on the values present in these higher risk areas. Environmental benefit outweighs additional cost.	Yes
Testing of SOPEP.	P = Yes E = Effective	Prior to the commencement of survey operations, the SOPEP will be tested including testing of communications and a vessel-based drill in hydrocarbon spill response. Good industry practice, environmental and safety benefit outweighs additional cost.	Yes
Appropriate use of radio communication at sea.	P = Yes E = Effective	Survey vessels will keep open radio communications between each other as well as scanning local working channels and the emergency channel (VHF 16) for contact with other vessels that may be operating in the vicinity, and therefore reduce the potential for collision. Good industry practice, environmental and safety benefit outweighs additional cost.	Yes
Vessel fuel to be stored in compartmentalised and/or multiple separate onboard fuel tanks.	P = Yes E = Effective	Fuel systems onboard the survey vessels (carrying MGO) will consist of multiple smaller tanks throughout the vessel or larger tanks built of multiple separate compartments. This will reduce the potential volumes of MGO that could be released to the environment in the event of a tank being ruptured during a collision/sinking event. Good industry practice, environmental benefit outweighs additional cost.	Yes
Utilising accurate weather forecasting information for planning operations.	P = Yes E = Effective	SLB will subscribe to a weather monitoring service that will provide updated forecasts (including wind, waves/seas and currents) four times daily allowing vessel masters to best plan the vessels movements and operations to occur when and where in the OA the weather is safest/most-suitable. Good industry practice, environmental and safety benefit outweighs additional cost.	Yes
Contract in place with appropriate service provider to initiate real-time modelling in case of a spill.	P = Yes E = Effective	Undertaking real-time modelling will provide assurances that response options can be tailored to the specific spill situation. The modelling will be based continuous weather monitoring which will be utilised in conjunction with hindcast data to predict the potential beaching locations (if any exist).	Yes
In case of a spill <10m^3, SLB will implement relevant Type I Operational Monitoring.	P = Yes E = Effective	Type I Operational Monitoring (such as using the Support Vessel to monitor the spill) will be undertaken in the unlikely event of a hydrocarbon spill to provide up-to-date information on the fate of hydrocarbon in the water. This monitoring will allow appropriate response options to be established with the Control Agency. Good industry practice, safety benefit outweighs additional cost.	Yes
Type II Scientific Monitoring undertaken (informed by updated NEBA/SIMA) in case of spill if real-time modelling shows the spill will impact land, in consultation with the CA.	P = Yes E = Effective	Depending on the fate of any hydrocarbon spill, based on the real-time modelling and operational monitoring described above, Scientific Monitoring may be required (if directed by the Control Agency) to monitor the impacts from a spill occurrence. Good industry practice, environmental benefit outweighs additional cost.	Yes
Hydrocarbon spill response training and competencies will be maintained throughout the Seismic Survey to avoid unplanned environmental impacts due to human error.	P = Yes E = Effective	Ensuring all staff members have appropriate training is vital in responding to a hydrocarbon spill. Drills will also be undertaken to ensure all staff are competent in responding to spills under the vessel specific SOPEP; these drills will be conducted at regular intervals to ensure the competencies are maintained throughout the operation. Good industry practice, environmental and safety benefit outweighs additional cost.	Yes
AIS transponders fitted to survey vessels and tail buoy.	P = Yes E = Effective	AIS transponders will transmit key information to all vessels able to receive AIS data and will include details such as vessel GPS position, identity, type, speed, course and caution notes). The AIS system will also receive AIS information from other vessels in the area. Good industry practice, environmental and safety benefit outweighs additional cost.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
All crew will participate in the vessel and environmental induction prior to the commencement of operations.	P = Yes E = Effective	It is a standard industry practice to hold inductions for all onboard the vessels, with participation in induction meetings compulsory. During inductions, crew will be made aware of their responsibilities with regard to effects of discharges to the marine environment and their roles with regard to clean-up of any accidental discharges. Good industry practice, environmental and safety benefit outweighs additional cost.	Yes
Spill response equipment will be available and maintained onboard each vessel and located in close proximity to hydrocarbon areas and crew onboard will be trained in how to respond to any incident utilising the response equipment available.	P = Yes E = Effective	The availability of spill response equipment in close proximity to any hydrocarbon areas allows a quick response to any hydrocarbon spills into the marine environment. Vessel master will authorise actions in accordance with the vessel-specific SOPEP and the survey specific OPEP to limit the escape of hydrocarbons. Good industry practice, environmental and safety benefit outweighs additional cost.	Yes
Undertake hydrocarbon spill modelling prior to EP submission.	P = Yes E = Effective	A hydrocarbon spill modelling prior to the submission of this EP has been undertaken and was considered being useful to map the potential risks of vessel collision and hydrocarbon spills. As the OA covers a very wide area it is difficult to determine the ideal location to base the modelling on, thereby the spill modelling was undertaken at three different locations, see method and results in **Section 8.3.1.1.** As outlined in the control measures to be implemented above, SLB will also implement real-time modelling in the event of a spill which will provide more detailed and realistic areas of potential beaching along the coastline to assist in responding to a spill occurrence. Good industry practice, environmental benefit outweighs additional cost.	Yes
Pre-survey consultation with relevant persons (e.g., commercial fisheries, Petrofac), confirming the Seismic Survey will proceed, no less than four weeks before operations commence.	P = Yes E = Effective	Pre-survey consultation with relevant persons, confirming the Seismic Survey will proceed, allows relevant persons to be informed of the status of the Seismic Survey and plan or adjust their activities accordingly. Implementation of the control will reduce the likelihood of interactions with marine users, reducing the potential for a vessel collision. Good industry practice, environmental and safety benefit outweighs additional cost.	Yes
Publication of a Notice to Mariners of survey presence and towed array, no less than four weeks before operations commence.	P = Yes E = Effective	AHO will be contacted four weeks prior to the commencement of the survey for the publication of related Notices to Mariners. This will ensure that marine users are aware of the survey. Implementation will reduce the likelihood of interactions with vessels, reducing the potential for a vessel collision. Good industry practice, environmental and safety benefit outweighs additional cost.	Yes
Daily notification to the JRCC, for the promulgation of navigational warnings (i.e. AUSCOAST warnings).	P = Yes E = Effective	The JRCC will be contacted 24 – 48 hours before operations commence for issuing of radionavigation warnings. This will ensure that other vessels are aware of the survey. Implementation will reduce the likelihood of interactions, reducing the potential for a vessel collision. Good industry practice, environmental and safety benefit outweighs additional cost.	Yes
Daily look-ahead reports will be provided to relevant persons (e.g., e.g., commercial fishers known to utilise the OA or have indicated they could use the area (i.e. WTBF concession owners)), detailing the current vessel location and proposed timing and location of operations within the next 48 hour period.	P = Yes E = Effective	Communication with relevant persons allows those potentially affected by the Seismic Survey to plan activities in a manner that reduces the risk of interactions with the survey vessels and towed equipment, including a 48-hour look-ahead and daily communications where requested. Provision of a daily 'look-ahead' plan which details the proposed operations for the next 48-hour period to is relevant persons. Information regarding proposed operations will include, as a minimum, the current positions of the survey vessels and the proposed timing and location of operations for the following 48-hour period. Implementation will reduce the likelihood of interactions, reducing the potential for a vessel collision. Good industry practice, environmental and safety benefit outweighs additional cost.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
At least one Support Vessel will accompany the Seismic Vessel when in operation and when safe to do so (e.g., outside of inclement weather periods), to manage interactions with other marine users.	P = Yes E = Effective	Support vessels (Support Vessel and Chase Vessel) will be present around the Seismic Vessel to intercept other vessels in the area that are at risk of interacting with the Seismic Vessel and/or equipment. This is a health and safety requirement and is standard practice for all MSSs. Implementation will reduce the likelihood of interactions, reducing the potential for a vessel collision. Good industry practice, environmental and safety benefit outweighs additional cost.	Yes
Seismic survey vessel contractor procedures include requirements to be implemented during refuelling operations, including: • A completed Permit to Work; • A Job Safety Analysis (JSA) implemented for bunkering operations; • Visual monitoring of gauges, hoses, fittings; • Sea surface bunkering; • Hose checks prior to commencement; • All crew are spill response trained; and • Spill response equipment is nearby, easily accessible and fully stocked	P = Y E = Effective	Each survey vessel will have refuelling and bunkering procedures outlining the steps to be taken during refuelling operations to ensure this is carried out in a safe manner and without incidents.	Yes
Dry-break couplings will be installed on refuelling hoses.	P = Y E = Effective	Dry-break couplings will be used to reduce the risk of a refuelling incident from occurring. Good industry practice. Environmental benefit outweighs additional cost.	Yes
Refuelling operations will only take place during daylight hours and within strict weather limit guidelines.	P = Yes E = Effective	Refuelling will only be undertaken during daylight hours and appropriate weather/sea conditions. Implementation of this control will reduce the risk of a refuelling incident from occurring. By limiting refuelling to daylight hours also reduces the likelihood of a spill entering the marine environment. Environmental benefit outweighs additional cost.	Yes
Alternatives/Substitutes Controls Considered:			
Eliminate vessels.	P = No E = Very Effective	There are no practicable methods for undertaking the Seismic Survey without the use of vessels.	No
Eliminate presence of other hydrocarbon fluids onboard vessels (e.g. lubricants, hydraulic fluids).	P = No E = Effective	Lubricating and hydraulic fluids are required for the normal operation and maintenance of the vessels and equipment and as such cannot be completely eliminated. Storage in suitably bunded areas as detailed above will reduce risk associated with these fluids. Lubricating oils and hydraulic fluids are typically stored in 50 – 200 L steel drums either in a designated storage room, or a bunded area on deck. Therefore, any potential spills of these substances on deck are likely to be <200 L in a contained area. Hydrocarbons which occur in greater (>200 L) quantities on the vessels, for example waste engine oil, hydraulic fluid and main engine lubricating oils, are generally stored in designated storage tanks below deck and therefore are unlikely to be a direct hazard for deck spills (unless smaller quantities have been transported to the deck to be used for deck activities). It is possible that spills or leaks from hydraulic hoses on hydraulically operated equipment such as cranes and winches may occur, but if so, the fluid is likely to be contained within a bund or drip tray, and the volume of fluid loss will be low (<1 L). It is therefore highly unlikely that a non-contained spill of hydrocarbon fluids will occur onboard vessels; however, should such fluids enter the marine environment, their impact is likely to be low-minimal as the small volumes will quickly evaporate, disperse and weather.	No

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Substitute MGO for an alternative fuel or wind-powered vessels.	P = No E = Not Effective	MGO is already a vast improvement over HFO, and lighter alternative fuels or wind power are not feasible to use in the vessels that will be utilised for the survey as they have not been commercially proven for use in large vessels. It is expected that the high energy marine environment in which the OA is located will aid in the rapid dispersion (in the direction of the prevailing wind and current) and evaporation of MGO should it enter the marine environment. Warmer water temperatures during summer months will further accelerate this process.	No
No refuelling will occur at sea.	P = No E = No	Refuelling operations are one of the most likely causes of a hydrocarbon spill occurring during marine operations. However, given the offshore location of the OA this activity cannot be removed from the operation of the Seismic Survey. It is not considered a Practical option and given the probable increase in vessel activity associated with bunkering, it is not considered effective at significantly reducing risk. The removal of this activity would reduce the potential risk of a hydrocarbon spill occurring in the first place, and the potential impacts of a spill on the environment. Removing the refuelling operations at sea from the Seismic Survey will potentially increase the risks to the health and safety of employees, and the environment with additional trips to port. These trips would be expected to incur additional risks in themselves (i.e., vessel collision/sinking) that are not considered insignificant.	No
Additional Control Measures Considered:			
Continue working towards reaching an agreement with the WGAC relating to the Seismic Survey and executing the agreement once reached	P = Yes E = Effective	SLB has undertaken significant consultation with the WGAC during the development of this EP and the processing of it by NOPSEMA. This consultation included the drafting of an agreement between SLB and WGAC. SLB has provided all of the support and information requested by WGAC to date, and SLB is committed to the continuing this through the life of the Seismic Survey; as such SLB will invite the WGAC on at least a fortnightly basis (from 9 November 2023) until the end date of the Seismic Survey to consult which will include, at a minimum, the following: • SLB providing updates on the progress of the approvals process for the Seismic Survey, and of the activity once commenced; • SLB offering to meet, either electronically or in person; • SLB offering to provide support to WGAC, should it be required; and • SLB being responsive to WGAC's requests Once this agreement is reached, SLB will execute their requirements within a timeframe agreed to by the WGAC. It is considered that the benefits of continuing this consultation with WGAC through the Seismic Survey outweighs additional cost.	Yes
Address WGAC concerns relating to hydrocarbon spill modelling, spill prevention, response and remediation as well as provision of adequate financial assurances.	P = Yes E = Effective	Through the consultation process, WGAC has raised concerns relating to: • SLBs oil spill response arrangements, including prevention and remediation methods; • An independent assessment of the fuel spill modelling undertaken for the activity and upon which the EMBA has been defined; and • Financial assurances including evidence of currency of adequate insurances that SLB hold and the requirement for SLB to indemnify WGAC from effects on their rights and interests. SLB Is committed to the key principles of effective consultation, particularly transparency, collaboration and integrity, and as such, ensuring the concerns raised by WGAC are addressed will ensure that potential impacts and risks to WGAC and their interests will be reduced to **ALARP** and an **Acceptable Level**. Therefore, the benefit outweighs additional cost.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Undertake refuelling at port.	P = No E = No	All refuelling will be undertaken offshore, within the OA (outside of the Non-Refuelling Area provided in **Figure 61**). It is expected this will be kept to a minimum and will occur every five weeks. Refuelling at port is not practical given the offshore location of the OA. Refuelling at port would incur increased risk of vessel collision and increase the duration of the Seismic Survey. All bunkering vessels will be required to adhere to the SOPEP and associated control measures. All bunkering operations will be undertaken during suitable weather conditions. No bunkering will take place during marginal/adverse weather conditions. All contractor approvals and permits will be in place prior to the Seismic survey commencing. All contractor processes will be assessed for compliance, including record keeping, maintenance, permits, and schedules. Costs would be disproportionate to the benefit that may be gained.	No
Use a Seismic Vessel with smaller fuel and oil tank sizes.	P = No E = Effective	This would mean more frequent trips to port for refuelling which would increase costs and the duration of the survey, as well as result in greater risks. Furthermore, implementing this control measure would likely lead to a delay in the timing of data acquisition due to the time needed to contract an appropriate Seismic Vessel. Data delivery to clients would consequently be delayed and requirements not met.	No
The Seismic Survey will be restricted to daylight hours.	P = No E = Effective	The cost of the survey would increase substantially as the survey duration would double. Health and safety risks and potential impacts to marine life (e.g. cetaceans) would also increase due to the longer survey duration.	No
Reduce size of the OA to decrease chance of spills reaching emergent lands.	P = No E = Effective	The size of the OA has already been reduced substantially (~ 25,800 km^2). Further reductions would result in SLB being unable to fulfil primary objectives of the survey and data requirements. The likelihood of vessel collision or sinking and an associated hydrocarbon spill is extremely unlikely and is no greater than that for other vessels that may enter the OA and surrounding waters.	No
Residual Risk of Impact (Receptor)	**Consequence**	**Likelihood**	**Risk Ranking**
Marine environment quality	Minor	Remote	Low
Benthic invertebrates	Minor	Remote	Low
Zooplankton, fish eggs and larvae	Minor	Remote	Low
Bony fish and elasmobranchs	Minor	Remote	Low
Marine reptiles	Minor	Remote	Low
Cetaceans	Minor	Remote	Low
Seabirds and migratory shorebirds	Minor	Remote	Low
Cultural and heritage sites	Minor	Remote	Low
Marine Protected Areas	Minor	Remote	Low
Commercial fisheries	Minor	Remote	Low
Commercial shipping	Minor	Remote	Low
Tourism and recreation	Minor	Remote	Low
ALARP Statement			
The decision context has been assessed as Type A and the overall residual risk has been determined to be **Low**. SLB considers the adopted control measures are sufficient to minimise the risk of impacts from a vessel collision, sinking, bunkering incidents and associated hydrocarbon spill are appropriate to the nature and scale of the predicted environmental impacts. The proposed control measures have been developed in accordance with Good Industry Practice and legislative requirements, and taking into account the specific environmental, social, economic and cultural characteristics of the OA and predicted impacts to other marine users. Additional control measures were considered as part of the assessment process; however, it was considered that they did not provide any further environmental benefit or were not reasonably practicable to implement. Therefore, the predicted impacts to receptors from a vessel collision and associated hydrocarbon spill are reduced to **ALARP**.			

8.3.6 Impact and Risk Acceptability

Table 107 Demonstration of General Risk Acceptability for Vessel Collision, Sinking, and Bunkering and Associated Hydrocarbon Spill

Criteria for Acceptance	Acceptability Summary
Residual Risk Ranking	The residual risk has been determined to be Low.
Ecologically Sustainable Development	The management of the impacts associated with vessel collision, sinking and bunkering incident and associated impacts (e.g. hydrocarbon spill) can be carried out in compliance with principles of ecologically sustainable development as defined within the EPBC Act. The assessment has not identified any adverse impacts to the principles of ESD, with no threats of serious or irreversible damage, no impacts to biological diversity and ecological integrity, no degradation of inter-generational equity, or negative effects on the social and economic integrity in the short or long-term.
SLB's Internal Context	The proposed management of the risks of vessel collision, sinking and bunkering incident and the associated impacts are within **Acceptable Levels** of SLB's Environmental and QHSE Policy.
Existing Environmental Context	Following the implementation of the control measures detailed in this assessment, the impacts/risks to the marine environment and associated receptors from vessel collision/sinking could have *Severe* consequences. In the remote likelihood of a collision/sinking which results in a hydrocarbon and/or debris release, impacts to the marine environment are not expected to be long-term, given the properties of MGO in the ocean, with full recovery in time. Consideration has been given to the potential impacts on the environmental sensitivities within the OA. Of relevance to the OA, is the potential risk of impact to protected species such as marine mammals (including the pygmy blue whale), whale sharks, marine turtles and seabirds. Following the implementation of control measures the potential risk of any impacts occurring to protected species are considered to be Low. In the unlikely event that a spill occurs, toxicity will be highest in areas close to the spill source. However, MGO is expected to rapidly evaporate and disperse/partition the offshore environment, reducing the acute toxicity of the spill. Whilst some of the potential impacts to sensitive receptors identified were substantial, including localised mortality (e.g., zooplankton), toxic effects (e.g., whale shark) and/or, in the case of oil beaching, disruption or damage to important habitat (e.g., turtle and seabird nesting habitat), the effects are expected to be localised and short term. Therefore, the threat to protected ecological populations was considered to be Low. Due to the low risk of potential impacts to benthic habitats and communities which contribute to the value of protected areas such as the Oceanic Shoals Marine Park and Carbonate bank and terrace system of the Sahul Shelf KEF, impacts to these sensitivities are not expected. The release of hydrocarbons has the potential to impact the coastal environment and, by extension, sites of cultural heritage value through beaching. The worst-case outcome from the simulations resulted in 13% of the spilled volume beaching on the North Kimberley Coast, an area typified by high incidence of registered cultural heritage sites and two areas determined to have native title. Results of the modelling indicate that rapid dispersion and evaporation of MGO will significantly reduce the volume reaching shoreline locations where this material will be broken down through natural weathering and biodegradation. Based on this assessment and the implementation of proposed control measures, the risks to the coastal marine environment and sites of cultural heritage value are considered Low. Debris released from a collision/sinking may pose a temporary and localised navigational risk to commercial shipping and tourism operations, as well as causing temporary impacts to visual amenity which preclude typical tourism activities. Additionally, impacts to the profitability of fishing activities following a hydrocarbon spill are expected to impact fishers and their associated operations initially. Following the implementation of the proposed control measures these potential impacts to shipping, tourism, recreational and commercial fishing activities if a spill occurred, the impacts are considered to be Low. The proposed control measures provide appropriate protection to the marine environment and from the risk of vessel collision/sinking and associated effects (debris and hydrocarbon release), and further/alternative control measures would give very little or no further protection from vessel collision/sinking while greatly increasing time and cost of the survey and also increase the potential conflict and displacement with the fishing industry.
Existing Environmental Context – Management Plans, Species Recovery Plans and Conservation Advice	The residual risk of a hydrocarbon spill response has been determined to be Low, and will not have a significant impact on a matter of national environmental significance in accordance with EPBC Act Policy Statement 1.1. The OA does not overlap with any AMP boundaries; however, the EMBA overlaps with five relevant AMPs (Kimberley, Cartier Island and Ashmore Reef Marine Parks, as well as Oceanic Shoals and Joseph Bonaparte Gulf Marine Parks). Oil pollution response, environmental monitoring and remediation activities can be undertaken with IUCN Category VI zones (Oceanic Shoals, Kimberley and Joseph Bonaparte Marine Parks), when undertaken in accordance with a NOPSEMA approved EP that has met all required environmental management arrangements for the activity covered in the class approval. However, any oil pollution incident that may affect other IUCN category zones requires prompt consultation with the Director of National Parks. Any spill occurring within, or likely to impact, any Australian Marine Park should be notified to the Director of National Parks as soon as possible, by contacting the Marine Park Compliance Duty Officer (0419 293 465). Notifications must include time and location of the incident, response arrangements as per the OPEP and contact details for titleholder and response coordinators.
Social Acceptance – Relevant Persons Expectations	During consultation with relevant persons no concerns about the impacts from responding to a hydrocarbon spill were raised and as such no additional control/mitigation measures were expected or put in place. However, the Director of National Parks noted that they are to be made aware of oil/gas pollution incidences which occur within a marine park, or are likely to impact on a marine park, as soon as possible. To ensure this expectation is met, a corresponding control measure is proposed to be implemented, as outlined in **Table 108**. As such, the environmental impacts relating to responding to a hydrocarbon spill were considered to be at a socially **Acceptable Level**.

Criteria for Acceptance	Acceptability Summary
External Context – Commonwealth and State Legislative Criteria	The proposed control measures for vessel collision/sinking/refuelling incidents during the Seismic Survey are consistent with the following relevant legislation: • The Navigation Act 2012 – requires approved navigation systems for maritime safety, navigation efficiency and management of marine pollution; • The PSPPS Act; • The Environment Regulations; and • Control measures relating to hydrocarbon spills to the ocean are consistent with MARPOL (Annex 1 Regulations for Prevention of Pollution by Oil) and Marine Order 21, 30 and 91, including having an approved and tested SOPEP for all vessels involved in the survey.
Industry Best Practice	The proposed control measures to decrease vessel collision, sinking and bunkering incidents follow industry best practice and best practice guidelines, including: • The IAGC Environmental Manual for Worldwide Geophysical Operations which contains recommendations for SOPEPs, the mitigation of spills and leaks, and incident reporting; and • APPEA Code of Environmental Practice: offshore geophysical surveys are recommended to have environmental objectives to reduce impacts from spills and disturbance to seabed (e.g. in event of sinking), including having evidence of appropriate management procedures and emergency response plans being in place.
ALARP	Total elimination of all risks associated with potential vessel collision, sinking and bunkering incidents cannot be achieved as there are no practicable alternatives to using vessels to undertake the survey safely and effectively. Following the implementation of the control measures detailed in this assessment, the impacts/risks to the marine environment and associated receptors from vessel collision/sinking could have minor consequences. In the remote likelihood of a vessel collision, sinking and bunkering incident which results in a hydrocarbon and/or debris release, impacts to the marine environment are not expected to be long-term, given the properties of MGO in the ocean, with full recovery in time. The risks of a vessel collision occurring are reduced in a number of ways, including the adherence to legislative requirements and industry best practice, along with operating conditions (such as vessel operating at slow speeds). Therefore, the risks associated with a vessel collision and any associated hydrocarbon spill is considered to be **ALARP**. Should an unlikely vessel collision occur, which results in a hydrocarbon spill, SLB has put in place numerous measures to ensure monitoring of the situation is maintained to allow appropriate remediation. Therefore, the residual risk of a vessel collision occurring, with the associated controls in place, is considered to be at an **Acceptable Level**.

Acceptability Statement
Impacts and risks classified as Type A are considered acceptable if the requirements in **Table 40** can be demonstrated and it can be determined that the predicted levels of impact and/or residual risk are at or below pre-defined acceptable levels for that impact or risk, including those described in **Table 41**. Based on the above evaluation, the potential impacts from potential vessel collision, sinking and bunkering incidents meets the requirements of the risk acceptability criteria. The control measures that will be implemented throughout the Seismic Survey have been developed in accordance with these criteria and are considered appropriate to manage the impacts of a hydrocarbon spill response on all receptors to an **Acceptable Level**.

8.3.7 Environmental Performance

Table 108 Environmental Performance Outcomes, Standards and Measurement Criteria for Vessel Collision, Sinking, Bunkering and Associated Hydrocarbon Spill

Number	Environmental Performance Outcome	Environmental Performance Standard(s)
EPO 24	No collision with other marine users	**EPS 215** to **EPS 220**, **EPS 229**, **EPS 236**, **EPS 237**, **EPS 240** to **EPS 245**
EPO 25	No release of hydrocarbons into the marine environment	**EPS 215**, **EPS 216**, **EPS 218** to **EPS 228**, **EPS 230** to **EPS 235**, **EPS 237** to **EPS 239**, **EPS 246** to **EPS 254**

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
The Seismic Survey will be undertaken in accordance with the approved EP.	**EPS 215**: The Seismic Survey may only commence following acceptance of the EP by NOPSEMA.	Pre-mobilisation audit and inspection are completed prior to operations and confirm an accepted EP has been obtained. Audit records verify compliance with the requirements of the EP.	SLB Project Manager Vessel Master Survey Environmental Advisor SLB QC and HSE Representative

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
	EPS 216: The Seismic Survey will be undertaken in accordance with the accepted EP.	Bridge logs verify compliance with the requirements of the EP. Audit records verify compliance with the requirements of the EP.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
All survey vessels will adhere to the requirements of the national and international legislation, including the International Regulations for Preventing Collisions at Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the Navigation Act 2012 and associated Marine Orders 21, 30, 91 and the STCW Convention.	**EPS 217**: Essential navigation lighting and day-shapes will be utilised to maintain compliance with COLREGs.	Pre-mobilisation audit and inspection prior to beginning of survey will confirm correctly functioning lighting and communication equipment.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
	EPS 218: The Seismic Vessel is equipped with Radar and AIS systems which will be operating and monitored at all times for both transmitting and receiving vessel positions in the surrounding vicinity.	Pre-mobilisation audit and inspection are completed prior to vessel leaving port and confirm Radar and AIS are present and operational. Bridge logs confirm Radar and AIS are used.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
	EPS 219: Qualified crew maintain 24/7 watch-keeping during the survey in compliance with the STCW Convention. Watch keeping duties includes monitoring of vessel position (radar and plotter) and water depth at all times during seismic acquisition.	Bridge logs verify watch has been undertaken during the Seismic Survey.	Vessel Master.
	EPS 220: Watch keepers are qualified in accordance with STCW95 (or equivalent).	Procurement process includes requirement for Contractor to review/provide qualifications/training of crew members. Induction records outline qualifications/training of all crew members.	Vessel Master. Survey Environmental Advisor. SLB QC and HSE Representative Party Chief.
Vessels over 400 gross registered tonnage hold and approved and tested SOPEP, with crew trained in its implementation.	**EPS 221**: SOPEP formulated, known to all staff and kept up to date onboard the vessels so that in the event of a collision where hydrocarbons are released there is a plan in place to contain or clean-up.	Pre-mobilisation audit and inspection prior will confirm vessels holds an up to date SOPEP. Induction records show content of induction meeting and participation of crew.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative Party Chief.
	EPS 222: The Vessel Master will authorise actions in accordance with the vessel specific SOPEP and survey specific SOPEP to avoid, and where avoidance is not possible, minimise the escape of hydrocarbons.	Incident Report from a hydrocarbon spill response will confirm whether SOPEP has been followed.	Vessel Master. Party Chief.
	EPS 223: Notification procedures will be implemented, including AMSA and regulatory agencies, including: • AMSA report notification; • NOPSEMA reports; • Regulatory agencies (including DNP); • SLB incident report; and • Pollution report (**POLREP**).	In event of vessel collision/sinking and release of MGO all appropriate forms will be completed and submitted to relevant authorities	SLB Project Manager. Vessel Master.
In the event of a spill to the marine environment, the OPEP will be implemented.	**EPS 224**: The Vessel Master will authorise actions in accordance with the vessel specific SOPEP and the survey specific OPEP to avoid, and where avoidance is not possible, minimise the escape of hydrocarbons.	Incident Report from a hydrocarbon spill response will confirm whether OPEP has been followed	SLB Project Manager. Vessel Master.
Vessels will only utilise MGO.	**EPS 225**: MGO is the primary fuel for vessels associated with the Seismic Survey. No HFO powered vessels will be used.	Bunker note shows MGO utilised.	Vessel Master.
Refuelling will occur away from shallow water features, Oceanic Shoals Marine Park and Sahul Shelf KEF.	**EPS 226**: Refuelling is not undertaken within the sensitive areas as shown in **Figure 61.**	Bridge logs show refuelling undertaken outside of sensitive areas	SLB Project Manager. Vessel Master
	EPS 227: Shape files will be loaded onto the survey vessels' navigation system outlining exclusion areas within which refuelling operations cannot occur	Exclusion polygons on survey vessel's navigation system.	Vessel Master SLB QC and HSE Representative Survey Environmental Advisor

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
Testing of SOPEP.	**EPS 228**: Prior to the commencement of the Seismic Survey operations, the SOPEP will be tested including testing of communications and a vessel-based drill in hydrocarbon spill response.	Induction records and bridge logs confirm testing of SOPEP has occurred and drills have been carried out.	Vessel Master. Party Chief.
Appropriate use of radio communication at sea.	**EPS 229**: The survey vessels will have the appropriate communication equipment onboard and will be contactable and also able to communicate with other vessels by radio at all times (i.e. VHF and SSB radio).	Bridge Logs confirm VHF and SSB radio communications are always available.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
Vessel fuel to be stored in compartmentalised and/or multiple separate onboard fuel tanks.	**EPS 230**: Fuel tanks onboard the vessels will be compartmentalised or consist of multiple smaller tanks throughout the vessel.	Pre-mobilisation audit and inspection prior to beginning of survey will confirm the vessel's fuel storage system.	Vessel Master. Survey Environmental Advisor. SLB QC and HSE Representative
Utilising accurate weather forecasting information for planning operations.	**EPS 231**: Survey vessels, as well as onshore project team, to receive wind, wave and current information for the OA four times daily from subscription service.	Copies of the forecasts will be included with the daily reports/logs and kept on file.	SLB Project Manager. Vessel Masters.
Contract in place with appropriate service provider to initiate real-time modelling in case of a spill.	**EPS 232**: Prior to the commencement of the Seismic Survey, SLB will secure services (signed contract) with a third party for provision of real-time modelling of a hydrocarbon spill if and when required	Service contract in place prior to commencement of the survey.	SLB Project Manager.
In case of a spill <10m^3, SLB will implement relevant Type I Operational Monitoring.	**EPS 233**: If health & safety requirements permit, the Support Vessel assisting the Seismic Survey will be used in the monitoring of any hydrocarbon spill.	Incident report provides details on operational monitoring undertaken.	Vessel Master. Party Chief.
Type II Scientific Monitoring undertaken (informed by updated NEBA/SIMA) in case of spill if real-time modelling shows the spill will impact land, in consultation with the CA.	**EPS 234**: Prior to the commencement of the Seismic Survey, SLB will secure services (signed contract) with a third party for standby services in order to undertake Type II scientific monitoring as specific within the OPEP, should a hydrocarbon spill reach the shoreline,	Service contract in place prior to commencement of the survey.	SLB Project Manager.
Hydrocarbon spill response training and competencies will be maintained throughout the Seismic Survey to avoid unplanned environmental impacts due to human error.	**EPS 235**: Prior to the commencement of the Seismic Survey an audit will be conducted to ensure all staff are trained and inducted satisfactorily to ensure they are competent in responding to a hydrocarbon spill.	Pre-mobilisation audit results confirm inductions have been completed. Induction and daily records confirm training and induction has been carried out and crew present.	SLB Project Manager. Vessel Master. Survey Environmental Advisor. SLB QC and HSE Representative
AIS transponders fitted to survey vessels and tail buoy.	**EPS 236**: Vessels and associated survey equipment (e.g. tail buoys) will have correctly fitted and functioning AIS transponders.	Pre-mobilisation audit and inspection prior to beginning of survey confirms correct operation of all AIS transponders for both transmitting and receiving.	Vessel Master. Survey Environmental Advisor. SLB QC and HSE Representative
All crew will participate in the vessel and environmental induction prior to the commencement of operations.	**EPS 237**: All crew will participate in a vessel and environmental induction prior to the commencement of the survey, or on each crew change.	Induction records show content of induction meeting and participation.	Vessel Master. Party Chief.
Spill response equipment will be available and maintained onboard each vessel and located in close proximity to hydrocarbon areas and crew onboard will be trained in how to respond to any incident utilising the response equipment available.	**EPS 238**: Spill response equipment will be available and maintained/re-stocked onboard each vessel and located in close proximity to hydrocarbon areas. Crew will be trained in using response equipment.	Inspection records confirm equipment is fit-for-purpose and records any re-stocking of supplies as required.	Vessel Master.
Undertake hydrocarbon spill modelling prior to EP submission.	**EPS 239**: Hydrocarbon spill modelling will be used to guide the risk assessment of the EP.	Spill modelling incorporated into EP.	SLB Project Manager
Pre-survey consultation with relevant persons (e.g., commercial fisheries, Petrofac), confirming the Seismic Survey will proceed, no less than four weeks before operations commence.	**EPS 240**: Pre-survey consultation will be undertaken with all identified relevant persons, confirming the Seismic Survey will proceed, no less than four weeks before operations commence.	Documentation of consultation, consultation log demonstrates compliance.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative
Publication of a Notice to Mariners of survey presence and towed array, no less than four weeks before operations commence.	**EPS 241**: A Notice to Mariners will be published and distributed by the AHO under the Navigation Act 2012, informing relevant persons of the Seismic Survey, no less than four weeks before operations commence	Inspection of Notices to Mariners publications to formally confirm notice has been issued. Copies kept on file.	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
	EPS 242: Should any changes occur the survey acquisition plan throughout the duration of the survey, All Notice to Mariners will be updated as soon as reasonably practicable	An updated Notice to Mariners will be issued	SLB Project Manager Survey Environmental Advisor SLB QC and HSE Representative Vessel Master
Daily notification to the JRCC, for the promulgation of navigational warnings (i.e. AUSCOAST warnings).	**EPS 243** Daily notification to JRCC, for the promulgation of navigational warnings (i.e. AUSCOAST warnings).	Documentation of consultation/notification. Forms part of ongoing consultation strategy.	SLB Project Manager
Daily look-ahead reports will be provided to relevant persons (e.g., e.g., commercial fishers known to utilise the OA or have indicated they could use the area (i.e. WTBF concession owners)), detailing the current vessel location and proposed timing and location of operations within the next 48 hour period.	**EPS 244**: A 48-hour 'look-ahead plan' will be provided to relevant persons identified throughout the relevant persons consultation process, detailing the survey activities over the next 48 hours. The 48-hour look-ahead plans will be updated and issued every 24 hours and distributed to relevant persons via email.	Documentation of consultation and issuing of 48-hour look-ahead plans demonstrate compliance. Forms part of ongoing consultation strategy.	SLB Project Manager
At least one Support Vessel will accompany the Seismic Vessel when in operation and when safe to do so (e.g., outside of inclement weather periods), to manage interactions with other marine users.	**EPS 245**: The support vessels will manage vessel interactions through travelling between and maintaining communications with any third-party vessels in the OA.	Bridge logs verify support vessels have successfully communicated with all third-party vessels encountered in the OA.	SLB Project Manager. Vessel Master.
Seismic survey vessel contractor procedures include requirements to be implemented during refuelling operations, including: • A completed Permit to Work; • A JSA implemented for bunkering operations; • Visual monitoring of gauges, hoses, fittings; • Sea surface bunkering; • Hose checks prior to commencement; • All crew are spill response trained; and • Spill response equipment is nearby, easily accessed and fully stocked.	**EPS 246**: Each vessel will carry out refuelling and bunkering in accordance with a vessel-specific refuelling and bunkering procedure which includes the following minimum requirements: • A completed Permit to Work; • A JSA implemented for bunkering operations; • Visual monitoring of gauges, hoses, fittings prior to any refuelling or bunkering activity; • Sea surface bunkering; • Hose checks prior to commencement; • All crew are spill response trained; and • Spill response equipment is nearby, easily accessed and fully stocked.	Pre-mobilisation audit confirms refuelling and bunking procedures are in place. Audits/inspection records confirm refuelling and bunkering is being performed in compliance with the vessel-specific refuelling and bunkering procedures.	Vessel Master. Survey Environmental Advisor. SLB QC and HSE Representative
	EPS 247: Vessel crew are to maintain constant surveillance and communication while refuelling.	Bunker note provides details on PTW, JSA and bunkering procedures undertaken.	Vessel Master.
Dry-break couplings will be installed on refuelling hoses.	**EPS 248:** Dry-break couplings will be installed on refuelling hoses.	Pre-mobilisation audit and inspection prior to beginning of survey will confirm.	Vessel Master. Survey Environmental Advisor. SLB QC and HSE Representative
Refuelling operations will only take place during daylight hours and within strict weather limit guidelines.	**EPS 249:** Refuelling operations will only take place during daylight hours and within strict weather limit guidelines	Bunker note provides details on time of day and weather during refuelling operations.	Vessel Master.
Continue working towards reaching an agreement with the WGAC relating to the Seismic Survey and executing the agreement once reached.	**EPS 250**: SLB will invite the WGAC on at least a fortnightly basis (from 9 November 2023) until the end of the Seismic Survey to consult in order to reach an agreement. This consultation will include, at a minimum, the following: • SLB providing updates on the progress of the approvals process for the Seismic Survey, and of the activity once commenced; • SLB offering to meet, either electronically or in person; • SLB offering to provide support to WGAC, should it be required; and • SLB being responsive to WGAC's requests.	Documentation of consultation, consultation log demonstrates compliance.	SLB Project Manager.
	EPS 251: Once the agreement with WGAC is in place, SLB will address the requirements of the agreement in order to execute it within a time period agreed upon with WGAC.	Documentation of the signed agreement and resolution of matters agreed too.	SLB Project Manager.
Address WGAC concerns relating to hydrocarbon spill modelling, spill prevention, response and remediation as well as provision of adequate financial assurances.	**EPS 252:** Prior to the Seismic Survey commencing, an independent specialist in hydrocarbon spill modelling will be contracted to assess the hydrocarbon spill modelling undertaken for the activity and upon which the EMBA has been defined and provide a summary of this assessment to the WGAC	Report from independent hydrocarbon spill modelling specialist and summary provided to WGAC.	SLB Project Manager.

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
	EPS 253:. Prior to the Seismic Survey commencing, SLB will provide their arrangements for hydrocarbon spill response, including prevention and remediation methods to the WGAC	Evidence of SLBs hydrocarbon spill response arrangements, including methods for prevention and remediation provided to WGAC.	SLB Project Manager.
	EPS 254:. Prior to the Seismic Survey commencing, SLB will provide financial assurances to the WGAC including evidence of currency of insurances that SLB hold and the requirement for SLB to indemnify WGAC from effects on their rights and interests	Evidence of the financial assurance documentation provided to WGAC.	SLB Project Manager.

8.3.8 Vessel Collision, Sinking, and Bunkering and Associated Hydrocarbon Spill Impact and Risk Summary

Based on the discussions above, including the potential impacts on the environment and the associated controls measures to be implemented, the residual risk of vessel collision/sinking/bunkering incidents and associated hydrocarbon spill is considered to be **Low**.

The risks of a vessel collision occurring are reduced in a number of ways, including the adherence to legislative requirements and industry best practice, along with operating conditions (such as vessel operating at slow speeds). In addition, SLB has removed the chance of a hydrocarbon spill occurring at sea from vessel refuelling as these operations will be undertaken in port. Consequently, it is considered that the environmental impacts and risks on the marine environment and receptors arising from a vessel collision/sinking/bunkering incident and associated hydrocarbon spill are reduced to **ALARP**.

In accordance with the acceptability requirements prescribed in **Section 6.4**, the suite of control measures is considered appropriate to manage the risks and impacts arising from a vessel collision/sinking/bunkering incident and associated hydrocarbon spill during the Seismic Survey on all receptors to an **Acceptable Level**.

8.4 Hydrocarbon Spill Response

8.4.1 Description of Source of the Impact and Risk

In the unlikely event that a hydrocarbon spill occurs within the marine environment from a vessel associated with the Seismic Survey, a number of spill response options can be initiated for a clean-up response.

Table 109 provides an overview of the response options available with an assessment on the advantages and disadvantages of each option, and their appropriateness for use if a spill occurred during the Seismic Survey.

Table 109 Assessment of Spill Response Options

Response Option	Advantages of use	Disadvantages of use	Appropriateness of use
Source control (securing cargo / trimming)	Reduction in volume of MGO entering the marine environment.	No disadvantages identified.	This response option is suitable to both Level 1 and Level 2 responses and will be adopted in accordance with the SOPEP onboard the vessels. In the event of a fuel tank rupture, or hydrocarbon storage spill occurring, cargo of the affected tank/storage containers is to be secured by any available means, including transfer to another storage area, another vessel or through pumping in water to create a water cushion. Trimming the vessel may also be used to avoid further damage to intact tanks. These actions will minimise the volume of MGO spilled.
Natural weathering (monitor and evaluate – vessel/aerial surveillance and trajectory modelling)	Provides valuable information for situational awareness to inform response options. Surveillance results can also be used to assist in escalating or de-escalating response strategies as required.	Does not directly reduce potential impacts from the spill. Potential increase in the vessel/aviation activity in the area resulting in increased disturbance to fauna, including increased risk of collisions.	Vessel surveillance will be done for level 1 and level 2 spills using available vessels on scene, such as the Support Vessel and Chase Vessel, for opportunistic surveillance operations. However, priority for human health and safety will take place should a significant vessel casualty occur. SLB will have a contract in place with an appropriate service provider to initiate real-time modelling in the case of a spill. These modelling outputs can be used to guide appropriate response options. Monitoring requirements and approach will be assessed by the relevant Control Agency.
Physical break-up (vessel prop-washing)	Enhances natural degradation processes through the water column.	Increased vessel activity – additional noise, light, and atmospheric emissions. Increased health and safety risks from the presence of additional vessels.	This response option may be utilised during the Seismic Survey.

Response Option	Advantages of use	Disadvantages of use	Appropriateness of use
		Potential for reduced evaporation of MGO by entraining it into the water column.	Vessel prop washing promotes entrainment within the water column and reduces potential evaporation, potentially keeping the substance in the water for longer periods. However, this option would only be undertaken if requested by the Control Agency, which their decision-making process would be dependent on the spill location and a NEBA.
Application of dispersants	No advantages identified for MGO as it is not a persistent hydrocarbon. MGO has a high natural dispersion rate in the marine environment.	Additional release of chemicals into the marine environment that may have toxic effects on marine fauna.	This response option is not recommended for the Seismic Survey as it is not beneficial for reducing the net environmental impact of a MGO spill. It has a low probability of increasing the dispersal rate of the spill whilst introducing more chemicals into the marine environment.
Contain and recover (booms and skimming)	MGO potentially removed from the environment. Reduces chances for fauna to become oiled.	Use is restricted by surrounding weather conditions – i.e. in rough weather conditions, booms and skimmers will not work. Increased vessel activity – additional noise, light, and atmospheric emissions. Very labour intensive with an increased volume of waste generated.	This response option is not recommended for the Seismic Survey as the fast-spreading rates of MGO and the low viscosity will cause the slick to break-up and disperse quickly resulting in a reduced ability to contain and recover the MGO from the ocean.
Protect and deflect (booms etc.)	MGO potentially removed from the environment. Reduces chances for shoreline fauna to become oiled.	Increased activity – additional noise, light, and atmospheric emissions. Very labour intensive with an increased volume of waste generated. Potential additional damage to intertidal and benthic habitats from equipment.	This option is not recommended for the Seismic Survey as MGO is not expected to be persistent and corralling of MGO is generally not effective. Tidal flushing and bioremediation are expected to be sufficient in the worst-case scenarios to prevent any significant environmental impact.
Shoreline clean-up (physical removal, surf washing, flushing, natural dispersion)	MGO potentially removed from the environment. Reduces chances for shoreline fauna to become oiled.	Increased activity – additional noise, light, and atmospheric emissions. Very labour intensive with an increased volume of waste generated. Potential damage to sensitive shoreline species. Weather dependant.	This option is not recommended as it is an intrusive response that requires careful site-specific planning in order to reduce secondary impacts of beach erosion and spreading oil beyond shorelines.

Response Option	Advantages of use	Disadvantages of use	Appropriateness of use
			This response has the potential to cause more harm due to secondary disturbance compared to the initial potential light oiling. Therefore, if light shoreline contact occurs, SLB considers that any onshore response options would best occur under the National Plan.
Oiled Wildlife Response (capture and rehabilitation)	Aids recovery of oiled wildlife.	Increased activity – additional noise, light, and atmospheric emissions. Approaching marine fauna could flee and dive into spilled MGO as a result of activity. Pre-emptive capture may result in reduced survival.	Undertaking this response option has the potential to result in more harm if poorly executed. Activities such as hazing (dispersing) of birds will not be undertaken given the low likelihood of a spill of a size presenting a significant risk of oiling wildlife unless at the direction of, and under direct supervision of trained personal from the Control Agency. Capture and rehabilitation may be undertaken under the National Plan.

The activities associated with a response to a hydrocarbon spill introduce further risks to marine fauna and flora, including:

- Increased disturbance of avifauna (both shore and sea birds) and marine mammals;
- Increased risk of vessel strikes with an increased number of vessels in the area conducting the response;
- Potential inclusion of additional chemical agents into the marine environment (i.e. dispersants);
- Potential physical damage to habitats from deployment of booms in the intertidal zone; and
- Potential damage to intertidal habitats from trampling (via foot or vehicles), removal of oiled sediment, chemical control agents and dispersants.

8.4.2 Evaluation of Known and Potential Impacts and Risks to Environmental Receptors

Using the information presented in **Section 2** to **Section 5**, the impact and risk assessment has been undertaken for those receptors determined to be relevant to the activity as listed in **Table 96**.

Table 110 Environmental Receptors Assessed

Receptor	Section reference
Seabirds and shorebirds	**Section 8.4.2**
Marine mammals	
Relevant persons (marine shipping, commercial fisheries, recreational users)	
Benthic habitats (intertidal and shoreline)	
Seabirds and shorebirds	

Undertaking clean-up activities have the potential to disturb the physical environment and marine/coastal habitats and fauna through the use and operation of vehicles, personnel and other necessary equipment. These disturbances can also cause impacts to cultural and amenity values.

Each of the potential response options has been assessed within **Table 109** which includes the potential disadvantages associated with each option, including those potential impacts on the environment, including:

- Increase in the vessel/aviation activity in the area, resulting in increased disturbance to fauna, including additional risks of collisions;
- Additional noise, light and atmospheric emissions causing disturbances to fauna and other users of the marine environment (tourism and recreation, cultural heritage etc.);
- Increased health and safety risks from the presence of additional vessels; and
- Potential damage to sensitive shoreline species from shoreline clean-up.

To reduce the potential impacts from response options, the potential response actions will be based on a Net Environmental Benefit Analysis (**NEBA**) approach which considers the advantages and disadvantages of the different spill response options to determine if there would be a net environmental benefit resulting from the implementation of a particular response.

NEBA and Spill Impact Mitigation Assessment (**SIMA**) are commonly used globally for evaluating the potential benefits versus impacts of implementing a pre-defined spill response strategy. The purpose is to identify the most appropriate response strategy(ies) which can be implemented under real-time factors influencing the spill dynamics (location, amount, prevailing weather conditions etc). It can also be a rapid decision-making tool employed by the Controlling Authority (**CA**) under time constraints.

The following is a summary of steps normally used by the CA to conduct a NEBA/SIMA for a Level 2 (summarised from IPICEA 2017):

- Compile and evaluate data for relevant spill scenarios (oil properties, situational awareness, oil spill trajectory modelling (OSTM), environmental sensitivities, identification of resources at risk, and determination of feasible response options).
- Predict outcomes/impacts for the no intervention for the ‘no intervention’ (or ‘natural attenuation’ / unmitigated spill impact) option as well as the effectiveness (i.e. relative mitigation potential) of the feasible response options for each scenario.
- Balance trade-offs by weighing and comparing the range of benefits and drawbacks associated with each feasible response option, including no intervention, for each scenario.
- Select the best response option(s) to form the strategy for each scenario, based on the combination of techniques that will minimize the overall ecological, socio-economic and cultural impacts and promote rapid recovery, and maximise potential for environmental protection

NEBA takes into account the hydrocarbon type, the sensitivities within the wider area of the spill, and the potential impacts, both positive and negative, of the proposed response strategy. This analysis is used for the preliminary assessment to determine the level of spill response required, and to assist in the prioritisation of response actions. During a spill event, the NEBA will be revisited regularly by the CA (and subject matter experts as required) as more information becomes available on weather conditions relevant to at spill location, the spill trajectory and locations of sensitive receptors in the surrounding areas.

Initial response to an oil spill incident will be undertaken by the relevant Vessel Master. For vessel oil spill incidents, the Vessel Master will act in accordance with the relevant Shipboard Oil Pollution Emergency Plan (**SOPEP**) where applicable. Oil spills from vessels are categorised in two levels:

- **Level 1 Vessel Spill** – Initial activations for a Level 1 spill are based on a spill incident that is small in scale/volume (up to 10 m^3), will not have an adverse effect on the public or the environment and can be controlled by the use of resources typically available aboard the vessel without the need to mobilise an Incident Management Team or other external assistance. Spills that require this level of response may arise from blown hydraulic hoses, dropped or leaking drums of fuel or lubricant or minor refuelling accidents; and

- **Level 2 Vessel Spill** – Level 2 spills are those that require external assistance and resources to mitigate impacts from a larger spill (up to 1,000 m^3) and will involve response activation through additional support teams. The worst-case vessel spill scenarios during the activities fall into this category which include a vessel refuelling incident and a fuel tank rupture incident.

The residual risk to environmental receptors from the response methods utilised to clean up a hydrocarbon spill have been assessed as **Low** (*Minor* x *Remote*).

8.4.3 Decision Context

The decision context for the hydrocarbon spill response has been assessed as Type A given the predicted impacts and risks are well understood and uncertainty is minimal, with little or no interest from relevant persons.

8.4.4 Identification of Control Measures, Residual Risk Assessment and Demonstration of ALARP

Control measures that have been considered for the Seismic Survey to manage the potential risk/impacts associated with hydrocarbon spill response options to ALARP are listed in **Table 112**. SLB has considered a number of control measures to determine the benefits of their implementation towards risk reduction based on a Hierarchy of Controls methodology (**Table 111**). The control measures that will be adopted are those that have been assessed and characterised as effective and practicable to implement.

Table 111 Hierarch of Control Measures for Hydrocarbon Spill Response

Eliminate	A significant response to a hydrocarbon spill is required; however, those methods that increase the risks to the environment have been eliminated (such as releasing a chemical dispersant) as the benefit of using these methods does not outweigh the risks associated with their use.
Substitute	There are no suitable substitutes for the response to a hydrocarbon spill event. The most applicable response has already been determined, using the NEBA approach (**Table 112**).
Reduce	The methods will also be analysed in consultation with the CA through a NEBA process to ensure the most appropriate method is used in responding to a spill event. Any reduction in the impacts of a response to a hydrocarbon spill will be weighed against the net environmental benefit achieved.
Mitigate	Control measures have been assessed within **Table 112** to mitigate impacts associated with the nominated response(s) to a hydrocarbon spill to **ALARP** and **Acceptable Levels**. Those measures which are appropriate and are not impractical or unfeasible will be implemented during the Seismic Survey.

Table 112 Assessment of Control Measures for Hydrocarbon Spill Response

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Legislative Requirements:			
The Seismic Survey will be undertaken in accordance with the approved EP.	P = Yes E = Effective	All vessels undertaking an offshore activity in waters between 3 and 200 NM must undertake that activity in line with an approved EP. The approved EP outlines the measures that will be taken to ensure that environmental effects from the activity will be reduced to **ALARP** and **Acceptable Levels**, including the management of routine permissible waste discharges.	Yes
The SOPEP will be implemented for first strike response to level 1 and level 2 spills.	P = Yes E = Effective	SLB will implement the response strategy in accordance with the SOPEP, and also in line with relevant legislation and industry standards.	Yes
Good Industry Practice:			
Operational monitoring will be undertaken in order to inform and update the CA about the behaviour of the spill.	P = Yes E = Effective	Operational Monitoring (such as using the Support Vessel to monitor the spill) will be undertaken in the unlikely event of a hydrocarbon spill to provide up-to-date information on the fate of any hydrocarbon spill in the water. This monitoring will allow appropriate response options to be established with the CA and undertake appropriate NEBA analysis to reduce the potential impacts from responding to a hydrocarbon spill. Good industry practice, environmental benefit outweighs additional cost.	Yes
Contract in place with appropriate service provider to initiate real-time modelling in case of a spill.	P = Yes E = Effective	Undertaking real-time modelling will provide assurances that response options can be tailored to the specific spill situation. The modelling will be used to predict the potential beaching locations (if any exist) and inform the responders in order to assist in reducing the potential impacts from the response options if possible. Good industry practice, environmental benefit outweighs additional cost.	Yes
Hydrocarbon spill response training and competencies will be maintained throughout the Seismic Survey to avoid unplanned environmental impacts due to human error.	P = Yes E = Effective	Ensuring all crew have appropriate training is vital in responding to a hydrocarbon spill, and ensuring that impacts to the environment are not exacerbated through the response options themselves. Drills will also be undertaken to ensure all crew are competent in responding to spills under the vessel specific SOPEP. These drills will be conducted at regular intervals to ensure competencies are maintained for the duration of the Seismic Survey. Good industry practice, environmental benefit outweighs additional cost.	Yes
A hydrocarbon spill will be immediately reported from the SLB onboard representative to SLB in Perth to ensure all notifications are provided as per **Section 10.7.**	P = Yes E = Effective	Notifications will ensure quick and appropriate response to a spill scenario and will be in accordance with SOPEP and in accordance with relevant legislation and industry standards, ultimately informing the response options and allowing a NEBA to be undertaken. Good industry practice, environmental benefit outweighs additional cost.	Yes
Fishing industry and other relevant persons will be notified.	P = Yes E = Effective	Communication with relevant persons allows those potentially affected by a hydrocarbon spill to plan activities in a manner that reduces the risk of interactions. Good industry practice, environmental benefit outweighs additional cost.	Yes
NEBA to be conducted prior to response actions.	P = Yes E = Effective	Response actions will be based on a NEBA approach which considers the advantages and disadvantages of the different spill response options to determine if there would be a net environmental benefit resulting from the implementation of a particular response. Good industry practice, environmental benefit outweighs additional cost.	Yes
Alternatives/Substitutes Controls Considered:			
Eliminate vessels to avoid spill, and hence avoid impacts from response options.	P = No E = Very Effective	There are no practicable methods for undertaking the Seismic Survey without the use of specialist survey vessels. Costs would be disproportionate to the benefit that may be gained.	No
Additional Control Measures Considered:			
Pre-activity monitoring program and development of detailed Type II Monitoring Plan.	P = No E = Fairly Effective	SLB do not consider it practicable to undertaken monitoring or development of a detailed Type II monitoring program in response to the unlikely risk of a hydrocarbon spill.	No

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
		The characteristics of MGO will likely result in rapid dispersion. In addition, SLB will implement various controls that will reduce the risks of vessel collision; implementation of SOPEP to prevent loss of an entire tank contents. Costs would be disproportionate to the benefit that may be gained.	
Additional response equipment on board the Support Vessel.	P = No E = No	It is not reasonable for additional resources to be provided and maintained on the Support Vessel in the unlikely event of a spill. The Support Vessel is already equipped to best practice levels and supported by the National Plan. In order to carry the additional equipment (such as booms), additional vessels would be required. Costs would be disproportionate to the benefit that may be gained.	No
Arrangements for aerial monitoring	P = No E = No	It is not considered that these resources could be mobilised faster than what can already be achieved under the National Plan arrangement. Costs would be disproportionate to the benefit that may be gained.	No
Residual Risk of Impact (Receptor)	**Consequence**	**Likelihood**	**Risk Ranking**
Seabirds and shorebirds	Minor	Remote	Low
Marine mammals	Minor	Remote	Low
Relevant persons (marine shipping, commercial fisheries, recreational users)	Minor	Remote	Low
Benthic habitats (intertidal and shoreline)	Minor	Remote	Low
ALARP Statement			
The decision context has been assessed as Type A and the overall residual risk has been determined to be **Low**. SLB considers the adopted control measures are sufficient to minimise the risk of impacts from a hydrocarbon spill response are appropriate to the localised nature and small scale of the predicted environmental impacts associated with a spill response. The proposed control measures have been developed in accordance with Good Industry Practice, taking into account the specific environmental, social, economic and cultural characteristics of the OA and predicted impacts to other marine users. Additional control measures have been considered as part of the assessment process; however, it was considered that they did not provide any further environmental benefit or were not reasonably practicable to implement. Therefore, the predicted impacts to receptors from a hydrocarbon spill response are reduced to **ALARP**.			

8.4.5 Impact and Risk Acceptability

Table 113 Demonstration of General Impact and Risk Acceptability for Hydrocarbon Spill Response

Criteria for Acceptance	Acceptability Summary
Residual Risk Ranking	The residual risk has been determined to be Low.
Ecologically Sustainable Development	The management of the risk proposed by SLB associated with the response to a hydrocarbon spill can be carried out in compliance with the five principles of ecologically sustainable development as defined within the EPBC Act. These principles have been considered as part of the development of the EP and risk assessment process. The assessment has not identified any adverse impacts to the principles of ESD, with no threats of serious or irreversible damage, no impacts to biological diversity and ecological integrity, no degradation of inter-generational equity, or negative effects on the social and economic integrity in the short or long-term.
SLB's Internal Context	The proposed management of the risks of an impact from the response to a hydrocarbon spill are consistent with SLB's Environmental and QHSE Policy.
Existing Environmental Context	Following implementation of control measures the potential risk of any impacts occurring to water quality, and marine flora and fauna in the surrounding marine environment from the response to a hydrocarbon spill is unlikely. It is also highly unlikely to pose a risk to the management objectives for protected or sensitive areas (i.e. Australian Marine Parks, KEFs etc.), habitats (i.e. subtidal), fauna and flora present. No impacts are predicted on the existing environment within or surrounding the OA from a response to a hydrocarbon spill. Due to the open ocean nature of the OA, in the unlikely event that a spill occurs, the MGO would undergo rapid and significant dilution as soon as it entered the receiving environment, and concentrations would quickly dilute and disperse. The resulting response to a spill of this nature would be to primarily monitor and observe the spill, with the resulting impacts of such a response principally being from additional vessels within the OA. The proposed control measures provide appropriate protection to the marine environment from the response to a hydrocarbon spill, and from a detailed assessment process it is considered that any further/alternative control measures would give very little or no further protection from the response to a hydrocarbon spill.
External Context – Management Plans, Species Recovery Plans and Conservation Advice	The residual risk of a hydrocarbon spill response has been determined to be Low and will not have a significant impact on a matter of national environmental significance in accordance with EPBC Act Policy Statement 1.1.

Criteria for Acceptance	Acceptability Summary
	The OA does not overlap with any AMP boundaries, however, the EMBA overlaps with 5 relevant AMPs (Kimberley, Cartier Island and Ashmore Reef Marine Parks, as well as Oceanic Shoals and Joseph Bonaparte Gulf Marine Parks). Oil pollution response, environmental monitoring and remediation activities can be undertaken with IUCN Category VI zones (Oceanic Shoals, Kimberley and Joseph Bonaparte Marine Parks), when undertaken in accordance with a NOPSEMA approved EP that has met all required environmental management arrangements for the activity covered in the class approval. However, any oil pollution incident that may affect other IUCN category zones requires prompt consultation with the Director of National Parks.
Social Acceptance – Relevant Persons Expectations	During consultation with relevant persons no concerns about the impacts from responding to a hydrocarbon spill were raised and as such no additional control/mitigation measures were expected or put in place. However, the Director of National Parks noted that they are to be made aware of oil/gas pollution incidences which occur within a marine park, or are likely to impact on a marine park, as soon as possible. To ensure this expectation is met, a corresponding control measure is proposed to be implemented, as outlined in **Table 114.** As such, the environmental impacts relating to responding to a hydrocarbon spill were considered to be at a socially **Acceptable Level**.
External Context – Commonwealth and State Legislative Criteria	The proposed control measures for responding to a hydrocarbon spill during the Seismic Survey are consistent with the following relevant legislation: • Australian Maritime Safety Authority Act 1990; • International Convention on Oil Pollution Preparedness, Response and Cooperation 1990; • United Nations Convention on the Law of the Sea 1982; • International Convention for the Prevention of Pollution from Ships 1973; • Protection of the Sea (Civil Liability for Bunker Fuel Pollution Damage) Act 2008; • EPBC Act; • EPBC Regulations; and • Protection of the Sea (Prevention of Pollution from Ships) Act 1983 and its associated Marine Order 91 (Marine Pollution Prevention – Oil).
Industry Best Practice	The NEBA controls are in line with industry best practice with the depth of controls provided considered to reflect best practice and reasonable for the nature and scale of the activity. The APPEA Code of Environment Practice objectives with respect to reducing the impact from events such as spills to a level which is **ALARP** and acceptable are met by demonstrating the adoption of appropriate management procedures for the activity and having an appropriate emergency response plan. The IAGC Environmental Manual for Worldwide Geophysical Operations sets objectives in relation to hazardous materials for spill leak response which is met by the Seismic Survey.
ALARP	Complete elimination is not possible as the response is required in the event of a hydrocarbon spill. Based on the assessment above, including consideration of the potential impacts on the environment and the associated controls measures to be implemented, the residual risk to the marine environment and associated receptors from the response to a hydrocarbon spill is considered to be **Low** and to **ALARP**. Therefore, the potential risk of impacts occurring from the response to a hydrocarbon spill during the Seismic Survey is considered to be at an **Acceptable Level**.

Acceptability Statement
Impacts and risks classified as Type A are considered acceptable if the requirements in **Table 40** can be demonstrated and it can be determined that the predicted levels of impact and/or residual risk are at or below pre-defined acceptable levels for that impact or risk, including those described in **Table 41**. Based on the above evaluation, the potential impacts from a hydrocarbon spill response meets the requirements of the risk acceptability criteria. The control measures that will be implemented throughout the Seismic Survey have been developed in accordance with these criteria and are considered appropriate to manage the impacts of a hydrocarbon spill response on all receptors to an **Acceptable Level**.

8.4.6 Environmental Performance

Table 114 Environmental Performance Outcomes, Standards and Measurement Criteria for Hydrocarbon Spill Response

Number	Environmental Performance Outcome	Environmental Performance Standard(s)
EPO 26	No secondary impacts to the marine environment associated with a response to a hydrocarbon spill and all responses will be undertaken in accordance with the vessel SOPEP	**EPS 255** to **EPS 265**

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
The Seismic Survey will be undertaken in accordance with the approved EP.	**EPS 255**: The Seismic Survey may only commence following acceptance of the EP by NOPSEMA.	Pre-mobilisation audit and inspection are completed prior to operations and confirm an accepted EP has been obtained. Audit records verify compliance with the requirements of the EP.	SLB Project Manager Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
	EPS 256: The Seismic Survey will be undertaken in accordance with the accepted EP.	Bridge logs verify compliance with the requirements of the EP. Audit records verify compliance with the requirements of the EP.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
The SOPEP will be implemented for first strike response to level 1 and level 2 spills.	**EPS 257**: The Vessel Master will authorise actions in accordance with the vessel specific SOPEP and survey specific SOPEP to avoid, and where avoidance is not possible, minimise the escape of hydrocarbons.	Incident Report from a hydrocarbon spill response will confirm whether SOPEP has been followed.	Vessel Master. Party Chief.
Operational Monitoring will be undertaken in order to inform and update the CA about the behaviour of the spill.	**EPS 258**: Support Vessel that is associated with the Seismic Survey will be available as a vessel of opportunity to monitor the spill if safe to do so and where NEBA identifies a net benefit to do so, as agreed with the CA.	Incident Report from a hydrocarbon spill response will confirm results of spill monitoring. NEBA Report will outline the results of the monitoring	SLB Project Manager. Vessel Master.
Contract in place with appropriate service provider to initiate real-time spill modelling in case of a spill.	**EPS 259**: Prior to the commencement of the Seismic Survey, SLB will secure services (in the form of a signed contract) with a third party for provision of real-time modelling (dispersion and trajectory) if and when required.	Service contract in place prior to commencement of Seismic Survey and provided in pre-mobilisation audit.	SLB Project Manager.
Hydrocarbon spill response training and competencies maintained throughout the Seismic Survey to avoid unplanned environmental impacts due to human error.	**EPS 260**: Prior to the commencement of the Seismic Survey an audit is conducted with all maritime crew to ensure all staff are trained and inducted satisfactorily to ensure they are competent in responding to a hydrocarbon spill. This will occur for all new staff joining the vessel during crew changes to ensure full coverage	Pre-mobilisation audit results detail hydrocarbon spill response training and competencies of staff prior to undertaking Seismic Survey. Induction and daily records confirm training and induction has been carried out and crew present.	SLB Project Manager. Vessel Master.
A hydrocarbon spill will be immediately reported from the SLB onboard representative to SLB in Perth to ensure all notifications are provided as per **Section 10.7.**	**EPS 261**: Initial SOPEP report requirements will be undertaken and SLB will be immediately notified.	Phone/email records show notification undertaken. Consultation records show notification undertaken.	SLB Project Manager. Vessel Master.
	EPS 262: External notifications in the event of a level 1 or level 2 spill will be carried out as per the following reporting schedule: • SLB Project Manager – immediately; • NOPSEMA – verbal notification within two hours; • NOPSEMA – written NOPSEMA Incident Report Form no later than three days after notification; • National Offshore Petroleum Titles Administration – verbal or written incident summary within one day; and • Director of National Parks – as soon as practicable following incident.	Phone/email records show notification undertaken. Consultation records show notification undertaken.	SLB Project Manager. Vessel Master.

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
	EPS 263: External notifications in the event of a Level 2 spill will be carried out as per the following reporting schedule: • AMSA – verbal notification within two hours, with follow-up written POLREP as soon as practicable; • WA DoT MEER (if spill affects Western Australian state waters) – verbal notification as soon as possible, with follow-up written POLREP as soon as practicable; • NT DEPWS (if spill affects Northern Territory waters) – verbal notification as soon as possible, with follow-up written POLREP as soon as practicable; • Type II Monitoring Service Provider – verbal notification within two hours with follow-up formal notification if and when a scientific monitoring program initiation criterion is met.	Phone/email records show notification undertaken. Consultation records show notification undertaken.	SLB Project Manager. Vessel Master.
Fishing industry and other relevant persons will be notified.	**EPS 264**: Notification with the fishing industry and other relevant persons will be undertaken utilising the same contacts associated with the 48-hour 'look-ahead' plan.	Documentation of consultation. Forms part of ongoing consultation strategy.	SLB Project Manager.
NEBA to be conducted prior to response actions.	**EPS 265**: Response actions will be based on a NEBA approach in consultation with CA.	NEBA Report will show the methodology and results of the NEBA.	SLB Project Manager.

8.4.7 Hydrocarbon Spill Response Impact and Risk Summary

Based on the discussions above, including the potential impacts on the environment and the associated controls measures to be implemented, the residual risk from the response to a hydrocarbon spill is considered to be **Low.**

The suite of control measures to be implemented have been developed in accordance with Industry Best Practice and relevant legislation. Consequently, it is considered that the environmental impacts and risk on the marine environment and receptors arising from a hydrocarbon spill response are reduced to **ALARP**.

In accordance with the acceptability requirements prescribed in **Section 6.4**, the suite of control measures are considered appropriate to manage the risks and impacts arising from a hydrocarbon spill response during the Seismic Survey on all receptors to an **Acceptable Level**.

8.5 Accidental Release of Hazardous and Non-Hazardous Materials

8.5.1 Description of Source of the Impact and Risk

The survey vessels utilised during the Seismic Survey will use, store and/or carry a range of chemicals onboard as part of standard day to day operations, including paints, hydraulic fluid, cleaning products and others. The activities will also result in the generation of a range of wastes both solid and liquid, including sewage, bottles, cardboard, paper, cans, domestic garbage and other liquid wastes. Routine discharges of biodegradable wastes have been assessed in **Section 7.3** and incineration of wastes have been assessed in **Section 7.4**, while garbage waste not able to be macerated or incinerated will be stored onboard the vessels for onshore disposal at suitable facilities. The following section deals with risks and impacts associated with accidental releases of hazardous and non-hazardous materials to the marine environment during the Seismic Survey.

Hazardous and non-hazardous materials can be accidentally released to the marine environment through machinery failure, malfunction, or operator error (such as split hydraulic hoses releasing fluids), leak from containment or inadequate clean-up of hazardous substances (such as following a split container), or if materials are lost overboard during bad weather or while transferring between vessels.

Notably, **Section 8.2** assesses the risks associated with unplanned release of hazardous materials, specific to hydrocarbon liquids (spills). These are not considered further within this section.

8.5.2 Evaluation of Known and Potential Impacts and Risks to Environmental Receptors

Using the information presented in **Section 2** to **Section 5**, the impact and risk assessment has been undertaken for those receptors determined to be relevant to the activity as listed in **Table 115**.

Table 115 Environmental Receptors Assessed

Receptor	Section reference
Marine environment quality (water quality)	**Section 8.5.2**
Plankton	
Marine fauna	
EPBC Act listed marine fauna	
Marine protected areas and sensitive areas	

The release of hazardous chemicals/liquid wastes has the potential to reduce water quality to a degree which poses risk to marine receptors. This could impact on marine organisms from plankton through to large marine mammals, fish and seabirds, either through direct exposure or as a result of ingesting prey in which toxic substances have bioaccumulated. The potential impacts associated with exposure to (hazardous and non-hazardous) wastes depend on a range of factors, including the toxicity, concentration and phase of the relevant compound and the nature of the exposure scenario itself. The amalgamation of these factors determines whether there is an observable effect, such as toxic, sub-lethal and lethal effects. The volume of hazardous materials that could potentially be released unintentionally from either of the survey vessels is small and, therefore, is likely to be rapidly dispersed and diluted to a point where concentrations are below levels expected to cause effects to marine organisms. In the event of an onboard spill, it's expected that hazardous waste would be contained on the vessel and cleaned up in accordance with the SOPEP and standard clean-up procedures, decreasing chances of a major release to the receiving marine environment.

Due to the offshore nature of the OA, and the localised nature of any unplanned releases, sensitive marine habitats are unlikely to be affected as these exist primarily on the seabed and/or in the nearshore environment. Potential decreases in water quality and effects on pelagic species following an accidental release of hazardous material would be highly localised and temporary.

Non-hazardous materials such as paper, cardboard, wood and packaging can also potentially cause impacts if accidentally released into the marine environment, including direct physical impacts to marine organisms (strangling, choking) or the benthic environment if materials sink (localised crushing, smothering), or indirect impacts related to a reduction in water quality (e.g. through the breakdown of materials into smaller components and/or leaching of chemicals into the water column). Consequently, control measures are in place for the management of this waste to prevent any such discharge overboard.

The residual risk to environmental receptors arising from an accidental release of hazardous and non-hazardous materials during the Seismic Survey has been assessed as **Low** (*Minor* x *Unlikely*).

8.5.3 Decision Context

The decision context for the accidental release of hazardous and non-hazardous materials has been assessed as Type A given the predicted impacts and risks are well understood and uncertainty is minimal, with little or no interest from relevant persons.

8.5.4 Identification of Control Measures, Residual Risk Assessment and Demonstration of ALARP

Control measures that will be put in place during the Seismic Survey to manage any potential impacts and risks from the accidental release of hazardous and non-hazardous materials to **ALARP** have been included in **Table 117**. SLB has considered a number of control measures to determine the benefits of their implementation towards risk reduction (**Table 117**), based on a Hierarchy of Controls methodology (**Table 116**). The control measures that will be adopted are those that have been assessed and characterised as effective and practicable to implement.

Table 116 Hierarchy of Control Measures for Accidental Release of Hazardous and Non-Hazardous Materials

Eliminate	Hazardous and non-hazardous wastes will be generated throughout the voyage as a result of critical operations required to support the activities and hazardous materials are required to keep the vessels operational, thus these cannot be completely eliminated from the Seismic Survey.
Substitute	While the least harmful substance that will perform the specified role will be chosen during the survey, and materials with biodegradable/recyclable packaging will be used where possible, some materials cannot be safely substituted without placing greater risk on the vessel/crew and increasing risk of accidental release.
Reduce	Waste storage areas will be tightly secured/closed and fitted with the relevant bunding to prevent accidental release overboard of materials. Equipment will be serviced and maintained appropriately, and operated only by trained and experienced personnel, to reduce risk of equipment failure which can lead to accidental releases.
Mitigate	Control measures have been assessed within **Table 117** in order to mitigate the risk of impacts from accidental release of hazardous and non-hazardous materials to **ALARP** levels. Those which are appropriate and are not impracticable or unfeasible due to disproportionately large costs will be implemented during the Seismic Survey.

Table 117 Assessment of Control Measures for Accidental Release of Hazardous and Non-Hazardous Materials

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
Legislative Requirements			
The Seismic Survey will be undertaken in accordance with the approved EP.	P = Yes E = Effective	All vessels undertaking an offshore activity in waters between 3 and 200 NM must undertake that activity in line with an approved EP. The approved EP outlines the measures that will be taken to ensure that environmental effects from the activity will be reduced to **ALARP** and **Acceptable Levels**, including the management of routine permissible waste discharges.	Yes
Vessels over 400 gross registered tonnage hold and approved and tested SOPEP, with crew trained in its implementation.	P = Yes E = Effective	This control measure meets the requirements of Annex I of MARPOL which requires vessels over a certain size to have a SOPEP. It is a legislative requirement for vessels to comply with MARPOL.	Yes
Vessels over 100 gross registered tonnage (or certified for more than 15 persons on board) will have a Garbage Management Plan.	P = Yes E = Effective	As per MARPOL Annex V, all ships of 100 gross tonnage and above, every ship certified to carry 15 persons or more must carry a garbage management plan on board, which includes written procedures for minimizing, collecting, storing, processing and disposing of garbage, including the use of the equipment on board. It is a legislative requirement for vessels to comply with MARPOL, and Marine Order 95.	Yes
Vessels over 400 gross registered tonnage (or certified for more than 15 persons on board) will have a Garbage Record Book.	P = Yes E = Effective	As per MARPOL Annex V, all ships of 400 gross tonnage and above and every ship which is certified to carry 15 persons or more engaged in voyages to ports under the jurisdiction of another party to MARPOL to provide a Garbage Record Book and to record all disposal and incineration operations. It is a legislative requirement for vessels to comply with MARPOL, and Marine Order 95.	Yes
Management and storage of hazardous substances complies with regulations 2 to 5 of MARPOL Annex III: • Packages shall be adequate to minimise the hazard to the marine environment, having regard to their specific contents; • Packages containing harmful substances shall be durably marked with the correct technical name and, further, shall be durably marked or labelled to indicate that the substance is a marine pollutant. This shall be supplemented where possible by any other means (e.g. relevant United Nations number); • The method of marking and affixing labels shall be such that this information will still be identifiable on packages surviving at least three months' immersion in the sea • In all documents relating to the carriage of harmful substances by sea where such substances are named, the correct technical name of each substance shall be used, and the substances further identified by the addition of the words 'MARINE POLLUTANT'; • Each ship carrying harmful substances shall have a special list or manifest setting forth the harmful substance on board and the location thereof. A detailed stowage plan setting out the location of the harmful substance may be used in place of such list or manifest. Copies of such documents shall be made available on request; and • Harmful substances shall be properly stowed and secured so as to minimise the hazards to the marine environment without impairing the safety of the ship and persons onboard.	P = Yes E = Effective	Regulations 2 to 5 of MARPOL Annex III outlines the regulations in place for the safe management and storage of hazardous substances. It is a legislative requirement for vessels to comply with MARPOL.	Yes
Good Industry Practice:			
All wastes will be stored in suitably capped/lidded receptacles to ensure they remain secure on the vessels under all conditions.	P = Yes E = Effective	Ensuring all waste is securely stored aboard the vessels will prevent hazardous and non-hazardous wastes from being accidentally lost overboard into the marine environment. No domestic, maintenance, hazardous, solid or plastic waste will be intentionally discharged to the ocean. Such wastes will be stored onboard to be disposed at suitable facilities onshore. Good industry practice, environmental benefit outweighs any additional cost.	Yes

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
All hazardous substance storage areas will be designed and maintained to support some form of containment/bunding.	P = Yes E = Effective	Containment/bunding will be in place around all locations where hazardous substances/materials are stored onboard the vessels to capture any spilled substances/materials and prevent them from entering the marine environment. Good industry practice, environmental benefit outweighs any additional cost.	Yes
All hazardous substances carried onboard the vessels must have Material Safety Data Sheets (**MSDS**) with all crew trained in their location and use.	P = Yes E = Effective	MSDS contain detailed information about each hazardous substance and required information for handling and clean-up procedures in event of a spill, which will assist with minimising risk to the environment and workers in the event of an incident. Good industry practice, environmental benefit outweighs any additional cost.	Yes
Suitable spill kits will be located close to the location of hazardous substances to allow timely response and clean-up in the event of a spill/incident.	P = Yes E = Effective	Hazardous substances carried onboard the vessels will be stored in different areas and may require different methods to contain/clean-up a spill. Suitable spill kits will be located in close proximity to storage and areas of use to allow timely response and minimise the risk of release to the marine environment. Crew will be appropriately trained in the use of the spill kits. Good industry practice, environmental benefit outweighs any additional cost.	Yes
All equipment shall be regularly serviced and maintained in accordance with original manufacturer's specifications and the vessels planned maintenance schedules.	P = Yes E = Effective	To reduce the risks of equipment failure, leading to accidental release of hazardous/non-hazardous materials, all equipment should be regularly serviced and maintained to detect early faults/defects that could cause failures. This control will reduce the likelihood of the risk of an accidental release of hazardous and non-hazardous materials. Good industry practice, environmental benefit outweighs any additional cost.	Yes
Vessels and equipment will be operated by trained and experienced crew.	P = Yes E = Effective	Accidental release of materials may occur as a result of improper/incorrect use of onboard equipment during normal operations. Crew will not operate equipment/machinery they are not trained/experienced in operating and will follow SOP or manufacturers guidelines for safe operation. This control will reduce the likelihood of the risk of an accidental release of hazardous and non-hazardous materials. Good industry practice, environmental benefit outweighs any additional cost.	Yes
All crew will participate in the vessel and environmental induction prior to the commencement of operations.	P = Yes E = Effective	It is a standard industry practice to hold inductions for all onboard the vessels, with participation in induction meetings compulsory. During inductions, crew will be made aware of their responsibilities with regard to effects of discharges to the marine environment and their roles with regard to clean-up of any accidental discharges. This control will reduce the likelihood of the risk of an accidental release of hazardous and non-hazardous materials. Good industry practice, environmental benefit outweighs any additional cost.	Yes
All equipment located on the vessel's deck that uses hydrocarbons will be surrounded by primary bunding (e.g. deck edge lip), as a minimum	P = Yes E = Effective	Accidental release of materials may occur as a result of the use of machinery on deck. Bunding captures materials onboard the vessels and allows for an appropriate clean-up response, to avoid accidental release to the receiving marine environment. Good industry practice, environmental benefit outweighs any additional cost.	Yes
Deck scupper plugs will be available beside all deck drainage points that lead overboard.	P = Yes E = Effective	Deck scupper plugs allow for drainage to be blocked off, stopping wastes (including hazardous wastes) from entering the marine environment through deck drainage systems. Good industry practice, environmental benefit outweighs any additional cost.	Yes
Alternative/Substitute Controls Considered:			
All packaging, handling and containers to be made of biodegradable materials.	P = No E = Somewhat Effective	Some materials/substances carried onboard cannot be safely contained within biodegradable containers and attempting to do so may place crew at greater danger and increase risk of incident which could result in risk to environment. Due to the potential increase in risk to crew and the environment, this control measure is not considered appropriate in reducing the impacts to ALARP.	No
Additional Control Measures Considered:			

Control Measure	Practicability/ Effectiveness	Justification	Will it be adopted?
No generation of hazardous/non-hazardous wastes onboard the vessels which require storing.	P = No E = Very Effective	Health and safety of crew requires that foods, materials, equipment be appropriately packaged for storage onboard the vessels for use at later date, thereby generating packaging wastes which must be stored aboard the vessels to be later disposed of onshore. Costs would be disproportionate to the benefit that may be gained.	No
Residual Risk of Impact and Risk (Receptor)	**Consequence**	**Likelihood**	**Risk Ranking**
All receptors (outlined in **Section 8.5.2**).	Minor	Unlikely	Low
ALARP Statement:			
The decision context has been assessed as Type A and the overall residual risk has been determined to Low. SLB considers the adopted control measures minimise the risk of impacts from the accidental release of hazardous and non-hazardous material and are appropriate to the localised nature and small scale of the predicted environmental impacts associated with the Seismic Survey. The proposed control measures have been developed in accordance with the legislative requirements, good industry practice, using professional experience and taking into account the specific environmental, social, economic and cultural characteristics of the OA and predicted impacts to other marine users. Additional control measures were considered as part of the assessment process; however, it was considered that they did not provide any further environmental benefit or were not reasonably practicable to implement. Therefore, the predicted impacts to receptors from the introduction of IMS are reduced to **ALARP.**			

8.5.5 Impact and Risk Acceptability

Table 118 Demonstration of General Risk Acceptability for Accidental Release of Hazardous and Non-Hazardous Materials

Criteria for Acceptance	Acceptability Summary
Residual Risk Ranking	The residual risk has been determined to be Low.
Ecologically Sustainable Development	The management of the risk associated with an accidental release of hazardous and non-hazardous materials can be carried out in compliance with the five principles of ecologically sustainable development as defined within the EPBC Act. These principles have been considered as part of the development of this EP and risk assessment process. The assessment has not identified any adverse impacts to the principles of ESD, with no threats of serious or irreversible damage, no impacts to biological diversity and ecological integrity, no degradation of inter-generational equity, or negative effects on the social and economic integrity in the short or long-term.
SLB's Internal Context	The proposed management of the impact/risks the accidental release of hazardous and non-hazardous materials are consistent with SLB's Environmental and QHSE Policy.
Existing Environmental Context	The release of hazardous wastes into the marine environment can adversely impact on marine environmental (water) quality and, subsequently marine species, biodiversity ecosystem function, social amenity and human health. Marine debris such as plastic wastes and/or packaging can potentially pose a risk for many marine organisms, including protected species, through multiple impact pathways, including ingestion, entanglement, chocking and smothering. Impacts to water quality and marine organisms resulting from the unplanned release of hazardous and non-hazardous substances are expected to be minor, temporary, highly localised and, in the case of non-hazardous materials, proportional to the size of solid waste. Hazardous substances accidentally released into the marine environment would be quickly diluted and/or dispersed. Therefore, impacts to marine organisms are not expected. Of relevance to the OA, are the maintenance of management objectives and values for protected areas such as the adjacent Oceanic Shoals Marine Park and Carbonate bank and terrace system of the Sahul Shelf KEF. Following the implementation of proposed control measures, the potential risk of impacts to marine environmental quality, marine receptors and, therefore, protected areas from the accidental release of hazardous and non-hazardous materials is Low.
External Context – Management Plans, Species Recovery Plans and Conservation Advice	The residual risk of the accidental release of hazardous and non-hazardous materials has been determined to be Low and will not have a significant impact on a matter of national environmental significance in accordance with EPBC Act Policy Statement 1.1. **Section 4.5.8** provides an outline of the EPBC Act Conservation Management Plans, Recovery Plans and Conservation Advice relevant to the Seismic Survey. Within these documents, the risk of marine debris impacting those relevant species is highlighted, with the actions required including supporting the implementation of the EPBC Act in accordance with the *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life* (Commonwealth of Australia 2018). The control measures in place during the Seismic Survey will support the implementation of this threat abatement plan.
Social Acceptance – Relevant Person Expectations	No concerns were raised during the consultation process in regard to the risks of accidental release of hazardous and non-hazardous materials. As such the risk of environmental impacts relating to accidental releases of hazardous and non-hazardous materials from Seismic Vessel and Support Vessel were considered to be at a socially **Acceptable Level**.
External Context – Commonwealth and State Legislative Criteria	The proposed control measures during the Seismic Survey are consistent with the following relevant standards/documents: • MARPOL Annex III Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form; • MARPOL Annex V Prevention of Pollution by Garbage from Ships; • The Protection of the Sea (Prevention of Pollution from Ships) Act 1993; • Marine Order 94 (Marine pollution prevention – packaged harmful substances) 2014; • Marine Order 95 (Marine pollution prevention – garbage) 2013; and • Marine Notice 2017/4 MARPOL Annex V Discharges.

Industry Best Practice	The proposed control measures to decrease the risk of an accidental release of hazardous and non-hazardous materials follows industry best practice and best practice guidelines for MSSs, including:
	• The IAGC Environmental Manual for Worldwide Geophysical Operations which recommends that:
	  - Vessels ensure they have MSDS for all hazardous materials and that they are up to date (i.e. within four years of issue date);
	  - Carry suitable spill kits;
	  - No direct discharge of any products into the sea;
	  - Vessels ensure hazardous materials are handled and stored correctly; and
	  - Records of hazardous material use, storage, disposal and incidents/spills are kept;
	• The APPEA Code of Environmental Practice which recommends that suitable waste management practices are used based on preventing, minimising, recycling, treating and disposing of wastes in accordance with any statutory requirements and procedures.

ALARP	Hazardous and non-hazardous wastes will be generated throughout the voyage as a result of critical operations required to support the activities and hazardous materials are required to keep the vessels operational, thus these cannot be completely eliminated from the Seismic Survey and there are no practicable alternatives. Following the implementation of the control measures, the potential risk of impacts to the marine environment and associated receptors associated with the release of hazardous and non-hazardous materials are likely to be temporary and highly localised.

Criteria for Acceptance	Acceptability Summary
	Based on the assessment above, including the potential impacts on the environment and the associated controls measures to be implemented, the residual risk of an accidental release of hazardous and non-hazardous materials from the survey vessels is considered to be **Low** and to **ALARP** levels. Therefore, the impacts from this activity associated with the Seismic Survey are considered to be at an **Acceptable Level**.

Acceptability Statement
Impacts and risks classified as 'Type A' are considered acceptable if the requirements in **Table 40** can be demonstrated and it can be determined that the predicted levels of impact and/or residual risk are at or below pre-defined Acceptable Levels for that impact or risk, including those described in **Table 41.** Based on the above evaluation, the potential impacts from the accidental release of hazardous and non-hazardous materials meets the requirements of the risk acceptability criteria. The control measures that will be implemented throughout the Seismic Survey have been developed in accordance with these criteria and are considered appropriate to manage the impacts of the accidental release of hazardous and non-hazardous materials to an **Acceptable Level.**

8.5.6 Environmental Performance

Table 119 Environmental Performance Outcomes, Standards and Measurement Criteria for Accidental Release of Hazardous and Non-Hazardous Materials

Number	Environmental Performance Outcome	Environmental Performance Standard(s)
EPO 27	No accidental release of hazardous and non-hazardous materials into the marine environment	**EPS 266** to **EPS 284**
EPO 28	Management of hazardous and non-hazardous waste to meet or exceed the requirements of MARPOL Annex V and Marine Order 95	**EPS 266** to **EPS 276**

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
The Seismic Survey will be undertaken in accordance with the approved EP.	**EPS 266**: The Seismic Survey may only commence following acceptance of the EP by NOPSEMA.	Pre-mobilisation audit and inspection are completed prior to operations and confirm an accepted EP has been obtained. Audit records verify compliance with the requirements of the EP.	SLB Project Manager Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
	EPS 267: The Seismic Survey will be undertaken in accordance with the accepted EP.	Bridge logs verify compliance with the requirements of the EP. Audit records verify compliance with the requirements of the EP.	Vessel Master Survey Environmental Advisor SLB QC and HSE Representative
Vessels over 400 gross registered tonnage hold and approved and tested SOPEP, with crew trained in its implementation.	**EPS 268**: Each vessel utilised during the Seismic Survey that is over 400 gross registered tonnage holds and approved and tested SOPEP.	Pre-mobilisation inspection confirms that each vessel > 400 gross registered tonnage holds an approved SOPEP and has been tested in the preceding 12 months	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
Vessels over 100 gross registered tonnage (or certified for more than 15 persons on board) will have a Garbage Management Plan.	**EPS 269**: Each vessel utilised during the Seismic Survey that is over 100 gross registered tonnage (or certified for more than 15 persons on board) holds a Garbage Management Plan	Pre-mobilisation inspection confirms that each vessel > 100 gross registered tonnage (or certified for more than 15 persons on board) holds a Garbage Management Plan	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
Vessels over 400 gross registered tonnage (or certified for more than 15 persons on board) will have a Garbage Record Book.	**EPS 270**: Each vessel utilised during the Seismic Survey that is over 400 gross registered tonnage (or certified for more than 15 persons on board) holds a Garbage Record Book	Pre-mobilisation inspection confirms that each vessel > 400 gross registered tonnage (or certified for more than 15 persons on board) holds a Garbage Record Book	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
Management and storage of hazardous substances complies with regulations 2 to 5 of MARPOL Annex III. • Packages shall be adequate to minimise the hazard to the marine environment, having regard to their specific contents; • Packages containing harmful substances shall be durably marked with the correct technical name and, further, shall be durably marked or labelled to indicate that the substance is a marine pollutant. This shall be supplemented where possible by any other means (e.g. relevant United Nations number);	**EPS 271**: Packaging will be adequate to minimise the hazard to the marine environment, having regard to their specific contents.	Pre-mobilisation inspection confirms that each vessel > 400 gross registered tonnage holds a Garbage Record Book	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
	EPS 272: Packages containing a harmful substance shall be durably marked with the correct technical name (trade names alone will not be used) and shall be durably marked or labelled to indicate that the substance is a marine pollutant and include the common technical name, UN Classification and CAS numbers.	Pre-mobilisation audit records confirms packaged harmful substances are stowed in accordance with MARPOL Annex III.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
	EPS 273: The method of marking the correct technical name and of affixing labels on packages containing a harmful substance shall be such that this information will still be identifiable on packages surviving at least 3 months immersion in the sea. In considering suitable marking and labelling, account shall be taken of the durability of the materials used and of the surface of the packaging.	Pre-mobilisation audit records confirms packaged harmful substances are stowed in accordance with MARPOL Annex III.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
	EPS 274: A stowage plan is to be displayed with the location of harmful substances onboard and these substances are to be stored in the locations identified in this plan.	Pre-mobilisation audit records confirms packaged harmful substances are stowed in accordance with MARPOL Annex III.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
• The method of marking and affixing labels shall be such that this information will still be identifiable on packages surviving at least three months' immersion in the sea • In all documents relating to the carriage of harmful substances by sea where such substances are named, the correct technical name of each substance shall be used, and the substances further identified by the addition of the words 'MARINE POLLUTANT'; • Each ship carrying harmful substances shall have a special list or manifest setting forth the harmful substance on board and the location thereof. A detailed stowage plan setting out the location of the harmful substance may be used in place of such list or manifest. Copies of such documents shall be made available on request; and • Harmful substances shall be properly stowed and secured so as to minimise the hazards to the marine environment without impairing the safety of the ship and persons onboard.	**EPS 275**: Hazardous substances are to be properly stored and secured so as to minimise the hazards to the marine environment without impairing the safety of the ship and crew onboard.	Pre-mobilisation audit records confirms packaged harmful substances are stowed in accordance with MARPOL Annex III.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
All wastes will be stored in suitably capped/lidded receptacles to ensure they remain secure on the vessels under all conditions.	**EPS 276**: Generated solid wastes will be separated and securely stored in tightly capped/lidded containers/areas for later disposal onshore. Generated wastes will be characterised and managed in accordance with MARPOL Annex V, Marine Order 94 and Marine Order 95.	Pre-mobilisation inspection confirms suitable storage areas for generated wastes which are labelled and have appropriate means of preventing wastes from escaping.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
All hazardous substance storage areas will be designed and maintained to support some form of containment/bunding.	**EPS 277**: Hazardous storage areas (e.g. hydrocarbons and chemicals) will be fully bunded and drain to the bilge water tank treatment system. Spill response kits will be stored nearby the storage location of these hazardous substances for clean-up purposes in the event of an unplanned spill.	Audit records confirm location of stored hazardous substances, the spill kit and appropriate bunding.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
All hazardous substances carried onboard the vessels be recorded in a Hazardous Chemicals Register and accompanying SDS. All crew are to know where the register is stored.	**EPS 278**: Hazardous materials must be recorded in a Hazardous Chemicals Register with accompanying SDS. All hazardous materials will be appropriately stored and handled in accordance with the relevant MSDS requirements and the International Maritime Dangerous Goods Code to reduce the risk of an environmental incident. SDS for all hazardous substances (as defined in the International Maritime Dangerous Goods Code) onboard the vessel will be kept readily available in locations known to all crew.	Pre-mobilisation inspection confirms a Hazardous Chemicals Register is in place and includes the correct and in-date SDS for all hazardous substances are readily available to all crew.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
Suitable spill kits will be located close to the location of hazardous substances to allow timely response and clean-up in the event of a spill/incident.	**EPS 279**: Spill kits of appropriate size and composition for the type/class of hazardous substance will be located close to location of these hazardous substances. Crew will be appropriately trained in how to use the spill kits and how to properly dispose of any soiled spill kits following clean up.	Pre-mobilisation inspection confirms correct type and size of spill kit and their proximity to the hazardous substance location. Induction records show crew are appropriately trained in how to use the spill kits.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
All equipment shall be regularly serviced and maintained in accordance with original manufacturer's specifications and the vessels planned maintenance schedules.	**EPS 280**: Risk of equipment failure (leading to accidental material releases) reduced by regular service and maintenance according to vessel SOP, original equipment manufacturer's recommendations and vessel service schedule.	Pre-mobilisation inspection confirms equipment is in current test/ certification and maintenance records show completed work.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
Vessels and equipment will be operated by trained and experienced crew.	**EPS 281**: All equipment to be correctly operated only by trained and experienced staff.	Induction records show which crew hold suitable certification/training to operate equipment.	Vessel Master. Party Chief.
All crew will participate in the vessel and environmental induction prior to the commencement of operations.	**EPS 282**: All crew will participate in a vessel induction prior to the commencement of the survey, outlining their roles and responsibilities while onboard.	Induction records show content of induction meeting and participation of crew.	Vessel Master. Party Chief.

Control Measure	Environmental Performance Standard	Measurement Criteria	Responsible Party
All equipment located on the vessel's deck that uses hydrocarbons will be surrounded by primary bunding (e.g. deck edge lip), as a minimum.	**EPS 283**: All equipment located on the vessel's deck that uses hydrocarbons will be (as a minimum) surrounded by primary bunding (e.g. deck edge lip).	Pre-mobilisation inspection confirms appropriate bunding is in place around relevant deck machinery/equipment.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative
Deck scupper plugs will be available beside all deck drainage points that lead overboard.	**EPS 284**: Scupper plugs, or equivalent drainage control measures, will be readily available to allow drains to be blocked in the event of a hydrocarbon or chemical spill to deck (i.e. outside bunded areas).	Audit records confirm location of drainage control measures. Induction records show crew are appropriately trained in how to implement scupper plugs.	Vessel Master. Survey Environmental Advisor SLB QC and HSE Representative Party Chief.

8.5.7 Accidental Release of Hazardous and Non-Hazardous Material Impact and Risk Summary

Based on the assessment above, including the potential impacts on the environment and the associated controls measures to be implemented, the residual risk of an accidental release of hazardous and non-hazardous materials from the survey vessels is considered to be **Low.**

The suite of control measures to be implemented have been developed in accordance with industry best practice, and all relevant legislation. Consequently, it is considered that the environmental impacts and risk on the marine environment and receptors arising from the accidental release of hazardous and non-hazardous material from the Seismic Survey, are reduced to **ALARP** levels.

In accordance with the acceptability requirements prescribed in **Section 6.4,** the suite of control measures is considered appropriate to manage the risks and impacts arising from the accidental release of hazardous and non-hazardous material from the Seismic Survey on all receptors to an **Acceptable Level**.

9 Cumulative Effects

Cumulative effects due to exposure to seismic energy may occur under the following scenarios, including:

- Simultaneous exposure to separate MSSs being conducted in the same area, at the same time – acoustic footprints overlap in space and time;
- Multiple exposures due to individual MSS undertaken consecutively – two or more MSS undertaken across the same area within a short period of time;
- Multiple exposures during a single MSS – including infill of seismic data gaps within the same survey; and
- Interaction between different sources of sound – e.g. vessel noise and seismic energy.

Any of these scenarios could increase the overall underwater sound exposure for key receptors to levels that are above those associated with the conduct of a single MSS. Acoustic energy from multiple seismic surveys and shipping traffic are of particular interest as these are the two most likely potential contributors to cumulative effects of underwater noise in the Bonaparte Basin. There is also a high likelihood that infill of seismic data gaps will be required. The noise impacts of infill lines have been identified throughout **Section 7.2**.

9.1 Characterising the Nature and Scale of Cumulative Effects

Potential cumulative impacts from successive seismic surveys on receptors are highly variable based on the recovery period of the receptors and the timing between the surveys. As outlined through **Section 7.2**, the range at which the various receptors recover from sounds exposure can be between minutes and hours, through to weeks and months; examples of the recovery periods for the key receptors are as follows:

- Zooplankton abundance (including eggs and larvae) will likely recover and replenish to natural levels within hours of exposure as discussed within **Section 7.2.2.2.1**;
- Benthic invertebrates may experience sub-lethal and chronic effects for weeks to months as outlined within **Section 7.2.2.2.2**. However, it is worth noting that no population-level effects are expected and any increased mortality are considered to be negligible in relation to natural variability;
- Potential effects on fish species are dependent on the species and their hearing sensitivity, but effects will likely last for minutes to hours as discussed in **Section 7.2.2.2.3**; and
- Changes in migrating or foraging marine fauna (e.g. cetaceans, turtles, whale sharks) will likely return to normal within hours or days after exposure as outlined within **Section 7.2.2.2.6** and **7.2.2.2.7**.

Based on the discussions above, the longest potential recovery period relates to immobile benthic invertebrate communities, although noting that those effects are considered negligible in relation to the natural variability of those communities.

9.2 Concurrent and Consecutive Marine Seismic Surveys

To assess the potential for concurrent and consecutive seismic surveys to occur in the Bonaparte Basin, an online search of NOPSEMA's 'Activity Status and Summaries' web page was undertaken to identify any EP applications (i.e., open for comment or under assessment with NOPSEMA), recently approved EPs (i.e. between 2021 and 2022) or historical seismic activity (i.e. between 2015 and 2020) within 400 km of the OA. Overall, fourteen historical and three proposed MSSs were identified through this process with their details and status provided in **Table 120**, and locations in **Figure 62**.

In some instances, it was not possible to ascertain whether approved activities had been undertaken. Where this occurred, a precautionary approach was adopted, and it was assumed the MSS proceeded in accordance with the project description and timeline provided in the EP.

Table 120 MSS in the Bonaparte Basin submitted and/or approved by NOPSEMA since 2015

Survey Name	Applicant	Date of EP submission	Status
Proposed MSSs			
Collaborative Seismic Environment Plan Project Overlaps with OA	CGG Services (Australia) Pty Ltd	8 September 2022	Open for comment. Acquisition to occur within five years of acceptance of EP by NOPSEMA.
Galactic Hybrid 2D MSS Located approximately 388 km northeast of OA	Woodside Energy Ltd	10 September 2021	Under assessment
Petrel Sub-Basin South-West 3D Marine Seismic Survey Located approximately 174 km southeast of OA	Santos Offshore Pty Ltd	12 July 2021	Approved on 6 January 2022 Planning to be finalised in March 2023 (Maximum 90 days of acquisition)
Historical MSSs			
Gem 3D MSS Overlaps with OA	Sapura OMV Upstream (WA) Pty Ltd	18 September 2019	Accepted on 4 February 2020 Finalised during 2020 (Maximum 27 days of acquisition)
Petrelex 3D MSS Located approximately 213 km southeast of OA	Polarcus Seismic Limited	11 July 2019	Approved on 4 October 2019 Finalised during 2020 (Maximum 64 days of acquisition)
Cygnus 3D MSS Phase 3 South Partially overlaps with OA	Polarcus Seismic Limited	21 March 2019	Approved on 5 June 2019 Finalised during 2020 (Maximum 36 days of acquisition)
Factory 3D MSS Located approximately 55 km southwest of OA	Shell Australia Pty Ltd	29 March 2019	Approved 16 September 2019 Finalised during 2020 (Maximum 90 days of acquisition)
Beehive 3D MSS Located approximately 287 km southeast of OA	Finniss Offshore Exploration Pty Ltd	8 February 2018	Approved 22 May 2018 Finalised during 2019 (Maximum 30 days of acquisition)

Survey Name	Applicant	Date of EP submission	Status
Zénaïde 3D MSS Located approximately 35 km southeast of OA	Polarcus Seismic Limited	13 September 2017	Approved 7 December 2017 Finalised during 2018 (Maximum 60 days of acquisition)
Fishburn WA-459-P 3D MSS Located approximately 130 km southeast of OA	Santos Offshore Pty Ltd	8 June 2017	Approved 22 June 2017 Finalised during 2017 (Maximum 21 days of acquisition)
Bethany 3D MSS Located approximately 195 km northeast of OA	Santos Offshore Pty Ltd	13 April 2017	Approved 28 March 2018 Finalised during 2018 (Maximum 75 days of acquisition)
Cygnus SW MSS Located approximately 52 km southwest of OA	Spectrum Geo Pty Ltd	24 January 2017	Approved 4 May 2017 Finalised during 2018 (Maximum 90 days of acquisition)
Cygnus 3D MSS (2017-2018) Partially overlaps with OA	Polarcus Seismic Limited	6 October 2017	Approved 1 December 2017 Finalised 2017 – 2018 (Maximum 12 months of acquisition)
Cygnus 3D MSS (2015-2017) Partially overlaps with OA	Polarcus Seismic Limited	20 August 2015	First approval 14 December 2015 Finalised 2015 – 2016 (Maximum 12 months of acquisition)
Gravis MC3D MSS Partially overlaps with OA	CGG Services (Australia) Pty Ltd	14 April 2015	Approved 25 August 2015 Finalised in 2017 (Maximum 24 months of acquisition)
Quoll 3D MSS Located approximately 17 km west of OA	Searcher Seismic Pty Ltd	1 May 2015	Approved 16 June 2015 Finalised 2015 (Maximum 6 months of acquisition)
Forge MC3D MSS Partially overlaps with OA	PGS Australia Pty Ltd	19 June 2015	Approved 4 November 2015 Finalised 2016 (Maximum 24 months of acquisition)

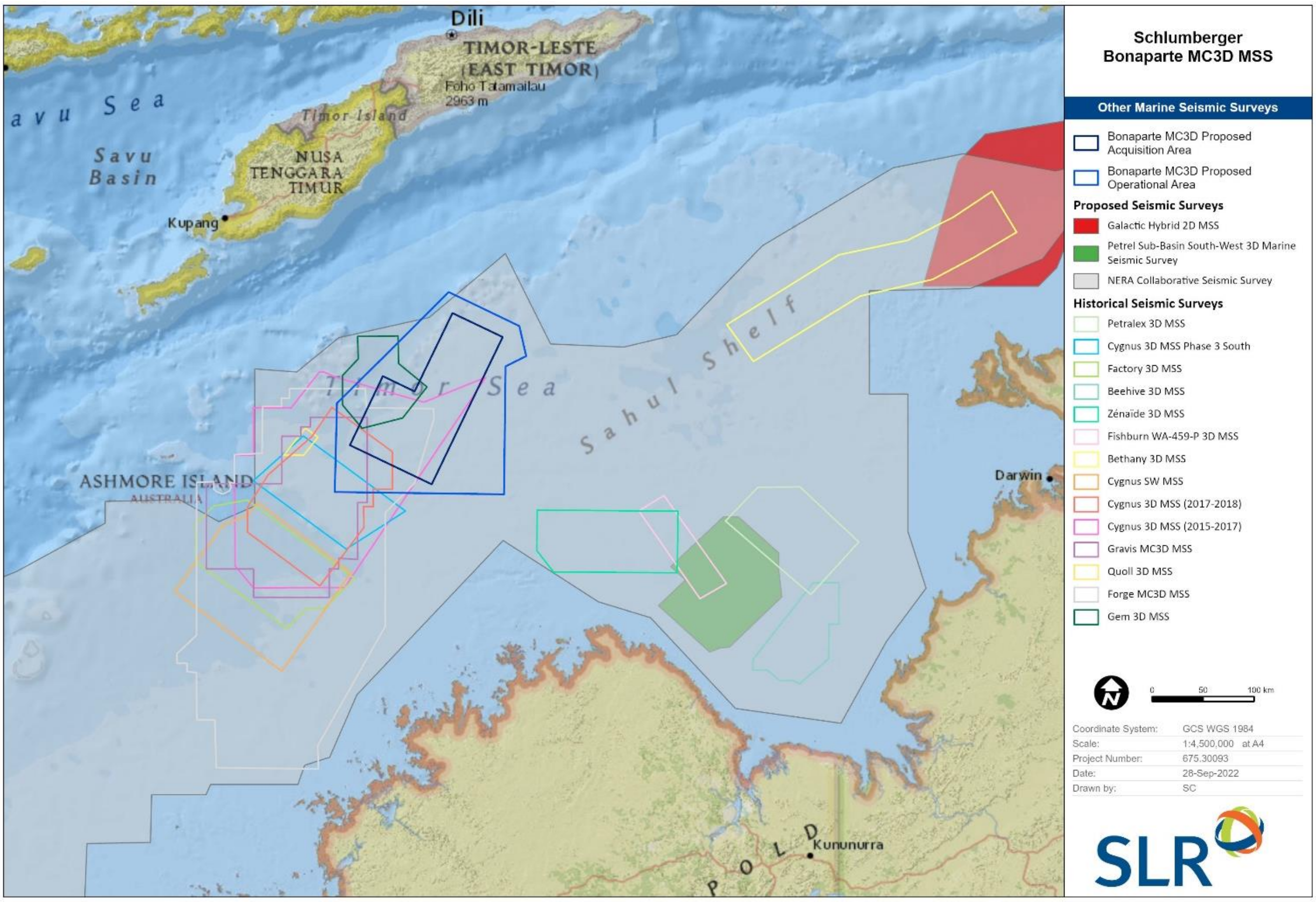


Figure 62 Planned and Previous Seismic Surveys Acquired since 2015 in the Bonaparte Basin

The OA of the Collaborative Seismic EP Project, that is currently open for comment, covers SLB's OA and as the EP states that the MSS will occur '*over five years from NOPSEMA acceptance*' there is also potential for acquisition of both surveys to occur concurrently. However, the Collaborative Seismic EP Project has committed to a temporal separation to mitigate against potential cumulative effects on commercial fishers, whereby acquisition will not occur within the same ASAs of other MSSs within the same fishing season. This effectively allows one year separation between surveys acquiring over the same area. Therefore, it is anticipated that multiple MSSs will not be conducted within the OA, neither at the same time or within quick succession of the proposed Seismic Survey.

Given that Seismic Activity has not been undertaken within or close to the OA since mid-2020, ecological receptors are expected to have recovered. As a result, there is not expected to be any potential for cumulative impacts on marine receptors from seismic energy released from the previous MSSs. In addition, recent research indicates that short-term (acute) noise exposures (like those associated with seismic surveys) are less likely to affect marine species at a population level compared to long-term (chronic) noise exposures (Ellison *et al.*, 2016).

SLB are not aware of any additional proposed MSSs for the Bonaparte Basin and given the timeframe for gaining regulatory approval for an EP, it is unlikely that any emerging projects would contribute to potential cumulative acoustic disturbance within the OA. Should SLB become aware of another MSS being approved for the Bonaparte Basin, the potential for cumulative effects from spatially and/or temporally overlapping surveys would be reassessed.

Section 7.1.5 contains control measures that will be implemented in the event that potential concurrent MSSs are identified. In particular, a SIMPOS Plan will be developed which will include the implementation of a 40 km spatial separation between the Seismic Vessel and any other operating Seismic Vessel in the Bonaparte Basin area. This 40 km separation reduces the potential for cumulative noise impacts through liming sound source levels to those associated with a single acoustic source. Following recommendations developed by the Bureau of Ocean Energy Management (BOEM, 2014), the 40 km separation has become an industry starting point for managing concurrent seismic surveys, whereby a corridor is developed between vessels conducting simultaneous surveys that animals may pass through rather than travel larger distances to go around the survey vessels.

9.3 Multiple Exposures – Infilling

During the acquisition of seismic data, occasional gaps in the data coverage occur, due to a variety of possible causes, such as malfunction of seismic equipment, minor navigation errors causing the vessel to move off-track, data errors, or enforced periods of non-acquisition due to interactions with marine species, weather constraints or vessel issues. These data gaps may negatively impact on the overall integrity and usefulness of the seismic data and prevent the objectives of the survey being achieved. Critical gaps in the seismic data coverage require ‘infilling’ with new data and the Seismic Vessel is required to re-run data acquisition across each area of data gap.

Infilling has the potential to expose resident marine species, such as site-attached benthic species (including fish species targeted by commercial fisheries), to a second dose of seismic energy within a relatively short period of time. The time interval between initial data acquisition and infilling depends on a variety of factors, including data processing, vessel scheduling, local conditions and competing data priorities. SLB will ensure at least 24 hours has passed before undertaking any infilling, and this interval is expected to reduce the cumulative seismic exposure risk to site-attached species. Note however that Przeslawski *et al.* (2016) concluded that none of the most recent studies (i.e. Parry *et al.*, 2002; Harrington *et al*., 2010; Aguilar de Soto *et al.,* 2013; Day *et al.*, 2016) indicate that MSSs cause catastrophic or short-term mortality on benthic shellfish (scallops) under realistic exposure scenarios. Furthermore, Przeslawski *et al.* (2016) state that effects on the catch rates or abundances have not been detected for cephalopods, bivalves, gastropods, decapods, stomatopods, or ophiuroids (Wardle *et al.,* 2001; Parry *et al.*, 2002; Christian *et al.,* 2003; Parry and Gason, 2006). These scientific results indicate that MSSs are unlikely to impact site-attached benthic species populations; however, it is noted that these studies focused on the effects associated with single exposure scenarios.

Infill lines need to be done on a planned basis as it takes a lot of time to turn the Seismic Vessel around and traverse the same area. This means that often the infill lines will be left to the end of the operations to best acquire them most efficiently. TSLB will ensure at least 24-hours has passed between the original acquisition and the infill line. This control measure has been included in **Table 70**.

Repeated exposure to the seismic source may also occur should the Seismic Vessel deviate from the predetermined sail lines whilst the seismic source is active. Whether resident marine species may be exposed to a second dose of seismic energy under this scenario is contingent upon a number of operational factors, range-dependant environmental properties and the relative sensitivity of each receptor to seismic disturbance. SLB will ensure at least 24 hours has passed since the previous pass of the acoustic source on an adjacent sail line, before deviating whilst the seismic source is active. The nature and scale of impacts arising from repeat exposure are considered consistent with those described for infilling

SLB will implement the '*Commercial Fisheries Compensation Protocol for the Bonaparte MC3D Marine Seismic Survey'* to provide potential for commercial fishers who experience an economic loss as a result of the Seismic Survey to claim compensation. The protocol will mitigate against any financial loss to commercial fishers as a result of potential impacts from the Seismic Survey, including potential cumulative effects, whether they be from concurrent and consecutive surveys, or due to multiple exposures. This protocol is described in **Section 7.2.3.1.**

9.4 Multiple Sound Sources

Cumulative noise impacts can also occur due to seismic activities overlapping with existing background noise in and around the OA, such as from vessel traffic (including fishing vessels, oil and gas support vessels and regional shipping traffic). **Section 4.7.4** provides details on the shipping activity that occurs in the general Bonaparte Basin. The 'background' noise levels associated with shipping are known to affect the communication calls between marine mammals due to 'masking', whereby calls are not as easily heard above the noisy background. Masking is a complex phenomenon and masking levels are difficult to predict for any particular combination of sender, environment, and receiver characteristics (Erbe *et al*., 2016). The Seismic Survey will comprise of one Seismic Vessel, and two smaller ancillary vessels including a Support Vessel and Chase Vessel. Consequently, the increase in vessel noise will be small compared to the regular acoustic disturbance generated by commercial vessels traversing the OA.

The Bonaparte Basin is transited by large commercial vessels, hence shipping noise is an existing feature of these waters, and marine mammals that are resident within the area are likely to have adapted to the persistent background noise. In the presence of constant noise, marine mammals sometimes adapt their vocalisations in order to overcome the effects of masking (e.g. McGregor *et al*., 2013) (further described in **Section 7.2.2**). In contrast, marine mammals that seasonally migrate through the OA are more likely to experience masking effects from vessel noise and noise generated during the Seismic Survey.

The cumulative effects of exposure to multiple sound sources may be more relevant at the population level on a chronic basis than at the individual level on an acute basis (Ellison *et al*., 2016), and therefore introducing short-term (acute) seismic-based noise to an area that has an existing high background of vessel noise, such as the Bonaparte Basin, is unlikely to impact marine species at the population level.

Marine environments differ in their resilience to anthropogenic stressors (Ban *et al*., 2010), and the potential for cumulative effects is likely to be related to physical features such as water depth, seabed characteristics and coastline shape. A higher risk from noise is evident in shallow waters and enclosed bays where the attenuation potential is lower, whereas open coastlines allow sound to dissipate more rapidly and therefore the risk is lower.

9.5 Conclusions

The potential for cumulative noise impacts associated with the proposed Seismic survey is low considering that:

- Given the time that has elapsed since previous surveys were undertaken in this area, all receptors are expected to have recovered from the effects of previous surveys prior to commencement of the proposed Seismic Survey. Therefore, cumulative impacts to ecological receptors are not expected to occur as a result of any of the identified previous seismic surveys in the region and the proposed Seismic Survey;

- The Collaborative Seismic EP Project is currently undergoing assessment and has the potential to overlap spatially and temporally with the Seismic Survey. However, the Collaborative Seismic EP Project has committed to temporal separation to mitigate against potential cumulative effects on commercial fishers which would separate the two MSSs by one year, allowing environmental receptors to fully recover. Furthermore, SLB has committed to a 40 km separation between Seismic Vessels operating concurrently to the Seismic Survey which would act to mitigate against potential cumulative effects from acoustic emissions;
- The necessity of infilling critical gaps in the seismic data is not expected to significantly increase sound exposure impacts on marine species, especially since the open ocean environment of the OA will ensure continual movement and mixing of the water mass, and the minimum time between undertaking infilling; and
- Additional vessel noise associated with the survey vessels will be small compared to the background noise associated with marine traffic and fishing. The introduction of short-term (acute) seismic-based noise to this area that has an existing high background of vessel noise is unlikely to impact marine species at a population level.
- SLB will ensure at least 24 hours has passed before undertaking any infilling, and this interval is expected to reduce the cumulative seismic exposure risk to site-attached species, including those species that are commercially targeted; and
- SLB will implement the '*Commercial Fisheries Compensation Protocol for the Bonaparte MC3D Marine Seismic Survey'* to provide potential for commercial fishers who experience an economic loss as a result of the Seismic Survey to claim compensation. The protocol will mitigate against any financial loss to commercial fishers as a result of potential impacts from the Seismic Survey, including potential cumulative effects, whether they be from concurrent and consecutive surveys, or due to multiple exposures.

10 Implementation Strategy

Regulation 14 of the Environment Regulations requires an EP to contain an implementation strategy. As outlined within NOPSEMA (2020), there are four key elements that an implementation strategy should include, these are:

- An environmental management system consistent with AS/NZS ISO 14001;
- Provision of reporting, monitoring, recording, audit, management or non-conformance and review of the titleholder's environmental performance to ensure that EPOs and EPSs in the EP are being met;
- An OPEP and demonstration that appropriate arrangements are in place for the activation of this plan in the event of a spill; and
- Arrangements for ongoing consultation with relevant authorities, persons and organisations in order to demonstrate that there is an effective two-way communication process in place between the titleholder and relevant person.

The following sections outline the methods in which SLB will conform to the requirements of Regulation 14.

10.1 Schlumberger Environmental Management System

As defined within Regulation 4 of the Environment Regulations, an Environmental Management System includes the responsibilities, practices, processes and resources used by a properly resourced and competent organisation to manage the environmental aspects of an activity. The design and implementation of the Seismic Survey will be conducted within the framework of SLBs Quality, Health, Safety and Environmental (**QHSE**) Policy and Environmental Management System.

SLB requires the active commitment to and accountability for, QHSE from all employees and contractors to the extent that they comply with the QHSE Policy and Environmental Management System.

SLB's QHSE Management System defines the principles by which SLB conduct operations worldwide with regard to health, safety and the environment and comprises eight interrelated elements, as shown in **Figure 63** and further described in **Table 121**. These elements are continually improved by conformance checks on day-to-day standards and procedures (control), by conformance checks on the management system (correction), and through modifications on the management system (improvement).

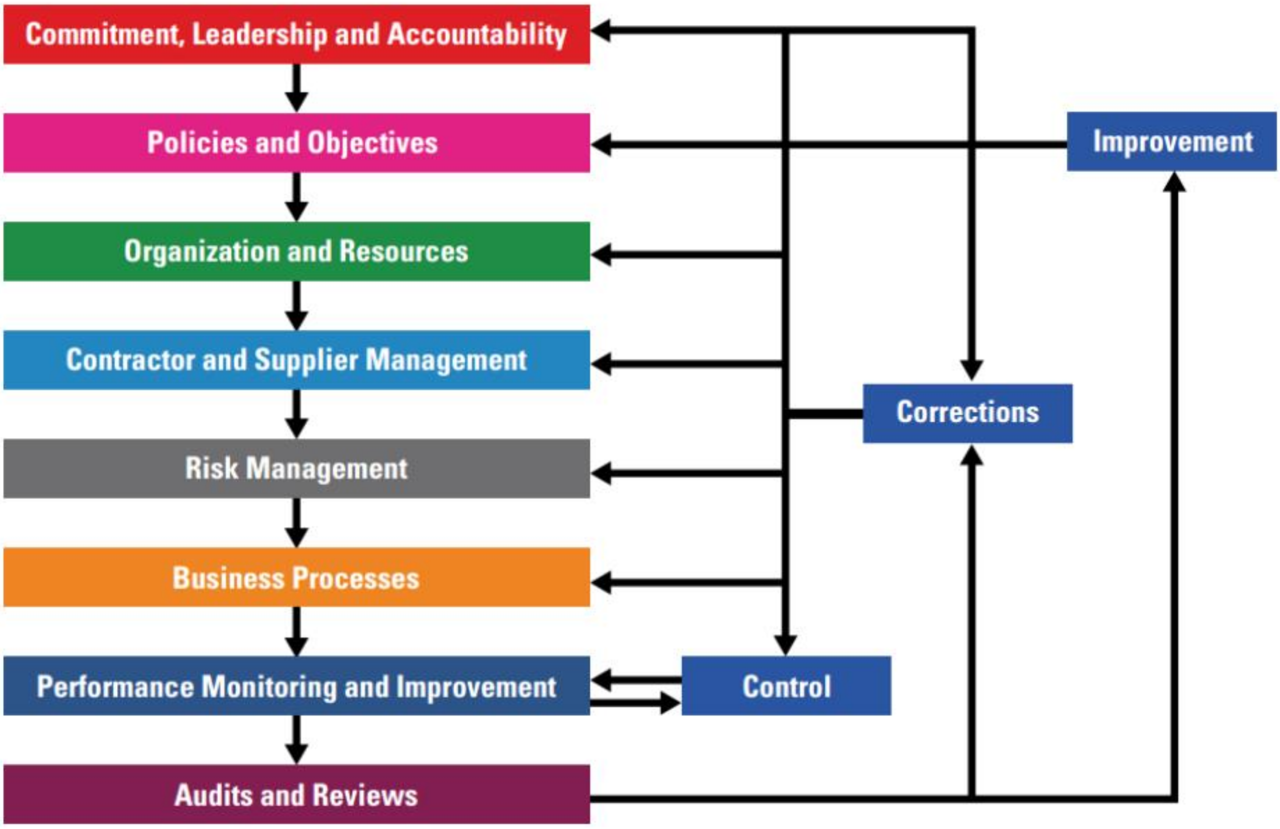


Figure 63 The Eight Elements of SLB's QHSE Management System

Table 121 Description of the elements of SLB's QHSE Management System

Element	Objectives and Mechanisms
Commitment, leadership and accountability	Management shall provide strong, visible commitment, leadership, accountability, and personal involvement in all activities. Management shall make available the resources necessary to achieve HSE objectives. Management shall ensure that all employees are held accountable for their actions and responsibilities.
Policies and objectives	Policies and objectives shall be issued at the highest level of organisation, deployed and maintained at all organisational levels. Managers shall identify HSE objectives and set performance expectations taking into account input and feedback from their whole teams. These expectations shall be communicated to all those concerned including, where appropriate, employees, customers, and contractors. Systems shall be in place to assess compliance and performance.

Element	Objectives and Mechanisms
Organisation and resources.	Organisational responsibilities shall be defined, and the necessary resources provided to achieve HSE objectives. Managers are responsible for HSE, and all employees are individually responsible and accountable for all HSE issues relating to themselves or others with whom they associate. Recruiting and training programs shall be implemented to ensure that all employees are competent to meet their responsibilities. The competence requirements shall be regularly assessed and updated as necessary. All employees shall maintain an up-to-date training and competency passport. Recruiting Systems shall be in place to identify and recruit suitable candidates. All newly hired personnel shall receive general and job-specific orientations in HSE prior to their first work assignment. Employees transferring to new positions or locations shall receive formal orientation about specific HSE issues related to their new environment. On the job training and formal training shall be provided to fulfil the competence requirements for all job functions. Effective communications processes shall be in place to ensure proper circulation of information throughout the organisation. Effective two-way communications shall also be maintained with customers, contractors, relevant government agencies and third parties. Processes shall be in place for managing documentation, including storage and sharing knowledge. HSE bridging documents shall be established as necessary to ensure a coherent approach between all operating parties, including client and contractors. Standards ("sets of rules for implementing policies that define the requirements and minimum acceptable criteria") shall be defined and maintained for all essential business activities. Guidelines ("companion documents to standards") shall provide additional technical or procedural information for those who implement the programs or processes required to ensure compliance with standards.
Contractor and supplier management.	Contractors and suppliers shall be managed to ensure that their products and services meet applicable HSE standards. Contractors and suppliers shall be evaluated, qualified and selected based on their ability to deliver a quality product or service in an ethical, professional, safe, healthy and environmentally acceptable manner. Mechanisms for monitoring contractor HSE performance shall be implemented. Good HSE performance shall be expected and recognized, and Contractors shall be actively involved in the continuous improvement process. Poor HSE performance shall not be tolerated and may result in early termination. Risks associated with every service provided and every product used, manufactured, sold or transported by SLB or its contractors shall be assessed, and systems shall be in place to incorporate risk assessment in all activities. Appropriate employees shall receive formal training in risk management. Systems shall be in place to communicate the assessed risks to the appropriate, accountable level of management, commensurate with the magnitude of the assessed risk. All related decisions shall be clearly documented. Risk control shall include the implementation and verification of appropriate prevention and mitigation measures. A common system shall be used to manage the management of change process, and to record all deviations, their cause, the alternative measures taken, and their formal approval.

Element	Objectives and Mechanisms
Business processes	Business processes for all essential activities shall be put in place and properly managed. The design, procurement, implementation and/or use of assets, products and systems used in SLB operations shall comply with Company QHSE policies and standards and incorporate systematic HSE requirements. Facilities, equipment, product and systems shall be suitable for the required purpose and shall comply with their design specifications. Processes shall be in place to ensure that unauthorized modifications to assets, products and systems are prevented. Maintenance programs shall be in place to ensure the HSE integrity of SLB facilities, equipment, and products. All essential processes shall systematically incorporate HSE requirements and shall be supported by documented procedures and work instructions as necessary. A formal HSE assessment shall be conducted prior to initiating any project or operation, to ensure that all HSE aspects have been addressed as planned. The exposure of all employees, customers, contractors and the general public to hazardous conditions associated with our operations shall be assessed on a continual basis to minimize risks to health. Measures to limit exposure to identified health hazards shall be defined and implemented, and any exposure to hazardous agents shall be measured periodically, and the health of relevant personnel monitored. The company shall also pursue a proactive approach toward the general health awareness of all employees, their families and contractors. SLB shall continually strive to minimize the impact of its operations on the environment. Plans shall be developed, and appropriate actions taken to prevent environmental pollution, conserve resources and minimize waste. Where elimination of a pollution source is not practical, appropriate treatment of waste shall be undertaken and monitored to minimize the impact of discharges and disposals on the environment. Exercises and drills shall be conducted on a regular basis and, over an agreed period of time, cover all scenarios of high-risk potential and all aspects of the contingency plans and response procedures. In addition, key personnel shall be trained to a level of competence appropriate to their responsibilities in emergency scenarios. All Schlumberger locations and managed sites shall have appropriate spill contingency plans.
Performance monitoring and improvement.	Systems shall be in place to monitor Company results versus expectations, compliance with applicable QHSE policies, standards and other requirements and the results of continuous improvement efforts. Each location shall encourage non-conformance reporting and recording of all HSE events. All serious, and potentially serious events shall be investigated and analyzed, and lessons learned from these investigations shall be communicated and corrective actions implemented. Line management shall prioritize the remedial actions recommended in investigations, assign responsibilities and monitor their progress until completion. Investigation teams shall include line management, the local HSE organization and appropriate internal or external resources. Systematic assessments and inspections shall be conducted in all locations to ensure compliance with defined QHSE policies, standards and procedures, and with local laws and regulations. Programs shall be in place in all locations and shall actively involve all our employees and our customers. A ‘no blame’ culture shall be promoted to encourage employees to report problems, non-compliances and non-ethical behaviours. All employees shall be encouraged to suggest improvements to existing standards, processes and systems. Procedures shall be developed to ensure that critical information is collected and analysed. Records shall be maintained to assess compliance with QHSE policies, standards and procedures and to monitor improvements in our processes

Element	Objectives and Mechanisms
Audits and reviews	Audits and reviews shall be conducted to verify the implementation and effectiveness of the QHSE Management System. Adherence to the HSE Management System, and associated requirements shall be evaluated by means of both internal and external audits. The frequency of these audits shall be determined by the perceived business risk. Managers shall record and report the results of audits and any other self-regulation processes to all concerned parties. Line management shall maintain an effective control process to ensure that the findings of audits are recorded, prioritized, actioned and closed out. Key lessons shall then be disseminated throughout SLB. Periodic management reviews of the QHSE Management System shall be conducted to ensure the effectiveness of the system, and to identify and implement system improvements.

The underlying approach for SLBs QHSE Environmental Management System has been developed in accordance with the Plan-Do-Check-Act concept outlined within AS/NZS ISO 14001:2016 as well as managing all environmental risks associated with SLBs activities to minimise any impacts on the environment. SLBs QHSE Environmental Management System reflects the organisations demonstrated capacity to implement QHSE principles analogous to those which underpin the development of this EP. SLB and their nominated contractors will rely on this experience to put into effect the Implementation Strategy outlined within this EP.

The nominated contractors may also have a suite of procedures that may apply to specific vessels and acoustic equipment; however, these documents are generally equipment specific. For completeness, SLB will ensure all of the equipment specific workflows and procedures required to be implemented by contractors are not inconsistent with the requirements of this EP, through the requirement to supply a compliant Contractors QHSE Plan (**Section 10.3.1**).

10.2 Roles and Responsibilities

As stated in the NOPSEMA Guidance Note (NOPSEMA, 2020), a clear definition of the roles and responsibilities of all personnel involved in the Seismic Survey ensures effective and consistent implementation of all the environmental management requirements set out in this EP and SLB's commitments to reducing potential impacts to the receiving environment to **ALARP** and an **Acceptable Level**.

While the respective Vessel Master has the overall responsibility to maintain health and safety standards for everyone on-board the survey vessels, it is the responsibility of all SLB employees and contractors to adhere to the requirements of any HSE Policy and the approved EP to ensure that their work is carried out in a safe manner and in a way that minimises any further potential risk to the receiving environment.

Table 122 outlines the roles of SLB employees and contractors that will be involved in the Seismic Survey and their responsibilities for the duration of the survey. The organisational structure of the SLB project team and HSE representatives is provided in **Figure 64**. This is the management structure that will be in place for the duration of the Seismic Survey.

Table 122 Roles and Responsibilities during the Seismic Survey

Role	Responsibility
SLB Project Manger (Onshore)	• Coordinates all regulatory approvals required for the Seismic Survey; • Responsible for hiring qualified and experienced personnel, including contractors; • Communicates with all third parties and government officials to ensure all activities and associated reporting complies with SLB company policies and relevant legislation; • Ensures all reporting required under **Section 10.6** occurs in accordance with the relevant requirements; • Ensures that everyone offshore has access to communication materials, such as Bahasa and Tetum language communication sheets; • Responsible for all consultation activities and ensures that ongoing consultation with relevant persons is carried out in a manner that is consistent with SLB's consultation strategy (**Section 5.5**) and control measures; • Ensures all relevant ongoing consultation which may impact the Seismic Survey or relevant persons is communicated to personnel offshore, as required; • Ensures all records are kept and maintained, and made available to relevant authorities on request; and • Ensure that any review of, and subsequent change to, the approved EP is undertaken in accordance with SLB's MoC process (**Section 10.4.6**).
SLR Environmental Consultant (Onshore)	• Prepare environmental induction information on contents of the approved EP; • Provides pre-mobilisation training and awareness to the Vessel Master, SLB QC and HSE Representative, SEA, MFOs/MMOs, PAM Operators, Party Chief and Seismic Operator(s) joining the vessel. This will be undertaken prior the environmental induction for each swing shift; • Provides an environmental induction to all offshore personnel, including vessel crew, to ensure and that they have a full understanding of the approved EP and control measures; • Assist with the review, investigation and reporting of any environmental incidents or non-compliances; and • Respond to any questions that may arise from SLB or from personnel onboard the Survey Vessels in relation to the contents and commitments of the approved EP.

Role	Responsibility
SLB QC and HSE Representative	• Assists the SEA in ensuring compliance with the requirements of the EP • Responsible for reviewing Contractors QHSE Plans and confirming consistency with the requirements of the EP; • Ensures that everyone offshore has access to all relevant documents and shapefiles of exclusion areas; • Ensures that shapefiles of environmental sensitivities are correctly loaded onto all the navigation systems that define the boundaries where the acoustic source cannot be active within the OA, as well as the MFO/MMO and PAM observers computer system is provided to all those required that will need it to implement control measures. The shapefiles will include blue whale BIA and 17 km buffer zone, AMP boundaries, KEF-Sahul Shelf, shallow water features where no acoustic source can be discharged (i.e. <60 m depth contour) and shallow water features for bunkering or towing a streamers over (i.e. <40 m depth contour); • Ensures that all relevant documents are disseminated to offshore personnel, prior training and awareness activities and the environmental induction, as required; • Reports to SLB Project Manager; • Responsible for notifying SLB Project Manager of any incidents and maintains the collection of records; • Responsible for the internal recording and reporting of any QHSE incidents and leads the investigation on such incidents; • Reports any incidents or non-compliances to the SLB Project Manager; • Ensures communication is maintained with any other titleholders undertaking an MSS in the Bonaparte Basin if/where SIMOPS is required; • Ensures that the relevant records and monitoring data is undertaken; • Ensures that all vessel crew are adhering to the requirements stipulated within the approved EP; • Responsible for carrying out any QHSE inductions with regard to any internal SLB policies; • Conducts environmental inspections/audits of the survey activities against the approved EP; and • Prepares and submits daily status reports to SLB Project Manager.

Role	Responsibility
Vessel Master	• Overall control of vessel and operates vessel in a safe and responsible manner, and is responsible for the management of health and safety of all crew; • Ensure vessel complies with all relevant legislation such as the Navigation Act 2012, COLREGs, UNCLOS, MARPOL and the EPBC Regulations 2000 (with regard to interactions between the vessel and cetaceans); • Ensure compliance with the approved EP and the associated control measures are enforced; • Provide schedule updates for Notice to Mariners to the AHO; • Maintain clear communication with vessel crew; • Ensure all crew members go through a vessel induction when first boarding the vessel, and on each crew change so that they are aware of their roles and responsibilities and any workplace, health and safety requirements/hazards while on-board the vessel; • Ensure all maintenance, emergency drills, and training are undertaken to schedule and all records are maintained; • Be the point of contact for fishermen on water if there are any issues; • Liaise with all SLB representatives including SLB QC and HSE Representative and SLB Project Manager; and • Notify the appropriate authorities of any incidents at sea (e.g. collision, near-miss, hydrocarbon spill, etc.) and follow-up with any required actions.
Watch Keeper	• Maintenance of bridge watch in compliance with the International Convention of Standards of Training, Certification and Watch keeping for Seafarers, including visual scanning, and monitoring of AIS and radar systems.
Party Chief	• The ultimate leader of the seismic operators and vessel crew; • Ensures the quality of work the crew is performing in the field is high; • Ensures the job is progressing according to the plan agreed by the client and seismic crew; • Ensures all the vessel crew are aware of, and undertake operations, in compliance with all relevant systems and policies; and • Produce reports as necessary, including logging and reporting on the day-to-day conduct of the survey.
Seismic Operator(s)	• Ensuring the correct source capacity is selected; • Appropriate deployment and maintenance of acoustic source and streamer; • Operation of acoustic source, including initiation of Soft-start and Shut-down Procedures; and • Communicate with Party Chief, Vessel Master, SEA, MFOs/MMOs and PAM Operators to implement Soft-start and Shut-down Procedures, and to ensure acquisition/activation of the acoustic source only occurs within the prescribed AA and does not occur within the defined exclusion zones.

Role	Responsibility
General Vessel Crew (survey vessels)	• Undertake work in a manner that is in accordance with all health and safety procedures and to ensure there are no unforeseen adverse effects on the marine environment; • Keep a watching brief on any potential changes to the Seismic Survey which have the potential for changing the impact and/or risk profile, or which may cause deviation from the EP; • Report all hazards, near-misses and incidents to supervisor as soon as possible; • Maintain a high standard of housekeeping; and • Participate in vessel inspections, inductions, safety drills, and health and safety meetings when required.
Survey Environmental Advisor (SEA)	Ensures that • The SEA has overall responsibility for ensuring the requirements of the EP are implemented and appropriately met in an effective and consistent manner; • Ensures the development and delivery of a satisfactory Marine Fauna Mitigation Plan, which is compliant with the approved EP, prior to pre-mobilisation inspection and audit • Provides MFOs/MMOs with additional pre-mobilisation training and awareness, where required; • All personnel are made aware of their requirements under the approved EP; • Ensures that all relevant control measures are implemented • Impacts and risks are continually reduced to ALARP by implementing the approved EP and its associated controls in accordance with **Section 7** and **Section 8**; • Ensures that all vessel crew are adhering to the requirements stipulated within the approved EP; • All changes to the approved EP are subject to a MoC assessment in accordance with **Section 10.4.7**; • Evidence is gathered to ensure compliance with the approved EP commitments and that this is assessed at recommended intervals as stated within the approved EP; • SLB QC and HSE representative is updated each day on daily operational matters; • Compliance with the approved EP is verified in accordance with **Section 7** and **Section 8**; • Prepares weekly reports, as well as a report at completion of Seismic Survey that can be provided to NOPSEMA; and • Completes review of environmental performance in accordance with **Section 10.4**.
EPI Supervisor (Onshore)	• Responsible for providing current and representative CVs for MFOs/MMOs; • Assists with the review, investigation and reporting of any marine fauna incidents (collision or entanglement) or non-compliances; and • Responds to any questions that may arise from SLB or from personnel onboard the Survey Vessels in relation to the contents and commitments of the Marine Fauna Management Plan.

Role	Responsibility
MFOs/MMOs	• Ensure adherence to the Marine Fauna Management Plan • Maintenance of constant day light visual observations for marine mammals and marine fauna; • Maintenance of communication with Vessel Master, Party Chief, Seismic Operator, PAM Operators and broader acoustic control room to initiate EPCA Act Policy Statement 2.1. Part A and additional Part B mitigation measures described in **Section 2** and **Section 3.4** such as, implementation of Soft-start and Shut-down Procedures of the acoustic source as appropriate, Shut-down Zones and extended Shut-down Zones; • Monitor and record any interactions with cetaceans and other marine fauna; and • Preparation of cetacean survey reports (in collaboration with PAM Operator) that outline any marine mammal observations, interactions, and mitigation actions taken.
PAM Operator(s)	• Deployment and maintenance of PAM equipment; • Maintenance of 24-hour monitoring (day and night) of PAM equipment for acoustic detections of cetacean presence; • Maintenance of communication with Vessel Master, Party Chief, MMOs and Seismic Operator to initiate mitigation measures described in **Table 70** and **Section 3.4** such as shut-downs of acoustic source; and • Preparation of cetacean survey reports (in collaboration with MMO) that detail any cetacean detections, interactions, and mitigation actions taken.

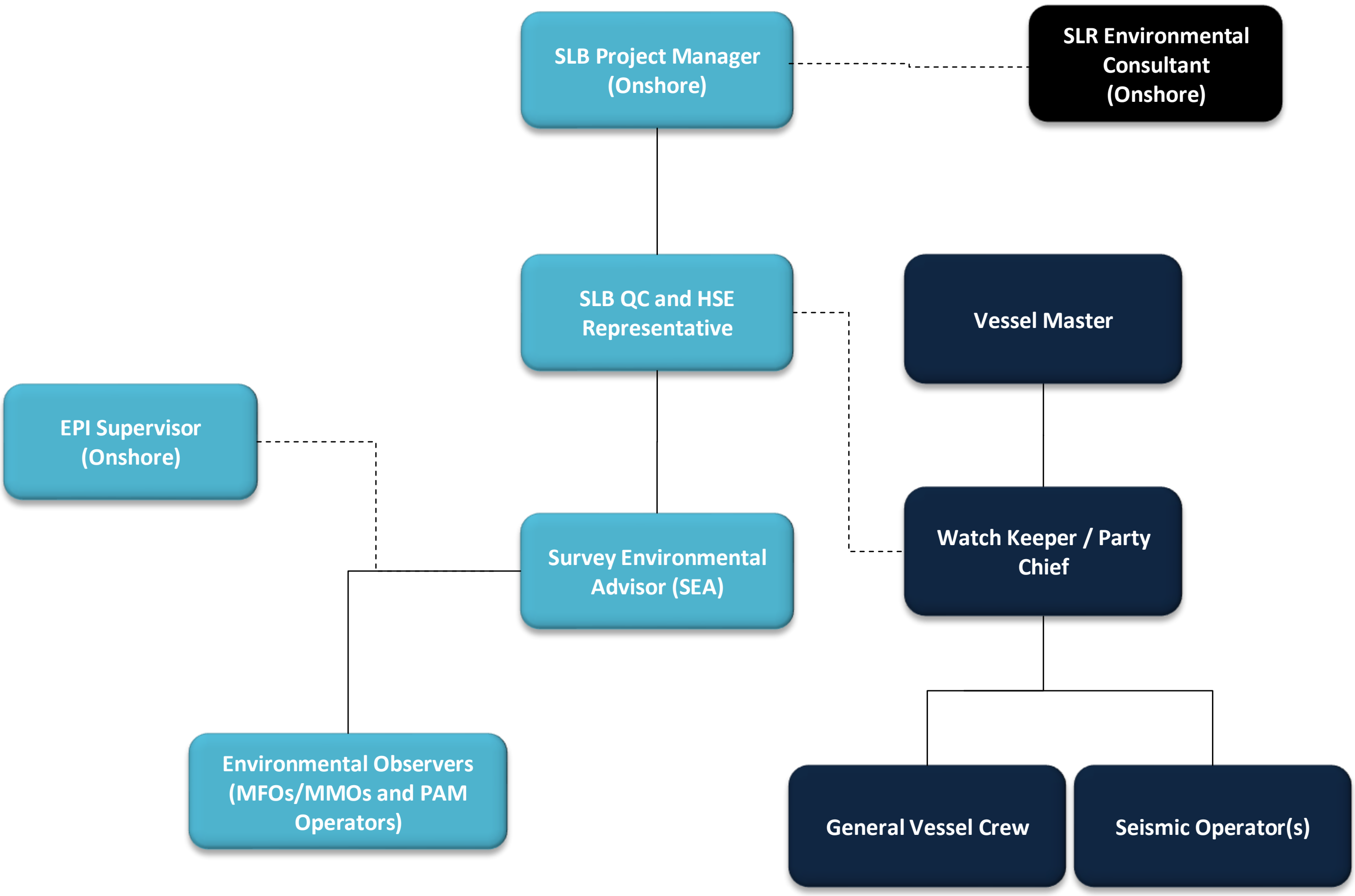


Figure 64 Organisation Chart

10.2.1 Communications

The Vessel Master, SLB QC and QHSE Representative and SEA are jointly responsible for keeping the vessel crew informed about environmental issues, acting as a focal point for personnel to raise environmental issues, and consulting and involving all personnel in the following areas:

- Issues associated with the implementation of the EP;
- Any proposed changes to equipment, systems, or methods of operation of plant, where these may have potential environmental implications; and
- Any proposals for the continuous improvement of environmental protection, including the setting of environmental outcomes and training schemes.

Weekly QHSE meetings will be held onboard each vessel used for the duration of the Seismic Survey with minutes recorded for all items and issues discussed and what the action items are. The minutes of each meeting, including action items from the meetings, will be made available to all personnel following the meeting.

Other forms of internal communication include daily toolbox meetings, which are undertaken at the start of each day, at the start of each shift or before every critical or unfamiliar job. This toolbox meeting includes all personnel involved in the task and includes aspects such as housekeeping, health and safety, and spill prevention requirements. Any QHSE matters that have arisen in the preceding 24-hours will be discussed during these meetings.

Any concerns or issues that arise in relation to environmental performance/requirements of the EP will be recorded and communicated through:

- Personnel related issues/concerns raised are to be communicated with the Vessel Master or SLB Onboard Representative, and are communicated/recorded in daily meetings if required; and
- Infield communications with fishing and shipping activities is managed by the vessel master/crew and recorded on the vessel log (i.e. any vessel within the OA must follow mariners' warnings and navigational requirements and/or agreed controls under this EP).

Ongoing consultation with relevant persons identified in this EP throughout will occur throughout the Seismic Survey, as described in **Section 5.5.12.** The SLB Project Manager will communicate any updates determined through the ongoing consultation process to the Vessel Master, where they have the potential to impact the Seismic Survey and/or relevant persons, in accordance with the Communications Protocol in place to manage concurrent at-sea activities.

10.3 Training, Competencies and Awareness

The correct selection, placement, training and ongoing assessment of competent employees and contractors is a key component of any offshore activity in order to ensure that operations meet all organisational, and statutory requirements, including the requirements of the approved EP. Essentially, this means that all personnel onboard the vessels have to be competent to undertake their roles and responsibilities.

The basis of recruitment relies on a position description for each role that details the necessary qualifications, experience and skill levels required to undertake the defined operational and HSEQ responsibilities of that position. Managers are responsible for ensuring that employees under their supervision are competent to perform the tasks assigned to them. Similarly, SLB ensures that Managers possess the competencies and awareness to supervise over QHSE matters.

All crew onboard the vessel will hold current certification appropriate to their duties. Appropriate training will be provided to ensure individuals are capable and aware of the QHSE responsibilities specific to the Seismic Survey and, consequently, the approved EP. Training may be in the form of inductions, 'on the job' or external courses. A training, induction and competency checklist will record that relevant crew have been trained as necessary for their position. Routine monitoring of crew competency will be achieved throughout the survey duration, as a component of compliance auditing (**Section 10.4.4**)

10.3.1 Contractor Management

Prior to engagement, contractors will be screened through SLBs pre-qualification process designed to evaluate their qualifications, experience and ability to deliver a quality product or service in an ethical, professional, safe, health and environmentally acceptable manner. If selected, relevant contractors and any documentation provided as part of the pre-qualification process will be retained in a register for the duration of the Seismic Survey, including required insurances. All contracts for engagement will establish the following minimum requirements and commitments:

- Contractors will comply with the approved EP, as it relates to their roles and responsibilities;
- Contractors will maintain a copy of the approved EP throughout the Seismic Survey, as provided by SLB;
- Contractors will develop and submit a compliant Contractor QHSE Plan to acknowledge, and demonstrate their ability to adhere too, the relevant commitments of the approved EP, prior to mobilisation;

- Contractor personnel will hold current certification appropriate to their duties and will be able to provide relevant CVs which reflect this;
- Contractor personnel will attend QHSE inductions, as required;
- Contractors will participate in an audit of contractor compliance with the relevant EPS and above requirements, prior to mobilisation (as a component of the pre-mobilisation audit).

Although many individuals have assigned responsibilities under the approved EP, selected persons are responsible for implementing critical operations for which the procedures and processes may be specific to their equipment. Accordingly, the Seismic Survey will be supported by a Bridging QHSE Document between SLB and the contractor for the operation of the Seismic Vessel and survey vessels to ensure a coherent approach between all operating parties.

A compliant Contractor QHSE Plan is considered sufficient to demonstrate coherence with, and adherence to, the approved EP for the Survey Environmental Advisor, MFOs/MMOs and PAM Operators.

10.3.2 Vessel Master

The survey vessel master will possess the appropriate qualifications, experience and skill to command the vessel as required by AMSA for the tonnage and vessel class to be utilised.

As part of the induction process (**Section 10.3.7**), the Vessel Master operators will meet with the SLR Environmental Consultant and SLB QC and HSE Representative to familiarise themselves with the project and EP requirements, the Contractors QHSE Plan, and the Bridging QHSE Document. While the respective Vessel Master has the overall responsibility to maintain health and safety standards for everyone on-board the survey vessels, the SLB QC and HSE Representative will be present and verify this has occurred at the conclusion of this meeting. Likewise, the Vessel Master will ensure the SLB QC and HSE Representative is aware of and understands all the requirements set out in the approved EP, at the conclusion of this meeting.

During this meeting, the Vessel Master and SLB QC and HSE Representative will review the accuracy and completeness of Contractors QHSE Plans, the Bridging QHSE Document and the shape files denoting key environmental sensitivities to be avoided, against the boundary extents of the AA and OA, to ensure they are adequate for further circulation.

10.3.3 Survey Environmental Advisor

The Survey Environmental Advisor (**SEA**) will possess the appropriate qualifications, experience and skill to oversee compliance with the requirements of the approved EP. While the respective Vessel Master has the overall responsibility to maintain health and safety standards for everyone on-board the survey vessels, the SEA has overall responsibility for ensuring the requirements of the EP are implemented and appropriately met in an effective and consistent manner. The SLB QC and HSE Representative will provide secondary check of adherence to the requirements of the EP. Hence, they are commonly cited as responsible persons for a given control measure and EPS.

To achieve this, it is expected that the SEA will have experience exceeding that described for MFOs/MMOs (**Section 10.3.4**). As a minimum, the SEA will have logged a minimum of 20 week's relevant sea-time engaged in MSS operations in Australian waters as an environmental advisor or MFO/MMO.

The Survey Environmental Advisor will be issued a copy of the approved EP, the Contractors HSEQ plan, any relevant tools and workflows from the SLB QC and HSE Representative. As part of the induction process (**Section 10.3.7**), the Survey Environmental Advisor will meet with the SLR Environmental Consultant, MFOs/MMO and PAM to familiarise themselves with the project and EP requirements, as they relate to their roles. The SLB QC and HSE Representative will be present to verify the Survey Environmental Advisor is aware of and understands all the relevant requirements set out in the approved EP, at the conclusion of this meeting.

10.3.4 Marine Biofouling Inspector

As detailed in **Table 95**, a qualified marine biologist will provide a written report on the biofouling inspection carried out on the survey vessels. The inspector will be suitably trained and competent to carry out the biofouling inspection. This experience will be identified by their professional CVs and records of relevant past experience. To be classed as 'suitably trained and competent', the following criteria will be considered when contracting a marine biologist for the purpose of the biofouling inspection:

- Knowledge and experience:
- Experience and qualifications in the marine environment and marine quarantine/biosecurity fields. For example, BSc or MSc in marine biology and relevant industry experience;
- Knowledge and understanding of applicable legislation (see **Section 2.1**);
- Additional evidence provided on a case-by-case basis such as relevant experience, sectors covered, specialist work, professional memberships, and research conducted in the biosecurity field; and
- Maintenance of experience – maintains knowledge, ability and experience through conducting at least three IMS inspections every two years and demonstrates a commitment to ongoing professional development to remain up to date with inspection methods and technology.
- Fit and proper person:
- History of complying with relevant biosecurity legislation and reporting suspected and confirmed IMS; and
- No convictions in relation to honesty or fraud under any written law or history of making false or misleading records of returns.
- Ability:
- Demonstrated ability to determine IMS likely to be present on the vessel;
- Demonstrated ability to effectively inspect internal sea water systems and topsides, and to prepare briefings for divers and dry inspection teams;
- Demonstrated ability to deliver a dry inspection and in-water inspection, to identify IMS and deliver biofouling inspection reports; and
- Demonstrated ability to provide accurate advice relating to risk minimisation in accordance with relevant legislation, policies and guidelines, remediation and corrective measures, and ongoing management and best practice to achieve and maintain a low-risk status.

The Marine Biofouling Inspector will undertake an evaluation of the risk profile of the survey vessel/s prior to vessel entry into Australian waters, during recent dry-docking or during inspection of the hull and niche areas, as required, and which concludes a low risk of IMS presence. The Marine Biofouling Inspector is not included in the chain of command and will not be required to attend project specific inductions as they have no role onboard the vessel following mobilisation from port. The Marine Biofouling Inspector will be contracted in accordance with the requirements set out in **Section 10.3.1.**

10.3.5 MFOs/MMOs and PAM Operators

The EPBC Act Policy Statement 2.1 requires MMOs to have '*proven experience in whale observation, distance estimation and reporting*'. SLB will employ dedicated, trained and experienced MFOs/MMOs, as identified by their professional CVs and records of relevant past experience. Due to the sensitivity towards mammals in the OA and the 17 km extended shut-down zone for blue whales/pygmy blue whales and the extended 2 km Shut-down Zone for other baleen whales and toothed whales that will be implemented throughout the OA for the entire duration of the survey (**Section 3.4**), the following minimum level of experience will be required for the MFOs/MMOs:

- MFOs/MMO's must have logged a minimum of 20 weeks' relevant sea-time engaged in MSS operations in Australian waters as an MMO or MFO.
- MFOs/MMOs will need to be able to demonstrate competency in identifying the species that have been identified as likely to be present during the Seismic Survey (as stated in this EP).
- Competency will need to be demonstrated in assessing behaviour and estimating distance.

Likewise, PAM Operators employed during the Seismic Survey will need to be experienced in the use of PAM for the detection and monitoring of cetacean vocalisations. This experience will be identified by their professional CVs and records of relevant past experience. The following minimum level of experience will be required for the PAM Operators:

- PAM Operators must have logged a minimum of 20 weeks' relevant sea-time engaged in MSS operations in Australian waters as a PAM Operator (following the recommendation of the Marine Mammal Observer Association (MMOA, 2019)).
- PAM Operators will need to be able to demonstrate competency in the acoustic identification of the species that are likely to be present during the Seismic Survey (as stated in this EP); noting that the ability to acoustically detect some species (e.g. blue whales) is limited.
- Competency will need to be demonstrated in interpreting acoustic software and estimating distance to any whale calls detected.

Two dedicated, trained and experienced MFOs/MMOs will be contracted for the Seismic Survey to undertaken observations on the Seismic Vessel. An additional two dedicated, trained, and experienced MFOs/MMOs will be positioned onboard the Chase Vessel when the acoustic source is in the water. These dedicated, trained, and experienced MFOs/MMOs will have the same qualifications and responsibilities as the MFOs/MMOs onboard the Seismic Vessel and will provide marine fauna observations from a secondary platform.

Two dedicated, trained and experienced PAM Operators will be contracted for the for the Seismic Survey to undertaken observations on the Seismic Vessel. PAM Operators will hold PAM certification and must have prior experience monitoring a PAM system offshore before.

MFOs/MMOs and PAM Operators and PAM Operators will be aware of the requirements of the EPBC Act Policy Statement 2.1 Part A procedures and adopted Part B procedures. MFOs/MMOs and PAM Operators will also have experience with the preparation of compliance and sighting reports (see **Section 10.6.2**).

All MFOs/MMO's and PAM Operators will be issued a copy of the approved EP, the Contractors HSEQ plan(s), with respect to the MFOs/MMOs this will take the form of the Marine Fauna Management Plan, and any relevant tools and workflows from the SLB QC and HSE Representative. As part of the induction process (**Section 10.3.7**), MFOs/MMO and PAM operators will meet with the SLR Environmental Consultant and Survey Environmental Advisor to familiarise themselves with the project and EP requirements, as they relate to their roles no less than one week prior to mobilisation. The SLB QC and HSE Representative will be present to verify MFOs/MMOs and PAM Operators are aware of and understand all the relevant requirements set out in the approved EP, at the conclusion of this meeting.

10.3.6 Marine Fauna Mitigation Plan Induction

Persons involved in the delivery of, or support of, the requirements of the Marine Fauna Mitigation Plan will meet to undertake an induction onto the document prior to mobilisation. During this induction, persons will be made aware of, to the extent that they understand and can coordinate, any workflows required to put into effect the Marine Fauna Mitigation Plan. This includes confirming the workflow for the communications protocol component of the Marine Fauna Mitigation Plan. This meeting will occur prior to the Environmental Induction and in the presence of the SLR Environmental Consultant.

10.3.7 Environmental Inductions

As a minimum, all SLB employees and contractors will be required to attend a survey-specific environmental induction prior to the commencement of operations. The induction will be conducted to ensure everyone's awareness and compliance with the approved EP. Accordingly, the environment component of the induction will cover:

- Environmental regulatory and reporting (environmental incidents or hazards) requirements (i.e. EPBC Policy 2.1 requirements);
- Environmental sensitivities, heritage and conservation values within the EMBA, and the key impacts/risks associated with the Seismic Survey;
- Overview of the project description in the accepted EP which is the basis on which NOPSEMA accepted the document, with a detailed description on those activities that have highest risk for an impact and associated response and management procedures;
- A summary of what constitutes a reportable and recordable incident, and the associated internal and external reporting requirements;
- An overview of QHSE expectations and chain of command for personnel onboard
- Roles and environmental responsibilities of key personnel onboard the vessels;
- As a minimum, the control measures and relevant EPSs, EPOs and measurement criteria, as they relate to:
- The relevant requirements of the EPBC Policy Statement 2.1;
- Marine fauna likely to be in the area;
- Marine fauna sighting procedures;

- Marine fauna interaction requirements;
- Protocols for communicating and interacting with any commercial fishers in the OA;
- Waste and chemical management requirements;
- Housekeeping and spill prevention; and
- Spill preparedness and response, the SOPEP, OSMP and OPEP
- Incident, emergency response and spill management procedures; and
- Procedures for reporting of any environmental incidents, non-conformances or hazards.
- Roles and responsibilities, triggers and processes effected under the Management of Change
- Workflows which have been developed to successfully implement any of the above

As summarised above, all vessel crew will be given an overview and presentation during the induction process regarding the requirements of the environmental management systems that are contractor specific as well as requirements of the EP. All crew will be required to become familiar with these systems and contractor specific requirements.

The vessel contractor will conduct their own company and vessel-specific inductions independently of the induction summarised above. This induction will include the management of QHSE risks to vessel personnel that are associated with working in the offshore environment, which are not related to the implementation of the EP. Communication of QHSE issues will typically be through the daily toolbox meetings and weekly QHSE meetings.

All personal are required to sign and attendance sheet to confirm their participation in the inductions and their understanding of the details and information provided in the inductions, which is retained by the SLB QC and HSE Representative. All vessel-based personnel will be required to conform to all applicable guidelines and requirements for management of any HSE issues that may arise during the Seismic Survey.

In conjunction with the contractor specific training and awareness activities described in **Section 10.3.2 to Section 10.3.4**, the actions required to ensure call SLB employees and contractors are suitably inducted, in accordance with the implementation strategy, are summarised in **Table 123.**

Table 123 Environmental Induction and Training and Awareness Schedule

Personnel **(Attending)**	**Personnel (Leading)**	Information covered	Timing
Vessel Master SLB QC and HSE Representative	SLR Environmental Consultant	All Contractors QHSE Plan(s), and the Bridging QHSE Document, Environmental Induction[33]	Prior to Environmental Induction, no less than one week prior to mobilisation
Survey Environmental Advisor MFOs/MMOs SLB QC and HSE Representative	SLR Environmental Consultant	Contractors QHSE Plan(s), the Marine Fauna Management Plan, Environmental Induction	Prior to Environmental Induction, no less than one week prior to mobilisation

[33] Information covered is as described for Environmental Inductions in **Section 10.3.7**

Personnel **(Attending)**	**Personnel (Leading)**	Information covered	Timing
Vessel Master MFOs/MMOs PAM Operators Party Chief Seismic Operator(s) SLB QC and HSE Representative	SLR Environmental Consultant/Survey Environmental Advisor	Marine Fauna Mitigation Plan	Prior to Environmental Induction, no less than one week prior to mobilisation
All other SLB employees and contractors	SLR Environmental Consultant/SLB QC and HSE Representative	Environmental Induction	Prior to pre-mobilisation audit/Prior to mobilisation[34]

10.4 Review of Environmental Performance

The development of this EP resulted in various control measures, EPOs, EPSs and relevant measurement criteria to ensure the control measures are operating to reduce the impacts and risks to **ALARP** and **Acceptable Levels**. These provisions have been based on various pieces of legislation (**Section 2**) to provide a suite of control measures (**Section 7** and **8**) that ensure the levels of environmental performance specifically defined in the EP are met.

As per Regulation 14(6) of the Environment Regulations, SLB will continue to monitor the environmental performance of the control measures during the duration of the Seismic Survey to ensure that:

- The EPOs and the associated EPSs are being met. This will be done through a review process which will ensure that, where necessary, the EPSs can be amended to maintain the management of impacts and risks to the receiving environment to **ALARP** and an **Acceptable Level**, as per the EPOs contained within the EP;
- Any opportunities for improvement are identified promptly to further reduce potential impacts and risks, and any non-conformances are identified to allow appropriate corrective action to be undertaken;
- Compliance with SLBs policies, manuals and procedures;
- All required monitoring requirements have been undertaken prior to the completion of the Seismic Survey; and
- Any concerns raised by relevant persons during or after completion of the Seismic Survey are followed up by an appropriate liaison, as required.

The key aspects and objectives of SLBs environmental performance review process, include:

- Ensuring sufficient monitoring and recording is undertaken (**Section 10.4.1**);
- Maintenance of accurate records as required within the Environment Regulations (**Section 10.4.2);**
- Undertaking auditing to ensure the processes and systems adopted are effective (**Section 10.4.3**);
- The management of non-conformances (**Section 10.4.5**); and
- The review of the EP to continuously look for ways to improve operations during the Seismic Survey (**Section 10.4.6**).

[34] Applicable to all SLB employees and contractors deployed for swings subsequent to the first swing.

Findings of the environmental performance review will be used to inform continuous improvement throughout the duration of the Seismic Survey and for use in future surveys, as appropriate. Further, any such findings will be incorporated into the Environmental Performance report that SLB will submit to NOPSEMA.

10.4.1 Monitoring and Recording

As required by Regulation 14(7), each vessel operating as part of the Seismic Survey will prepare a daily report and carry out a weekly inspection (which will be included within the end-of-week daily report) to ensure that:

- Environmental issues and/or concerns raised through the MoC (**Section10.4.7**) process are communicated to SLB management and recorded for future learnings;
- Any issues arising from SOPEP testing (**Section 10.10.1**) are reported;
- Monitoring of key parameters (**Table 124**) are recorded for when a review of the approved EP is undertaken, including an evaluation of environment performance based on the potential impacts and risks associated with the Seismic Survey (i.e. record of emissions and discharges, seismic operation records, waste discharges and estimates of sewerage discharges); and
- The performance of key equipment as described in the approved EP is checked at least weekly to ensure ongoing reduction of risks and impacts to **ALARP** and **Acceptable Levels**, and any potential issues (i.e. observations of poor operating condition/performance or non-conformances) are continually monitored and raised as soon as practicable.

The results will be reported in the end-of-survey EP performance report submitted to NOPSEMA (**Section 10.6.1**).

Table 124 Summary of Key Parameters[35]

Environment Aspect/Activity	Parameter Measured	Reporting to be Maintained	Responsibility[36]
Physical presence of Seismic Vessel and towed equipment			
Negative interactions with marine fauna due to physical presence of vessels	Adherence to the EPBC Regulations 2000, Part 8, Division 8.1	Bridge logs. Daily and weekly MFO/MMO reports. Daily and weekly PAM reports	Vessel Master MFOs/MMOs PAM Operator
	Marine fauna ship strike or entanglement incidents	Incident report of location, time, type of marine fauna, expected injury. Bridge logs. Daily and weekly MFO/MMO reports. Daily and weekly PAM reports DoEE Ship Strike Database.	MFOs/MMOs Vessel Master MFOs/MMOs PAM Operator MFOs/MMOs

[35] Monitoring of key parameters identified within the OPEP are not considered herein. Instead, these are described in **Section 10.10.**

[36] Note that the allocation of responsibilities *specific to the reporting component* of a control measure, may vary from the total suite of personnel responsible for ensuring a given control measure is undertaken. Where additional personnel are cited against a given control and EPS, they have been identified as being required to co-operate and communicate as a component of, or oversee, the execution of the control measure.

Environment Aspect/Activity	Parameter Measured	Reporting to be Maintained	Responsibility[36]
Interactions with other marine users	Communications relating to concurrent at-sea activities	Consultation log 48-hour look-ahead's Notice to Mariners	SLB Project Manager SLB Project Manager/ Vessel Master SLB Project Manager
	Incident or near miss involving the Seismic Vessel and other marine users	Bridge logs Incident report of location, time, and description of near miss. Report provided to AMSA on any incidents/near misses that threaten the safety of the Seismic Vessel and/or requires remedial action by the Support Vessel. Vessel track records	Vessel Master Vessel Master Vessel Master Vessel Master
Acoustic disturbance to the marine environment			
Impacts on pygmy blue whales and other through acoustic disturbance	Adherence to EPBC Policy Statement 2.1	Compliance and sighting reports as per EPBC Act Policy Statement 2.1 Part A.4 Daily and weekly MFO/MMO reports. Daily and weekly PAM reports Whale Observation Report Bridge logs.	MFOs/MMOs/Survey Environmental Advisor MFOs/MMOs PAM Operator MFOs/MMOs Vessel Master
	Application of Marine Fauna Mitigation Plan	Daily and weekly MFO/MMO reports	MFOs/MMOs
	Restrictions of acoustic release outside of OA and the BIA and 17 km buffer between 14 April and 14 January	Shape files of environmental sensitivities, AA and OA are up to date and accessible Bridge logs Daily and weekly MFO/MMO reports Digital record of vessel movements, such as via AIS.	SLB QC and HSE Representative/Vessel Master Vessel Master MFOs/MMOs Vessel Master
	Crew training	Induction records/register Audit records	SLB QC and HSE Representative SLB QC and HSE Representative
Impacts to marine fauna through acoustic disturbance	Application of Marine Fauna Mitigation Plan	Daily and weekly MFO/MMO reports	MFOs/MMOs
	Restrictions on acoustic release in exclusion zone comprising water depths <60 m and 421 m horizontal buffer	Shape files of environmental sensitivities, AA and OA are up to date and accessible Bridge logs Daily and weekly MFO/MMO reports Digital record of vessel movements, such as via AIS.	SLB QC and HSE Representative/Vessel Master Vessel Master MFOs/MMOs Vessel Master
Routine permissible waste discharges			

Environment Aspect/Activity	Parameter Measured	Reporting to be Maintained	Responsibility[36]
Grey water and sewage discharge	Liquid waste discharges	Discharge Log Maintenance logs confirm equipment/machinery functioned correctly.	Survey Environmental Advisor Vessel Master
Atmospheric emissions			
Refuelling	MGO volume	Bridge logs will record the day of bunkering and provide sufficient detail to confirm the bunker note. Bunker note Fuel data sheet Refuelling checklist is completed	Vessel Master Vessel Master Vessel Master Vessel Master
Minimisation of atmospheric emissions	MGO usage	Oil usage records	Vessel Master
No deliberate discharge of ODS	ODS discharges	ODS Record Book confirms no deliberate discharge of ODS.	Survey Environmental Advisor
Incineration of approved substances	Substances incinerated	Incineration Log confirms only wastes approved by the Garbage Management Plan is incinerated and at a distance greater than 12 NM from shore.	Survey Environmental Advisor
Artificial light emissions			
Light generation from Seismic Vessel	Directional lighting and minimisation of unnecessary lighting	Pre-mobilisation audit records Induction records/register Bridge logs	Vessel Master SLB QC and HSE Representative Vessel Master
	Separation distances from shore maintained	Bridge logs Digital records, such as vessel track records and AIS tracking, showing separation distance of at least 3 NM from shore maintained.	Vessel Master Vessel Master
Invasive marine species			
Introduction of invasive marine species	Ballast water exchange	Pre-mobilisation audit records Ballast Water Logbook detailing all ballast water exchanges, in accordance with Ballast Water Management Plan. Ballast Water Record System	Vessel Master/ SLB QC and HSE Representative Survey Environmental Advisor Survey Environmental Advisor

Environment Aspect/Activity	Parameter Measured	Reporting to be Maintained	Responsibility[36]
	Vessel hull biofouling	Biofouling Risk Assessment Report. Biofouling Record Book. Incident record form for any sighting or suspicion of any IMS on vessel(s), in niche areas, and in ports/harbours.	Survey Environmental Advisor Survey Environmental Advisor Survey Environmental Advisor
Streamer Loss			
Physical damage to benthic environment from physical impact/loss of streamer	Exclusion zones (water depths <40 m) for deployed streamers adhered too	Shape files of environmental sensitivities, AA and OA are up to date and accessible Bridge logs and digital records, such as vessel track records and AIS tracking, show no breach of these requirements.	SLB QC and HSE Representative/Vessel Master Vessel Master
	Location, equipment type, duration of incident and response option taken	Incident report outlining details of equipment loss.	Vessel Master
Vessel Collision and Associated Hydrocarbon Spill			
Vessel collision	Location, volume, duration, type of spill and response option taken	Incident report outlining details of incident. AMSA Report Notification. NOPSEMA Reports. POLREP.	Vessel Master Vessel Master Vessel Master Vessel Master
Vessel refuelling	Refuelling operations	Bridge logs will record the day of bunkering and provide sufficient detail to confirm the bunker note. Bunker note Fuel data sheet Refuelling checklist is completed	Vessel Master Vessel Master Vessel Master Vessel Master
	Exclusion zones around AMP and KEF for refuelling adhered too	Shape files of environmental sensitivities, AA and OA are up to date and accessible Bridge logs and digital records, such as vessel track records and AIS tracking, show no breach of these requirements.	SLB QC and HSE Representative/Vessel Master Vessel Master
Hydrocarbon Spill Response			
Secondary impacts from response options	Implementation of response options	Vessel incident report outlining 'first-strike' response options undertaken. NEBA Report.	Vessel Master Vessel Master/ SLB Project Manager
Accidental Release of Hazardous and Non-Hazardous Materials			

Environment Aspect/Activity	Parameter Measured	Reporting to be Maintained	Responsibility[36]
Hazardous and non-hazardous solid waste management	Solid waste generation	Garbage Record Book Safety Data Sheets Waste Transfer Certificate issued by licensed facility of carrier for onshore transfers.	Survey Environmental Advisor Survey Environmental Advisor Survey Environmental Advisor
Accidental release of hazardous and/or non-hazardous material	Location, volume, and duration of incident, and response option taken	Vessel incident report detailing the release. Notice to Mariners lodged for objects unable to be found/retrieved.	Vessel Master SLB Project Manager

10.4.2 Record Management

The collection of records against the project-specific measurement criteria will form part of the permanent record of compliance maintained by SLB.

As required by Regulations 27 and 28 of the Environment Regulations, SLB will maintain all documents and reports relevant to the Seismic Survey for a minimum of five years following the completion of the survey. Records will be made available upon request. Documents and reports to be kept by SLB are summarised in **Table 125.**

Table 125 Records obtained or utilised in fulfilment of the Seismic Survey to be maintained by SLB

Environmental Management Aspect	Record to be maintained
General	The Seismic Survey EP and associated documents, including any reviews or revisions;
	Vessel certification
	Pre-mobilisation checklist;
	Training and awareness and induction materials;
	Training, competency, and awareness checklist;
	Environmental induction records/register;
	All Contractors QHSE Plans;
	Audit records;
	Relevant persons consultation documentation and logs, complaints register;
	48-hour look-aheads;
	Notice to Mariners;
	SIMOPS Plan (where required);
	Bridge logs;
	Vessel track records;
	Records of emergency/oil spill response exercise;

Environmental Management Aspect	Record to be maintained
	Records of reportable and recordable incidents and written incident notifications and investigation records;
	NEBA Report (where required);
	EP Change Register
	Environmental Performance Report
	Environmental Compliance Register
	Annual Report
	End-of-survey EP performance report;
	End of survey closeout report;
Marine Fauna Mitigations	CVs of MMO and PAM Operators;
	Marine Fauna Mitigation Plan;
	Marine fauna sighting reports;
	MFOs/MMOs daily and weekly logs;
	PAM daily and weekly logs;
	Whale Observation reports’
Routine permissible discharges to	Discharge logs;
	Incineration logs;
	ISPP certificate;
	IOPP certificate;
	IAPP certificate;
	Maintenance logs;
Atmospheric emissions	ODS Record Book;
	Ship Energy Efficiency Management Plan
Invasive marine species management	Ballast Water Management Certificate
	Ballast Water Management Plan;
	Ballast Water Record System;
	Ballast Water Logbook;
	Biosecurity Status Document
	Biosecurity Clearance document
	International Anti fouling certificate;
	Biofouling Risk Assessment Report;
	Biofouling Record Book
Oil usage management	Fuel Data Sheets;
	Bunker notes;
	Oil usage records;
	Refuelling checklist;

Environmental Management Aspect	Record to be maintained
Hazardous and non-hazardous materials management	Garbage Management Plan
	Garbage Record Book
	Waste Transfer Certificate (where required);
	Safety data sheets (SDS) for any hazardous chemicals onboard;

All records will be stored in a way that makes their retrieval for reference practicable. In accordance with regulation 28(2), SLB will make available any copies of records mentioned above, following a request in writing by:

- NOPSEMA;
- A delegate of the responsible Commonwealth Minister; and
- A greenhouse gas project inspector or a petroleum project inspector.

The records will be made available in the case of an emergency at any time of the day or night during the emergency and in any other case during normal business hours. If the records are stored on a computer, the records will be made available in hard-copy form, or if agreed, in electronic form.

10.4.3 Assurance Activities

An Environmental Compliance Register (**ECR**) will document all EPSs and EPOs and will serve as an auditing tool for compliance monitoring and will include a pre-mobilisation checklist. The ECR will include the identification of personnel responsible for the implementation of each commitment as well as the proposed assurance activity which will be used to confirm compliance with the commitments. The register will be maintained up to date with any changes from the EP, and subsequent Requests for Further Written Information (**RFFWI**), and commitments which have been documented through the requirements under MoC (**Section 10.4.7**).

The ECR will document all EPSs and EPOs and will be used to support audit, inspection and monitoring activities and record evidence of compliance. The ECR will document the following:

- The EPOs, EPSs and Measurement Criteria relevant to the Seismic Survey as set out in the EP;
- The person/party responsible for implementing the performance standard to meet the EPO;
- Whether there is evidence the Seismic Survey has complied with the relevant EPSs; and
- A brief description of this evaluation based on supporting information such as routine monitoring records, audit records, checklists, and certificates.

The ECR will be updated to reflect new obligations as, and when, they emerge, in accordance with the Management of Change process (Section **10.4.7**).

Any non-conformances identified during an assurance activity will be reported, tracked and closed-out in accordance with **Section 10.4.5**.

10.4.4 Auditing

SLB will maintain an ECR that will serve as an audit tool during the Seismic Survey. SLB will undertake audits at planned intervals, including pre-mobilisation, monthly during survey activities, once the survey is completed, and if a 'sub-audit' is triggered (see **Table 126**). These audits are principally intended to support early detection of any non-compliances.

Prior to the commencement of the Seismic Survey, the survey vessels and equipment will be subject to a pre-mobilisation audit and inspection, to ensure that they are fit for purpose, appropriately maintained, and to ensure compliance with the control measures outlined in the EP. The pre-mobilisation audit will comprise the following processes:

- A pre-mobilisation audit addressing pre-survey planning, preparedness for compliance with regulatory requirements, requirements defined within the EP (including the implementation strategy), operational considerations, and on-board preparedness. This audit will incorporate the training and awareness activities, responsibilities of those onboard the vessel, and environmental induction. Any corrective actions required will be implemented and recorded;
- An audit of the on-board spill response capability against the vessel SOPEP to verify spill preparedness; and
- A pre-mobilisation inspection of all vessels involved with the Seismic Survey to ensure they are all compliant with the commitments that have been stipulated within the EP.

An audit and QHSE inspection will be carried out monthly following the commencement of the Seismic Survey, with the purpose of assessing the implementation of the control measures and all requirements outlined within the EP. It will evaluate the following:

- Compliance with all requirements detailed in the EP;
- Monitoring of the control measures and EPSs to be implemented against the EPOs is being undertaken and has determined that they are effective, and the requirements of the EP are being met;
- Daily and weekly monitoring and recording of key parameters is being undertaken as appropriate;
- Management strategies, procedures, workflows, and tools outlined within the implementation strategy are in place and being implemented effectively;
- The roles and responsibilities of each personnel are being met, as demonstrated by operations which are carried out in compliance with the requirements of the EP, and that the provisions within the implementation strategy of the EP are up to date (e.g. contact details, etc.); and
- A desktop review in accordance with the process outlined in **Section 5.4.5** to assess for any new relevant persons.

A post campaign review will be undertaken upon completion of seismic activities to review compliance against relevant EPOs and EPSs and the requirements of the EP.

Throughout the duration of the Seismic Survey, smaller 'sub-audits' of the contents of the EP will be carried out, as appropriate. Sub-audits will focus on the particular sections of the EP relating to the sub-audit 'trigger' (e.g. the implementation of adaptive measures of blue whales/pygmy blue whales triggers a targets audit of the marine fauna control measures, EPSs, EPOs and components of the EP, such as the implementation strategy, pertaining to marine fauna). Occurrences which trigger for the need for a sub-audit include:

- If a marine fauna instigated shut-down occurs[37]
- An adaptive management measure is implemented;
- A reportable incident occurs;
- A recordable incident occurs or non-conformance is identified;
- There is a suspected IMS incursion identified;
- An unplanned event, as identified throughout **Section 8** occurs**;**
- A person/group/organisation contacts or approaches SLB who has not previously been identified or considered as a relevant person (e.g. are self-identified or have been nominally identified by another relevant person);
- Any requirements for revision of the EP are triggered (**Section 10.4.6**);
- The MoC process is triggered (**Section 10.4.7**); and
- As directed by NOPSEMA.

The triggers for a sub-audit and the relevant sections of the EP that will be the target of each sub-audit are provided in **Table 126**.

These audits will include ensuring the EPOs, EPSs and the measurement criteria are being implemented and reviewed to keep impacts and risks to **ALARP** and **Acceptable Levels**, as described in **Section 10.6.3.4**. Non-compliance identified through this auditing process will follow the management of non-conformance process outlined within **Section 10.4.5**.

Findings and recommendations obtained through the auditing process will be distributed to the relevant parties in order to undertake the appropriate actions. If an audit relates to a topic that had previously been raised by a relevant person, an updated response will be prepared and provided to the relevant person.

Table 126 Relevant Sections to be Audited During Planned Survey Audits and Sub-Audits

Audit	Relevant sections within EP to be audited
Pre-survey Audit	
Pre-survey planning, preparedness for compliance with regulatory requirements, requirements defined within the EP (including the implementation strategy), operational considerations, and on-board preparedness. This audit will incorporate the training and awareness activities, responsibilities of those onboard the vessel, and environmental induction.	Requirements of the EP, in full. Induction materials and induction register/records.
An audit of the on-board spill response capability against the vessel SOPEP to verify spill preparedness.	Requirements of the EP, in full, particularly focusing on control measures and EPSs pertaining to oil spills (**Sections 8.3** and **8.4**), the implementation strategy (**Section 10**) and the OPEP (**Section 10.10**).

[37] Given the relative frequency with which these may occur, a maximum of one sub-audit per week will occur in response to a marine fauna instigated shut down

Audit	Relevant sections within EP to be audited
A pre-mobilisation inspection of all vessels involved with the Seismic Survey to ensure they are all compliant with the commitments that have been stipulated within the EP.	Requirements of the EP, in full, with a focus on vessel-specific control measures (e.g. lighting onboard the vessels, navigation, storage and containment of hazardous substances, waste control, etc.).
Monthly Audit and QHSE Inspection	
Compliance with all requirements detailed in the EP.	Requirements of the EP, in full.
Monitoring of the control measures and EPSs to be implemented against the EPOs is being undertaken and has determined that they are effective, and the requirements of the EP are being met.	Control measures, EPSs and EPOs contained throughout **Sections 7.1** to **7.5** for planned activities, and **Sections 8.1** to **8.5** for unplanned activities.
Daily and weekly monitoring and recording of key parameters is being undertaken as appropriate.	Monitoring and recording requirements described within **Section 10.4.1** and provided in **Table 124.** Recording requirements provided in the OPEP **(Section 10.10**).
Management strategies, procedures, workflows, and tools outlined within the implementation strategy are in place and being implemented effectively.	**Section 10.**
The roles and responsibilities of each personnel are being met, as demonstrated by operations which are carried out in compliance with the requirements of the EP, and that the provisions within the implementation strategy of the EP are up to date (e.g. contact details, etc.)	**Section 10.**
Post Campaign Audit	
Compliance against relevant EPOs and EPSs and the requirements of the EP.	Requirements of the EP, in full.
Sub-audits	
Occurrence of a marine fauna instigated shutdown.	**Section 7.2, Table 70,** and **Table 73**. Provisions within **Section 10** pertaining to impact and risk management for marine fauna.
Adaptive management measure is implemented.	**Section 7.2, Table 70,** and **Table 73**. Provisions within **Section 10** pertaining to impact and risk management for marine fauna.
Occurrence of a reportable incident.	Relevant sections within **Section 7** and **Section 8** pertaining to the nature of the reportable incident. Control measures, EPSs, and EPOs are to be audited as appropriate. **Section 10**.
Occurrence of a recordable incident or identification of a non-conformance.	Relevant sections within **Section 7** and **Section 8** pertaining to the nature of the non-conformance. Control measures, EPSs, and EPOs are to be audited as appropriate. **Section 10**.
Identification of a suspected IMS incursion.	Section **8.1**, **Table 93** and **Table 95.**

Audit	Relevant sections within EP to be audited
Occurrence of an unplanned event.	Sections **8.1** to **8.5** and associated control measures, EPSs, and EPOs, as relevant to the nature of the unplanned event. **Section 10**.
Identification of a person/group/organisation who has not previously been identified or considered as a relevant person.	Search for new/unidentified relevant persons to be conducted as per the methodology provided within **Section 5**. Relevance of the newly identified relevant person and their claims to be assessed against the requirements provided within **Section 5** and consultation register to be updated as appropriate. Audit to be completed on relevant activities, control measures, EPSs, and EPOs pertaining to the claim made by newly identified relevant persons.
Any requirements for revision of the EP are triggered.	Sections within EP as appropriate to the required revision. Provisions within **Section 10**.
The MoC process is triggered.	Sections within EP as appropriate. Provisions within **Section 10**.
As directed by NOPSEMA.	All sections, control measures, EPSs, and EPOs, as relevant to the nature of the NOPSEMA request.

10.4.5 Management of Non-Conformances

Any breach of the EPOs, EPSs, Implementation Strategy, or any other commitment detailed in the EP will be considered a 'non-conformance'. Non-conformances may be identified by any crew member during routine observations, during monitoring, an inspection or audit, or as a consequence of an unplanned activity. Crew are required to report any non-conformance they identify.

Any non-conformance with an EPO, EPS that is defined within this EP will be considered as an (recordable) environmental incident (**Section 10.6.3.2**).

Following identification of a non-conformance, remedial actions will be required in order to resolve the issue and to prevent recurrence. Affected parties (including affected relevant persons) will be notified and follow-up actions will be communicated to all relevant crew and affected parties and relevant persons. Non-conformances will be tracked and monitored within the ECR until closed.

An internal risk assessment will be undertaken in response to any non-conformances identified, to determine whether any changes are required to operational procedures to ensure any impacts and risks are maintained or reduced to **ALARP** and **Acceptable Levels**. Any corrective actions required as a result of the non-conformance, will be commensurate with the magnitude of the resulting impacts and risks. Investigations will include the Vessel Master, Party Chief, SLB QC and QHSE Representative and SEA, as appropriate. Should a change be identified during this risk assessment process, the MoC process will be affected as detailed in **Section 10.4.6**.

All non-conformances/incidents and remedial actions taken will be recorded by the Onboard SLB QC and QHSE Representative, entered into the ECR, and included in the Post-Survey Review Report (**Section 10.6.1**). Continuous improvement and prevention of further non-conformances will be achieved by communicating the identification and management of non-conformances during weekly QSHE meetings and daily toolbox meetings, as outlined in **Section 10.2.1**.

10.4.6 Environment Plan Revision and Improvement

SLB will continuously look for ways to improve operations during the Seismic Survey. Regulation 17 of the Environment Regulations requires the resubmission of the EP to NOPSEMA in the event of a change or proposed change to circumstances or operations. The following criteria will trigger this requirement:

- Any significant modification or new stage of the Seismic Survey that is not provided for in the EP currently in force;
- The occurrence of any significant new environmental impact or risk, or significant increase in an existing environmental impact or risk that is not provided for in the EP;
- The occurrence of a series of new environmental impacts or risks, or a series of increases in existing environmental impacts or risks, which, taken together, amount to the occurrence of a significant new environmental impact or risk, or a significant increase in an existing environmental impact or risk that is not provided for in the EP;
- Identification of recent scientific publications that may have an influence on the risk assessment and increase the environmental risk of the survey;
- Identification of any changes to the biological (including the presence of threatened species not already considered under the EP), physical, and socio-economic environment which may have an influence on the risk assessment and increase the environmental risk of the survey;
- The existing suite of control measures are no longer considered suitable to reduce the environmental risk of the survey to **ALARP** and **Acceptable Levels**;
- During operations the number of sightings and/or power-downs of whales are higher than anticipated during the planning of the survey; and/or
- As requested by NOPSEMA.

In the event of an incident or non-compliance, SLB will review and audit the EP and implemented control measures to identify any potential shortfalls which may exist, any additional mitigation/control measures that could be implemented to prevent such an occurrence from arising again, and to further investigate the cause of the non-compliance.

10.4.7 Management of Change

The MoC process is utilised when there is a change to the proposed activity, or in the circumstances under which it is being undertaken, which may have the potential to increase or change the level of impact or risk of the Seismic Survey that is not currently detailed within an accepted EP. MoC is a transparent process used for the identification, assessment, control and documentation of any such change. This process ensures that changes to SLB, personnel, systems and procedures, and equipment are identified and managed so that QHSE and environmental risks arising from the change remain **ALARP** and at an **Acceptable Level**. Not all changes require a MoC review, and each change will be assessed on a case-by-case basis.

On 30 March 2016, NOPSEMA issued an Environment Alert[38] regarding the proper application of the MoC process. This alert was a result of inspections undertaken by NOPSEMA which found that titleholders manage change through partial or simplistic environmental assessments which differ to the assessments undertaken during the EP process. This alert requested better consideration of changes and a more robust MoC procedure that is in accordance with the procedures for impact and risk assessment within an accepted EP to confirm that these impacts and risks are **ALARP** and at an **Acceptable Level** throughout the life of the EP.

The MoC procedure that would be implemented by SLB for the proposed activity is consistent with this Environment Alert and is further detailed in the sub-sections below. SLB has a comprehensive MoC procedure that is tested and proven as part of other MSSs in Australia. This MoC procedure will implement a sound process of change identification, risk and impact assessment, establishment of modified or new controls if required, re-assessment of the risk and impact profile following the same risk assessment procedures as used in this EP, and documentation of the process, rationale and outcomes of the assessment.

10.4.7.1 Triggers for Management of Change

Three regulations under the Environment Regulations require changes to be assessed and managed; these include:

- Regulation 7 – Operations must comply with the accepted EP. This requires that titleholders do not undertake an activity in a way that is contrary to the EP that is in force for that activity. This means that any changes to the Seismic Survey, or the conditions under which it is being enacted, must be assessed for potential divergence from the accepted EP and possible increase in the environmental impact or risk profile;
- Regulation 8 – Operations must not continue if new or increased environmental risk is identified. This makes it an offence for the titleholder to undertake an activity after the occurrence of any significant new environmental impact or risk arising from the Seismic Survey; or any significant increase in an existing environmental impact or risk arising from the Seismic Survey; and the new impact or risk, or increase in the impact or risk, is not provided for in the EP in force for the Seismic Survey; and
- Regulation 17 – Revision because of a change, or proposed change, of circumstances or operations. This requires a titleholder to submit a proposed revision of the EP for an activity to the Regulator, before the commencement of any significant modification or new stage of the activity no provided for in the EP currently in force, including:
- The occurrence of any significant new environmental impact or risk, or significant increase in an existing environmental impact or risk, not provided for in the EP in force for the Seismic Survey;
- Changes in knowledge of environmental impacts, environmental risks or legislative requirements that may arise from (but not limited to) new or revised publications regarding matters of national environmental significance, new knowledge about the existing environment or the effects of the titleholder's activity, information provided by stakeholders, changes in legislation; or
- The occurrence of a series of new environmental impacts or risks, or a series of increases in existing environmental impacts or risks, which, taken together, amount to the occurrence of a significant new environmental impact or risk, or a significant increase in an existing environmental impact or risk, that is not provided for in the approved EP for the Seismic Survey.

[38] https://www.nopsema.gov.au/sites/default/files/documents/2021-03/A470472.pdf

The 2016 Environment Alert issued by NOPSEMA contained a number of deficiencies that were identified in managing change through the implementation of EPs. Specifically, the following points are relevant to the proposed Seismic Survey which will be regularly considered under this MoC process prior to, and during, the Seismic Survey:

- Extending the duration of a Seismic Survey;
- Consideration of a series of increases, or new, impacts and/or risks, arising from changes to the Seismic Survey over time which additively creates a significant increase in impacts or risk;
- Alteration or removal of an environmental performance standard in the accepted EP, including changes to the wording which may materially degrade or diminish the level of performance;
- Reporting of breaches to environmental performance standards after realising that the standard does not, or cannot, monitor the level of performance set in the EP; and
- Discharges to the marine environment are greater than predicted in the EP.

By considering the points listed above, SLB is committed to ensuring the MoC process will not be used to avoid or degrade the performance of control measures provided for in this EP to reduce the impacts and risks of the activity to ALARP and an Acceptable Level. This will be achieved through meeting the 'Key Lessons' outlined within the 2016 Environment Alert issued by NOPSEMA, specifically:

- The Environmental Inductions (**Section 10.3.7**) will ensure that users of the EP will be made aware of the project description provided within this document for which NOPSEMA has based its acceptance of the EP;
- The Project Description (**Section 3**) clearly identifies the boundaries and limitations that define the scope of the activity. In addition to this, various control measures, and associated EPOs, EPSs and Measurement Criteria are provided in sufficient detail throughout **Sections 7** and **8**;
- Undertaking the MoC process as per the details within **Section 10.4.7.3**, such that:
- A rigorous risk and impact assessment will be undertaken, using the same procedures as outlined in **Section 6** of this EP, when implementing the MoC process;
- Records of the MoC process will be kept, including the determination of whether the change trigger a requirement to revise and resubmit the EP under Regulation 17 of the Environment Regulations. The EP change register will document the assessment timing and its findings and summarise any changes to the EP which are required to manage risks and impacts to **ALARP** and to an **Acceptable Level**
- A continuous reduction of impacts and risks to **ALARP** and to an **Acceptable Level** will be achieved by ensuring that all personnel involved with the Seismic Survey be required to exercise vigilance and identify any potential changes to the Seismic Survey which have the potential for changing the impact and/or risk profile, or which may cause deviation from the EP; and
- Stopping work if the survey has started, or delay commencement of new activity, so that the MoC process can be completed prior to the change occurring.

If any of the following types of changes are identified, the MoC process will be implemented:

- A change in titleholder;
- Identification of new impacts or risks, such as a relevant person raises a new issue or concern prior to, or during, the implementation of the EP;

- There is an increase in impact or risk, such as if the acoustic source volume is required to be increased to improve quality of imagery;
- A new stage of the Seismic Survey is required, e.g. if a significant extension of timeline is required to complete the acquisition;
- Reduced ability to effectively implement the EP to meet its stated environmental performance standards, such as if an MMO is taken ill and demobilised;
- Any incremental change in the Seismic Survey increasing the risk of significant impact;
- There is a change to QHSE policies, procedures, and legislation; and
- There is a change to personnel and organisational changes.

External changes will also be monitored for a potential trigger for a MoC process, such as:

- New hazards or risks such as gazetting of a new marine park;
- NOPSEMA website listing of a new third-party EP including increased petroleum exploration in the region with potential for increased cumulative risks or simultaneous activities in the area that may impact Searcher or be impacted by Searcher’s activities;
- Legislative changes or government documents, such as changes to management plans, species recovery plans, or conservation advice releases;
- New publications, research, or guidelines; and
- External audits, inspections and investigations.

SLB will undertake monthly reviews of the currency of the list of relevant persons and may initiate MoC if new relevant persons are identified and/or new issues which have potential to increase the risk of interference with their functions, activities or interests are determined. A review of potentially new or previously unidentified relevant persons may also be initiated at any time, in the event that SLB is approached, contacted by, or made aware of a person/group/organisation (via self-identification or identified by other relevant persons) that had not previously been identified as a relevant person for the purpose of this EP. SLB will undertake an assessment of any newly identified person/group/organisation to determine if they have functions, activities or interests relevant to the Seismic Survey, and assess the merit of their claim as a relevant person as per the methodology provided in **Section 5** of the EP. This review will ensure that the impacts and risks of the Seismic Survey remain **ALARP** and at an **Acceptable Level**.

Likewise, should any revision of the EP be made, SLB will undertake further consultation with relevant persons to inform them of any changes to the Seismic Survey that may affect their functions, activities and interests.

Monitoring for potential external triggers of change will be conducted via subscriptions to relevant government websites, journals, and advice, as well as through the ongoing consultation process.

10.4.7.2 Originator of Management of Change

All personnel involved with the Seismic Survey, including vessel crew and SLB staff managing the survey, are required to exercise vigilance and identify any potential changes to the Seismic Survey which have the potential for changing the impact and/or risk profile, or which may cause deviation from the EP.

All personnel in charge of work functions will be required to report any changes within their area of work. For example, the Vessel Master will be required to report changes to the functionality of pollution control equipment on the vessel as they become aware of such changes. Similarly, the SLB QC and HSE Representative will be required to report any potential changes to the Seismic Survey before they are implemented. Potential MoC triggers shall be reported immediately to the SLB Project Manager.

Responsibilities for reporting MoC triggers will be reinforced to all personnel during the environmental induction process.

10.4.7.3 Management of Change Process

If potential changes to the Seismic Survey activity are identified which trigger a MoC as identified above, the following steps will be initiated and documented:

- Stop work if the survey has started, or delay commencement of new activity;
- Establish a risk assessment team and advise the SLB Project Manager;
- Assess the need for SLB to implement a MoC;
- Initiate a risk and impact assessment by SLR Environmental Consultant, using the same procedures as outlined in **Section 6** of this EP. This process will determine if the increase in risk is significant and would therefore trigger a requirement to revise and resubmit the EP under Regulation 17 of the Environment Regulations. The EP change register will document the assessment timing and it's findings and summarise any changes to the EP which are required to manage risks and impacts to **ALARP** and to an **Acceptable Level**;
- If resubmission of the EP is required, the work or the new activity is to be suspended until the revised EP is accepted by NOPSEMA;
- Further consultation with relevant persons will occur if any changes may affect their activities/interests or the risk profile of their activity. Further consultation will give consideration to previous feedback discussed throughout **Section 5** and **Appendix I**;
- Develop any additional controls required to reduce risks and impacts to **ALARP** and to an **Acceptable Level**;
- Develop an EP Addendum which documents the following:
- The MoC process followed;
- The risk and impact assessment process undertaken;
- Rationale for conclusions on residual risk;
- Relevant person consultation and any feedback received;
- Additional controls to be implemented;
- Demonstration of **ALARP** and justification for acceptability;
- Revised environmental performance standards, measurement criteria, control measures and any associated revisions to the responsibilities for each; and
- Confirmation that all sections of EP have been checked to ensure any potential deviations from the accepted plan have been captured and addressed.

An EP change register will be maintained for the EP to track the closeout of any actions implementing the change, including updating the EP. If there is a need to reissue the EP to NOPSEMA, all changes recorded in the register will be incorporated when revising the EP.

10.4.7.4 Approver of Management of Change Outcomes

If a resubmission and approval from NOPSEMA is not required under Regulation 17 resubmission (and hence approval from NOPSEMA), any work on new or modified activities will only commence on the authority of the SLB Project Manager.

10.5 Support Vessel and Chase Vessel Operations

One Support Vessel and one Chase Vessel will be present in close proximity to the Seismic Vessel for the duration of the Seismic Survey. The primary role of these vessels is to manage any possible interactions between the Seismic Vessel and the seismic array (i.e. acoustic source and streamer) with any other vessels or maritime activities occurring in the area. The Support Vessel and Chase Vessel will assist with informing any other vessels in the path of the approaching Seismic Vessel that cannot be raised on VHF radio or any other means. In addition, the Chase Vessel will also be utilised as an additional platform for marine mammal observations. The chase vessel will have two dedicated and trained MMOs onboard to support the MMO efforts from the Seismic Vessel.

While the presence of the Support Vessel and Chase Vessel in the OA does pose additional risk to marine mammals in the area, the Vessel Master of these vessels will be operating in accordance with the EPBC Regulations Part 8, Division 8.1 in regards to the minimum approach distances and vessel speed for “other craft” and follow the prescribed actions when adult cetaceans and/or calves are present within the caution zone (defined by these regulations as a 150 m radius around a dolphin, and 300 m radius around a whale).

The following procedures will be implemented onboard the Support Vessel and Chase Vessel:

Communications:

- The Support Vessel and Chase Vessel will be in close contact with the Seismic Vessel on VHF radio at all times to ensure clear communications are maintained;
- The Support Vessel and Chase Vessel will be able to receive and transmit communications via VHF radio at all times with all maritime traffic in the area; and
- The MMOs on the Chase Vessel will maintain direct communication with the MMOs and PAM Operators onboard the Seismic Vessel at all times throughout their observational shift.

Maintenance of distance to Seismic Vessel:

- The Support Vessel and Chase Vessel will be present around the Seismic Vessel at all times unless an intervention with another marine user is necessary;
- In the case that the Support Vessel or Chase Vessel is unable to maintain such a presence (e.g. it is undertaking intervention actions), the Masters of the survey vessels will maintain radio contact.
- The Chase Vessel will have an MMO on watch during daylight hours observing for marine mammals;
- The Chase Vessel will travel as far as practicable ahead of the Seismic Vessel (Defined as an 180° arc ahead of the Seismic Vessel, noting that the Chase Vessel should focus on the portion of the arc closest to the blue whale migratory BIA and buffer) and will conduct visual surveillance for marine mammals during daylight hours; and

- The Support Vessel and Chase Vessel will be equipped with radar, ARPA and AIS, allowing the exact position and distance between the survey vessels to be continuously monitored.

Use of Chase Vessel as a secondary observational platform for marine mammals:

- Two trained and experienced MMOs will be on the Chase Vessel to provide additional visual observational capabilities for the duration of the Seismic Survey;
- The on-duty MMO will be stationed on the bridge of the Chase Vessel during day light hours to assist the Seismic Vessel detect marine mammals;
- If the MMOs on the Chase Vessel observe a marine mammal, the lead MMO on the Seismic Vessel will be notified immediately;
- The MMOs on the Chase Vessel will have the same roles and responsibilities as those on the Seismic Vessel, including the full authority to direct control measures such as shut-down of the acoustic source if a whale is observed within a relevant Shut-down Zone; and
- After the Seismic Vessel has been notified by the Chase Vessel of a shut-down/power-down requirement, the appropriate control measure will be implemented immediately by the Seismic Vessel (including any required adaptive management procedure, see Section **7.2.2.3.6**).

10.6 Reporting

SLB has internal requirements for the recording and reporting of incidents (**Section 10.1**). There are also legal obligations under the Environment Regulations to report incidents to NOPSEMA within a specified time period.

The Environment Regulations requires a number of notifications for starting and ending an activity, and ending of an EP. SLB will comply with these notification requirements, as per the below:

- Start of Activity Notification – At least 10 days before the commencement of the Seismic Survey, SLB must provide written notification to NOPSEMA of the date of intention to commence the activities approved under the EP;
- End of Activity Notification - At least 10 days following the completion of the Seismic Survey, SLB must provide written notification to NOPSEMA of the date of the completion of the activities approved under the EP; and
- End of EP Notification – As soon as practicable on the completion of the last activity covered under the survey, SLB must provide written notification to NOPSEMA informing that all of the activities and obligations covered under the EP have been completed. Following acceptance of the notification by NOPSEMA, the EP is no longer in force.

Further pre-survey and post-survey notifications will also be provided to the relevant persons outlined within **Section 5.5.12** and **5.5.16**.

10.6.1 Environmental Performance Reporting

Under Regulation 14(2) of the Environment Regulations, SLB are required to '*report to the Regulator in relation to the titleholder's environmental performance of the activity, and provide that the interval between reports will not be more than one year*'. Accordingly, SLB will submit an Annual Report (also referred to as an Environmental Performance Report) to NOPSEMA within two months of the anniversary of the acceptance of the EP and will include an assessment of adherence to the requirements of the EP and a review of all recordable and reportable environmental incidents.

As described, SLB will implement an Environmental Compliance Register (**ECR**) to document environmental performance. The ECR will form part of the Annual Report.

Regulation 26(c) requires submission of a report to the regulator '*in relation to the titleholder's environmental performance for the activity, at intervals provided for in the EP*'. The Annual Report will be submitted to satisfy this requirement.

The Post-Survey Review Report/Annual Report will be submitted to NOPSEMA within two months of the completion of the survey. The content of this report will include the following:

- A review of routine activities and incident records, including:
- Whale sighting records, and any other interactions with whales requiring start-up delays;
- Records of any interaction between marine fauna and vessels of towed equipment used during the survey; and
- Records of any unplanned activities, such as accidental discharges of hazardous and non-hazardous substances, vessel collisions or negative interactions with commercial operators in the Bonaparte Basin (fishing, shipping etc.);

- An assessment of compliance with requirements set out in the EP (i.e. compliance with the EPOs and EPSs);
- An assessment of compliance with the SLB HSE Management Systems and Policies; and
- A review of all recordable and reportable incidents.

10.6.2 Marine Fauna Reporting

As required by the EPBC Policy Statement 2.1, a report on all whale interactions will be provided to the DoEE within two months of survey completion. In addition, given the other sensitivities in the area, this report will also include any interactions with turtles or whale sharks. The report will contain the following information as a minimum:

- The location, date and start time of the survey;
- Name, qualifications and experience of any MFOs/MMOs (or research scientists) involved in the survey;
- The location, times and reasons when observations were hampered by poor visibility or high winds;
- The location and time of any start-up delays, shut-downs or stop work procedures instigated as a result of whale, turtle and whale shark sightings;
- The location, time and distance of any whale, turtle and whale shark sighting including species, where possible;
- Details of any incidents (reportable and recordable) and non-conformances; and
- The date and time of survey completion.

The following additional information may also be collected for all marine mammals, during the Seismic Survey.

- The location, time and distance of any marine mammal sighting including species where possible;
- Method of detection (visual or PAM);
- Observation platform;
- Water depth at time of each whale sighting;
- Sea condition (Beaufort scale) at time of each marine mammal sighting;
- Number of animals involved in each marine mammal sighting (total);
- Number of juveniles involved in each marine mammal sighting (if present);
- Description of behaviour for each marine mammal sighting;
- Description of any injuries, mortality, entanglement or other interactions;
- Distance from acoustic source at first sighting;
- Closest subsequent distance to acoustic source;
- Behaviour at first sighting (travelling, feeding, milling etc.); and
- Subsequent behaviours (avoidance, attraction and other changes in behaviour).

Cetacean sightings will be recorded using the 'Cetacean Sightings Application' software as outlined in the EPBC Act Policy Statement 2.1. Upon completion of the survey the information entered into this application will be exported as a text file and emailed to sightingsdata@aad.gov.au.

10.6.3 Reportable and Recordable Incident Reporting

10.6.3.1 Reportable Incidents

Regulation 26 of the Environment Regulations requires SLB to report all 'reportable incidents' that occur in relation to the Seismic Survey. Under the Environment Regulations, 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'*. Within the risk assessment undertaken with **Section 6**, a reportable incident is based on the residual risk rating of *high* or *very high*.

For the purpose of the Seismic Survey, reportable incidents have been identified as:

- Any incident involving a collision between the survey vessels and marine megafauna;
- Any incident involving the entanglement of megafauna in towed equipment;
- Any incident involving a negative interaction between other marine users (i.e. those identified in the EP) such as a collision or whereby intervention by the Support Vessel is required; and
- Any incident that results in a hydrocarbon spill of > 80 L into the surrounding marine environment.

In line with guidance provided by NOPSEMA (Notification and Reporting of Environmental Incidents Guidance Rev 4 2014), additional environmental incidents that are required to be reported to NOPSEMA, whether or not they have been classified as having the potential to cause '*moderate to significant environmental damage*' includes any impacts to Part 3 Protected Matters under the *Environment Protection and Biodiversity Conservation Act 1999*. Matters under Part 3 of the EPBC Act that are relevant to the proposed activity are:

- National Heritage places;
- Listed Threatened Species and Communities;
- Listed Migratory Species;
- Commonwealth marine areas; and
- Nationally Important Wetlands.

NOPSEMA must be provided with an oral notification (phone 1300 674 472) of any reportable incident as soon as practicable after the reportable incident, and no later than two hours after the first occurrence of the reportable incident, or after first becoming aware of a reportable incident.

Notification of the Reportable Incident must be oral and must include the following:

- All material facts and circumstances concerning the incident that SLB knows, or is able to find out with reasonable effort;
- Actions taken to avoid, or mitigate adverse impacts arising from the reportable incident; and
- Any corrective actions that were taken, or have been proposed to be taken to stop, control, or remedy the reportable incident.

Following oral notification of the reportable incident, a written record of the notification must be provided to the following as soon as practicable, but within seven days of the incident:

- NOPSEMA (via submissions@nopsema.gov.au);
- National Offshore Petroleum Titles Administrator (via resources@nopta.gov.au); and

- Department of the responsible State Minister or the responsible Northern Territory Minister.

DMIRS will, as soon as practicable, be notified of any environmental incidents that could potentially impact on any land or water in WA state jurisdiction, and any notifications or reports will be sent to petroleum.environment@dmirs.wa.gov.au.

Even though a Level 2 incident/Tier 2 hydrocarbon spill will require involvement from a third-party control and control agency, the overall responsibility for reporting reportable incidents in accordance with the Environment Regulations is with SLB.

10.6.3.2 Recordable Incidents

Recordable incidents are breaches of EPSs (as outlined in this EP) that do not meet the definition of a reportable incident. A record detailing the incident must be provided to NOPSEMA as soon as practicable, but not later than 15 days, after the end of the calendar month. If no recordable incidents occur, a monthly 'nil incident' report is required to be submitted to NOPSEMA (via submissions@nopsema.gov.au). The monthly Recordable Incident Report must include the following:

- A record of all recordable incidents that occurred during the previous calendar month, including date of each incident;
- All material facts and circumstances concerning the incident that SLB knows, or is able to find out with reasonable effort;
- The EPS and/or EPO breached;
- Actions taken to avoid, or mitigate any adverse impacts arising from the recordable incident;
- Any corrective actions that were taken, or have been proposed to be taken to stop, control, or remedy the recordable incident; and
- Any actions that were taken, or have been proposed to be taken, to avoid a similar incident occurring in the future.

This information will also be documented within the ECR. If the non-conformance is identified to be the result of a deficient performance standard which does not, or cannot, monitor the level of performance set in the EP, the MoC process and reporting will be affected as detailed in **Section 10.4.6**.

The Annual report will include a summary of all recordable incidents that occurred during the Seismic Survey. Any lessons learnt during such an incident and the subsequent compliance audit, will be included in the Annual Report as well.

10.6.3.3 Incident Reporting to Other Agencies

In the event of a significant impact to NES, Searcher will, in addition to notifying NOPSEMA, provide a written notification to the DoCCEW within three days of becoming aware of the event, and provide additional information as available, if requested by the DoCCEW.

Introduction of IMS and any other species that appear to have clear impacts or invasive characteristics will be reported to the Commonwealth Department of Agriculture – Marine Biosecurity Unit and WA DPIRD within 24-hours following confirmation that species has invasive characteristics. This notification will be forwarded to industry bodies where relevant (e.g. WAFIC).

Actual or suspected injury/mortality of protected marine fauna as a result of vessel collision will be reported to the online National Ship Strike Database as soon as possible, or no later than seven days of becoming aware of the incident.

Additional requirements related to the reporting of oil spills are detailed in the OPEP (**Section 10.10**).

Vessels are responsible for reporting all chemical spills to water to AMSA.

Table 127 Summary of external incident reporting requirements and timing

Relevant person/organisation	Incident type and reporting requirements	Timing	Method
NOPSEMA	Notification and reporting of all **recordable** environmental incidents: Containing a record of all recordable environmental incidents that occurred during the calendar month. if no recordable environmental incidents have occurred during a particular month, a Nil Incident Report must be submitted.	ASAP after the end of the calendar month, and in any case, not later than 15 days after the end of the calendar month.	Written: NOPSEMA: submissions@nopsema.gov.au

Relevant person/organisation	Incident type and reporting requirements	Timing	Method
NOPSEMA NOPTA WA DMIRS	Notification and reporting of all **reportable** environmental incidents: • All material facts and circumstances concerning the incidents that are known at the time; • Any actions taken to avoid or mitigate any adverse environmental effects; and • Any corrective actions taken, or are proposed to be taken, to prevent a repeat of similar incidents occurring.	Verbal notification to NOPSEMA ASAP and no later than two hours of a reportable environmental incident occurring. Initial written notification using form N-03000-FM0831 ASAP to NOPSEMA. Part 1 not later than three days after the first occurrence of the reportable incident, or another period specified by NOPSEMA. Part 2 within 30 days of notified incident if the incident is an accident or dangerous occurrence. This report is provided to the NOPTA and WA DMIRS within seven days of giving the written report to NOPSEMA.	Verbal: NOPSEMA (1300 674 472) Written: NOPSEMA: submissions@nopsema.gov.au NOPTA: resources@nopta.gov.au WA DMIRS (to petroleum): environment@dmirs.wa.gov.au

Relevant person/organisation	Incident type and reporting requirements	Timing	Method
Director of National Parks	The DNP should be made aware of oil/gas pollution incidences which occur within a Marine Park or are likely to impact on a Marine Park ASAP. The DNP may request daily or weekly Situation Reports, depending on the scale and severity of the pollution incident. Notification should include: • Titleholder details; • Time and location of the incident (including name of Marine Park likely to be affected); • Proposed response arrangements as per the OPEP; • Confirmation of providing access to relevant monitoring and evaluation reports when available; and • Contact details for the response coordinator.	ASAP.	Notification should be provided to the 24-hour Marine Compliance Duty Officer on: 0419 293 465.
DoCCEEW NOPSEMA	Injury to EPBC Act listed or migratory threatened species.	ASAP, no later than 48-hours after becoming aware of the incident.	DoCCEEW: Phone: (02) 6274 1372 or 1800 110 395 Email: compliance@environment.gov.au NOPSEMA: submissions@nopsema.gov.au
Australian Antarctic Division – Australian Marine Mammal Centre	Actual or suspected injury to whales from ship strike.	ASAP or within seven days of becoming aware of the incident.	Online via the National Ship Strike Database: https://data.marinemammals.gov.au/report/ship strike/new

Relevant person/organisation	Incident type and reporting requirements	Timing	Method
Commonwealth Department of Agriculture – Marine Biosecurity Unit WA DPIRD Industry bodies where relevant (e.g. WAFIC)	Introduction of IMS – pests and any other species that appear to have clear impacts or invasive characteristics.	Within 24-hours following confirmation that species has invasive characteristics.	Written to: biosecurity@fish.wa.gov.au
WAPOL WA Registrar or Aboriginal Sites	Discovery of Aboriginal remains made during the activity, or through oil spill response activities.	ASAP	WAPOL: 131 444 WA Registrar or Aboriginal Sites: (08) 6551 800 registar@dplh.wa.gov.au

10.6.3.4 Incident Investigation

Any non-compliance with the EPOs and EPSs contained within the EP will be investigated and follow-up actions will be assigned and carried out as appropriate. The findings and recommendations of the investigation will be documented and distributed to relevant personnel for review. Actions will be tracked and closed-out as appropriate.

Investigation outcomes will be communicated to all project personnel via daily operations meetings, daily toolbox meetings, and/or weekly QHSE meetings and notified and reported to external agencies as described in Sections **10.6.3.1** to **10.6.3.3**.

10.6.4 Audit records

As described in **Section 10.6.1**, the ECR will be maintained by SLB and will serve as a tool to assist with all audits undertaken during the Seismic Survey. The ECR will provide sufficient detail such that auditors can determine whether the EPO and EPSs for the Seismic Survey have been met, and that requirements of the EP, including the implementation strategy, are up-to-date and continue to function as intended. The audit records will confirm audits were undertake pre-mobilisation, monthly following commencement of the Seismic Survey, and once the survey is completed. Sub-audits will also be recorded, and, at a minimum, the audits will address the following information:

Prior to the mobilisation:

- A pre-mobilisation audit which will include evaluation of pre-survey planning, compliance with regulatory requirements, requirements defined within the EP (including the implementation strategy), operational requirements and considerations. This audit will incorporate the training and awareness activities (Vessel Master, SLB QC and HSE Representative, SEA, MFOs/MMOs, PAM Operators and environmental induction and any corrective actions required will be implemented and recorded;
- An audit of the on-board spill response capabilities against the vessel SOPEP to verify spill preparedness;

- A pre-mobilisation inspection of all vessels involved with the Seismic Survey to ensure they are all compliant with all commitments that have been stipulated within the EP.

Monthly following commencement of the Seismic Survey:

- Compliance with all regulatory requirements defined in the EP;
- Monitoring of the control measures and EPSs to be implemented against the EPOs is being undertaken and has determined that they are effective and the requirements of the EP are being met;
- Daily and weekly monitoring and recording of key parameters is being undertaken appropriately;
- Management strategies, procedures, workflows, and tools outlined within the implementation strategy are in place an being implemented effectively; and
- The roles and responsibilities of each personnel are being met, as demonstrated by operations which are carried out in compliance with the requirements of the EP, and that the provisions within the implementation strategy of the EP are up to date (e.g. contact details).

Sub-audit records will capture similar information as that for monthly audits, but will be targeted, focusing on select sections of the EP as determined by the nature of the trigger for a sub-audit (**Section 10.4.4**). For example, the implementation of adaptive management measures for blue whales/pygmy blue whales would trigger a targeted audit of marine fauna control measures, EPSs, and EPOs and components of the EP, such as the implementation strategy, pertaining to marine fauna. As is the case for audits, the ECR will serve as a tool for sub-audit compliance monitoring which is recorded therein. Once the survey is complete:

- Compliance with all regulatory requirements defined in the EP;
- Monitoring of the control measures and EPSs against the EPOs was being implemented and it was determined that they are effective. Therefore, the requirements of the EP were met
- Daily and weekly monitoring and recording of key parameters were appropriately undertaken; and
- The roles and responsibilities of each personnel were met, as demonstrated by operations which were carried out in compliance with the requirements of the EP.

If any action items are identified these will be followed up and any required management of non-conformance or change implemented in accordance with the relevant processes described in **Section 10.4.5** and **Section 10.4.7.** All audit records will be made available to NOPSEMA upon request. Any lessons learnt from the audit will also be included in the Annual Report that SLB will submit to NOPSEMA.

10.7 Regulatory Inspections

Under Part 5 of the OPGGS Act, NOPSEMA inspectors have authority to enter SLB premises, including the survey vessel/s for the purposes of undertaking monitoring or investigations against the EP. SLB will fully cooperate with NOPSEMA during such inspections.

10.8 Emergency Response

Health and safety to all personnel on the vessels and all aspects of the marine environment are of the highest importance to SLB and have been considered very seriously throughout the planning and development phase of the Seismic Survey EP. Safety plans, control measures, operational procedures and management plans have been developed by SLB to minimise the potential risk of any emergency that could result in any injury to personnel onboard the vessels or lead to the loss of hydrocarbons exposing marine life within the Bonaparte Basin to hazardous substances. All of these control measures, operational procedures and management plans have been detailed throughout this EP.

As identified in **Section 8.2**, bunkering operations are considered to be the greatest risk for a release of hydrocarbons; however, the greatest consequence from a release of MGO into the marine environment is in relation to a vessel collision or rupture of the hull of the Seismic Vessel. Nevertheless, with the extensive control measures in place and operational procedures, the risks associated with this have been reduced to **ALARP** and an **Acceptable Level**. This is also further supported by the fact that there have been no vessel collisions or groundings with survey vessels recorded in Australian waters in over the last 30 years.

The emergency response procedures that SLB require the active commitment to, and accountability for from all employees and contractors during the Seismic Survey are included in the QHSE Policy (**Figure 2**). The QHSE Policy is regularly reviewed and will be incorporated as part of the crew induction process. Of relevance to the emergency response procedures, the QHSE Policy contains SLBs commitment to:

- Protect and strive for improvement of the health, safety and security of personnel at all times;
- Eliminate any QHSE accidents;
- Plan for, respond to and recover from any emergency, crisis and business disruption; and
- Minimise disruption on the environment through pollution prevention.

The following sub-sections provide further details of how SLB are prepared for emergency response, primarily in regard to approaching adverse weather conditions or hydrocarbon spill through the Oil Pollution Emergency Plan. These procedures and plans detail the processes SLB will undertake in the event of an approaching adverse weather system or a hydrocarbon spill. SLB has developed a detailed OPEP which is aligned with the statutory plans of both Commonwealth and State agencies for oil spill response. The roles and responsibilities are clearly defined, in particular who will be the Control Agency in the event of a hydrocarbon release, and likewise, the role of SLB in supporting the relevant Control Agency to achieving the best environmental outcome.

In the event of any emergency occurring during the Seismic Survey, the Master of the Seismic Vessel will assume overall onsite command of all vessels and crew and will take on the role as the Emergency Response Coordinator. The Seismic Vessel will have suitable equipment onboard to respond to any emergencies should they arise, and suitably trained crew will be sufficient in the use of such equipment, they will be familiar with where the equipment is stored, and all crew will undertake regular exercises, which will be documented and recorded.

The emergency response equipment onboard the survey vessels is for first response and will include medical equipment/supplies, firefighting equipment and oil spill response equipment. However, as mentioned some of these items will be limited, such as any serious medical injury or illness would require a medivac to the nearest hospital. In addition, the intention of the oil spill response equipment on the survey vessels is for the purpose of containing and cleaning any spills onboard the vessel, and preventing discharges of hydrocarbons into the ocean, the equipment will not be carried for spill response of hydrocarbons in the ocean.

10.8.1 Emergency Response Tests

As part of the pre-mobilisation audit, SLB will initiate emergency response tests as required with the assigned personnel. This will include a desktop-based exercise to confirm on-call emergency response team contact details, and to record any lessons and actions required for improvement.

The Vessel Master will conduct a vessel SOPEP and OPEP test via a drill assessment and evaluation with recommendations for future drills. This testing will be undertaken:

- Prior to the commencement of the Seismic Survey;
- When response arrangements are significantly modified, following response exercises; and
- Where required by any action defined in the post-activity report.

The outcomes of any emergency response test will be communicated to all participants and all actions will be recorded and tracked to completion.

10.9 Adverse Weather Procedures

Damage to survey equipment, risks to health and safety of survey personnel and increased risks of hazardous material spills can all occur during severe weather events. To mitigate these potential risks, SLB will operate in accordance with the Seismic Vessel contractor's marine *Adverse Weather Procedures*, which will define a set of controls for managing risks of adverse weather whilst undertaking marine offshore operations, as well as the roles and responsibilities of the key personnel onboard the survey vessels. However, SLB has not finalised the selection of a seismic contractor for the Seismic Survey and consequently the *Adverse Weather Procedures* document is not currently available for submission with this EP. SLB will ensure that a suitable *Adverse Weather Procedures* document of the successful seismic contractor is in place and that it is aligned with SLBs QHSE Policy (**Figure 2**) as part of prequalification process and prior to commencing the Seismic Survey.

During adverse weather, the Vessel Master is responsible for:

- Ensuring the safety of all personnel onboard the vessel;
- Monitoring of all available weather forecasts and predictions;
- Initiating the vessel safety management systems and QHSE procedures;
- Keeping the SLB Project Manager (Onshore), SLB QC and HSE Representative and SEA fully informed of the prevailing situation and intended action to be taken;
- Assessing and maintaining the safety and integrity of the vessel;
- Proceeding to identified safer waters as appropriate; and
- Any other appropriate responsibilities that may be required as dictated by the situation.

In addition to the *Adverse Weather Procedures* that will be in place, SLB will subscribe to a weather monitoring service that will provide forecasts that update regularly throughout the day. This monitoring service will provide information on wind, waves/seas and currents, primarily to plan the movements and operations to occur when and where in the OA the weather is safest and operationally feasible to acquire the survey safely. The benefit of this service will provide SLB prior warning of any severe weather event forming within, or approaching, the OA.

If sustained severe weather looks to be forming within the region, the survey vessels may leave the area for safer waters. All seismic equipment will be retrieved prior to leaving the OA when moving to safer waters. In a worst-case scenario, the vessels will proceed to the nearest port.

The petroleum activity commences when the seismic source is first deployed within the OA and extends until the seismic source has been retrieved and the Seismic Vessel has exited the OA. This EP does not cover period when the survey vessels are not engaged in survey or associated activities; at those times, the survey vessels are deemed to be operating under the Navigation Act 2012 and not performing a petroleum activity.

10.10 Oil Pollution Emergency Plan

The following OPEP provides an overview of SLB's arrangements for responding to a hydrocarbon spill event during the Seismic Survey. It is important to note that SLB's response arrangements do not negate the requirements for a SOPEP (**Shipboard Oil Pollution Emergency Plan**). Once contracting has been completed with the successful Seismic Vessel, the SOPEP for this vessel will be reviewed, tested, and incorporated into the OPEP arrangements as part of this EP.

This OPEP does not describe spills for petroleum operator infrastructure as the Seismic Survey will have no interactions with offshore infrastructure, thus is out of scope for this EP.

10.10.1 Vessel Shipboard Oil Pollution Emergency Plan

MARPOL Annex I require a SOPEP to be carried on all vessels greater than 400 gross tonnes. In general, a SOPEP describes the steps to be taken:

- In the event that a hydrocarbon spill has occurred;
- If a vessel is at risk of a hydrocarbon spill occurring, and
- For notification procedures in the event of a hydrocarbon spill occurring and provides all important contact details.

The Vessel Master is the overall in charge of the SOPEP and ensuring that all crew comply with the plan.

Although Support Vessels are not required under MARPOL Annex I to have a SOPEP, SLB will require the Support Vessel, Seismic Vessel and Chase Vessel hold a SOPEP.

Each SOPEP will be specific to the vessel that holds it (i.e. separate SOPEPs will be held by the survey vessels and will contain vessel-specific details). The SOPEP will provide the following:

- A description of all actions to be taken by onboard personnel to reduce or control the discharge following a hydrocarbon spill incident;
- A detailed description of all spill response equipment held onboard the vessel including what equipment is available and its stored location;
- Detailed diagrams of the vessel, including locations of drainage systems, location of spill response equipment, and general layout of the vessel;
- An outline of the roles and responsibilities of all onboard personnel with regard to hydrocarbon spill incidents;
- A description of the procedures and contacts required for the co-ordination of hydrocarbon spill response activities with the relevant National and Local Authorities; and
- Requirements for testing of the SOPEP and associated drills.

The SOPEP also includes specific emergency procedures including steps to control discharges for bunkering spills, hull damage, grounding and stranding, fire and explosions, collisions, tank failure, sinking and vapour release.

In accordance with the control measures that will be implemented during the Seismic Survey (**Section 8.3.5**), each vessel involved in the Seismic Survey will have:

- An IMO certified SOPEP;

- A SOPEP drill conducted prior to the Seismic Survey commencing (i.e. within three months). A SOPEP drill is normally every three months; however, due to the proposed duration of the Seismic Survey, with this measure in place a SOPEP drill will be performed at least once during the Seismic Survey;
- The spill kits will be kept fully stocked (to vessel class requirements) and any items will be replaced if they are used; and
- In the event of a hydrocarbon spill, the Vessel Master will implement available controls and resources of the SOPEP.

10.10.2 Statutory Plans

10.10.2.1.1 Commonwealth Waters

If an oil spill occurs within Commonwealth waters the National Plan will apply and integrates with the relevant State response plans (discussed in **Section 10.10.2.1.2**). Initial actions would be undertaken immediately by the Vessel Master, with any further actions determined following immediate contact with AMSA.

The National Plan integrates the response from both the Commonwealth and relevant State Governments to ensure an effective response to marine pollution incidents. The National Plan provides for AMSA to be the Control Agency when responding to a spill event who works closely with the relevant State Governments, emergency services and industry to ensure a robust response capability.

10.10.2.1.2 State Waters

Should a spill occur during the Seismic Survey which originates within, or is likely to move into, State/Territory waters, the relevant statutory plans are as follows (depending on the location and trajectory of the spill):

- The Western Australia (WA) state plan is the WA Department of Transport (**DoT**) Offshore Petroleum Industry Guidance Note – Marine Oil: Response and Consultation Arrangements[39]. Under this plan, the DoT Maritime Environmental Emergency Response (**MEER**) unit is the Control Agency;
- The Northern Territory (**NT**) territory plan is the NT Department of Environment, Parks and Water Security (**DEPWS**) NT Oil Spill Contingency Plan. The NT DEPWS is the Control Agency for Territory waters.

10.10.3 Hydrocarbon Spill Response Framework

SLB utilise the incident classification as outlined in the National Plan (AMSA, 2019) for hydrocarbon spills to provide direction on the potential consequence and impact of the incident and to provide guidance for preparedness, incident notifications and response actions.

Two levels of incident are possible for the Seismic Survey:

- **Level 1:** Incidents are generally able to be resolved through the application of local or initial resources only (e.g. first-strike capacity); and
- **Level 2:** Incidents are more complex in size, duration, resource management and risk and may require deployment of jurisdiction resources beyond the initial response.

The division of the responsibilities in the event of a hydrocarbon spill that affects State and Commonwealth Waters is provided in **Table 128**.

[39] https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_Westplan_MOP_OffshorePetroleumIndGuidance.pdf

Table 128 State and Commonwealth Hydrocarbon Spill Responsibilities

Location	Spill Source	Statutory Authority	Control Agency	
			Level 1	Level 2
Commonwealth waters	Shipping sourced spill	NOPSEMA	AMSA	AMSA
Western Australia state waters		WA DoT	WA DoT	WA DoT
Northern Territory waters		NT DEPWS	NT DEPWS	NT DEPWS

10.10.3.1.1 Control Agency

AMSA is the designated Control Agency if a hydrocarbon spill occurs from a ship associated with the Seismic Survey within Commonwealth waters. AMSA will assume control of the incident and respond in accordance with the National Plan. SLB will assume a Support Agency role and provide all available assistance to AMSA during their Control Agency responsibilities.

10.10.3.1.2 Cross Jurisdictional Coordination

As stated in the National Plan, maritime environmental emergencies have the potential to impact upon the interests of two or more Australian jurisdictions, where both jurisdictions have legitimate administrative and regulatory interests in the incident. In this case, the National Plan addresses these complexities through the *Guidance on the Coordination of Cross Border Incidents* which provides for the establishment of an incident coordination process and the determination of a 'lead' jurisdiction, if appropriate.

10.10.4 Nature and Scale of Preparedness

10.10.4.1.1 Maximum Credible Scenario

As described in **Section 8.2** it is considered that either a vessel collision or refuelling at sea are the only credible scenarios in which a hydrocarbon spill could occur during the Seismic Survey. As the vessel collision, and associated hydrocarbon spill, would result in the greatest impact on the receiving environment, this scenario is considered here. Based on AMSAs "*Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities*" (AMSA, 2015), the largest fuel tank is adopted as the worst-case Maximum Credible Scenario (**MCS**) that may result from a vessel collision. In the absence of vessel specifications, a spill of 1,000 m^3 of MGO from the Seismic Vessel (through vessel collision) is considered to be the MCS. This MCS is considered to be very conservative, as it is assumed vessel fuel tanks will be at smaller capacity than 1,000 m^3, fuel will be compartmentalised into separate tanks, and while the survey is underway it is likely that the tank will not be 100% full. In addition, there is a hierarchy of controls in place to avoid this MCS from occurring.

10.10.4.1.2 Hydrocarbon Characteristics and Behaviour

The fuel to be used during the Seismic Survey is MGO which is a light petroleum distillate. This would undergo rapid dispersion and evaporation if it was released into the high energy offshore marine environment of the Bonaparte Basin. DNV (2011) estimates that the half-life of MGO is 2.5 hours in wind speeds of 10 m/s, 1 hour at 20 m/s and approximately 12 minutes in storm conditions with wind speeds over 30 m/s.

Based on outcomes of scenario modelling (summarised in **Section 8.3.1.1**, and **Appendix B**) for the Bonaparte Basin, the MGO will initially be present longer on the surface; but then undergo partitioning to vapour (i.e. to air), water (as dissolved and dispersed fractions), with a small fraction expected to be beached. The worst-case scenario, whilst predicting that under calm weather and the most proximate release point to result in up to 13% of a 1,000 m^3 spill to be beached, is considered highly conservative. It is highly unlikely given the hierarchy of controls in place to prevent this occurrence.

10.10.4.1.3 Spatial Extent of Maximum Credible Scenario

Hydrocarbon spill modelling has been summarised in **Section 8.2** to inform the development of this EP and risk assessments. In case the unlikely event that a vessel collision occurs, real-time modelling is also proposed to confirm any assumptions about the EMBA, and level of response required. The extent of the MCS has been based on stochastic modelling using the opensource OpenOil modelling software, modified to include dissolution processes.

Outputs of the scenario modelling were used to define the extent of the EMBA and identification of intersections with potential impacts on sensitive receptors which have the potential to be subjected to surface-oiling (assessed in **Section 4.1**)

10.10.5 Net Environmental Benefit Assessment / Spill Impact Mitigation Assessment

NEBA and SIMA are commonly used globally for evaluating the potential benefits versus impacts of implementing a pre-defined spill response strategy. The purpose is to identify the most appropriate response strategy(ies) which can be implemented under real-time factors influencing the spill dynamics (location, amount, prevailing weather conditions etc). It can also be a rapid decision-making tool employed by the CA under time constraints.

The following is a summary of steps normally used by the CA to conduct a NEBA/SIMA for a Level 2 spill (summarised from IPICEA 2017):

1. **Compile and evaluate data** for relevant spill scenarios (oil properties, situational awareness, Oil Spill Trajectory Modelling, environmental sensitivities, identification of resources at risk, and determination of feasible response options);
2. **Predict outcomes/impacts** for the no intervention (or ‘natural attenuation’ / unmitigated spill impact) option as well as the effectiveness (i.e. relative mitigation potential) of the feasible response options for each scenario;
3. **Balance trade-offs** by weighing and comparing the range of benefits and drawbacks associated with each feasible response option, including no intervention, for each scenario; and
4. **Select the best response option(s)** to form the strategy for each scenario, based on the combination of techniques that will minimize the overall ecological, socio-economic and cultural impacts and promote rapid recovery, and maximise potential for environmental protection.

For any response initiated in Commonwealth Waters, SLB will provide support to the AMSA IMT (CA) for NEBA/SIMA though utilisation of existing SLB personnel, or third-party Subject Matter Experts where appropriate. For State waters (either Western Australian or Northern Territories) SLB will also provide support. Oil spill response and planning tools[40] listed on the WA DoT website will be used throughout the planning and response process.

[40] https://www.transport.wa.gov.au/imarine/oil-spill-response-and-planning-tools.asp

10.10.6 Hydrocarbon Spill Response Arrangements

10.10.6.1.1 Hydrocarbon Spill Resources

SLB will ensure that the vessels used for the Seismic Survey will have on-site response equipment for the prevention and minimisation of loss of oil to the sea. This equipment will include the on-board spill containment and recovery kits which includes absorbent material to meet the flag state and class requirements. All crew onboard will be trained in the use of this spill response equipment and know the location of the response kits. However, this response equipment that will be onboard will not be suitable for deployment to sea for any spills.

For Level 2 spills, the equipment needed (such as booms – although this is not likely needed for MGO) will come from AMSA stockpiles (either from the Perth (Western Australia), Darwin (Northern Territory) stockpile dependant on location of the spill) deployed through the National Plan arrangements. AMSA also has access to stockpiles in other states which are managed by the Australian Marine Oil Spill Centre.

10.10.6.1.2 Spill Response Options

An assessment of the hydrocarbon spill response options was undertaken within **Section 8.4**. These options include:

- Source control including securing cargo and trimming;
- Natural weathering relating to monitoring and evaluating the spill via vessel/aerial surveillance and trajectory modelling;
- Physical break-up via vessel prop-washing;
- Application of dispersants;
- Containment and recovery through booms and skimmers;
- Protection and deflection utilising booms in the intertidal area;
- Shoreline clean-up through physical removal, surf washing, flushing and natural dispersion; and
- Oiled wildlife response via capture and rehabilitation.

This assessment concluded that source control and natural weathering are the preferred options when dealing with a hydrocarbon spill during the Seismic Survey due to the location of the OA and the likely break-up of MGO.

Source control will be undertaken as part of a Level 1 response in accordance with the vessels SOPEP. For Level 2 responses, SLB will assist where required by the Control Agency, including provision of up-to-date monitoring information from visuals from the available vessels, and trajectory modelling.

10.10.6.1.3 Notifications

The Vessel Master has the responsibility for notification and reporting of any spills into the marine environment (via POLREP Form contained in the vessel's SOPEP) to the AMSA Response Coordination Centre. Once this initial report has been undertaken, further reports will be sent at regular intervals to keep relevant parties (such as AMSA, SLB, NOPSEMA, etc.) informed.

The SLB On-board Representative is responsible for advising the SLB Project Manager of the spill incident. The SLB Project Manager is then responsible for notifying NOPSEMA.

The Notification and associated timeframes for both Level 1 and 2 responses are outlined in **Table 129**.

Table 129 Hydrocarbon Spill Response Notifications and Timeframes

Incident Classification	Notification Timing	Authority/Company	Contact Number	Instructions
Level 1 and Level 2	Immediately	SLB Project Manager	(08) 9420 4801	Verbally notify SLB of event and estimated volume and hydrocarbon type.
	Within 2 hours	NOPSEMA	(08) 6461 7090	Verbally notify NOPSEMA for spills > 80 L Record notification using Initial Verbal Notification Form or equivalent and send to NOPSEMA as soon as practicable
	Within 3 days			Provide a written NOPSEMA Incident Report Form as soon as practicable (no later than 3 days after notification)
	Within 1 day	NOPTA	(08) 6424 5317	Provide a verbal or written incident summary
	As soon as possible	DNP	(04) 19 293 465	Provide titleholder details, time and location of incident, name of marine park likely to be affected, proposed response arrangements (as per OPEP), confirmation of providing access to relevant monitoring and evaluation reports when available and contact details for the response coordinator.
	As soon as possible	WAFIC	(08) 9432 7704	Verbally notify WAFIC of a fuel oil spill, providing details of the spill in terms of volume and where it is heading. WAFIC have made a commitment to notify commercial fishers that utilise the wider EMBA in case if a spill occurred. SLB are to be copied into the communications so they can verify the notifications have been completed.
	As soon as possible	NT Department of Industry Tourism and Trade	(08) 8999 2144	Verbally notify NT DITT of a fuel oil spill, providing details of the spill in terms of volume and where it is heading. SLB are to be copied into the communications so they can verify the notifications have been completed.

Incident Classification	Notification Timing	Authority/Company	Contact Number	Instructions
	As soon as possible	Kimberley Land Council	[redacted]	Verbally notify KLC if a fuel oil spill occurs with as much information as possible to that can be provided. A request for KLC to advise native title holder groups and any traditional owners that the spill may be of relevance too based on cultural values and sensitivities.
	As soon as possible	WGAC	[redacted]	Verbally notify WGAC if a fuel oil spill occurs with as much information as possible to that can be provided.
	As soon as possible	Northern Land Council	[redacted]	Verbally notify NLC if a fuel oil spill occurs with as much information as possible to that can be provided. A request for NLC to advise native title holder groups and any traditional owners that the spill may be of relevance too based on cultural values and sensitivities.
Level 2	Within 2 hours	AMSA	1800 641 792	Verbally notify AMSA Response Coordination Centre of the hydrocarbon spill. Follow up with a written POLREP as soon as practicable following verbal notification.
	As soon as possible if spill affects Western Australia state waters	WA DoT MEER	(08) 9480 9924	Verbally notify WA DoT MEER. Follow up with a written POLREP as soon as practicable following verbal notification.
	As soon as possible if spill affects Northern Territory waters	NT DEPWS	(08) 8999 5511	Verbally notify NT DEPWS. Follow up with a written POLREP as soon as practicable following verbal notification.

Incident Classification	Notification Timing	Authority/Company	Contact Number	Instructions
	Within 2 hours	Type II Monitoring Service Provider	To be confirmed prior to commencement	Verbally notify the nominated emergency contact person for the Type II Monitoring service provider (see **Section 10.10.7.1.2**). Note that the initial notification may not be able to provide key details (i.e. meeting the scientific monitoring program initiation criteria); however, will allow the service provider to commence planning activities to be at the ready. Follow up with more formal notification (includes written documentation), if and when a scientific monitoring program initiation criterion is met (see **Section 10.10.7.1.5**)

10.10.6.1.4 Control Measures for Hydrocarbon Spill Response

SLB has developed a number of control measures that are necessary to ensure timely response to an emergency that result, or may result, in hydrocarbon pollution. These control measures are described in **Section 8.4.4**.

10.10.6.1.5 Capability and Training Requirements

As part of the basic introductory and technical training, all staff will also receive environmental awareness training. SLBs environmental training programme provides addition training where required in accordance with SLBs Environmental Standards, such as for site-specific environmental exposures etc. as all employees are responsible for environmental protection and to minimise the potential impacts on the environment.

10.10.6.1.6 Arrangements for Testing the OPEP

Prior to the commencement of the Seismic Survey the OPEP will be tested. A summary of arrangements for testing the response arrangements is provided in **Table 130**.

Table 130 Testing Requirements of the Response Arrangements

Environment Regulations	Description
Regulation 14(8B) of the Environment Regulations requires the arrangements for testing the response arrangements to include:	
A statement of the objectives of testing:	The objectives of testing are to provide an opportunity for crew to gain confidence in using the onboard spill equipment and implementing the incident response procedures. The result of this will increase efficiency in the event of an emergency, review the efficiency of procedures and detect any failures in equipment.

Environment Regulations	Description
A proposed schedule of tests:	Three-monthly drills and exercise will be carried out on all vessels associated with the Seismic Survey in line with IMO/SOPEP. The timing of the drills will be scheduled to coincide at the start of the Seismic Survey. These drills will include, but not be limited to: • Spill response; • Collision and grounding; • Fire and explosion; and • Helicopter emergency.
Mechanisms to examine the effectiveness of response arrangements against the objectives of testing:	Refer to **Section 10.4**, in particular: • Issues raised (if any) will be described in daily report; • Weekly checklists will ensure that spill monitoring equipment is in place and fully stocked; • Requirements described for the review of the EP and OPEP; and • Requirements described for testing below.
Mechanisms to address recommendations arising from tests:	As mentioned above, any issues raised resulting from testing will be described in the daily report. Also, the Vessel Master is made aware that any change to this OPEP and EP is managed through MoC described in **Section 10.4.6**.
Regulation 14(8C) of Environment Regulations states that proposed schedule of tests must provide for the following:	
Testing the response arrangements when they are introduced:	As outlined in **Section 10.10.1**, SOPEP drill conducted prior to the Seismic Survey (within three months) and at least every three months during the Seismic Survey if it proceeds that long.
Testing the response arrangements when they are significantly amended:	The MoC process described in **Section 10.4.7** details the process for any changes to be introduced to the OPEP and EP. Where these changes reasonably affect the arrangements in place, the changed arrangements will be tested prior to finalising the MoC.
Testing the response arrangements, no later than 12 months after the most recent test:	As discussed above, and in **Section 10.10.1**, testing will occur every three months during the Seismic Survey. If this is longer than the duration of the survey, the testing will occur when the survey starts.
If a new location for the activity is added to the EP 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:	SLB will not be undertaking work outside of the OA described within **Section 3.2.1**.
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 to the Seismic Survey.

10.10.7 Operational and Scientific Monitoring Plan

The OSMP is set out in **Appendix L**. This sets out the framework for developing a specific OSMP following an oil spill based on the parameters of the spill, including the location, nature and scale of the spill, and any potentially impacted values including sensitive resources.

As part of the initial response, SLB and the Seismic Vessel operator will provide a first-strike response (i.e. local or initial resources to stop or contain spill) at the direction of the Control Agency and provide ongoing response and monitoring arrangements where requested.

10.10.7.1.1 Type I Operational Monitoring

As outlined in the OSMP and within **Section 8.2**, Type I 'Operational Monitoring' will be implemented where safe to do so and when there is a net benefit in doing so (as agreed with the Control Agency). This monitoring will be implemented to:

- Determine the extent and character of a spill;
- Visual tracking of the movement/ trajectory of surface slicks;
- Identify areas/ resources potentially affected by surface slicks; and
- Determine sea conditions/ other constraints.

This monitoring will enable the Vessel Master to provide the necessary information to the relevant Control Agency, via a POLREP form, to determine and plan appropriate response actions under the National Plan and the relevant State plan. Operational monitoring and observation in the event of a spill will inform an adaptive spill response and scientific monitoring of relevant key sensitive receptors.

Ongoing situational awareness information is provided to the Control Agency through the use of a Marine Pollution Situation Report.

For a Level 2 spill, SLB will undertake real-time spill trajectory modelling to provide assurances that response options can be tailored to the specific spill situation. The modelling will be based on continuous weather monitoring which will be utilised in conjunction with hindcast data to predict any potential beaching locations of the hydrocarbon, if any exist. This real-time spill trajectory modelling will be utilised to focus any potential scientific monitoring if it were to be required (and directed by the Control Agency) in order to monitor the impacts from a spill occurrence. Further discussion on scientific monitoring is detailed within the OSMP and summarised in **Section 10.10.7.1.2**.

Field-based monitoring, including vessel and/or aerial surveillance, will be undertaken immediately following a spill event. This monitoring will enable the Vessel Master to provide up-to-date information to the relevant Control Agency via the POLREP form to appropriate plan any response options. This field-based monitoring will be utilised further in the development of any scientific monitoring of key sensitive receptors if scientific monitoring is required and requested by the Control Agency. Field-based monitoring has its limitations in that it can only be conducted during daylight hours when the surface slick is visible.

SLB will assist with further operational monitoring (including funding if required) as directed by the Control Agency.

10.10.7.1.2 Type II Scientific Monitoring

In consultation with the Control Agency, SLB will commit to scientific monitoring dependent on the circumstances of the spill, and the sensitivities at risk. The proposed approach to any detailed scientific monitoring is set out in the OSMP. For the purpose of this EP, it is not considered that more detailed Scientific Monitoring Plans are required to be developed or environmental baseline monitoring is required prior to the Seismic Survey commencing due to the potential risks associated with the Seismic Survey and a hydrocarbon spill through vessel collision are considered very low with all of the associated control measures in place. The identified potential risks are assessed as short term, transient and in the very unlikely even that it did occur, it is unlikely to cause significant impact on the marine environment given the likely volumes and nature of the MGO onboard the Seismic Vessel. It is considered that this proposed approach is reasonable for the Seismic Survey as existing control measures, including meeting all of the legislative requirements and industry standards, will reduce the risk or a hydrocarbon spill to the marine environment.

As discussed in **Section 10.10.4**, it is recognised that there is a remote chance of shoreline contact depending on the location of a hydrocarbon spill. Therefore, SLB commit to having a service agreement with a service provider prior to the commencement of the Seismic Survey. This agreement will ensure SLB has a capability to undertake Type II monitoring if required and also enable the chosen service provider to act (in a capacity as agreed with all parties), to either assist the Control Agency or to undertake key Type II monitoring activities on SLBs behalf (if initiation criteria are triggered).

10.10.7.1.3 Type II – Scientific Monitoring Services Agreement

As outlined above, prior to the commencement of the Seismic Survey, SLB will commit to having a service agreement with a service provider who have demonstrated capability to undertake Type II Monitoring. Prior to agreement with a third-party service provider, they must demonstrate they have the following capabilities:

- Emergency manned mobile telephone number;
- Capacity to prioritise and deploy qualified personnel to execute each scientific monitoring plan (**Section 10.10.7.1.5**);
- Qualifications and capacity to prepare detailed supporting sampling analytical plans/ monitoring plans for each of the scientific monitoring plans described in **Section 10.10.7.1.5**;
- The ability to prioritise and mobilise resources to the region (i.e. logistics are in place); or resources are located within the region; and
- Capacity to mobilise personnel and resources to the region as soon as practicable.

After agreeing to a services agreement, should the service provider suggest amendments of **Section 10.7**, this will be managed through the MoC process outlined in **Section 10.4.6**.

A notification will be provided to the service provider within two hours of a known spill event, so the service provider can be ‘at the ready’, even in the event initiation criteria are not yet triggered.

10.10.7.1.4 Situational Awareness

In the event of a hydrocarbon spill, details that will be exchanged between SLB and the service provider describing situational awareness will include:

- Hydrocarbon type and size of spill;
- Is the spill under control;

- Potential environmental or external influences that may impact a monitoring response;
- Predicted behaviour and predicted trajectory of the spill;
- Potential sensitivities at risk;
- Any ongoing safety concerns; and
- Protection priorities.

10.10.7.1.5 Scientific Monitoring Plans

The framework for implementing SMPs is set out in the OSMP Document, **Appendix L**. The service provider will develop and implement a variety of scientific monitoring plans if and when the initiation criteria are met (**Table 131**). The monitoring plan(s) required in the event of a Level 2 hydrocarbon spill are assessed based on the nature and scale of the MCS and the situational awareness at the time of any spill.

Due to the potential beaching of a hydrocarbon spill as identified by modelled scenarios, a number of monitoring plans may be required to monitor the potential impacts of a hydrocarbon spill. **Table 131** provides rationale for the various monitoring plans that would be developed.

Any monitoring plans that are implemented are required to be adaptive to allow key sensitivities at risk to be identified. Such as, if a Control Agency makes a reasonable request for monitoring to be undertaken on a receptor which isn’t specified here, any service agreement will provide SLB with the capacity to react to these requests.

Table 131 Scientific Monitoring Plan Aims, Objectives and Rationale

Scientific Monitoring Plan	Key Receptor(s)	Aim	Objective	Rationale
Marine water quality	Background water quality	To monitor the hydrocarbons in marine waters to support assessment of impacts and recovery of sensitivities and to verify hindcast modelling	Assess and document the extent and severity of hydrocarbon contamination utilising observations and/or in-water measurements made during operational monitoring. Provide data to inform further scientific monitoring plans.	Reductions in water quality are likely to result due to aromatic hydrocarbons being entrained within the water column. Subsequent partitioning, including to the water column, is expected. Impacts on the water quality from a hydrocarbon spill are important to understand and evaluate as this will potentially impact a range of other receptors, and data will be used to inform other monitoring plans described below.
Intertidal and shoreline sediment quality	Background sediment quality, particularly focused on sensitive locations	Gain an understanding of the characteristics, persistence, and fate of spilled hydrocarbons within sediments exposed to beached oil	Estimate spilled hydrocarbon concentrations within sediment exposed to beached oil. Monitor changes over time in hydrocarbon concentrations. Provide data to assist assessment of impacts on benthic communities. Establish necessary response options.	Should a spill of hydrocarbons reach the shoreline it has the potential to impact on the sediment quality, and as such impact on intertidal biota (described below) which may be exposed to chronic toxicity levels of hydrocarbons.
Intertidal and shoreline habitats and benthos	Invertebrates, filter feeders, benthic primary producers, demersal fish, shorelines and intertidal habitats	Determine the impacts of spilled hydrocarbons on intertidal benthos and habitats	Monitor impacts on intertidal and shoreline habitats from beached hydrocarbon contamination. Define recovery parameters for benthos. Monitor benthos recovery to hydrocarbon contamination. Establish necessary response options.	Shoreline habitats can be impacted from a spill through stranded floating hydrocarbons, or droplets entrained within the water column, with hydrocarbons becoming increasingly entrained within the nearshore waters. Aquatic organisms utilising these habitats can be exposed to elevated levels of hydrocarbons over their thresholds which will ultimately impact the organism.

Scientific Monitoring Plan	Key Receptor(s)	Aim	Objective	Rationale
Seabirds and shorebirds population and recovery	Foraging seabirds and coastal shorebird populations	Assess impacts on seabird and shorebird populations.	Quantify foraging, nesting or breeding seabird and shorebird populations potentially impacted by spilled hydrocarbons. Quantify oiled avifauna, including mortalities. Establish necessary response options.	Seabirds and shorebirds can be impacted by hydrocarbons spills through the presence of hydrocarbons on the surface of the water and from hydrocarbons entrained within the water column. This can lead to potential behavioural, physiological and physical impacts such as deviation from migratory routes, disruption to their indigestion and/or coating their feathers resulting in the inability to fly.
Marine fauna (excluding avifauna)	Marine mammals, marine reptiles, bony fish, elasmobranchs	Assess impacts on non-avian marine fauna potentially impacted by a hydrocarbon spill.	Quantify oiled marine fauna, including mortalities.	Hydrocarbon spills resulting in a surface slick or entrained within the water column has the potential for long-term impacts to marine fauna. Contact between marine fauna and a surface slick or in-water concentrations of hydrocarbon has the potential to elicit lethal and sub-lethal impacts, including behavioural (avoidance of foraging habitats or migratory routes), physiological (inability to digest) and/or physical effects.
Socio economic impact monitoring (fisheries and tourism)	Target species or areas of importance for fishing/tourism	Assess impacts on fisheries (including aquaculture) and tourism activities	Monitor hydrocarbon concentration within tissue of species targeted by commercial fisheries. Identify potential impacts on human health as a result of hydrocarbon contamination. Assess recovery of tourism operations in area affected.	Commercial fishing operations for pelagic fish, prawn fisheries, shellfish can be impact from a hydrocarbon spill which can include lethal and sub-lethal physiological and physical effects. Any exposure to commercial and recreational target species can result in the tainting of flesh and increase in toxicity above human consumption thresholds. In terms of tourism, a hydrocarbon spill can result in a negative perception on the environment impacted by the spill.

10.10.7.1.6 Development of Detailed Scientific Monitoring Plans

The agreed service provider will develop detailed scientific monitoring plans after receiving the initial notification in the event of a spill, and when the initiation criteria outlined in **Table 131** have been met. A draft scientific monitoring plan will be provided to SLB as soon as practicable, but within 24 hours after receiving the initial notification that a hydrocarbon spill has occurred. A final proposed monitoring plan will then be provided to the relevant Control Agency for review as soon as practicable, but within 24 hours of initial notification.

The monitoring plans will include, as a minimum:

- Objectives and rationale of the monitoring plan: Each plan developed will outline the key objectives, rationale and focus of the plan;
- Baseline information: It is important for each monitoring plan to specify the details of the baseline to be applied, or a method for selection of suitable reference/control sites. If possible, previous monitoring from published studies and findings is to be utilised;
- Spatial awareness: It is important for any scientific monitoring plan to provide information and outcomes obtained from the operational monitoring (such as real-time spill trajectory modelling) to support the proposed design;
- Methodology: The proposed survey methodology should consider the statistical methods and sampling effort required to achieve the objectives of the scientific monitoring plan. If sampling is proposed as part of the monitoring plan, industry recognised methods for collection and analysis of the samples must be used. This includes utilising accredited laboratories and following best practice guidelines and applicable legislation where applicable. The methodology should include, as a minimum:
- Details of any permits or approvals required to undertake the work, including whether there are any exemptions;
- Collection and analysis requirements (i.e. permits);
- Personnel proposed to undertake the monitoring, including appropriate qualifications and skills;
- Equipment required to complete the proposed monitoring;
- HSSE requirements to complete the survey;
- QA/QC requirements if appropriate;
- Initiation criteria: The criteria used to initiate the proposed scientific monitoring plan;
- Termination criteria: Each monitoring plan will include a termination date at which time the monitoring can stop which is consistent with the objectives of the monitoring plan. These criteria must be adaptive and be able to change based on the actual circumstances of the impacts and/or risks of assessment;
- Management of change: The monitoring plans must be adaptive to ensure the impacts and risks are managed appropriately. As such, if a monitoring plan is required to change to adapt to these circumstances, then a process for change needs to be detailed so that any revision is provided to SLB and the relevant Control Agency for acceptance as soon as practicable. Any revisions undertaken must be tracked to clearly communicate the current status of the monitoring requirements; and

- Reporting: Each monitoring plan is required to detail the reporting of results during and post monitoring. This reporting will include ongoing situation reports during the implementation of monitoring; the timing of these situation reports will be based on the nature and scale of the impacts/risks. Post monitoring, a draft report and third-party peer reviewed report will be provided to SLB, the Control Agency and NOPSEMA which will include any recommendations resulting from the monitoring plan.

10.10.7.1.7 Implementation of Scientific Monitoring Plans

During the development of the monitoring plan(s) outlined in **Section 10.10.7.1.5** above, the service provider will undertake all planning actions required to mobilise to the site. This will include providing a brief proposal to SLB which will outline the resources and personnel required, transport arrangements and timeframes for implementation. The service provider will undertake all reasonable measures to mobilise to the site as soon as practicable. The ability for the service provider to mobilise within 24 hours will be required under the service agreement.

Due to the low likelihood of a spill occurring, it is not considered reasonable to have these resources on standby during the Seismic Survey. It would require considerable financial investments over and above the significant control measures implemented to reduce the risks of a vessel collision to **ALARP** and **Acceptable Levels**. Therefore, SLB consider the approach outlined above to be reasonably practicable based on the nature and scale of the risks associated with the Seismic Survey.

10.10.7.1.8 Initiation Criteria for Scientific Monitoring Plan

The initiation criteria (**Table 132**) for each monitoring plan is broadly applied to enact the response described within this EP. However, it is important to note that the final decision to commence each monitoring plan will be based on the net environmental benefit in which the environmental sensitivities should be avoided if the monitoring proposed may reasonably result in further impacts and offer no net benefit.

Table 132 Scientific Monitoring Plan Initiation Criteria

Plan	Initiation Criteria
Marine water quality	Notification of a Level 2 or greater hydrocarbon spill.
Intertidal and shoreline sediment quality	Notification of a Level 2 or greater hydrocarbon spill. and Where modelling and/or Operational Monitoring indicates likely exposure to intertidal and/or shoreline sediments. or Reports are received of shoreline and/or shoreline contact from hydrocarbon spill.
Intertidal and shoreline habitats and benthos	Notification of a Level 2 or greater hydrocarbon spill. and Where modelling and/or Operational Monitoring indicates likely exposure to intertidal and/or shoreline habitats or benthos. or Reports are received of shoreline and/or shoreline contact from hydrocarbon spill.
Seabirds and shorebirds population and recovery	Notification of a Level 2 or greater hydrocarbon spill. and Where modelling and/or Operational Monitoring indicates likely exposure to seabird and/or shorebird populations. and/or Reports are received of contact with avifauna from hydrocarbon spill. and/or Reports of oiled or dead avifauna are received.
Marine fauna (excluding avifauna)	Notification of a Level 2 or greater hydrocarbon spill. and Where modelling and/or Operational Monitoring indicates likely exposure to non-avian marine fauna. and/or Reports are received of contact with non-avian marine fauna from hydrocarbon spill. and/or Reports of oiled or dead non-avian marine fauna are received.
Socio economic impact monitoring (fisheries, aquaculture and tourism)	Notification of a Level 2 or greater hydrocarbon spill. and Where modelling and/or Operational Monitoring indicates likely exposure to aquaculture operations. and/or Reports are received of commercial fisheries closures due to hydrocarbon contamination. and/or Reports are received of tourism operation closures due to hydrocarbon contamination.

10.10.7.1.9 Termination Criteria for Scientific Monitoring Plan

Each scientific monitoring plan that is undertaken as part of a response operation will continue until certain termination criteria have been met (**Table 133**), in consultation with the relevant Control Agency.

Table 133 Scientific Monitoring Plan Termination Criteria

Plan	Termination Criteria
Marine water quality	Hydrocarbon spill has ceased, there are no visible sheens present and no further sheens are predicted by the modelling. Monitoring data of in-water concentrations of hydrocarbons have been compiled and analysed. Data confirm water concentrations are at background/reference levels. Reporting on sampling has been completed detailing extent and severity of spilled hydrocarbons which can enable further analysis of impacts on other receptors in any further scientific monitoring plans.
Intertidal and shoreline sediment quality	Hydrocarbon spill has ceased, there are no visible sheens present and no further sheens/beaching are predicted by the modelling. Any monitoring undertaken confirms concentrations of hydrocarbons present within sediments fall below relevant receiving guidelines (e.g. ANZG, 2018), and pose low to negligible ecological risk. Reporting on the sampling has been completed detailing the extent and severity of spilled hydrocarbons which can enable further analysis of impacts on benthic communities.
Intertidal and shoreline habitats and benthos	Hydrocarbon spill has ceased, there are no visible sheens present and no further sheens/beaching are predicted by the modelling. Impacts from hydrocarbon spill on benthos are quantified and recovery evaluated. Reporting on the monitoring has been completed detailing the extent and severity of spilled hydrocarbon impacts on benthos.
Seabirds and shorebirds population and recovery	Hydrocarbon spill has ceased, there are no visible sheens present and no further sheens/beaching are predicted by the modelling. Objectives and values associated with any relevant avian species recovery plans and/or conservation advice's have been met. Impacts from hydrocarbon spill on avifauna quantified and recovery evaluated. Reporting on the monitoring has been completed detailing the extent and severity of spilled hydrocarbon impacts on avifauna.
Marine fauna (excluding avifauna)	Hydrocarbon spill has ceased, there are no visible sheens present and no further sheens are predicted by the modelling. Objectives and values associated with any relevant species recovery plans and/or conservation advice have been met. Impacts from hydrocarbon spill on marine fauna (excluding avifauna) quantified and recovery evaluated. Reporting on the monitoring has been completed detailing the extent and severity of spilled hydrocarbon impacts on marine fauna (excluding avifauna).

Plan	Termination Criteria
Socio economic impact monitoring (fisheries, and tourism)	Hydrocarbon spill has ceased, there are no visible sheens present and no further sheens are predicted by the modelling. Impacts to important commercial fisheries quantified and recovery evaluated. Impacts to seafood quality and secondary impacts on human health evaluated. Impacts on tourism ventures quantified and evaluated. Reporting on the monitoring has been completed detailing the extent and severity of spilled hydrocarbon impacts on commercial fisheries, and tourism operations.

10.10.8 OPEP Review and Revision

In accordance with subregulation 14(8) of the Environment Regulations, the OPEP will be reviewed, updated and resubmitted to NOPSEMA should a change to the existing OPEP be required. It is considered, such changes to the OPEP could arise due to:

- A change to the EP that may impact spill response capabilities or coordination, such as an increase to the potential risk of a spill or release of hydrocarbons;
- When a significant change to the activities currently included within this EP has occurred, which could have implications on spill response or coordination;
- During routine testing of the OPEP, where improvements or corrections of the current OPEP are identified; and
- Any learnings from the result of a Level 1 or Level 2 spill or incident.

Any changes made to the OPEP, and any subsequent resubmission will be informed by the Environment Regulations or any other relevant Commonwealth regulations. If a change to the OPEP is required, SLB will undertake this in accordance with the MOC procedures defined in **Section 10.4.7**.

The SLB Project Manager will be responsible for the OPEP and ensuing that any relevant updates are made to the OPEP, and should any amendments be required, that the revised plan is submitted to NOPSEMA.

10.11 Continuous Improvement

SLB and its employees are committed to continually improve the standards, quality and safety of its products, activities, and services through improvements in its standards, processes and systems throughout all aspects of its business.

SLB will achieve this by continuing to encourage all employees and contractors to suggest improvements to existing standards, processes and systems and monitor the results of continuous improvement efforts, as described within SLBs Environmental Management Framework.

11 Conclusion

SLB has prepared this EP to support the application process for the Seismic Survey which may commence as early as November 2022 and will be completed before 30 June 2024, taking between 120 and 190 days to acquire the 12,000 km^2.

As part of developing the EP, an EMBA was derived utilising stochastic hydrocarbon dispersion and fate modelling (**Appendix B**) which provides a conservative area that may be impacted by the Seismic Survey. A comprehensive description of the key physical, biological, socio-economic and cultural characteristics of the existing environment and the sensitivities and receptors has focused on the EMBA.

This EP assesses the potential risks and associated impacts from the Seismic Survey on the biological and socioeconomic values of the EMBA, employing three key methods: 1) an extensive literature review; 2) project specific UAM to examine the spatial spread and magnitude of acoustic outputs from the Seismic Survey and to predict how this would affect various receptors; and 3) extensive consultation with relevant persons.

UAM (**Appendix A**) was undertaken to predict received SELs and spread of noise emissions, or the 'footprint' of acoustic emissions generated from the Seismic Survey. The UAM involved three key components: array source modelling; underwater acoustic propagation modelling; and animat modelling. The results from the UAM were then compared with a variety of noise criteria and sound levels identified in scientific research to cause the onset of PTS and TTS.

Through the development of the EP, SLB has undertaken an extensive consultation programme with relevant persons, including traditional owner groups, commercial and recreational fishers, industry bodies and associations, marine park authorities, tourism operators etc. The review and updates to the consultation programme, following the High Court Decision and NOPSEMA's Consultation Guidance Document, and subsequent iterations of the consultation process has provided SLB with a deep level of understanding with regard to the potential impacts (both real and perceived) from relevant persons. The nature of responses varied; some included requests for further information, to be kept informed and some noted that the proposed survey was not relevant for their interest in the area. Only one objection to the Seismic Survey was reported throughout the consultation programme which concluded that detailed consideration be given to the protection of BIAs and their corresponding receptors areas of cultural heritage significance. These claims were considered to be adequately addressed through the development of this EP.

One of the key sensitivities identified through the preparation of the EP was the proximity of the OA to the blue whale migratory BIA. SLB recognises that the potential to encounter whales increases as the Seismic Survey approaches and overlaps the blue whale migratory BIA. In addition to Standard and Additional Control Measures, the following control measures are proposed in relation to the location of the blue whale migratory BIA:

- A 17 km buffer will be established around the blue whale migratory BIA where it overlaps with the OA;
- The Seismic Vessel will not activate the acoustic source(s) within the blue whale migratory BIA or 17 km buffer from mid-April (14th) to mid-January (14th) which represents the period during which most migrations whales are expected to pass through the Timor Sea;
- Outside of this period (15 Jan to 13 April), any seismic operations will:

- Implement an extended 5+ km Observation Zone and Extended 5+ km Shut-down Zone throughout the entire OA, where shut-downs will be triggered by a blue whale/pygmy blue whale sighting at any distance, and to a minimum of 5 km from the acoustic source. Wherever possible the Chase Vessel will travel as far as practicable ahead of the Seismic Vessel and conduct visual surveillance for marine mammals during daylight hours. Trained and experienced MMOs/MFOs will be required to undertake these observations. Note: 'ahead of the Seismic Vessel is defined as an 180° arc ahead of the Seismic Vessel, noting that the Chase Vessel should focus on the portion of the arc closest to the blue whale migratory BIA and buffer;;
- Limit Soft-start Procedures to conditions that allow visual inspection of the 5+ km Observation Zone; and
- If species identity is uncertain at any location inside the blue whale migratory BIA or buffer, any unidentified whale will be assumed to be a blue whale.
- Shut-down the acoustic source immediately if any blue whale is sighted within a minimum of 5 km of the acoustic source;
- If higher than anticipated numbers of blue whales are observed (i.e. three or more blue whale instigated shut-downs are made during the preceding 48 hour period) at any time or location during the survey, the following controls apply:
    - the acoustic source will be shut-down and the Seismic Vessel will relocate to an area at least 17 km away from the last blue whale/pygmy blue whale sighting, and outside of the blue whale migratory BIA or buffer, before commencing Pre Start-up Visual Observations and Soft Start Procedures;
    - An extended 10+ km observation zone will be adopted such that MMOs/MFOs observe for blue whales/pygmy blue whales as far as practicable, and to a minimum of 10 km from the source. This zone will be monitored using the Chase Vessel as an additional observation platform with two MMOs/MFOs onboard;
    - night-time or low visibility operations shall cease and may only resume after 24 hours of no blue whale/pygmy blue whale instigated shut-downs; and
    - Normal operations may only resume after 48 hours of no blue whale/pygmy blue whale instigated shut-downs.

If a blue whale mother and calf pair is observed during the Seismic Survey, the acoustic source will be immediately shut-down and the Seismic Vessel will relocate to another area at least 17 km away (and outside of the blue whale migratory BIA or buffer).

In addition to the above control measures tailored to the blue whale migratory BIA, SLB has developed a suite of control measures to ensure that the impacts and risks from the planned and unplanned activities associated with the Seismic Survey are reduced as far as practicable. In light of the extensive suite of proposed controls, the overall conclusion from the environmental risk assessment is that the impacts from the Seismic Survey have been reduced to **ALARP** and **Acceptable Levels**. The survey will fully comply with all relevant legislation and industry best practice.

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APPENDIX A

Underwater Acoustic Modelling Report

Bonaparte Basin Marine Seismic Survey

Acoustic Modelling for Assessing Marine Fauna Sound Exposures

JASCO Applied Sciences (Australia) Pty Ltd

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Executive Summary

JASCO Applied Sciences (JASCO) performed a numerical estimation study of underwater sound levels associated with the planned Schlumberger Bonaparte Basin Marine Seismic Survey (MSS) to assist in understanding the potential acoustic impacts on key regional receptors including marine mammals, fish, turtles, benthic invertebrates, sponges, coral, and plankton. The modelling considered a single seismic source in triple configuration with a total volume of 3000 in^3, towed at a depth of 8 m behind a single vessel, with an impulse interval (inter-pulse interval) of 16.67 m and a crossline array separation of 40 m.

JASCO's specialised airgun array source model was used to predict the acoustic signature of the seismic source and complementary underwater acoustic propagation models were used in conjunction with the modelled array signatures to estimate sound levels over a large area around the sources. Single-impulse sound fields were predicted at 21 sites within the Operational Area, with water depths ranging from 95 to 221 m. Accumulated sound exposure fields were predicted for four static acoustic scenarios and five animal movement modelling scenarios, to address different line acquisition plans, for likely survey operations over 24 hours. In the scenarios the seismic source will be continuously operating, including on turns. The single-impulse modelling locations and accumulated sound exposure scenarios were designed to be applicable throughout the Operational Area, and thus provide ranges to thresholds relevant to all fauna and receptors considered within the Environment Plan (EP), including the pygmy blue whale migration Biologically Important Area (BIA) and the Sahul Shelf Key Ecological Feature (KEF).

The modelling methodology considered source directivity and range-dependent environmental properties likely to be encountered within the survey area. The geology associated with locations where the source would be active (accounting for depth-based exclusions around the shoals) and within the greater region was considered and accounted for. Estimated underwater acoustic levels are presented as sound pressure levels (SPL, L_p), zero-to-peak pressure levels (PK, L_{pk}), peak-to-peak pressure levels (PK-PK; $L_{pk\text{-pk}}$), and either single-impulse (i.e., per-pulse) or accumulated sound exposure levels (SEL, L_E) as appropriate for different noise effect criteria. A conservative sound speed profile that would be most supportive of sound propagation conditions for the period of the survey was defined and applied to all modelling.

SEL_{24h} is a cumulative metric that reflects the dosimetric effect of noise levels within 24 hours, based on the assumption that a receiver (e.g., an animal) is consistently exposed to such noise levels at a fixed position. More realistically, marine animals would not stay in the same location for 24 hours (especially in the absence of location-specific habitat) but rather a shorter period, depending on the animal's behaviour and the source's proximity and movements. Therefore, a reported radius for the SEL_{24h} criteria does not mean that marine fauna travelling within this radius of the source will be impaired, but rather that an animal could be exposed to the sound level associated with impairment (either Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS)) if it remained at that location for 24 hours.

A more realistic representation of the potential exposures for migrating pygmy blue whales in the migration BIA was undertaken using animal movement modelling ('animat modelling'). Simulations with animats restricted to the BIA provide an understanding of how animats will be exposed given the location and environment-specific context in which they are most likely to occur. Scenarios in which the pygmy blue whales are seeded in an unrestricted manner allow for the calculation of exposure range across the entire survey area. These ranges may then be interpreted to determine buffer zones around the BIA for different survey options and scenarios. The unrestricted seeding approach is informative in cases where there is very little overlap between the BIA and the planned acquisition area, as is the case for the majority of this survey.

While acoustic modelling inherently assumes static animals, the JASCO Animal Simulation Model Including Noise Exposure (JASMINE) combines modelled sound fields with realistic animal

movements to predict how animals might be impacted through sound exposure. JASMINE provides a framework for understanding and predicting sound exposure for species of interest and for calculating ranges to relevant regulatory thresholds. The distribution of distances to the source of simulated animals ('animats') predicted to be exposed to sound levels above relevant thresholds was used to calculate the 95th percentile exposure range ($ER_{95\%}$), and the probability of animats being exposed above threshold within the $ER_{95\%}$ (P_{exp}).

A total of four acquisition scenarios were considered using both acoustic and animal movement modelling. A fifth scenario was included for animal movement modelling only, in this scenario the considered survey lines were further from the BIA, and it was considered with the aim of determining potential buffer zones around the BIA through the use of unrestricted animat seeding. All animat simulations were run in two configurations: one with animats restricted to the BIA, and another with unrestricted animat seeding.

The acoustic analysis considered the distances away from the seismic source at which several effects criteria or relevant sound levels were reached. The results are summarised below considering all the representative single-impulse sites and all accumulated SEL scenarios for both acoustic modelling results and pygmy blue whale animat $ER_{95\%}$ results and probabilities.

Marine mammals – Acoustic results

- The maximum distance where the NOAA (2019) marine mammal behavioural response criterion of 160 dB re 1 µPa (SPL) for impulsive noise could be exceeded varied between 8.79 and 14.3 km for the 3000 in^3 seismic source, depending on modelled site – in particular related to the site depth and proximity to the shelf edge and shoals.
- The results for marine mammal injury considered the criteria from Southall et al. (2019a). These criteria contain two metrics (PK and SEL_{24h}), both required for the assessment of marine mammal PTS and TTS. The longest distance associated with either metric is required to be applied for assessment; Table 1 summarises the maximum distances, along with the relevant metric.
- The distance to PTS and TTS was always furthest in the broadside direction, distances are shown in Table 1.

Table 1. Summary of maximum (R_{max}) horizontal distances (in km) from all modelled sites and scenarios to behavioural response thresholds and temporary threshold shift (TTS) and permanent threshold shift (PTS) for marine mammals showing the relevant metric. Maximum extents are in the broadside direction of the 3000 in^3 seismic source.

Hearing group	Maximum modelled distance to effect threshold (R_{max})		
	Behavioural response[1]	Impairment: TTS[2]	Impairment: PTS[2]
LF cetaceans	14.3 (SPL)	47.5 (SEL_{24h})	6.84 (SEL_{24h})
HF cetaceans		0.08 (SEL_{24h})	–
VHF cetaceans		0.92 (PK)	0.48 (PK)
Sirenians		0.08 (SEL_{24h})	–

Noise exposure criteria: [1] NOAA (2019) and [2] Southall et al. (2019b).
A dash indicates the threshold was not reached within the limits of the modelling resolution (20 m).

Pygmy blue whales – Animat results

- The exposure ranges predicted using animat modelling are significantly more realistic, due to the incorporation of species-specific realistic movements, rather than conservative approach of calculating ranges using the maximum-over-depth sound fields and receivers which are stationary for 24 hours. This is because the exposure ranges account for animats sampling the sound field vertically and horizontally based on species-specific diving and movement parameters.

- Only two scenarios with pygmy blue whale BIA restricted animat seeding resulted in exposures. Of these, the maximum $ER_{95\%}$ to the marine mammal behavioural response threshold (NOAA 2019) was 11.47 km, with a probability of exposure of 86%. The maximum $ER_{95\%}$ to TTS and PTS thresholds (Southall et al. 2019b) were 14.0 km and 0.06 km, respectively, with probabilities of exposure of 63% and 93%.
- Exposure ranges ($ER_{95\%}$) for single exposure metrics, such as the SPL behavioural response criteria, are typically comparable to the predicted acoustic ranges. Exposure ranges are generally slightly lower than the R_{max} acoustic ranges and in this case are fairly aligned with the $R_{95\%}$ acoustic ranges.
    - For the scenarios run with unrestricted animat seeding, the $ER_{95\%}$ distances to the behavioural response were slightly shorter than for the restricted case, with a maximum of 9.74 km and a probability of exposure of 93%.
- Exposure ranges from animal movement modelling for PTS and TTS criteria are typically shorter than those predicted using acoustic propagation modelling because of the shorter dwell time of the moving animats. In all scenarios, for both BIA-restricted and unrestricted cases, PTS and TTS exposure ranges were substantially shorter than acoustic ranges to threshold.
    - Overall, the scenarios run with unrestricted animats had slightly longer TTS and PTS $ER_{95\%}$ than their BIA restricted counterparts, with a maximum of range for TTS 17.11 km and a probability of exposure of 75%.

Sea turtles

- The PK sea turtle injury criteria of 232 dB re 1 µPa for PTS and 226 dB re 1 µPa for TTS from Finneran et al. (2017) was not exceeded at a distance longer than 20 m from the acoustic centre of the source.
- The maximum distance to the SEL_{24h} metrics of 204 dB re 1 µPa^{2}s for PTS and 189 dB re 1 µPa^{2}s for TTS was 80 m for PTS onset and 6.11 km for TTS onset for the 3000 in^3 seismic source (Finneran et al. 2017). As is the case with marine mammals, a reported radius for SEL_{24h} criteria does not mean that sea turtles travelling within this radius of the source will be injured, but rather that an animal could be exposed to the sound level associated with either PTS or TTS if it remained in that location for 24 hours.
- Table 2 summarises the distances to where the criterion for behavioural response of turtles to 166 dB re 1 µPa (SPL) and the 175 dB re 1 µPa (SPL) threshold for behavioural disturbance ((McCauley et al. 2000) could be exceeded.

Table 2. Summary of horizontal distances (in km) to turtle behavioural response criteria, temporary threshold shift (TTS), and permanent threshold shift (PTS).

Hearing group	Maximum modelled distance to effect threshold (R_{max})			
	Behavioural response[1]	Behavioural disturbance[1]	Impairment: TTS[2]	Impairment: PTS[2]
Sea Turtles	7.68 (SPL)	2.44 (SPL)	6.11 (SEL_{24h})	0.08 (SEL_{24h})

Noise exposure criteria: [1] (McCauley et al. 2000), and [3] Finneran et al. (2017)

Fish, fish eggs, and fish larvae

- This modelling study assessed the ranges for quantitative criteria based on Popper et al. (2014) and considered both PK (seafloor and water column) and SEL_{24h} metrics associated with mortality and potential mortal injury as well as impairment in the following groups:
    - Fish without a swim bladder (also appropriate for sharks in the absence of other information),
    - Fish with a swim bladder that do not use it for hearing,
    - Fish that use their swim bladders for hearing,
    - Fish eggs and fish larvae.
- Table 3 summarises distances to effect criteria for fish, fish eggs, and fish larvae along with the relevant metric. Seafloor sound levels were assessed at eight different depths within the Active Source Zone (40, 50, 60, 75, 100, 125, 150, and 200 m).

Table 3. Summary of maximum fish, fish eggs, and larvae injury and temporary threshold shift (TTS) onset distances for single impulse and 24 hour sound exposure level (SEL_{24h}) modelled scenarios.

Relevant hearing group	Effect criteria	Water column		Seafloor	
		Metric associated with longest distance to criteria	R_{max} (km)	Metric associated with longest distance to criteria	R_{max} (km)
Fish: No swim bladder	Recoverable injury	PK	0.130	PK	0.130
	TTS	SEL_{24h}	10.5	SEL_{24h}	9.31
Fish: Swim bladder not involved in hearing and Swim bladder involved in hearing	Recoverable injury	PK	0.20	PK	0.25
	TTS	SEL_{24h}	10.5	SEL_{24h}	9.31
Fish eggs, and larvae	Injury	PK	0.20	PK	0.25

Benthic invertebrates, Sponges, Coral, and Plankton

To assist with assessing the potential effects on these receptors, the following results were determined:

- Crustaceans: The sound level of 202 dB re 1 µPa PK-PK from Payne et al. (2008) which is representative of no effects, was considered for seafloor sound levels; the sound level was reached at ranges between 307 and 778 m for the 3000 in^3 source.
- Bivalves: The distance where a particle acceleration of 37.57 ms^{-2} at the seafloor could occur was determined for comparing to results presented in Day et al. (2016a). This particle acceleration was reached at a maximum range of 6.0 and 10.5 m for water depths of 60 and 75 m.
- Sponges and coral: The PK sound level at the seafloor directly underneath the seismic source was estimated at all modelled sites and compared to the sound level of 226 dB re 1 µPa PK for sponges and corals (Heyward et al. 2018); the threshold was reached at the range of 11 m for the 40 m water depth and was not reached at any of the other considered depths.

1. Introduction

JASCO Applied Sciences (JASCO) performed a numerical estimation study of underwater sound levels associated with the planned Schlumberger Bonaparte Basin Marine Seismic Survey (MSS) to assist in understanding the potential acoustic effect on receptors including marine mammals, fish, sea turtles, benthic invertebrates, plankton, sponges, and corals.

This study considered a 3000 in^3 seismic source array. JASCO's specialised Airgun Array Source Model (AASM) was used to predict acoustic signatures and spectra (see Section 4.2). AASM accounts for individual airgun volumes, airgun bubble interactions, and array geometry to yield accurate source predictions.

Complementary underwater acoustic propagation models were used in conjunction with the array signature and spectra to estimate sound levels considering site specific environmental influences. Single-impulse sound fields were predicted at 21 unique geographic locations within the Operational Area and four representative scenarios for accumulated sound exposure level (SEL) modelling were considered. The single-impulse modelling locations and accumulated sound exposure scenarios were designed to be applicable throughout the Operational Area, and thus provide ranges to thresholds relevant to all fauna and receptors considered within the Environment Plan (EP), including the pygmy blue whale migration Biologically Important Area (BIA) and the Sahul Shelf Key Ecological Feature (KEF). The acquisition plan for the survey is proposed to be Continuous Line Acquisition, which involves acquiring during turns, and thus the source is continuously active - there is not a run out at the end of each line, followed by a quiet period and ramp up prior to the next acquisition line. Five representative animal movement modelling scenarios were considered for survey acquisition over 24 h (Section 2), with the scenarios designed to provide information which could be used to inform buffer zones around the pygmy blue whale migration BIA.

The modelling methodology considered source directivity and range-dependent environmental properties. The geology associated with locations where the source would be active (accounting for depth-based exclusions around the shoals) and within the greater region was considered and accounted for. The depth-based exclusion is defined as being the 60 m contour. Estimated underwater acoustic levels are presented as sound pressure levels (SPL, L_p), zero-to-peak pressure levels (PK, L_{pk}), peak-to-peak pressure levels (PK-PK; $L_{pk\text{-}pk}$), and either single-impulse (i.e., per-pulse) or accumulated sound exposure levels (SEL, L_E) as appropriate for different noise effect criteria.

The planned seismic acquisition area is adjacent to the pygmy blue whale migration BIA with a small overlapping area. Therefore, the acoustic modelling results were also used in conjunction with animal movement modelling ('animat modelling') simulations to predict the distance at which migrating pygmy blue whales (*Balaenoptera musculus brevicauda*) are expected to be exposed above threshold criteria for PTS, TTS, and behavioural response. Sound exposure distribution estimates are determined by moving large numbers of simulated animals (animats) through a modelled time-evolving sound field, computed using specialised sound source and sound propagation models. This approach provides the most realistic prediction of the maximum expected SPL and SEL_{24h} for comparison against the relevant thresholds.

Section 3 explains the metrics used to represent underwater acoustic fields and the effect criteria considered. Section 4 details the methodology for predicting the source levels and modelling the sound propagation, including the specifications of the seismic source and all environmental parameters the propagation models require. Section 4 also describes the methodology used in the animal movement and exposure modelling simulations. Section 5 presents the results, which are then discussed and summarised in Section 6.

2. Modelling Scenarios

A total of five nominal acquisition scenarios were considered using both acoustic propagation modelling and animal movement modelling, with one additional scenario considered using animal movement modelling only. Acoustic source and propagation modelling was done at 21 individual single-impulse sites for SEL and SPL while water column PK was assessed at six sites due to its low variability, with some sites being modelled at several tow azimuths to account for acquisition on turns. The locations of the modelled sites are provided in Table 4. The modelling considered a 3000 in^3 seismic source towed in a triple array configuration at a speed of ~4.5 knots. An impulse interval (inter-pulse interval) of 16.66 m and a crossline array separation of 40 m were assumed. The acoustic propagation modelling utilised a March sound speed profile as this this month will likely results favourable propagation conditions within potential acquisition time periods for the proposed survey.

The single impulse sites and the accumulated SEL scenarios were determined based on proposed survey line plans with lines orientated either at 26/206° or 159/339°. Where required for the 24 h scenarios, different tow directions were modelled due to the asymmetrical nature of the seismic source. The locations were selected based on their proximity to shoals and were inclusive of depths that support the greatest sound propagation into deep waters towards the pygmy blue whale (PBW) migratory Biologically Important Area (BIA). The single impulse sites and accumulated SEL scenarios are representative of the range of water depths and the potential sound propagation characteristics within the Acquisition Area. The modelling scenario design also considered the depth-based exclusion zone around the shoals, which is based on the 60 m contour. Seafloor sound levels were assessed at eight different representative depths within the Acquisition Area (40, 50, 60, 75, 100, 125, 150, and 200 m). Depths of 40, 50 and 60 m were assessed in relation to proximity to shoal features, and 75 m was representative of the minimum depth in the acquisition area not associated with shoals.

A total of four acquisition scenarios were considered using both acoustic and animal movement modelling. A fifth scenario was included for animal movement modelling only, in this scenario the considered survey lines were further from the BIA, and it was considered with the aim of determining potential buffer zones around the BIA through the use of unrestricted animat seeding. All animat simulations were run in two configurations: one with animats restricted to the BIA, and another with unrestricted animat seeding.

All five scenarios considered continuous 24 h acquisition, including on turns. A speed of 4.5 kts and an inter-pulse interval of 16.66 m results in a total of approximately 12,000 impulses per scenario.

Table 4. Location details for the single impulse modelled sites. Sites were modelled at the tow azimuths used to model the 24 h scenario.

Scenario	Site	Tow Azimuth (°)	Latitude (°S)	Longitude (°E)	MGA[1] Zone 51 X (m)	MGA[1] Zone 51 Y (m)	Water depth (m)
1	1	26	11° 02' 22.39"	125° 35' 14.24"	782697	8778424	221
	2	26	11° 06' 09.47"	125° 33' 02.29"	778630	8771478	211
	3	26	11° 12' 34.88"	125° 29' 54.01"	772813	8759678	115
	4	26	11° 20' 32.88"	125° 26' 0.19"	765595	8745044	103
	5	26	11° 44' 31.93"	125° 15' 07.03"	745435	8700971	114
	6	26	12° 05' 17.80"	125° 12' 48.97"	740947	8662710	108
	7	26	11° 17' 49.22"	125° 34' 47.81"	781646	8749937	104
2	8	26	11° 47' 30.06"	124° 57' 49.59"	713976	8695732	198
	9	26	11° 51' 28.63"	124° 55' 51.92"	710363	8688425	133
	10	26	12° 04' 07.95"	124° 49' 36.86"	698856	8665167	119
	11	26	12° 01' 55.17"	124° 58' 11.57"	714453	8669140	114
	12	26	11° 50' 33.44"	125° 03' 47.82"	724781	8690018	117
	13	71	11° 45' 41.09"	124° 59' 15.40"	716598	8699062	208
	14	116	11° 46' 07.88"	125° 02' 44.19"	722915	8698194	155
	15	26	12° 14' 20.82"	124° 47' 47.25"	695416	8646355	117
3	16	159	12° 16' 24.06"	125° 10' 56.47"	737379	8642258	95
	17	159	11° 54' 47.92"	125° 02' 38.27"	722618	8682212	118
	18	159	Reprocessing Site 12 with new tow azimuth				
	19	114	Reprocessing Site 14 with new tow azimuth				
	20	69	Reprocessing Site 8 with new tow azimuth				
	21	24	Reprocessing Site 9 with new tow azimuth				
	22	159	12° 01' 9.48"	125° 14' 40.57"	744386	8670315	101
4	23	296	11° 06' 17.02"	125° 40' 51.69"	792881	8771120	108
	24	26	11° 16' 25.43"	125° 59' 21.17"	826386	8752088	95
	25	296	11° 08' 15.83"	125° 52' 10.46"	813459	8767274	101
	26	251	Reprocessing Site 1 with new tow azimuth				
	27	161	Reprocessing Site 2 with new tow azimuth				
5	Scenario only for animal movement modelling using Sites 5, 7, and 25						

[1] Map Grid of Australia (MGA)

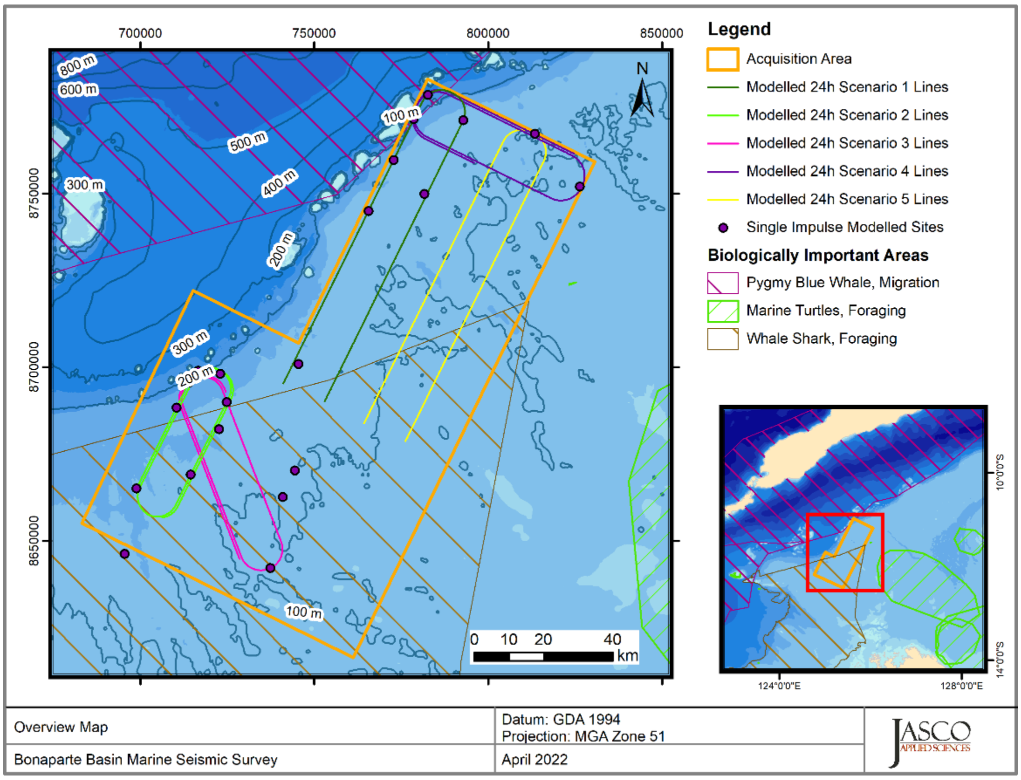

Figure 1. Overview of the modelled sites, acquisition lines, and features for the Bonaparte Basin Marine Seismic Survey (MSS).

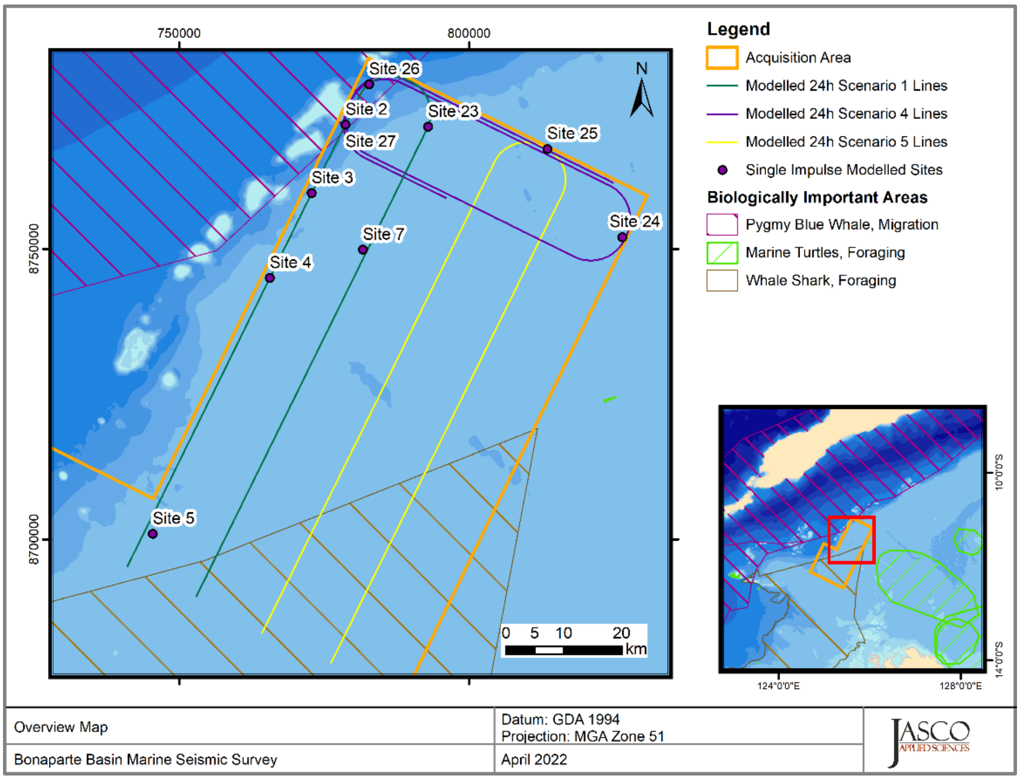

Figure 2. Scenarios 1, 4, and 5: Overview of the modelled sites, acquisition lines, and features for the Bonaparte Basin Marine Seismic Survey (MSS).

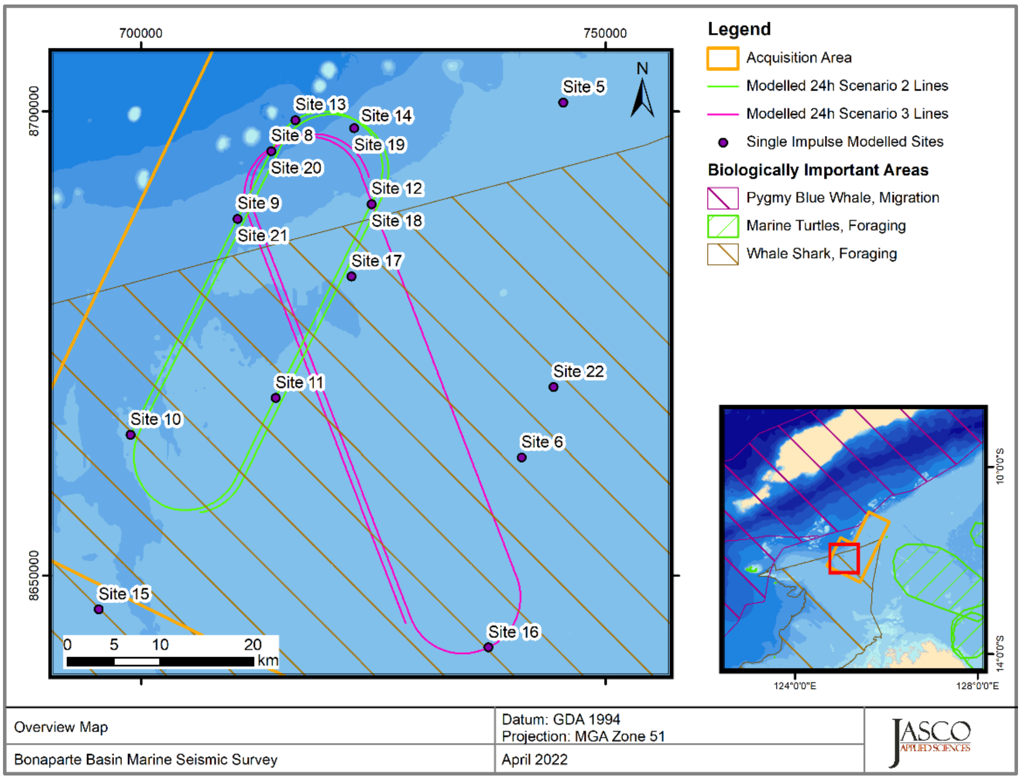

Figure 3. Scenarios 2 and 3: Overview of the modelled sites, acquisition lines, and features for the Bonaparte Basin Marine Seismic Survey (MSS).

3. Noise Effect Criteria

The perceived loudness of sound, especially impulsive noise such as from seismic airguns, is not generally proportional to the instantaneous acoustic pressure. Rather, perceived loudness depends on the pulse rise-time and duration, and the frequency content. Several sound level metrics, such as PK, SPL, and SEL, are commonly used to evaluate noise and its effects on marine life (Appendix A). The period of accumulation associated with SEL is defined, with this report referencing either a “per pulse” assessment or over 24 h. The acoustic metrics in this report reflect the updated ISO standard for acoustic terminology, ISO/DIS 18405:2017 (2017).

Whether acoustic exposure levels might injure or disturb marine mammals is an active research topic. Since 2007, several expert groups have developed SEL-based assessment approaches for evaluating auditory injury, with key works including Southall et al. (2007), Finneran and Jenkins (2012), Popper et al. (2014), United States National Marine Fisheries Service (NMFS 2018) and Southall et al. (2019b). The number of studies that have investigated the level of behavioural disturbance to marine fauna by anthropogenic sound has also increased substantially.

The following noise criteria and sound levels for this study were chosen because they include standard thresholds, thresholds suggested by the best available science, and sound levels presented in literature for species with no suggested thresholds (Sections 3.1–3.4 and Appendix A):

1. Peak pressure levels (PK; L_{pk}) and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24\text{h}}$) from (Southall et al. 2019b) for the onset of Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS) in marine mammals.
2. Marine mammal behavioural threshold based on the current US National Oceanic and Atmospheric Administration (NOAA 2019) criterion for marine mammals of 160 dB re 1 µPa (SPL; L_p) for impulsive sound sources.
3. Sound exposure guidelines for fish, fish eggs and larvae (including plankton) (Popper et al. 2014).
4. Peak pressure levels (PK; L_{pk}) and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24\text{h}}$) from Finneran et al. (2017) for the onset of permanent threshold shift (PTS) and temporary threshold shift (TTS) in turtles.
5. Sea turtle behavioural response threshold of 166 dB re 1 µPa (SPL; L_p), (McCauley et al. 2000) as cited in the Recovery Plan for Marine Turtles in Australia (Department of the Environment and Energy et al. 2017), along with a sound level associated with behavioural disturbance 175 dB re 1 µPa (SPL; L_p) (McCauley et al. 2000)
6. Peak-peak pressure levels (PK-PKS; $L_{pk\text{-pk}}$) and particle acceleration (ms^{-2}) at the seafloor to help assess effects of noise on crustaceans through comparing to results in Day et al. (2016a), Day et al. (2019), Day et al. (2016b), Day et al. (2017) and Payne et al. (2008).
7. A sound level of 226 dB re 1 µPa (PK; L_{pk}) reported for comparing to Heyward et al. (2018) for sponges and corals.

Additionally, to assess the size of the low-power zone required under the Australian Environment Protection and Biodiversity Conservation (EPBC) Act Policy Statement 2.1, Department of the Environment, Water, Heritage and the Arts (DEWHA 2008), the distance to an unweighted per-pulse SEL of 160 dB re 1 µPa^2·s (L_E) is reported.

The following subsections (Sections 3.1–3.4, along with Appendix A.3 and A.4), expand on the thresholds, guidelines and sound levels for marine mammals, fish, fish eggs, fish larvae, sea turtles, and benthic invertebrates.

3.1. Marine Mammals

There are two categories of auditory threshold shifts or hearing loss: permanent threshold shift (PTS), a physical injury to an animal's hearing organs; and Temporary Threshold Shift (TTS), a temporary reduction in an animal's hearing sensitivity as the result of receptor hair cells in the cochlea becoming fatigued.

To help assess the potential for the possible injury and hearing sensitivity changes in marine mammals, this report applies the criteria recommended by Southall et al. (2019b), considering both PTS and TTS. These criteria, along with the applied behavioural criteria (NOAA 2019), are summarised in Table 5, with descriptions included in Appendix A.3.1 (auditory impairment) and Appendix A.3.2 (behavioural response), with frequency weighting explained in Appendix A.4. Of particular note, whilst the newly published Southall et al. (2021) provides recommendations and discusses the nuances of assessing behavioural response, the authors do not recommend new numerical thresholds for onset of behavioural responses for marine mammals.

Table 5. Unweighted sound pressure level (SPL), 24-hour sound exposure level (SEL_{24h}), and peak pressure (PK) thresholds for acoustic effects on marine mammals.

Hearing group	NOAA (2019)	Southall et al. (2019b)			
	Behaviour	PTS onset thresholds[1] (received level)		TTS onset thresholds* (received level)	
	SPL (L_p; dB re 1 µPa)	Weighted SEL (L_E; dB re 1 µPa² s)	PK (L_{pk}; dB re 1 µPa)	Weighted SEL (L_E; dB re 1 µPa² s)	PK (L_{pk}; dB re 1 µPa)
Low-frequency cetaceans	160	183	219	168	213
High-frequency cetaceans		185	230	170	224
Very-high-frequency cetaceans		155	202	140	196
Sirenians		190	226	175	220

[1]Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS and TTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.
L_p-denotes sound pressure level period and has a reference value of 1 µPa.
L_{pk}, flat–peak sound pressure is flat weighted or unweighted and has a reference value of 1 µPa.
L_E - denotes cumulative sound exposure over a 24-hour period and has a reference value of 1 µPa²s.
Subscripts indicate the designated marine mammal auditory weighting.

3.2. Fish, Fish Eggs, and Fish Larvae

In 2006, the Working Group on the Effects of Sound on Fish and Turtles was formed to continue developing noise exposure criteria for fish and turtles, work begun by a panel convened by NOAA two years earlier. The resulting guidelines included specific thresholds for different levels of effects and for different groups of species (Popper et al. 2014). These guidelines defined quantitative thresholds for three types of immediate effects:

- Mortality, including injury leading to death.
- Recoverable injury, including injuries unlikely to result in mortality, such as hair cell damage and minor haematoma.
- TTS.

Masking and behavioural effects can be assessed qualitatively, by assessing relative risk rather than by specific sound level thresholds. However, as these depend upon activity-based subjective ranges, these effects are not addressed in this report and are included in Table 6 for completeness only. Because the presence or absence of a swim bladder has a role in hearing, fish's susceptibility to injury from noise exposure varies depending on the species and the presence and possible role of a swim bladder in hearing. Thus, different thresholds were proposed for fish without a swim bladder (also appropriate for sharks and applied to whale sharks in the absence of other information), fish with a swim bladder not used for hearing, and fish that use their swim bladders for hearing. Turtles, fish eggs, and fish larvae are considered separately. Table 6 lists relevant effects thresholds from Popper et al. (2014).

The SEL metric integrates noise intensity over some period of exposure. Because the period of integration for regulatory assessments is not well defined for sounds that do not have a clear start or end time, or for very long-lasting exposures, it is required to define a time. Popper et al. (2014) recommend applying a standard period, where this is either defined as a justified fixed period or the duration of the activity; however, Popper et al. (2014) also included caveats about how long the fish will be exposed because they can move (or remain in location) and so can the source. Popper et al. (2014) summarises that in all TTS studies considered, fish that showed TTS recovered to normal hearing levels within 18–24 hours. Due to this, a period of accumulation of 24 hours has been applied in this study for SEL, which is similar to that applied for marine mammals in NMFS (2016, 2018).

Additional information is provided in Appendix A.3.

Table 6. Criteria for seismic noise exposure for fish, adapted from Popper et al. (2014).

Type of animal	Mortality and Potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
Fish: No swim bladder (particle motion detection)	>219 dB SEL_{24h} or >213 dB PK	>216 dB SEL_{24h} or >213 dB PK	>>186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: Swim bladder not involved in hearing (particle motion detection)	210 dB SEL_{24h} or >207 dB PK	203 dB SEL_{24h} or >207 dB PK	>>186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: Swim bladder involved in hearing (primarily pressure detection)	207 dB SEL_{24h} or >207 dB PK	203 dB SEL_{24h} or >207 dB PK	186 dB SEL_{24h}	(N) Low (I) Low (F) Moderate	(N) High (I) High (F) Moderate
Fish eggs and fish larvae (relevant to plankton)	>210 dB SEL_{24h} or >207 dB PK	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Peak sound level (PK) dB re 1 µPa; SEL_{24h} dB re 1µPa^2·s. All criteria are presented as sound pressure, even for fish without swim bladders, since no data for particle motion exist. Relative risk (high, moderate, or low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

3.3. Sea Turtles

There is a paucity of data regarding responses of turtles to acoustic exposure, and no studies of hearing loss due to exposure to loud sounds. Popper et al. (2014) suggested thresholds for onset of mortal injury (including PTS) and mortality for sea turtles and, in absence of taxon-specific information, adopted the levels for fish that do not hear well (suggesting that this likely would be conservative for sea turtles).

Finneran et al. (2017) presented revised thresholds for sea turtle injury and hearing impairment (TTS and PTS). Their rationale is that sea turtles have best sensitivity at low frequencies and are known to have poor auditory sensitivity (Bartol and Ketten 2006, Dow Piniak et al. 2012). Accordingly, TTS and PTS thresholds for turtles are likely more similar to those of fishes than to marine mammals (Popper et al. 2014).

(McCauley et al. 2000) observed the behavioural response of caged sea turtles—green (Chelonia mydas) and loggerhead (Caretta caretta)—to an approaching seismic airgun. For received levels above 166 dB re 1 µPa (SPL), the sea turtles increased their swimming activity, and above 175 dB re 1 µPa they began to behave erratically, which was interpreted as an agitated state. The Recovery Plan for Marine Turtles in Australia (Department of the Environment and Energy et al. 2017) acknowledges the 166 dB re 1 µPa SPL reported by (McCauley et al. 2000) as the level that may result in a behavioural response to marine turtles. These thresholds are shown in Table 7.

Table 7. Acoustic effects of impulsive noise on sea turtles: Unweighted sound pressure level (SPL), 24 hour sound exposure level (SEL_{24h}), and peak pressure (PK) thresholds

Effect type	Criterion	SPL (L_p; dB re 1 µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	PK (L_{pk}; dB re 1 µPa)
Behavioural response	McCauley et al. (2000)	166	NA	
Behavioural disturbance		175		
PTS onset thresholds[1] (received level)	Finneran et al. (2017)	NA	204	232
TTS onset thresholds[1] (received level)			189	226

[1] Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS and TTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

L_p denotes sound pressure level period and has a reference value of 1 µPa.

$L_{pk,flat}$ denotes peak sound pressure is flat weighted or unweighted and has a reference value of 1 µPa.

L_E denotes cumulative sound exposure over a 24 h period and has a reference value of 1 µPa²s.

3.4. Invertebrates

3.4.1. Benthic Invertebrates (Crustaceans and Bivalves)

Research is ongoing into the relationship between sound and its effects on crustaceans, including the relevant metrics for both effect and impact. Available literature suggests particle motion, rather than sound pressure, is a more important factor for crustacean and bivalve hearing. Water depth and seismic source size are related to the particle motion levels at the seafloor, with larger arrays and shallower water being related to higher particle motion levels, more likely relevant to effects on crustaceans and bivalves.

At the seafloor interface, crustaceans and bivalves are subject to particle motion stimuli from several acoustic or acoustically-induced waves. These include the particle motion associated with an impinging sound pressure wave in the water column (the incident, reflected, and transmitted portions), substrate acoustic waves, and interface waves of the Scholte type. However, it is unclear which aspect(s) of these waves is/are most relevant to the animals, either when they normally sense the environment or their physiological responses to loud sounds so there is not enough information to establish similar criteria and thresholds as done for marine mammals and fish. Including recent research, such as Day et al. (2016b), current literature does not clearly define an appropriate metric or identify relevant levels (pressure or particle motion) for an assessment. This includes the consideration of what particle motion levels lead to a behavioural response, or mortality. Therefore, at this stage, we cannot propose authoritative thresholds to inform the impact assessment. However, levels can be determined for pressure metrics presented in literature to assist the assessment.

The pressure and acceleration examples provided in Day et al. (2016a)(Figures 11 and 12) indicate that the acceleration and pressure signals occurred simultaneously, which was interpreted as an indication that the waterborne sounds were responsible for the accelerations measured by the geophones. For clarity, it is important to distinguish that the acceleration from waterborne sound energy is *not* ground roll, which Day et al. (2016a) correctly define as the sound that propagates along the interface at a speed lower than the shear wave speed of the sediment. However, the report subsequently uses ground roll for all further discussions of particle acceleration. While Day et al. (2016a) discuss that they chose the simplest measure of ground roll, it should have been referring to as 'the acceleration from waterborne sound energy', or 'waterborne acceleration' for short.

For crustaceans, a PK-PK sound level of 202 dB re 1 µPa (Payne et al. 2008) is considered to be associated with no effect, and therefore applied in the assessment. Additionally for context related to different levels of potential impairment, the PK-PK sound levels determined for crustaceans in Day et al. (2016b), 209–212 dB re 1 µPa and 213 dB re 1 µPa from Day et al. (2019), are also included.

For bivalves, PK-PK sound levels of 212, and 213 are presented to allow comparison to the maximum sound levels measured in Day et al. (2016a) and Day et al. (2017) for scallops and pearl shell oyster.

Literature does not present a sound level associated with no impact, and as particle motion is the more relevant metric, particle acceleration from the seismic source has been presented for comparing the results in Table 7 of Day et al. (2016a). The maximum particle acceleration assessed for scallops was 37.57 ms^{-2}.

3.4.2. Plankton

To assess effects on plankton, there are only a few studies to base threshold criteria on. Popper et al. (2014) cites many of the references and studies on potential impacts of noise emissions on fish eggs and larvae prior to 2014. Results presented in Day et al. (2016b) for embryonic lobsters and Fields et al. (2019) for copepods align with those presented in Popper et al. (2014), which is that mortality and sub-lethal injury are limited to within tens of metres of seismic sources. Additionally, the Popper et al. (2014) criteria (Table 6), are extrapolated from simulated pile driving signals which have a more rapid rise time and greater potential for trauma than pulses from a seismic source.

Other research, such as McCauley et al. (2017), has indicated the potential for effects at longer range and at levels of 178 dB PK-PK, however, Fields et al. (2019) noted that it was difficult to reconcile the high mortality reported by McCauley et al. (2017) with the low mortalities reported in the greater previous body of earlier research and their experiment. They recommended further research into whether it is the sound pulse itself (i.e., the energy, peak pressures, or particle acceleration), the (turbulent) fluid flow occurring more slowly (i.e., not related to the sound pulse), or other effects such as the bubble cloud that which might cause higher mortality near the seismic source.

4. Methods

4.1. Parameter Overview

The specifications of the seismic sources and the environmental parameters used in the propagation models are described in detail in Appendix D. A single sound speed profile for March was considered in this modelling study; this was identified as the seasonal period that would provide the farthest propagation (Appendix D.3.2).

Seabed sediments in the Acquisition area were mostly characterised as sandy silt where the modelled sites are in depths of 95–221 m. The seabed was modelled as increasingly consolidated sandy silt. The geology used for the modelling is based on the geology under the modelled sites, rather than the geology of locations the active source was not passing over (the tops of the shoals off the continental shelf). A detailed description and discussion of the geology in relation to the shoals, along with the profile used, are presented in Appendix D.3.3.

4.2. Acoustic Source Model

The pressure signature of the individual airguns and the composite decidecade-band point-source equivalent directional levels (i.e., source levels) of the 3000 in^3 seismic source were modelled with JASCO's Airgun Array Source Model (AASM). Although AASM accounts for notional pressure signatures of each seismic source with respect to the effects of surface-reflected signals on bubble oscillations and inter-bubble interactions, the surface-reflected signal (known as surface ghost) is not included in the far-field source signatures. The acoustic propagation models account for those surface reflections, which are a property of the propagating medium rather than the source.

AASM considers:

- Array layout.
- Volume, tow depth, and firing pressure of each airgun.
- Interactions between different airguns in the array.

All seismic sources considered were modelled over AASM's full frequency range, up to 25 kHz. Appendix B.1 details this model.

4.3. Sound Propagation Models

Three sound propagation models were used to predict the acoustic field around the seismic source:

- Combined range-dependent parabolic equation and Gaussian beam acoustic ray-trace model (MONM-BELLHOP, 5 Hz to 25 kHz).
- Full Waveform Range-dependent Acoustic Model (FWRAM, 5 to 1024 Hz).
- Wavenumber integration model (VSTACK, 5 to 1024 Hz).

The models were used in combination to characterise the acoustic fields at short and long ranges in terms of SEL, SPL, PK, and PK-PK. Appendix C details each model. MONM-BELLHOP was used to calculate SEL of a 360° area around each source location. FWRAM was used to model synthetic seismic pulses and to generate a generalised range-dependent SEL to SPL conversion function for the considered modelled sites. The range-dependent conversion function was applied to predicted per-pulse SEL results from MONM-BELLHOP to estimate SPL values. FWRAM was also used to calculate water column PK and PK-PK levels.

VSTACK was used to calculate close range PK, PK-PK, and particle motion levels along 4 transects at the seafloor along the endfire and broadside directions of the seismic source at 8 water depths. For the depths 40, 50, 60, 75, 100, 125, 150, and 200 m PK values were calculated at 50 cm above the seabed. For depths 60, 75–200 the PK-PK ranges were calculated at 5 cm above the seabed, and water depths of 60, 75, 100, 150 m were used for particle motion calculations at 5 cm.

4.4. Geometry and Modelled Regions

To assess sound levels with MONM-BELLHOP, the sound field modelling calculated propagation losses up to distances of 100 km from the source in each cardinal direction, with a horizontal separation of 20 m between receiver points along the modelled radials. The sound fields were modelled with a horizontal angular resolution of $\Delta\theta$ = 2.5° for a total of N = 144 radial planes. Receiver depths were chosen to span the entire water column over the modelled areas, from 2 m to a maximum of 2600 m, with step sizes that increased with depth. To supplement the MONM results, high-frequency results for propagation loss were modelled using BELLHOP for frequencies from 1.25 to 25 kHz. The MONM and Bellhop results were combined to produce results for the full frequency range of interest.

FWRAM was run to 100 km along four radials (fore and aft endfire, and port and starboard broadside) for computational efficiency. This was done to compute SEL-to-SPL conversions (Appendix D.2) but also to quantify water column PK and PK-PK. The horizontal range step begins at 20 m and increases with range from the source.

The maximum modelled range for VSTACK was 1000 m, and a variable receiver range increment that increased away from the source was used, which increased from 10 to 25 m. Received levels were computed for receivers at 5 and 50 cm above the seafloor to assist in the assessment on invertebrates and fish respectively.

4.5. Accumulated SEL

During a seismic survey, new sound energy is introduced into an environment with each pulse from the seismic source. While some impact criteria are based on the per-pulse energy released, others, such as the marine mammal and fish SEL criteria used in this report (Sections 3.1–3.2), account for the total acoustic energy marine fauna is subjected to over a specified duration, defined in this report as 24 h. An accurate assessment of the accumulated sound energy depends not only on the parameters of each seismic impulse but also on the number of impulses delivered in a duration and the relative positions of the impulses.

When there are many seismic pulses, it becomes computationally prohibitive to perform sound propagation modelling for every single event. The distance between the consecutive seismic impulses is small enough, however, that the environmental parameters that influence sound propagation are virtually the same for many impulse points. The acoustic fields can, therefore, be modelled for a subset of seismic pulses and estimated at several adjacent ones. After sound fields from representative impulse locations are calculated, they are adjusted to account for the source position for nearby impulses.

The planned Bonaparte Basin MSS has been proposed to incorporate continuous line acquisition where the seismic source will be operational during line turns. It would be similarly impractical to model acquisition during turns where the tow azimuth for the seismic source is constantly changing. To approximate the sound field around a turn, modelled sites were reprocessed with 5 tow azimuths at angles of 0, 45, 90, 135, and 180° relative to the main survey line. As the modelled vessel traversed a curved track, the azimuth was calculated and at each point along the turn the closest azimuth of these 5 tow directions was used.

Although estimating the accumulated sound field with the described approach is not as precise as modelling sound propagation at every impulse location, small-scale, site-specific sound propagation features tend to blur and become less relevant when sound fields from adjacent impulses are summed. Larger scale sound propagation features, primarily dependent on water depth, dominate the cumulative field. The accuracy of the present method acceptably reflects those large-scale features, thus providing a meaningful estimate of a wide area SEL field in a computationally feasible framework.

To produce the map of accumulated received sound level distributions and calculate distances to specified sound level thresholds, the maximum-over-depth level was calculated at each sampling point within the modelled region. The radial grids of maximum-over-depth and seafloor sound levels for each impulse were then resampled (by linear triangulation) to produce a regular Cartesian grid. The sound field grids from all impulses were summed (Equation A-5) to produce the cumulative sound field grid with cell sizes of 20 m. The contours and threshold ranges were calculated from these flat Cartesian projections of the modelled acoustic fields.

The unweighted (fish) and frequency-weighted SEL_{24h} results were rendered as contour maps, including contours that focus on the relevant criteria-based thresholds. Only contours at ranges larger than the nearfield of the seismic source were rendered.

4.6. Animal Movement and Exposure Modelling

4.6.1. Methodology

The JASCO Animal Simulation Model Including Noise Exposure (JASMINE) was used to predict the exposure of animats to sound arising from the seismic activity. JASMINE integrates the predicted sound field with biologically meaningful movement rules for each marine mammal species (pygmy blue whales for the current analysis) that results in an exposure history for each animat in the model. In JASMINE, the sound received by the animats is determined by the proposed seismic operations. As illustrated in Figure 4, animats are programmed to behave like the marine animals that may be present in an area. The parameters used for forecasting realistic behaviours (e.g., diving and foraging depth, swim speed, surface times) are determined and interpreted from marine mammal studies (e.g., tagging studies) where available, or reasonably extrapolated from related or comparable species. For cumulative metrics, an individual animat's sound exposure levels are summed over a 24 h duration to determine its total received energy, and then compared to the relevant threshold criteria. For single-exposure metrics, the maximum exposure is evaluated against threshold criteria for each 24 h period. For additional information on JASMINE, see Appendix D.4.

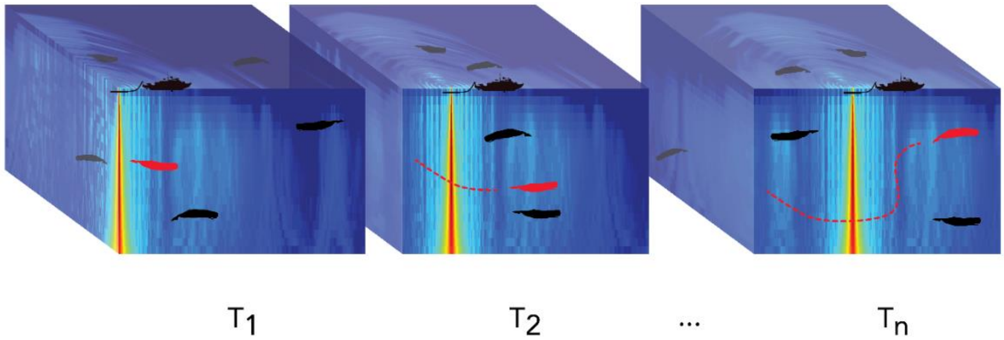

Figure 4. Depiction of animats in a moving sound field. Example animat (red) shown moving with each time step (T_n). The acoustic exposure of each animat is determined by where it is in the sound field, and its exposure history is accumulated as the simulation steps through time.

The exposure criteria for impulsive sounds (described in Section 3) were used to determine the number of animats that exceeded thresholds. To generate statistically reliable probability density functions, model simulations were run with animat sampling densities of 4 animats/km^2. The modelling results are not related to real-world density estimates for pygmy blue whales within the BIA, as the number of animals potentially exposed is not calculated. To evaluate PTS, TTS and behavioural response, exposure results were obtained using detailed behavioural information for migrating pygmy blue whales (described in Section 4.6.3). The simulation was run for a representative period of 24 h, with the spatial distribution of the animats restricted to the BIA.

The seismic source was modelled as a vessel towing an airgun array at a speed of ~4.5 knots, with an impulse interval of 16.66 m. The simulated source tracks followed a racetrack configuration with acquisition occurring on turns. At the time and location of each seismic pulse, the modelled source location with the closest distance was selected for exposure modelling. The track lines along with the acoustic modelling locations are shown in Figure 1.

Figure 5 shows an example animat track (generated for information purposes only and not related to the results presented in this report) with associated received levels from a stationary point source. The top panel displays the animat track relative to the point source, and the bottom panel displays the accumulation of SEL_{24h} for TTS and PTS criteria. At approximately 50 seconds, the animat is exposed so that the TTS threshold is exceeded, and at approximately 700 seconds the animat is exposed so that the PTS threshold is exceeded.

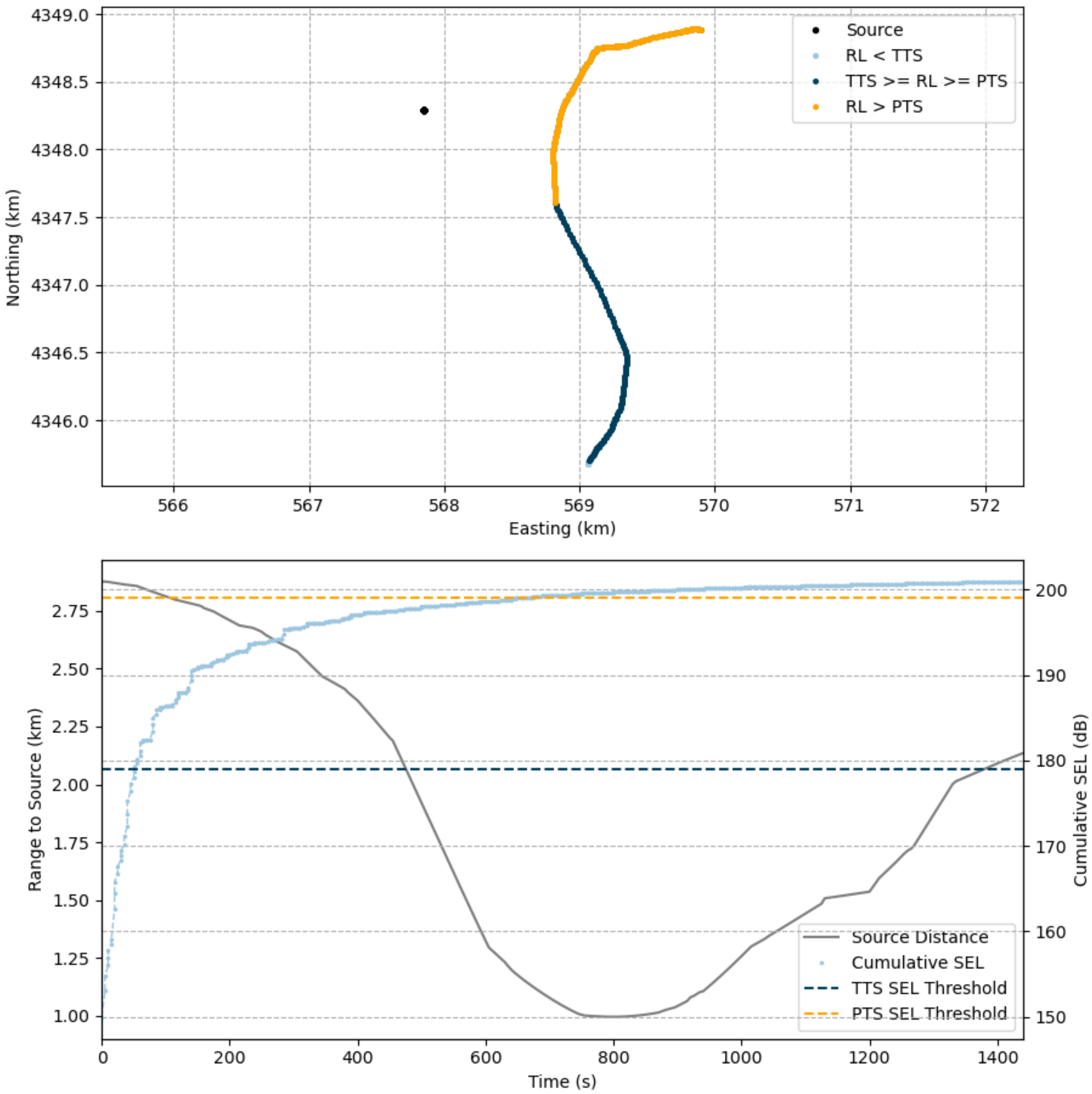

Figure 5. Animat track from an example simulation showing northward movement over a duration of 1400 seconds. The upper panel shows a plan view of both a stationary point source and a foraging animat. Animat steps are coloured to indicate whether the accumulated sound energy at that point has exceeded either TTS or PTS threshold criteria. The lower panel shows horizontal distance in kilometres to the source (grey line; left y-axis) and cumulative 24-h SEL ($L_{E,24h}$, dB re 1 µPa²·s; right y-axis) as a function of time. Note that this example does not use data from the current study.

4.6.2. Exposure–based Radial Distance Estimation

The results from the animal movement and exposure modelling provided a way to estimate radial distances to effect thresholds. The distance to the closest point of approach (CPA) for each of the animats was recorded. The $ER_{95\%}$ (95% Exposure Range) is the horizontal distance that includes 95% of the animat CPAs that exceeded a given effect threshold (see Section 3.1). Within the $ER_{95\%}$, there is generally some proportion of animats that do not exceed threshold criteria. This occurs for several reasons, including the spatial and temporal characteristics of the sound field and the way in which animats sample the sound field over time, both vertically and horizontally. The sound field varies as a function of range, depth, and azimuth based on a variety of factors such as bathymetry, sound speed profile, and geoacoustic parameters. The way the animats sample the sound field depends upon species-typical swimming and diving characteristics (e.g., swim speed, dive depth, surface intervals, and reversals). Furthermore, even within a particular species definition, these characteristics vary with behavioral state (e.g., feeding, migrating). As this results in some animats not exceeding threshold criteria even within the $ER_{95\%}$, the probability that an animat within that distance was exposed above threshold within the $ER_{95\%}$ was also computed (P_{exp}) to provide additional context.

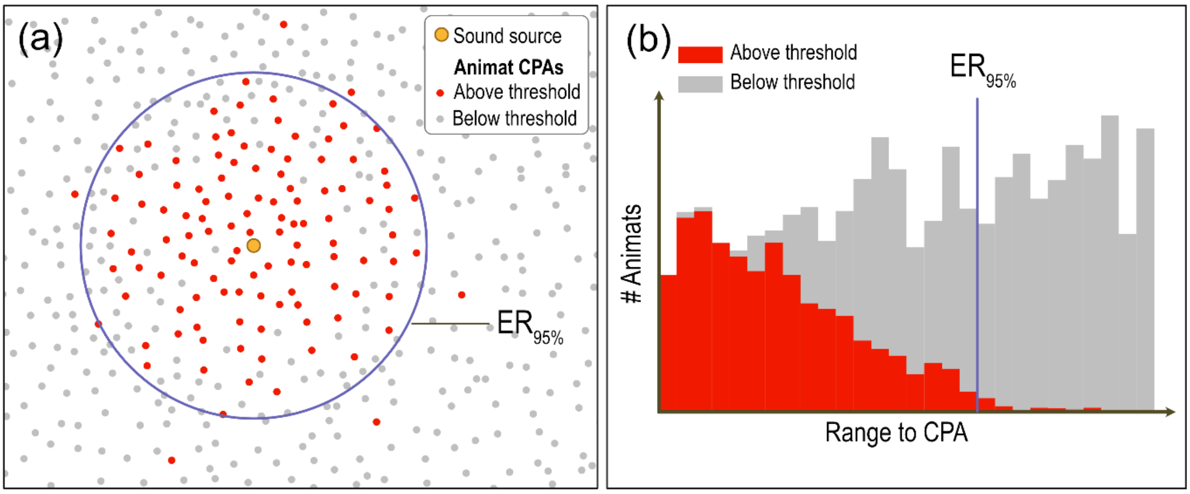

Figure 6. Example distribution of animat closest points of approach (CPAs). Panel (a) shows the horizontal distribution of animats near a sound source. Panel (b) shows the distribution of distances to animat CPAs. The 95% exposure range ($ER_{95\%}$) is indicated in both panels.

4.6.3. Pygmy Blue Whale Behaviour Profile

The Bonaparte Basin MSS is adjacent to and overlaps with the migration BIA for pygmy blue whales, along with the therefore migratory behaviour was the only behavioural profile considered. The north-bound migrations were modelled to account for variability in movement and diving behaviour during the month of March, which was selected for sound propagation modelling. The north-bound migration was used as a nominal migratory direction as there is insufficient publicly available data to differentiate between parameters for different migratory directions.

Detailed information on pygmy blue whales was derived from a range of sources that used multi-sensor tags to record fine-scale dive and movement behaviour (Owen et al. 2016, Möller et al. 2020). Where information was unavailable for pygmy blue whales, parameters were derived from blue whale (*B. musculus*) tagging data (Goldbogen et al. 2011).

Multi-sensor tags typically record the depth of an animal along with various movement parameters such as swim speed and their body's orientation. Owen et al. (2016) equipped a sub-adult pygmy blue whale with a multi-sensor tag off Western Australia. They identified dives for their tagged animal as migratory, feeding, or exploratory (i.e., no lunges recorded which would indicate feeding). Pygmy blue whales in the simulation area are presumed to be migrating, and so feeding was not included in the model. Exploratory dives were considered to be part of migratory behaviour, and so the two dive types were modelled together such that the animats were migrating 96% of the time and engaged in exploratory dives 4% of the time (Owen et al. 2016). Using data from Owen et al. (2016), the approximate length of a bout of exploratory dives could be determined, as well as the average (± SD) depth of this dive type. The analysis of the dive data showed that the depth of migratory dives was highly consistent over time and unrelated to local bathymetry. The mean depth of migratory dives was 14 ± 4 m while the mean maximum depth of exploratory dives was 107 ± 81 m (23–320 m range).

The behaviour of migrating pygmy blue whales was modelled to reflect animats transiting through the modelling area on a 50° track. This represents the animals migrating along the west coast of Australia, to and from Indonesia (Double et al. 2014, DoE (AU) 2015-2025). The speed of travel for migratory behaviour (1.17 ± 0.60 m/s) and exploratory dives (0.88 ± 0.14 m/s) were calculated from data presented in Möller et al. (2020).

5. Results

5.1. Acoustic Source Levels and Directivity

AASM (Section 4.2) was used to predict the horizontal and vertical overpressure signatures and corresponding power spectrum levels for the seismic sources, with results provided in Appendix B.3 along with the horizontal directivity plots for the selected source.

Table 8 shows the PK and per-pulse SEL source levels in the horizontal-plane broadside (perpendicular to the tow direction), endfire (along the tow direction), and vertical directions for the modelled array signature (3000 in^3 source). The vertical source level that accounts for the "surface ghost" (the out of phase reflected pulse from the water surface) is also presented to make it easier to compare the output of other seismic source models.

Figure B-2 in Appendix B.3 shows the broadside, endfire, and vertical overpressure signature and corresponding power spectrum levels for the source. The signature consists of a strong primary peak, related to the initial release of high-pressure air, followed by a series of pulses associated with bubble oscillations. Most energy was produced at frequencies below 500 Hz. Frequency-dependent peaks and nulls in the spectrum result from interference among airguns in the source and correspond with the volumes and relative locations of the airguns to each other.

Table 8. Far-field source level specifications for 3000 in^3 source, for an 8 m tow depth. Source levels are for a point-like acoustic source with equivalent far-field acoustic output in the specified direction. Sound level metrics are per-pulse and unweighted.

Direction	Peak source pressure level ($L_{S,pk}$; dB re 1 µPa m)	Per-pulse source SEL ($L_{S,E}$; dB 1 µPa^{2}m^{2}s)	
		10–2000 Hz	2000–25000 Hz
Broadside	250.1	225.3	185.4
Endfire	245.0	223.0	186.4
Vertical	256.3	228.8	195.1
Vertical (surface affected source level)	256.3	231.0	198.3

5.2. Per-pulse Sound Fields

This section presents the per-pulse sound fields in terms of maximum-over-depth SPL, SEL, PK, and seafloor PK and PK-PK. The different metrics are presented for the following reasons:

- SPL sound fields were used to determine the distances to marine mammal and turtle behavioural thresholds (see Sections 3.1 and 3.3).
- Per-pulse SEL sound fields are used as inputs into the 24 h SEL scenario and to provide context for the range to 160 dB re 1 µPa^2·s, relevant for the EPBC Act Policy Statement 2.1 (DEWHA 2008).
- PK metrics within the water column are relevant to thresholds and guidelines for marine mammals, sea turtles, fish, fish eggs and larvae (as well as plankton; Sections 3.1–3.3).
- PK metrics at the seafloor are relevant to guidelines for fish, fish eggs and larvae (Section 3.3) and the sound level for no effect on corals and sponges.

- PK-PK metrics at the seafloor are relevant to sound levels used in the assessment of effect on benthic invertebrates (Section 3.4.1).

The maximum and 95% distances to per-pulse SEL and SPL metrics are presented in Tables 9 through 16. The SPL sound fields, and distances to relevant isopleths can be visualised on the contour maps presented in Figures 7–33. The SPL sound fields are also presented as vertical slices for selected sites along the endfire and broadside directions out to 50 km, with the airgun array in the centre (Figures 34–39).

Maximum distances to maximum-over-depth water column PK thresholds were calculated for six modelled single impulse sites, Sites 1, 7, 8, 11, 14, and 22, this was done at the sites where FWRAM was applied to calculate the SEL-SPL conversion (Appendix C.2 and D-2), and presented in Table 17. Seafloor sound levels were assessed at eight different representative depths within the Operational Area (40, 50, 60, 75, 100, 125, 150, and 200 m), and Tables 18–19 present the PK and PK-PK results.

5.2.1. Tabulated Results

5.2.1.1. Entire Water Column

Table 9. *Scenario 1, 3000 in^3 source*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the seismic source to modelled maximum-over-depth and maximum-over-azimuth unweighted per-pulse sound exposure level (SEL) isopleths from the modelled single impulse sites, with water depth indicated.

Per-pulse SEL (L_E; dB re 1 µPa²·s)	Site 1 (221 m)		Site 2 (211 m)		Site 3 (115 m)		Site 4 (103 m)		Site 5 (114 m)		Site 6 (108 m)		Site 7 (103 m)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
190	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
180	0.19	0.16	0.18	0.16	0.33	0.28	0.33	0.29	0.32	0.27	0.33	0.28	0.33	0.29
170	0.96	0.83	0.99	0.83	1.47	1.20	1.54	1.28	1.49	1.20	1.52	1.22	1.56	1.31
160[1]	4.90	4.05	4.27	3.43	5.35	4.51	5.57	4.65	5.68	4.62	5.77	4.66	5.81	4.60
150	17.1	13.5	9.89	8.08	16.6	12.9	14.4	11.7	14.3	11.7	13.9	11.5	14.1	11.6
140	56.9	44.8	20.0	16.0	57.4	51.0	38.1	26.0	34.3	24.6	30.5	24.5	30.8	23.7
130	>100	/	68.3	46.7	>100	/	99.0	70.0	78.9	59.6	62.4	48.6	69.1	53.1

[1] Low power zone assessment criteria DEWHA (2008).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 10. *Scenario 2, 3000 in³ source*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the seismic source to modelled maximum-over-depth and maximum-over-azimuth unweighted per-pulse sound exposure level (SEL) isopleths from the modelled single impulse sites, with water depth indicated.

Per-pulse SEL (L_E; dB re 1 µPa²·s)	Site 8 (198 m)		Site 9 (113 m)		Site 10 (119 m)		Site 11 (114 m)		Site 12 (117 m)		Site 13 (208 m)		Site 14 (155 m)		Site 15 (117 m)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
190	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
180	0.20	0.17	0.30	0.25	0.32	0.27	0.32	0.27	0.32	0.27	0.19	0.16	0.25	0.21	0.32	0.27
170	1.19	0.94	1.33	1.06	1.37	1.19	1.49	1.20	1.43	1.19	1.22	0.89	1.17	1.00	1.41	1.19
160[1]	4.99	3.91	5.68	4.72	5.50	4.66	5.73	4.66	5.68	4.62	5.17	4.42	5.35	4.38	5.59	4.62
150	12.5	10.3	16.7	12.1	14.5	11.7	14.2	11.8	14.7	11.7	16.4	13.4	14.5	11.6	14.8	12.1
140	33.6	26.4	45.4	33.9	34.0	27.3	33.6	26.1	36.7	26.4	51.6	44.4	38.5	31.1	29.9	24.5
130	82.4	60.2	77.3	60.3	63.9	51.7	64.5	51.8	80.9	60.1	95.1	83.3	87.1	76.0	64.2	50.2

[1] Low power zone assessment criteria DEWHA (2008).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 11. *Scenario 3, 3000 in³ source*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the seismic source to modelled maximum-over-depth and maximum-over-azimuth unweighted per-pulse sound exposure level (SEL) isopleths from the modelled single impulse sites, with water depth indicated.

Per-pulse SEL (L_E; dB re 1 µPa²·s)	Site 16 (95 m)		Site 17 (118 m)		Site 18 (117 m)		Site 19 (155 m)		Site 20 (198 m)		Site 21 (133 m)		Site 22 (101 m)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
190	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
180	0.33	0.29	0.32	0.27	0.32	0.27	0.25	0.21	0.20	0.17	0.30	0.25	0.34	0.29
170	1.58	1.36	1.37	1.19	1.47	1.18	1.15	1.00	1.22	0.95	1.25	1.05	1.55	1.29
160[1]	5.37	4.61	5.48	4.66	5.38	4.63	5.31	4.39	5.80	4.33	5.73	4.77	5.72	4.74
150	14.0	11.5	14.6	11.7	13.9	11.7	14.7	11.7	17.4	13.9	15.9	12.0	15.0	12.2
140	33.4	27.3	33.8	26.5	32.6	27.0	40.5	31.9	54.8	46.8	44.0	32.4	30.9	26.0
130	90.0	63.8	71.3	55.2	72.8	56.7	87.9	77.5	>100	/	76.0	59.8	71.1	56.2

[1] Low power zone assessment criteria DEWHA (2008).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 12. *Scenario 4, 3000 in³ source*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the seismic source to modelled maximum-over-depth and maximum-over-azimuth unweighted per-pulse sound exposure level (SEL) isopleths from the modelled single impulse sites, with water depth indicated.

Per-pulse SEL (L_E; dB re 1 µPa²·s)	Site 23 (114 m)		Site 24 (108 m)		Site 25 (104 m)		Site 26 (95 m)		Site 27 (101 m)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
190	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
180	0.33	0.28	0.34	0.29	0.34	0.29	0.19	0.16	0.18	0.16
170	1.42	1.18	1.65	1.28	1.52	1.31	0.97	0.83	1.08	0.84
160[1]	5.50	4.55	5.49	4.72	5.58	4.58	5.18	4.10	4.81	4.03
150	19.8	12.3	14.6	12.0	14.7	12.1	16.0	12.1	12.9	10.3
140	30.2	24.7	33.3	27.0	35.5	28.0	50.4	40.9	27.6	23.1
130	66.2	50.8	70.1	56.6	71.6	53.6	>100	/	93.4	70.9

[1] Low power zone assessment criteria DEWHA (2008).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 13. *Scenario 1, 3000 in³ source*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the seismic source to modelled maximum-over-depth and maximum-over-azimuth per-pulse sound pressure level (SPL) isopleths from the modelled single impulse sites, with water depth indicated.

SPL (L_p; dB re 1 µPa)	Site 1 (221 m)		Site 2 (211 m)		Site 3 (115 m)		Site 4 (103 m)		Site 5 (114 m)		Site 6 (108 m)		Site 7 (103 m)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
200	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
190	0.16	0.14	0.16	0.14	0.27	0.22	0.28	0.23	0.27	0.22	0.27	0.23	0.28	0.23
180	0.86	0.71	0.90	0.75	1.20	0.96	1.27	1.08	1.23	1.01	1.25	1.05	1.25	1.07
175[1]	2.00	1.59	1.88	1.45	2.37	1.88	2.52	1.97	2.43	1.94	2.51	1.97	2.48	1.99
170	3.28	2.76	3.05	2.47	4.11	3.41	4.11	3.46	3.99	3.38	4.11	3.46	3.98	3.43
166[2]	6.15	5.16	4.87	3.82	6.07	4.84	6.07	5.06	6.19	5.14	6.24	5.13	6.18	5.16
160[3]	12.4	10.6	8.79	7.02	11.5	8.71	11.9	8.92	10.6	8.71	10.7	8.77	10.6	8.75
150	38.5	32.6	15.7	13.9	45.6	38.9	26.9	19.8	26.5	19.8	23.8	19.5	25.0	19.4
140	>100	/	51.4	31.0	>100	/	84.0	56.9	75.4	50.5	54.5	43.2	55.4	44.0

[1] Threshold for turtle behavioural disturbance from impulsive noise (McCauley et al. 2000).
[2] Threshold for turtle behavioural response to impulsive noise (McCauley et al. 2000).
[3] Marine mammal behavioural threshold for impulsive sound sources (NOAA 2019).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 14. *Scenario 2, 3000 in³ source*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the seismic source to modelled maximum-over-depth and maximum-over-azimuth per-pulse sound pressure level (SPL) isopleths from the modelled single impulse sites, with water depth indicated.

SPL (L_p; dB re 1 µPa)	Site 8 (198 m)		Site 9 (113 m)		Site 10 (119 m)		Site 11 (114 m)		Site 12 (117 m)		Site 13 (208 m)		Site 14 (155 m)		Site 15 (117 m)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
200	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
190	0.16	0.14	0.22	0.20	0.25	0.22	0.27	0.22	0.26	0.22	0.15	0.14	0.20	0.17	0.26	0.22
180	0.85	0.71	1.02	0.90	1.21	0.97	1.24	1.01	1.22	1.00	0.85	0.75	1.05	0.90	1.24	0.98
175[1]	2.00	1.69	2.08	1.84	2.18	1.93	2.37	1.87	2.44	1.91	1.82	1.55	2.16	1.80	2.39	1.88
170	4.38	3.47	3.90	3.22	3.97	3.26	3.96	3.31	4.03	3.29	3.64	2.85	3.59	3.02	3.94	3.27
166[2]	6.82	5.40	5.92	5.07	5.85	4.88	6.01	5.02	6.02	4.91	5.41	4.73	5.41	4.45	5.89	4.91
160[3]	11.5	9.41	11.5	9.14	10.4	8.68	10.4	8.66	10.4	8.45	11.6	9.18	11.9	10.0	11.3	8.86
150	22.3	18.5	36.0	24.2	26.2	21.2	26.8	20.7	27.3	19.4	38.6	32.4	26.4	21.3	23.3	19.4
140	73.1	56.0	69.9	55.9	57.3	45.4	59.3	45.5	71.6	55.1	83.8	72.9	72.1	61.4	55.8	43.2

[1] Threshold for turtle behavioural disturbance from impulsive noise (McCauley et al. 2000).
[2] Threshold for turtle behavioural response to impulsive noise (McCauley et al. 2000).
[3] Marine mammal behavioural threshold for impulsive sound sources (NOAA 2019).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 15. *Scenario 3, 3000 in³ source*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the seismic source to modelled maximum-over-depth and maximum-over-azimuth per-pulse sound pressure level (SPL) isopleths from the modelled single impulse sites, with water depth indicated.

SPL (L_p; dB re 1 µPa)	Site 16 (95 m)		Site 17 (118 m)		Site 18 (117 m)		Site 19 (155 m)		Site 20 (198 m)		Site 21 (133 m)		Site 22 (101 m)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
200	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
190	0.29	0.25	0.26	0.22	0.26	0.22	0.20	0.17	0.16	0.14	0.23	0.20	0.29	0.24
180	1.30	1.09	1.24	0.98	1.22	0.99	1.05	0.91	0.84	0.70	1.01	0.90	1.27	1.09
175[1]	2.50	2.04	2.19	1.95	2.14	1.90	2.17	1.81	2.14	1.71	2.07	1.84	2.49	1.99
170	4.07	3.53	4.11	3.40	3.98	3.28	3.65	3.04	4.81	3.82	3.87	3.22	4.34	3.39
166[2]	6.32	5.19	6.34	5.22	6.05	5.00	5.37	4.47	7.68	6.18	5.95	5.05	6.27	5.19
160[3]	10.9	9.07	10.7	9.00	10.4	8.73	11.8	10.1	14.3	11.3	11.4	9.11	11.5	9.44
150	27.4	22.6	28.1	22.0	25.3	20.7	27.5	21.6	47.9	40.8	34.2	23.1	26.4	21.7
140	77.0	54.1	62.3	48.4	59.9	47.6	73.6	62.8	91.6	74.7	68.2	55.4	61.0	49.0

[1] Threshold for turtle behavioural disturbance from impulsive noise (McCauley et al. 2000).
[2] Threshold for turtle behavioural response to impulsive noise (McCauley et al. 2000).
[3] Marine mammal behavioural threshold for impulsive sound sources (NOAA 2019).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 16. *Scenario 4, 3000 in^3 source*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the seismic source to modelled maximum-over-depth and maximum-over-azimuth per-pulse sound pressure level (SPL) isopleths from the modelled single impulse sites, with water depth indicated.

SPL (L_p; dB re 1 µPa)	Site 23 (114 m)		Site 24 (108 m)		Site 25 (104 m)		Site 26 (95 m)		Site 27 (101 m)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
200	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
190	0.27	0.23	0.29	0.25	0.29	0.24	0.15	0.14	0.15	0.14
180	1.23	1.04	1.31	1.09	1.24	1.06	0.87	0.71	0.83	0.69
175[1]	2.26	1.97	2.25	2.02	2.44	2.05	1.93	1.51	1.93	1.59
170	4.14	3.35	4.17	3.51	3.98	3.38	3.23	2.63	3.35	2.74
166[2]	5.90	4.92	6.27	5.12	6.07	5.00	5.82	4.71	5.96	4.71
160[3]	11.2	8.77	10.5	8.90	11.0	8.73	11.8	8.98	10.9	8.61
150	26.0	20.7	26.6	21.4	26.4	21.3	37.2	30.8	19.8	16.4
140	56.3	43.1	59.3	49.2	61.1	47.0	>100	/	73.4	52.5

[1] Threshold for turtle behavioural disturbance from impulsive noise (McCauley et al. 2000).
[2] Threshold for turtle behavioural response to impulsive noise (McCauley et al. 2000).
[3] Marine mammal behavioural threshold for impulsive sound sources (NOAA 2019).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 17. *3000 in³ source*: Maximum (R_{max}) horizontal distances (in km) from the seismic source to modelled maximum-over-depth peak pressure level (PK) thresholds based on Southall et al. (2019b) for marine mammals, and Popper et al. (2014) for fish and Finneran et al. (2017) for sea turtles, Sites 1, 7, 8, 11, 14, and 22), with water depth indicated.

Hearing group	PK threshold (L_{pk}; dB re 1 µPa)	Distance R_{max} (km)					
		Site 1 (221 m)	Site 7 (104 m)	Site 8 (198 m)	Site 11 (114 m)	Site 14 (155 m)	Site 22 (101 m)
Low-frequency cetaceans (PTS)	219	–	–	–	–	–	–
Low-frequency cetaceans (TTS)	213	0.08	0.08	0.08	0.08	0.08	0.08
High-frequency cetaceans (PTS)	230	–	–	–	–	–	–
High-frequency cetaceans (TTS)	224	–	–	–	–	–	–
Very-high-frequency cetaceans (PTS)	202	0.29	0.48	0.42	0.41	0.34	0.45
Very-high-frequency cetaceans (TTS)	196	0.92	0.82	0.85	0.79	0.87	0.81
Sea Turtles (PTS)	232	–	–	–	–	–	–
Sea Turtles (TTS)	226	–	–	–	–	–	–
Sirenians (PTS)	226	–	–	–	–	–	–
Sirenians (TTS)	220	–	–	–	–	–	–
Fish: No swim bladder (also applied to sharks)	213	0.08	0.08	0.08	0.08	0.08	0.08
Fish: Swim bladder not involved in hearing, Swim bladder involved in hearing Fish eggs, and larvae	207	0.17	0.19	0.17	0.15	0.16	0.20

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

5.2.1.2. Seafloor

Ranges presented at the seafloor (50 and 5 cm above the interface) provided in Tables 18 and 19 are different to those for the maximum-over-depth modelling results presented in Table 17. This is because the model used for the water column results, calculated using FWRAM do not represent the maximum sound levels at the seafloor close to the array. This is because FWRAM is based on a wide-angle parabolic equation (PE) algorithm which is valid to only approximately 70° down angle from the horizontal, and while it provides accurate predictions in the horizontal direction, it cannot predict sound levels directly under the array. The VSTACK model is used to determine the levels at the seafloor directly under the array, and due to seafloor interactions, these can be greater than those elsewhere in the water column.

Table 18. *3000 in³ source*: Maximum (R_{max}) horizontal distances (in m) from the seismic source to modelled seafloor (receiver located 50 cm above seafloor) peak pressure level thresholds (PK) at eight water depths within the Operational Area.

Hearing group/animal type	PK threshold (L_{pk}; dB re 1 µPa)	Distance R_{max} (m)							
		40 m	50 m	60 m	75 m	100 m	125 m	150 m	200 m
Sound levels for sponges and corals[1]	226	11	*	*	*	*	*	*	*
Fish: No swim bladder (also applied to sharks)	213	127	130	106	76	65	56	50	44
Fish: Swim bladder not involved in hearing, Swim bladder involved in hearing Fish eggs, and larvae	207	206	220	228	252	200	172	159	148

[1] Heyward et al. (2018)
An asterisk indicates that the sound level was not reached.

Table 19. *3000 in³ source*: Maximum (R_{max}) horizontal distances (in m) from the seismic source to modelled seafloor (receiver located 5 cm above seafloor) peak-peak pressure levels (PK-PK) at six water depths within the Operational Area. Results included in relation to benthic invertebrates.

PK-PK ($L_{pk\text{-}pk}$; dB re 1 µPa)	Distance R_{max} (m)					
	60 m	75 m	100 m	125 m	150 m	200 m
213[1,2,3]	220	241	259	214	185	132
212[2,3]	231	252	280	300	230	170
210[1,2]	266	267	302	320	336	220
209[1,2]	421	292	315	351	368	281
202[4]	778	307	340	365	394	426

[1] Day et al. (2019), lobster
[2] Day et al. (2016a), lobster and scallops
[3] Day et al. (2017), scallops.
[4] Payne et al. (2008), lobster

5.2.2. Sound Field Maps and Graphs

5.2.2.1. Sound Level Contour Maps

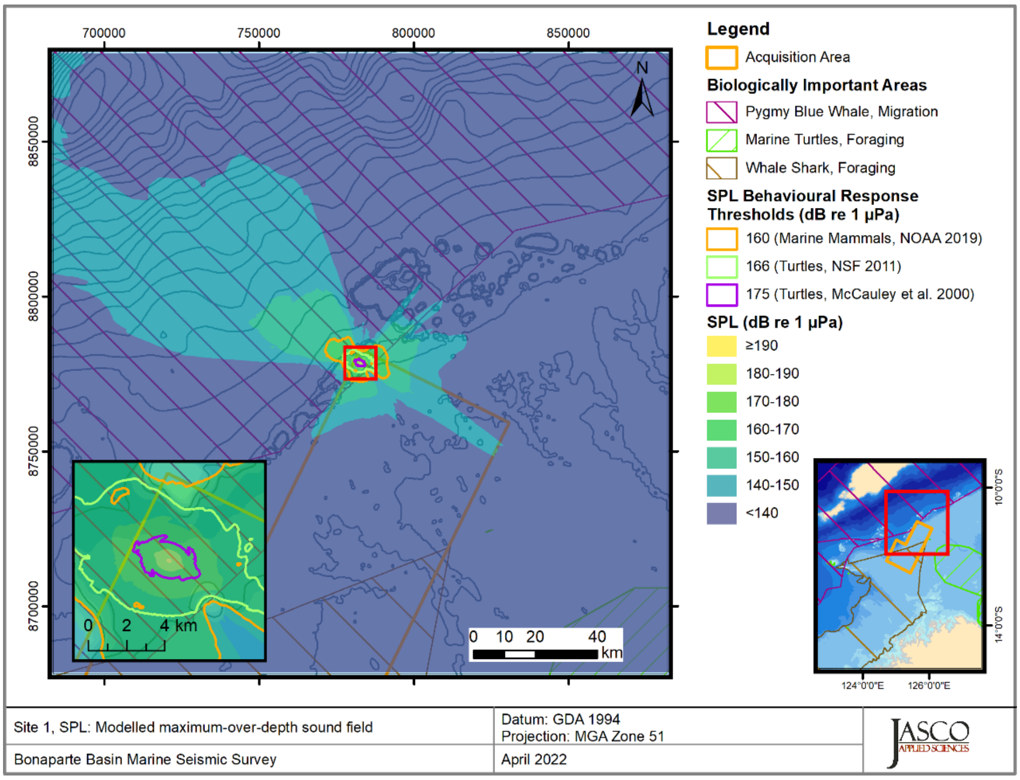

Figure 7. *Site 1, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

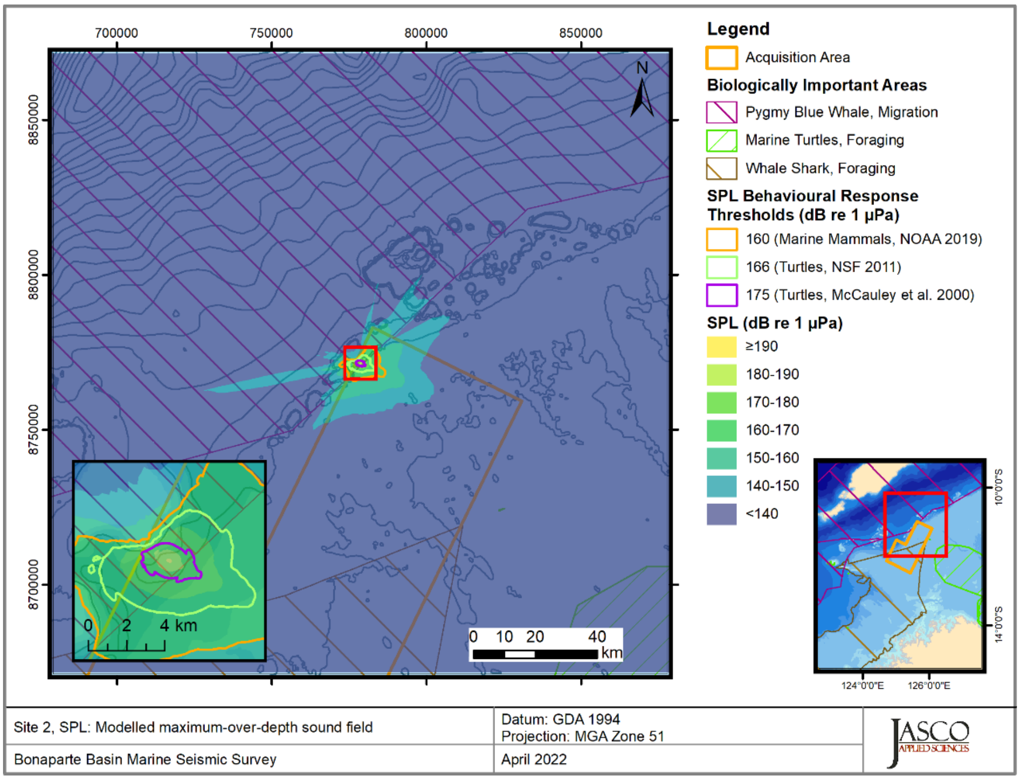

Figure 8. *Site 2, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

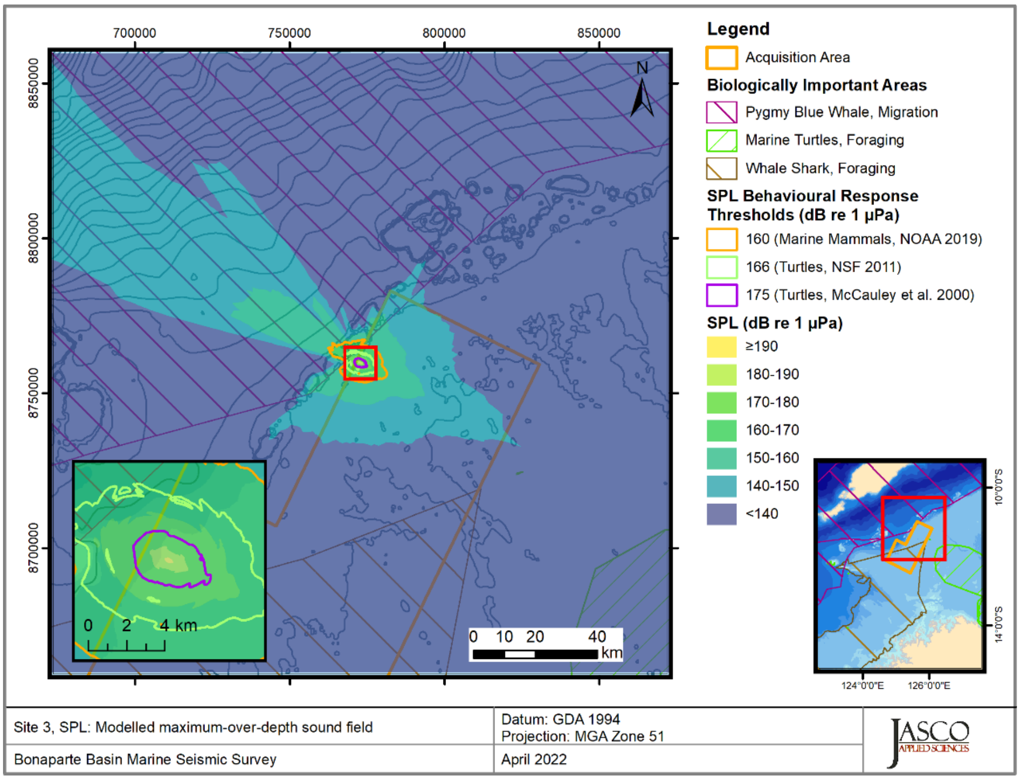

Figure 9. *Site 3, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

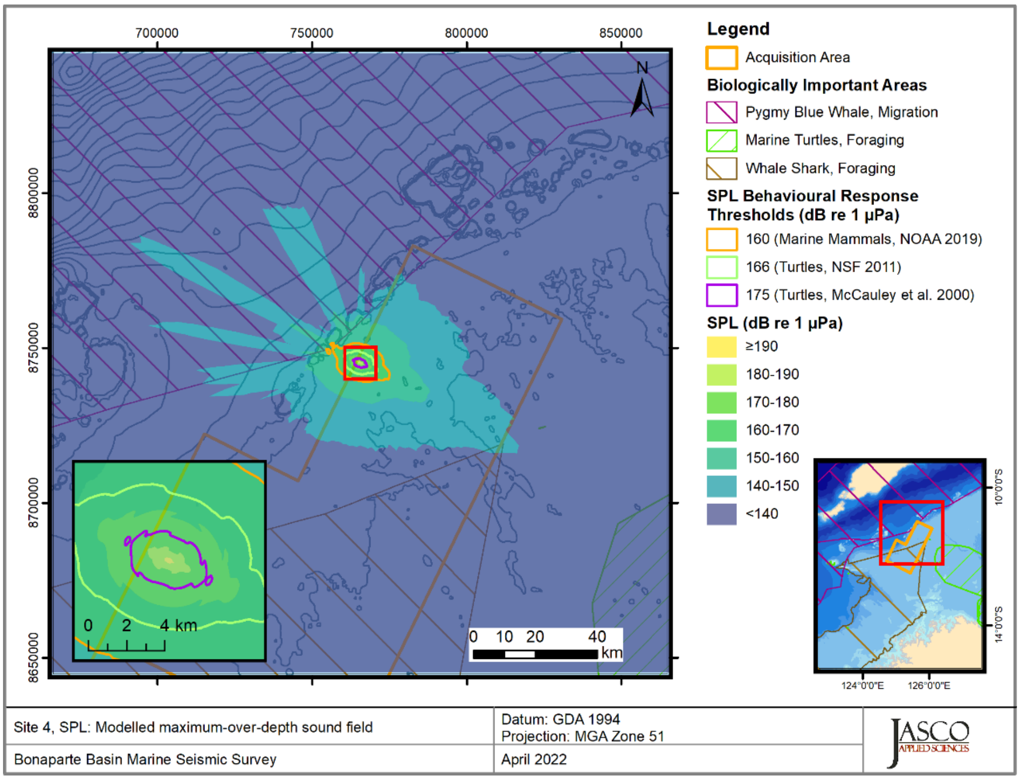

Figure 10. *Site 4, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

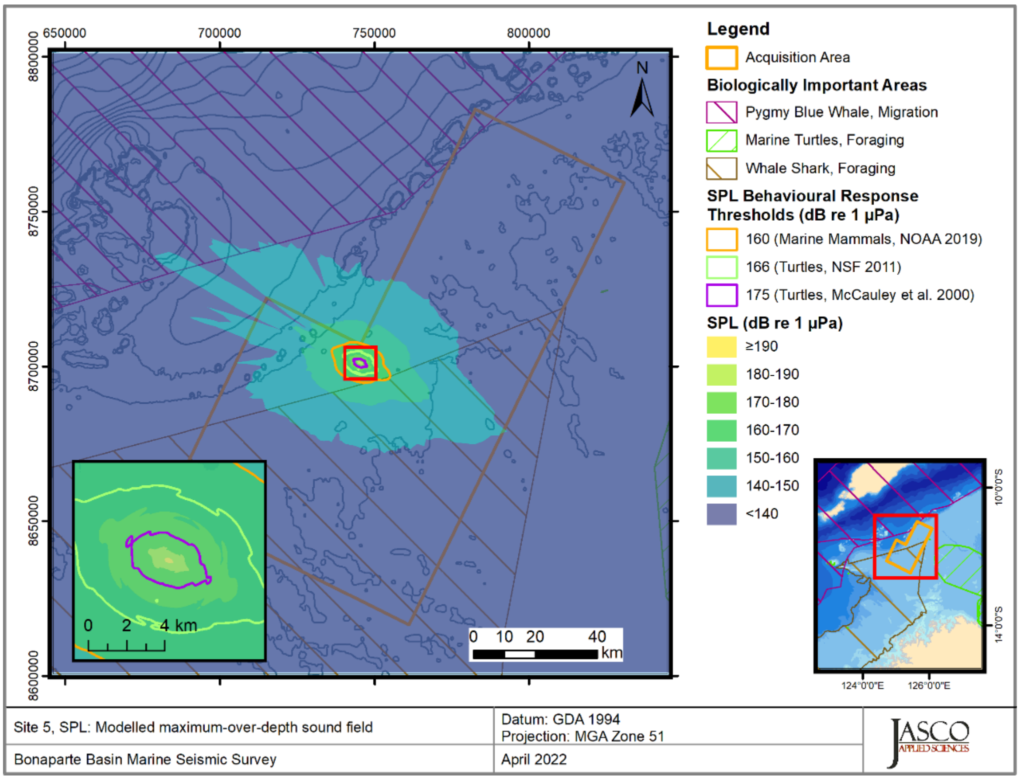

Figure 11. *Site 5, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

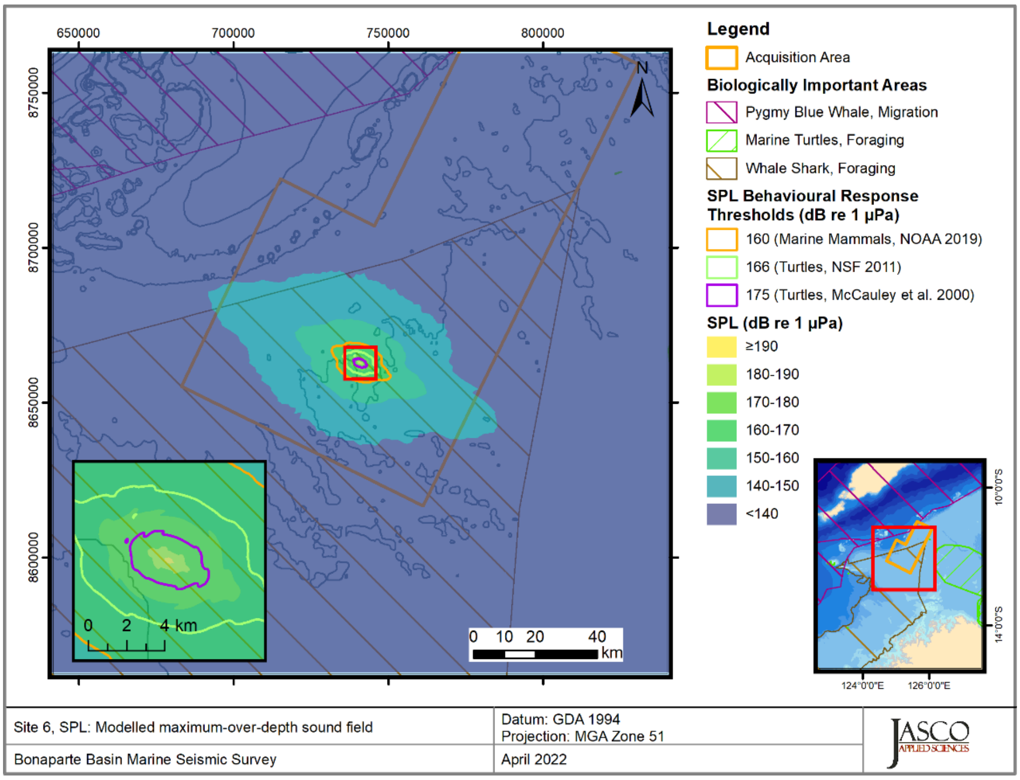

Figure 12. *Site 6, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

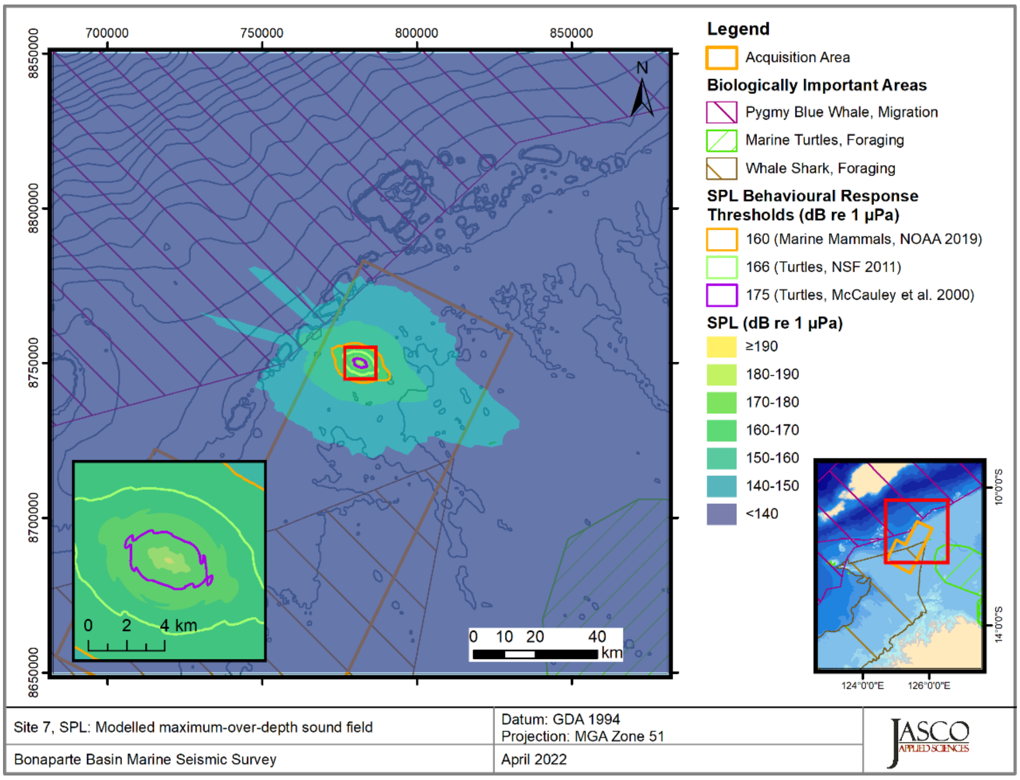

Figure 13. *Site 7, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

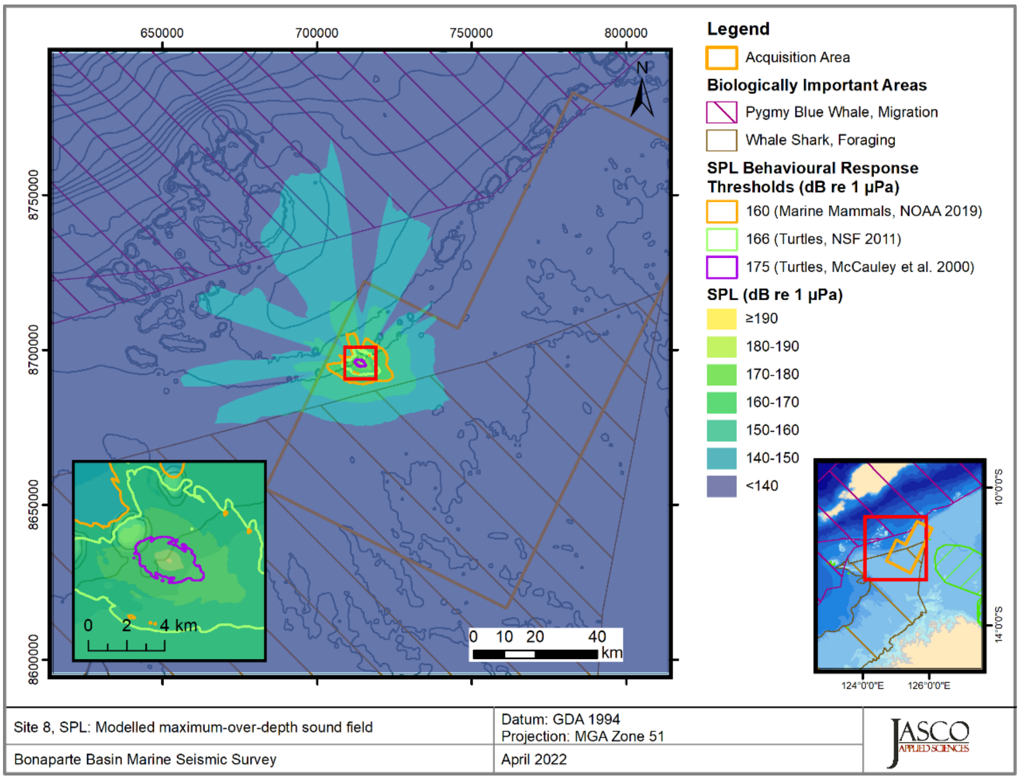

Figure 14. *Site 8, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

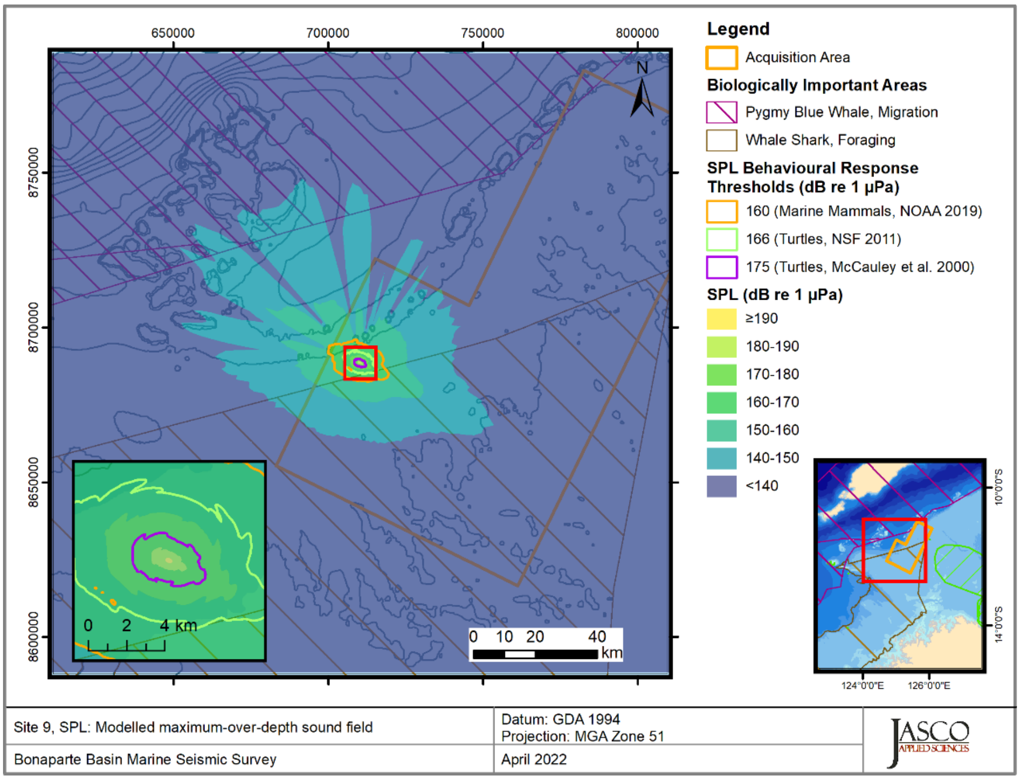

Figure 15. *Site 9, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

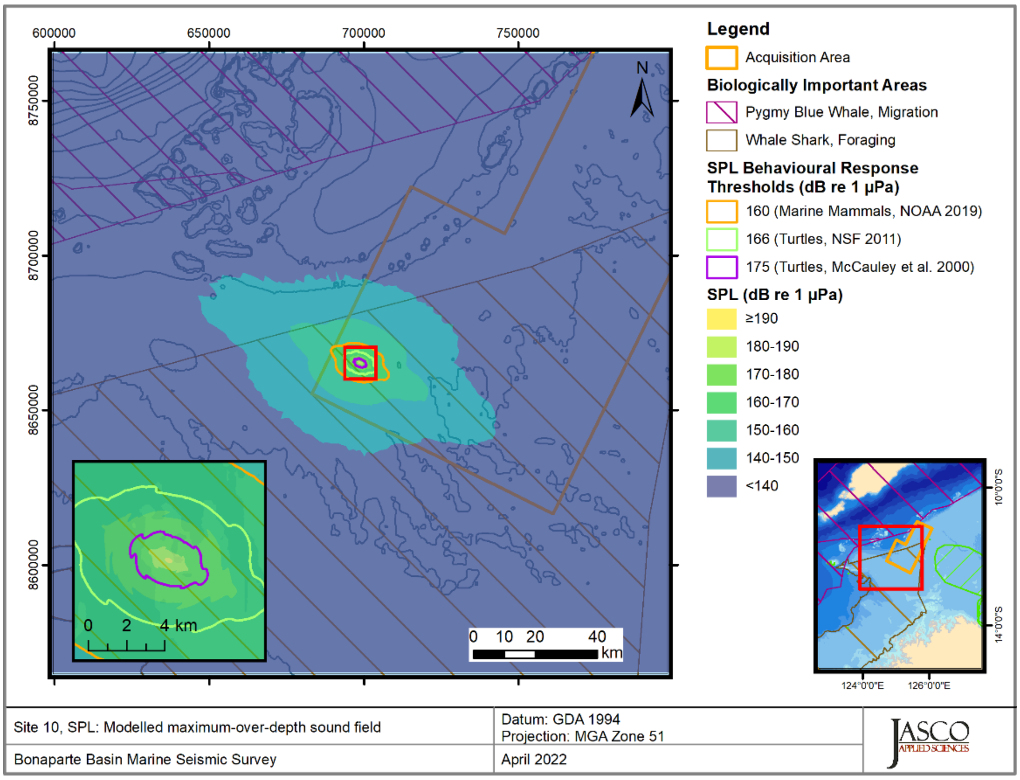

Figure 16. *Site 10, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

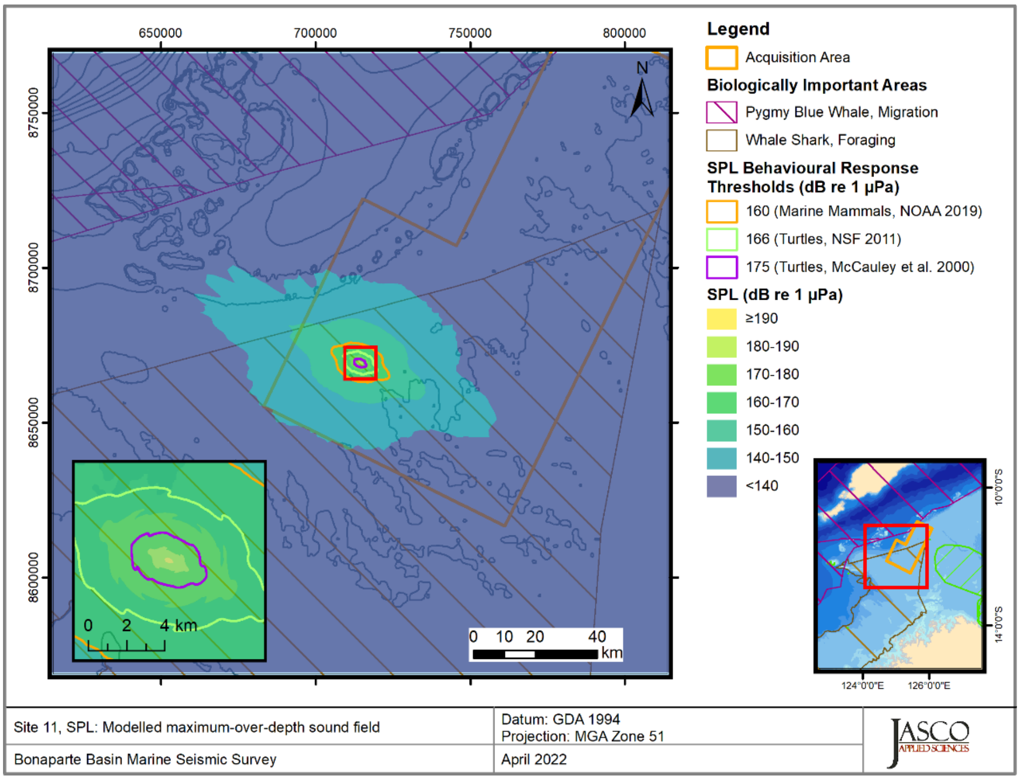

Figure 17. *Site 11, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

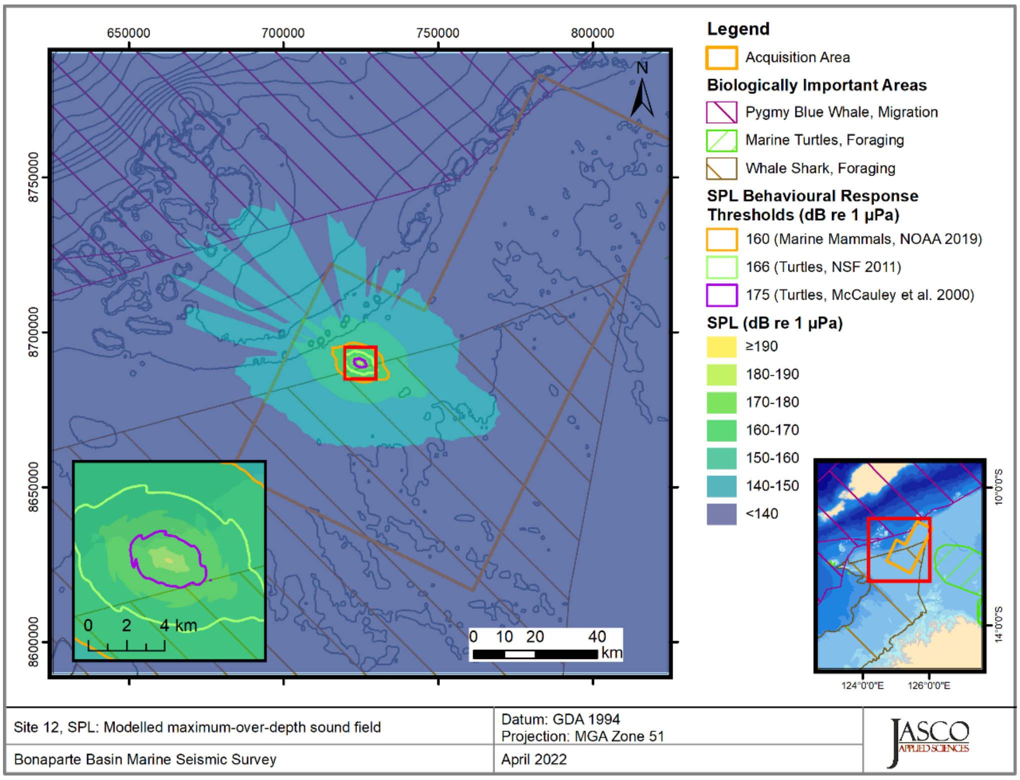

Figure 18. *Site 12, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

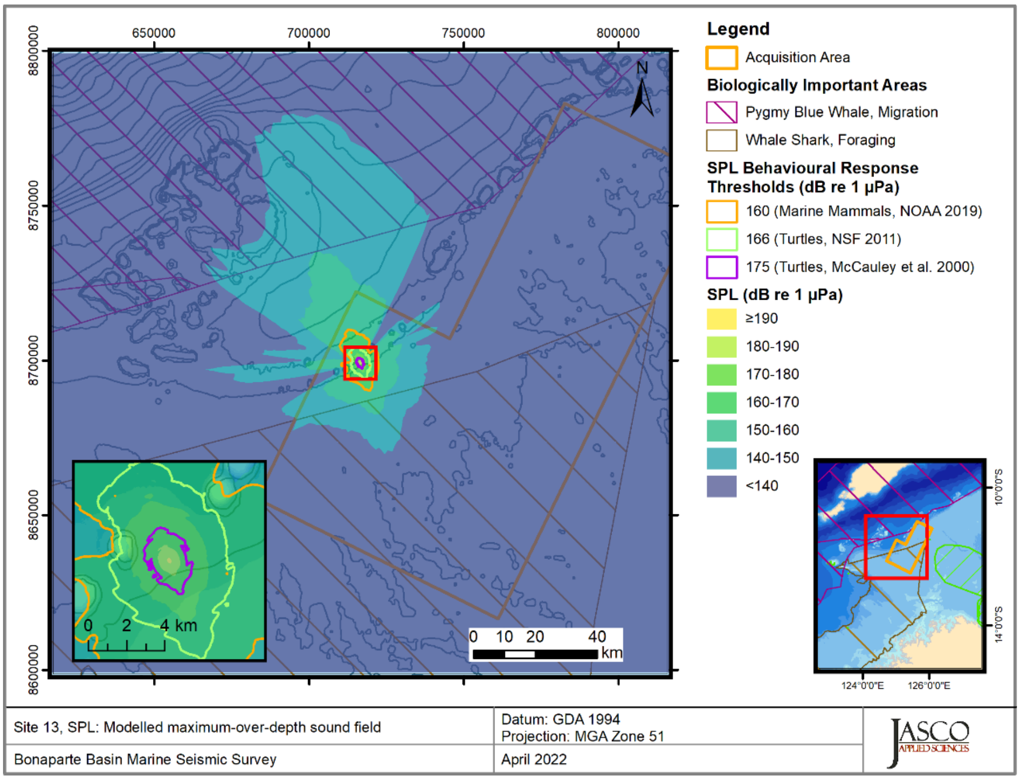

Figure 19. *Site 13, SPL, 3000 in³ source, tow azimuth 71°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

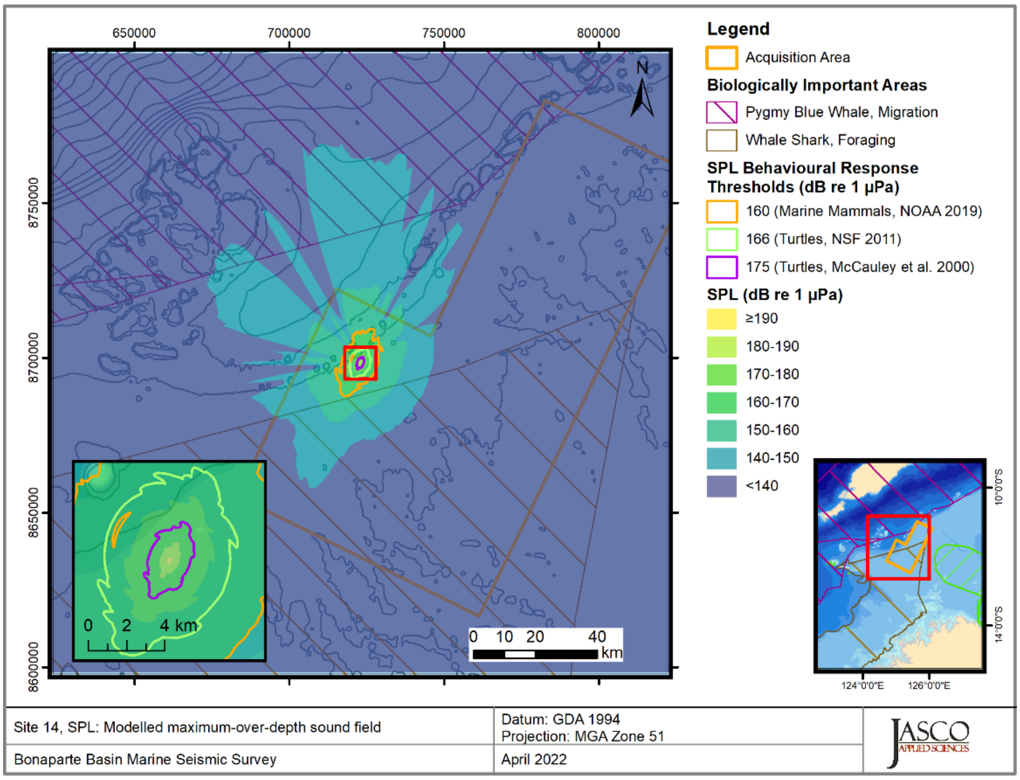

Figure 20. *Site 14, SPL, 3000 in³ source, tow azimuth 116°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

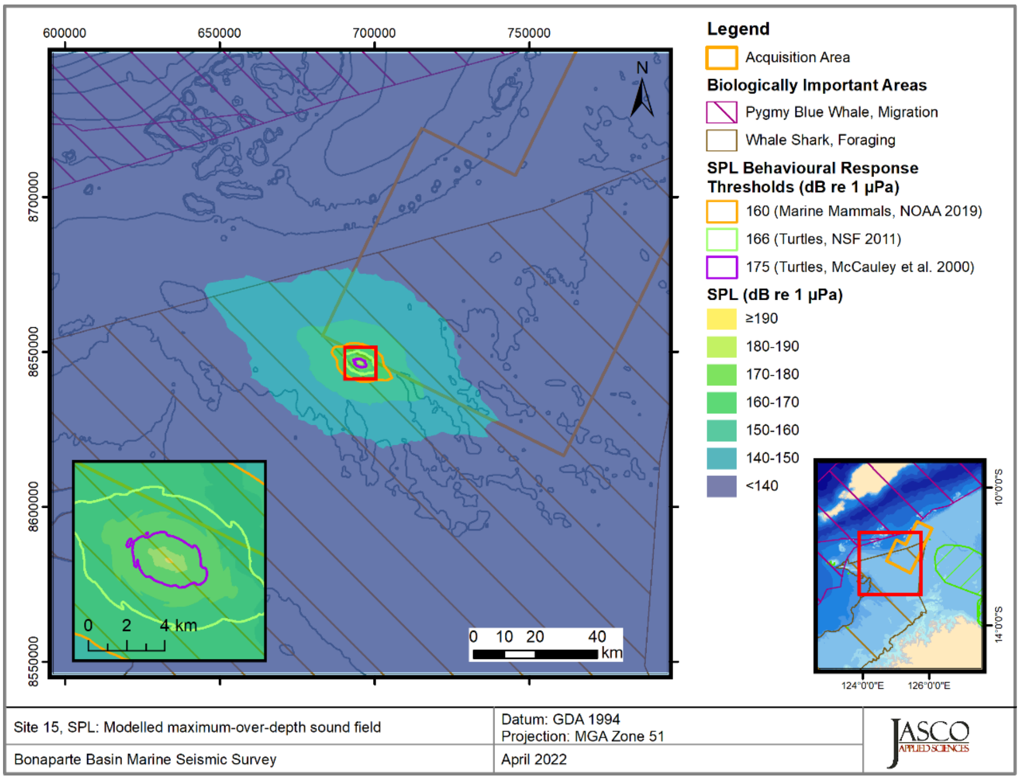

Figure 21. *Site 15, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

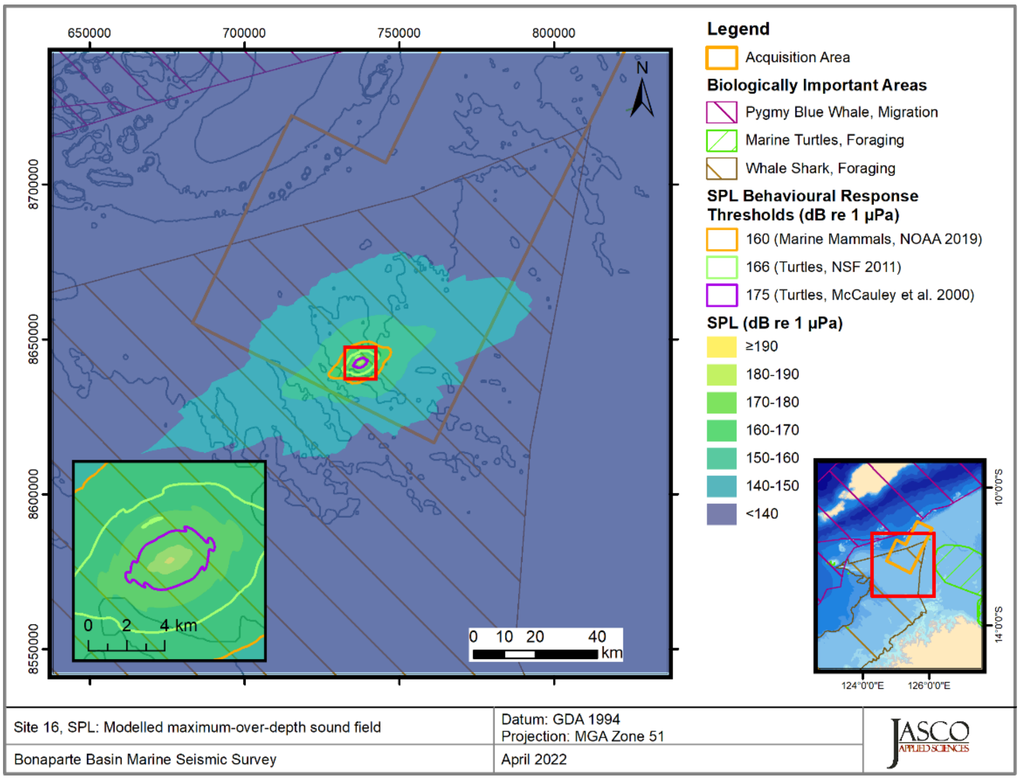

Figure 22. *Site 16, SPL, 3000 in³ source, tow azimuth 159°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

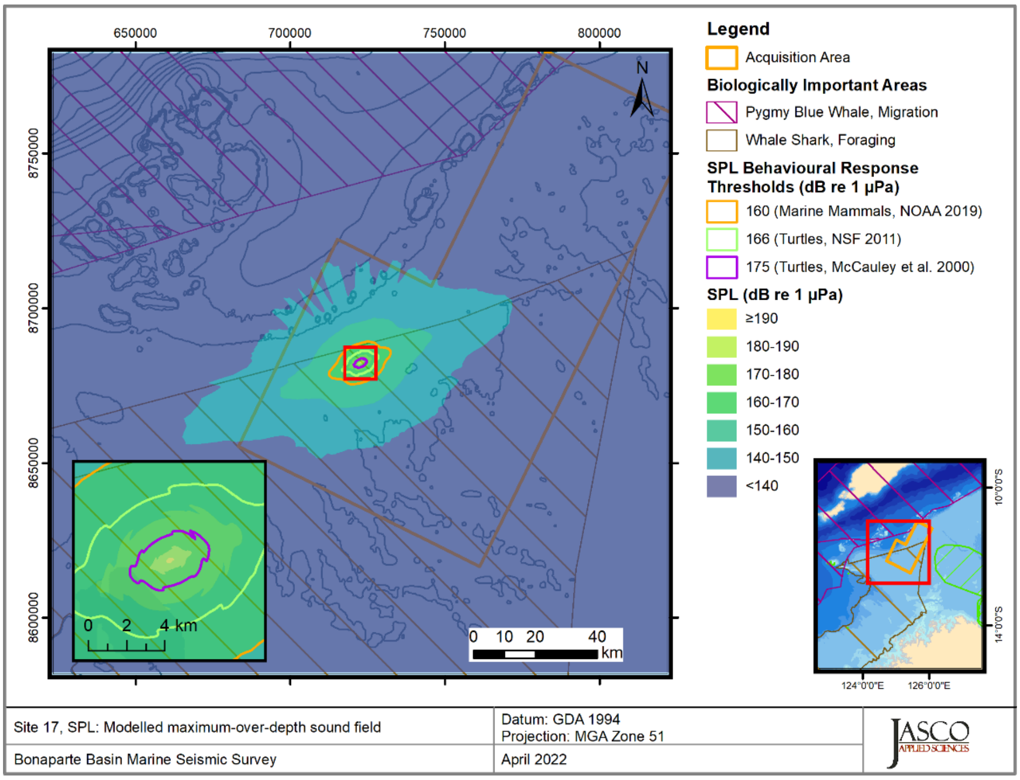

Figure 23. *Site 17, SPL, 3000 in³ source, tow azimuth 159°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

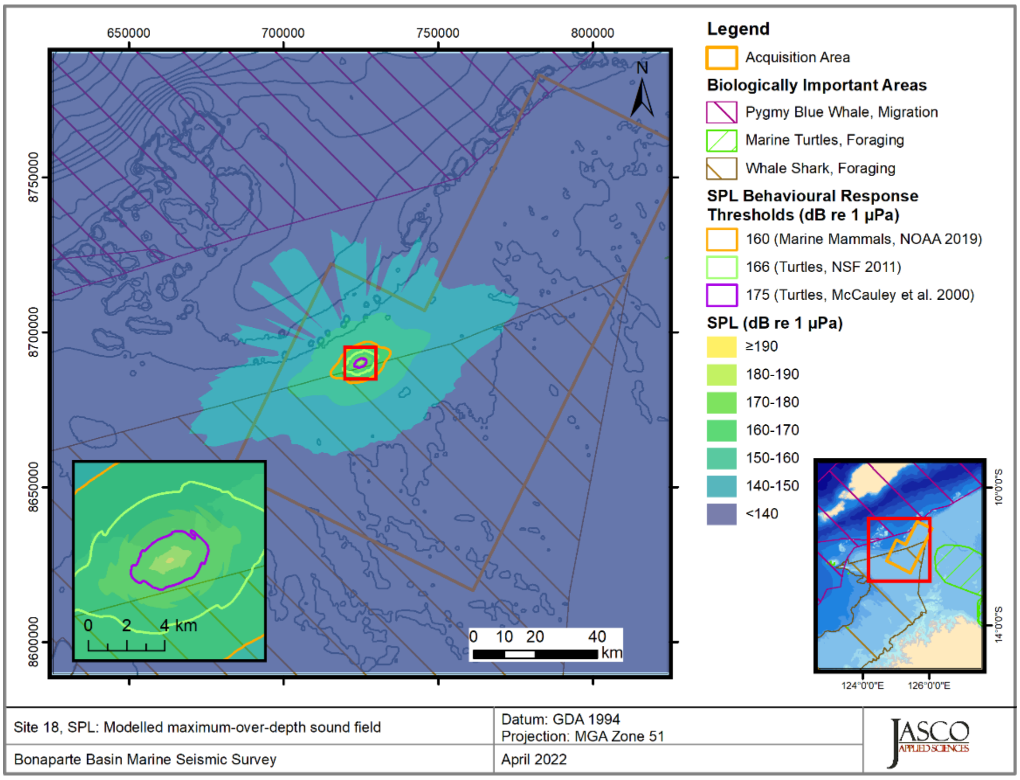

Figure 24. *Site 18, SPL, 3000 in³ source, tow azimuth 159°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

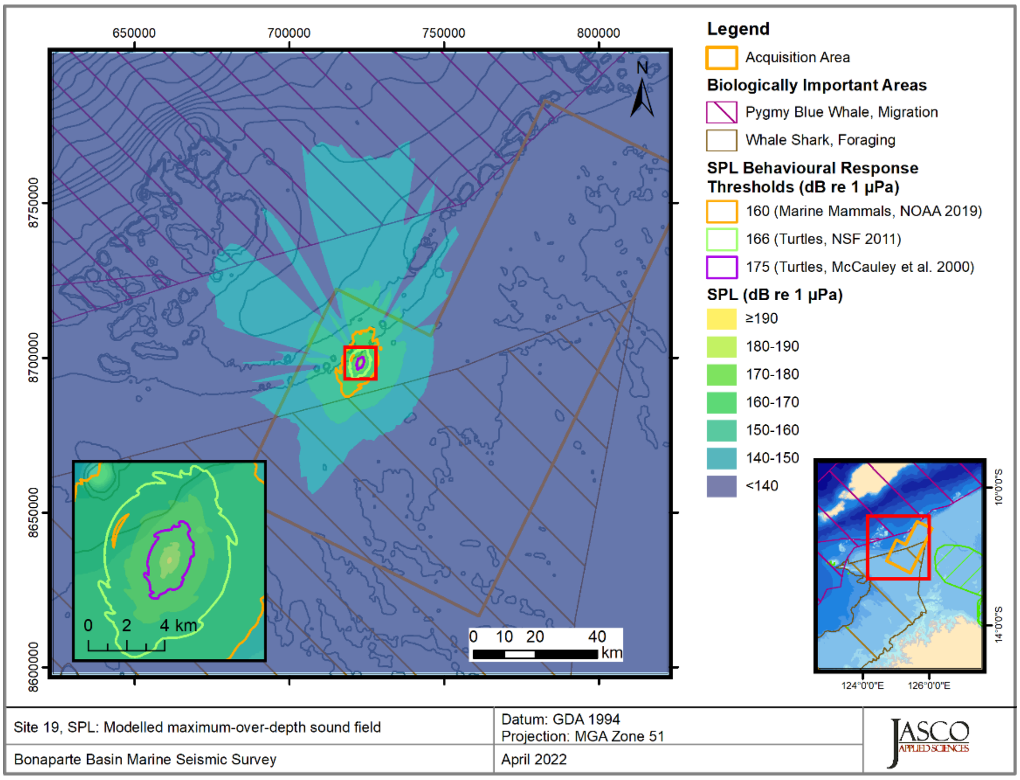

Figure 25. *Site 19, SPL, 3000 in³ source, tow azimuth 114°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

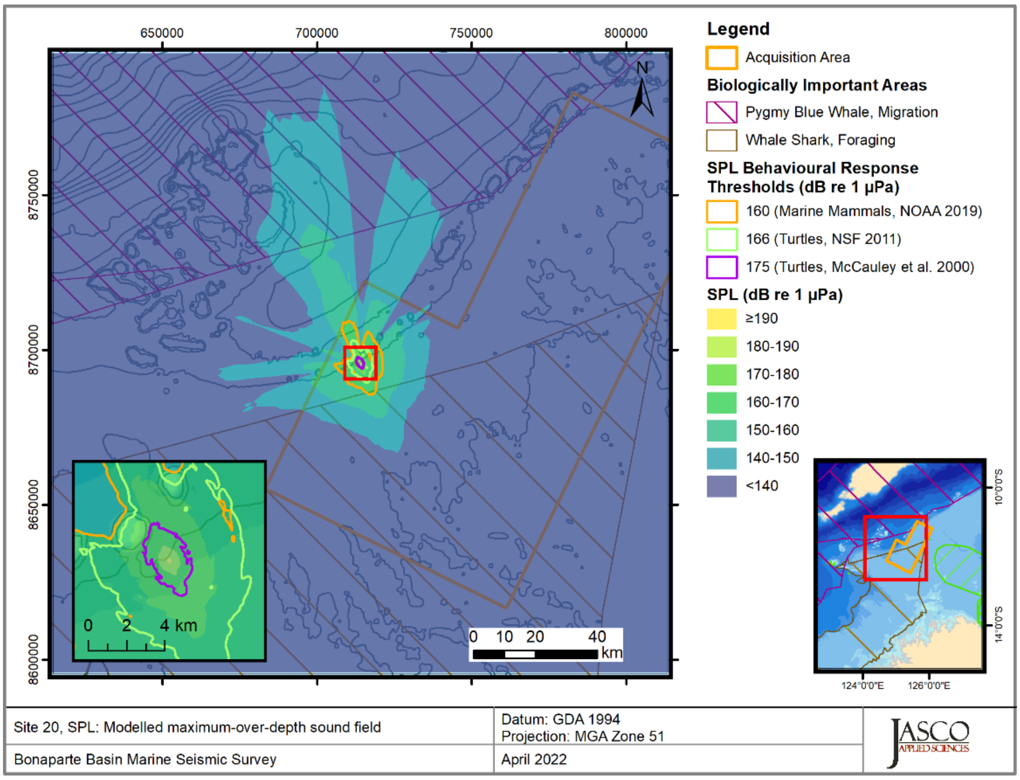

Figure 26. *Site 20, SPL, 3000 in³ source, tow azimuth 69°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

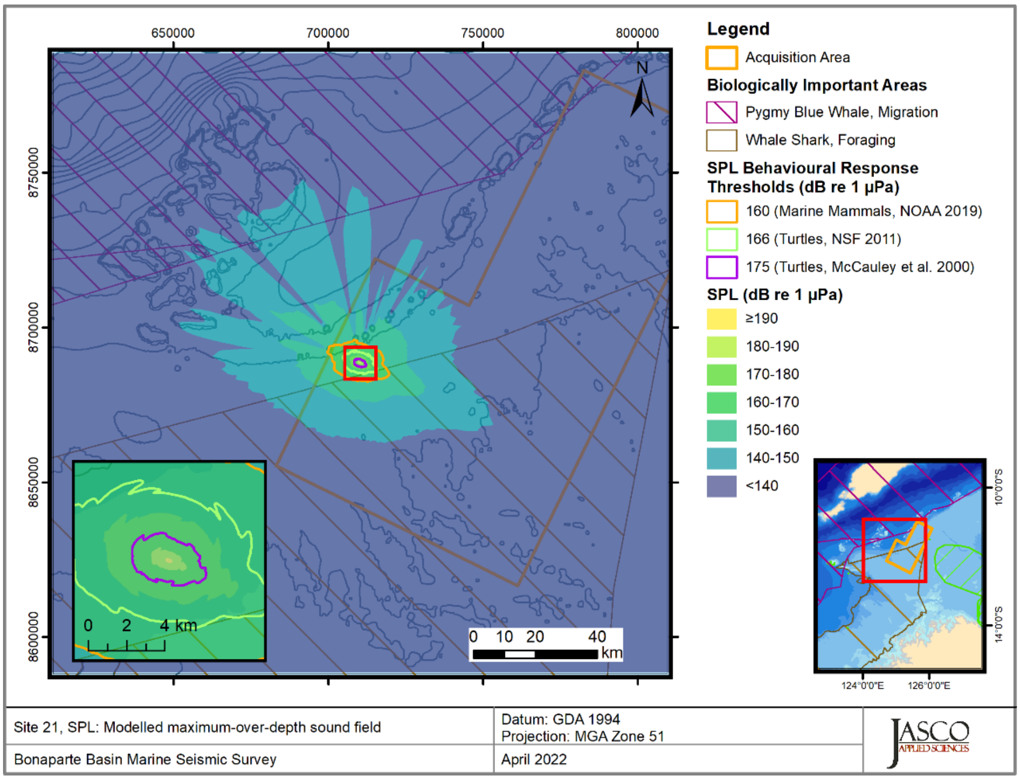

Figure 27. *Site 21, SPL, 3000 in³ source, tow azimuth 24°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

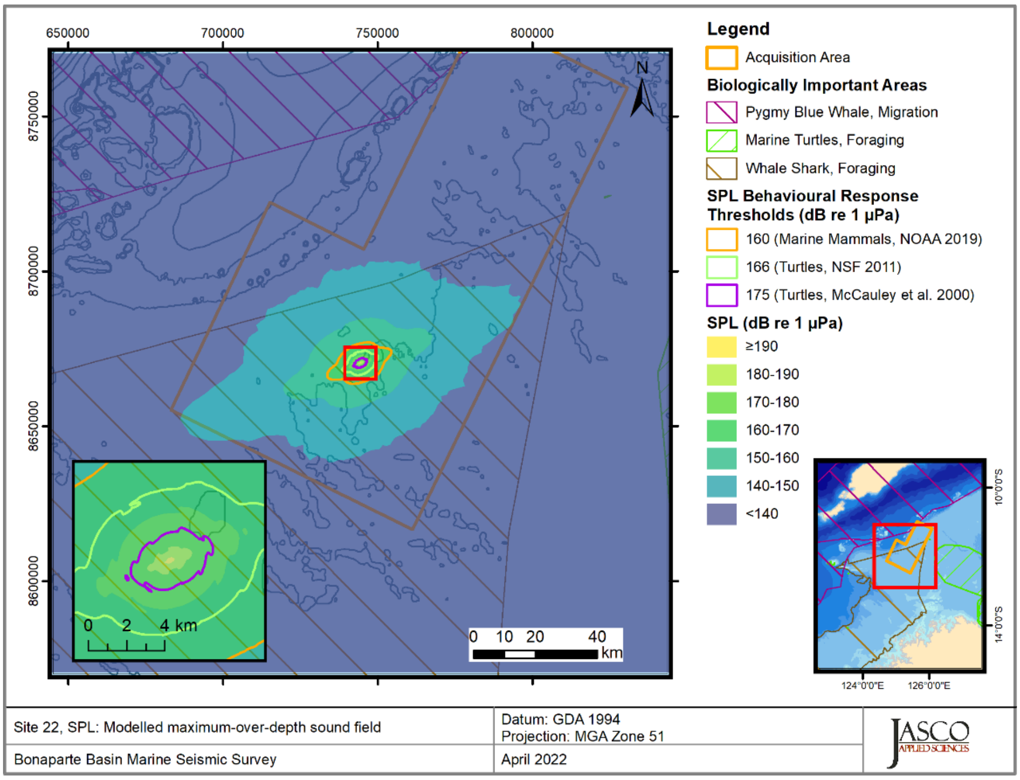

Figure 28. *Site 22, SPL, 3000 in³ source, tow azimuth 159°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

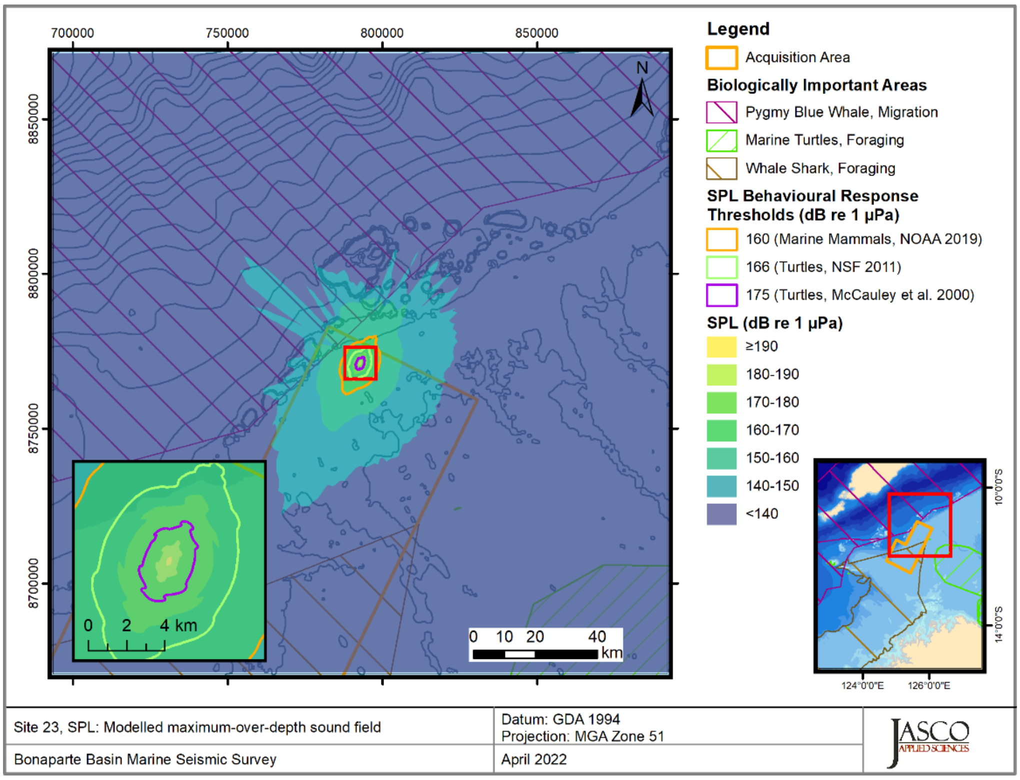

Figure 29. *Site 23, SPL, 3000 in³ source, tow azimuth 296°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

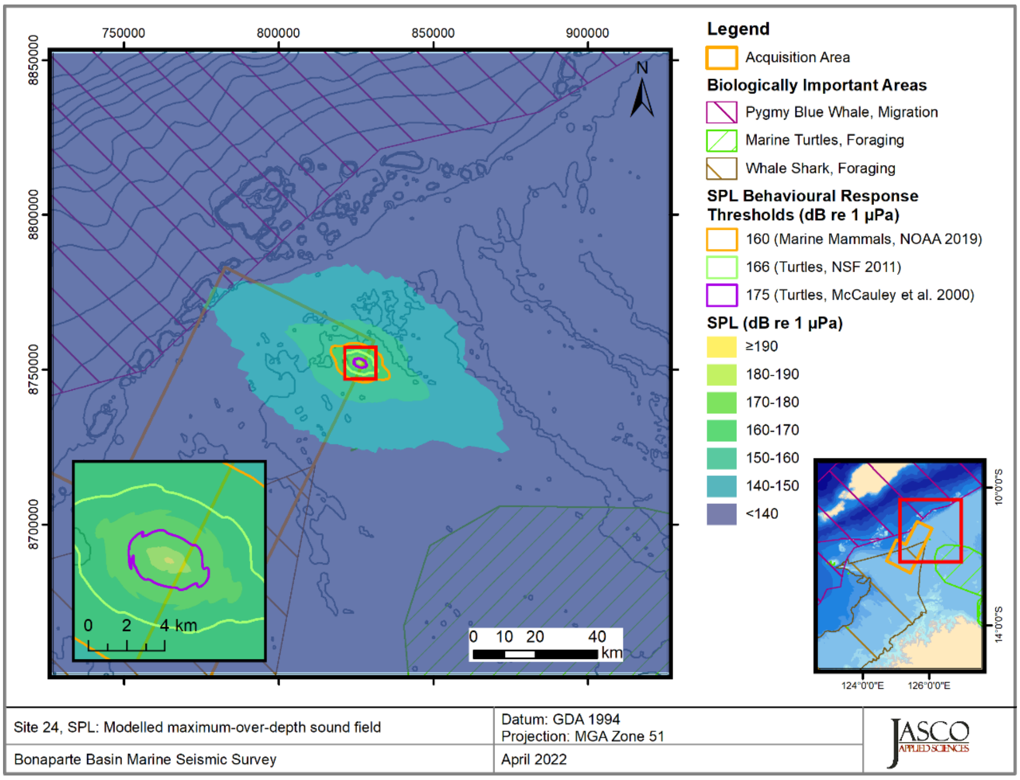

Figure 30. *Site 24, SPL, 3000 in³ source, tow azimuth 26°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

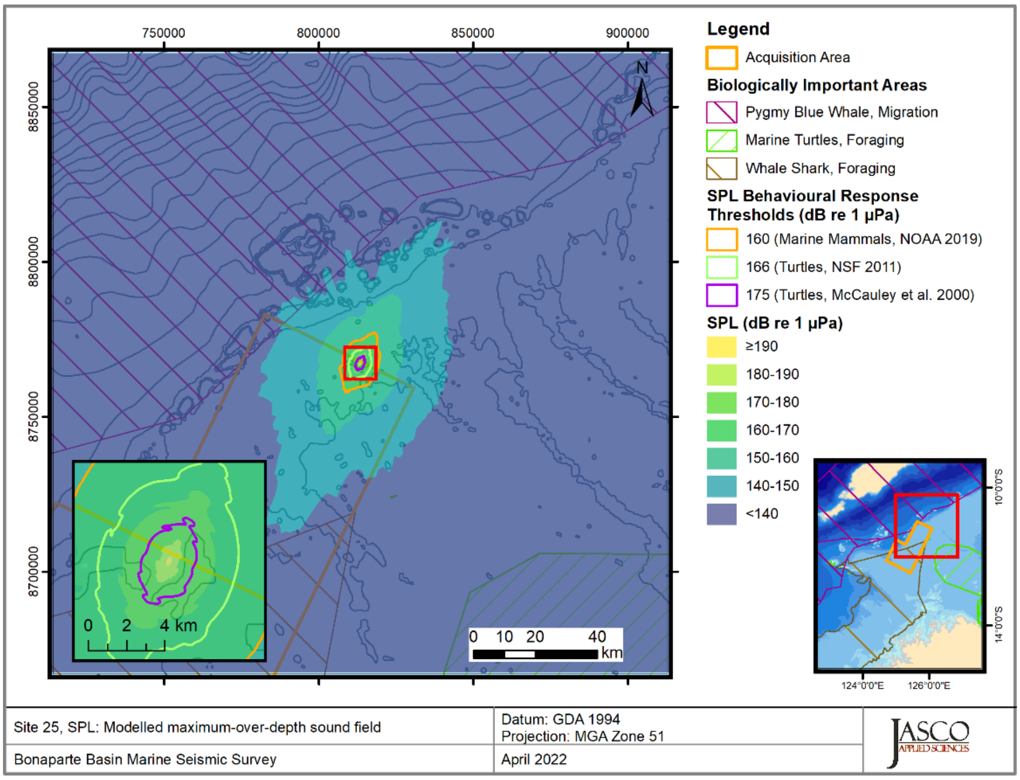

Figure 31. *Site 25, SPL, 3000 in³ source, tow azimuth 296°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

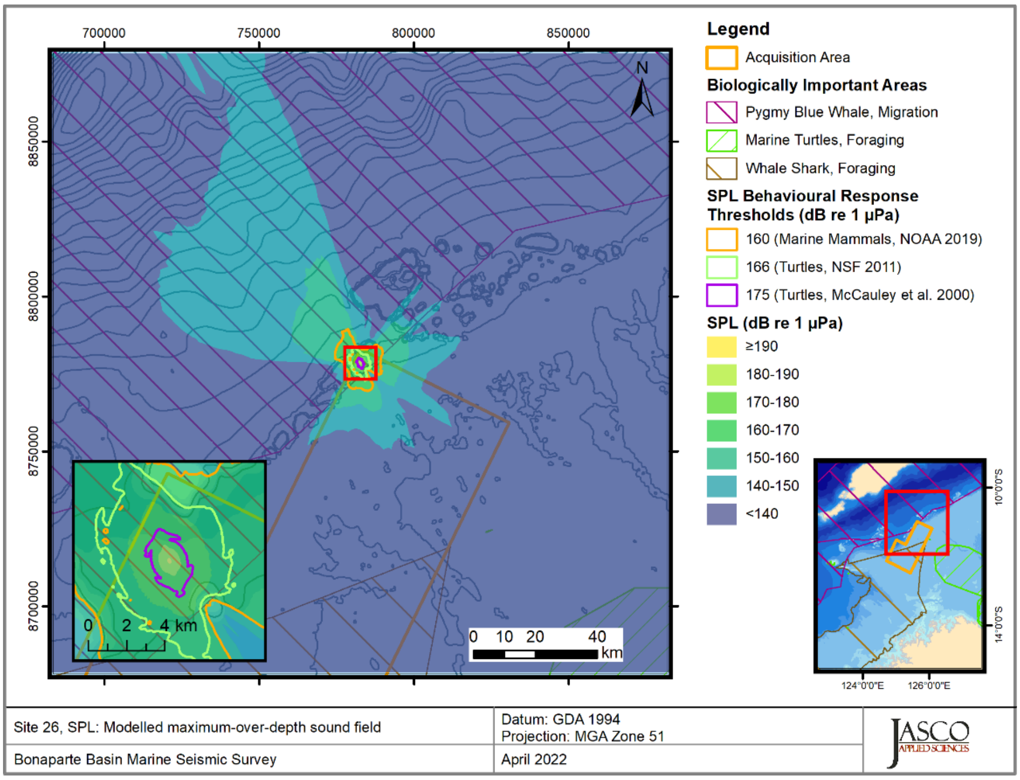

Figure 32. *Site 26, SPL, 3000 in³ source, tow azimuth 251°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

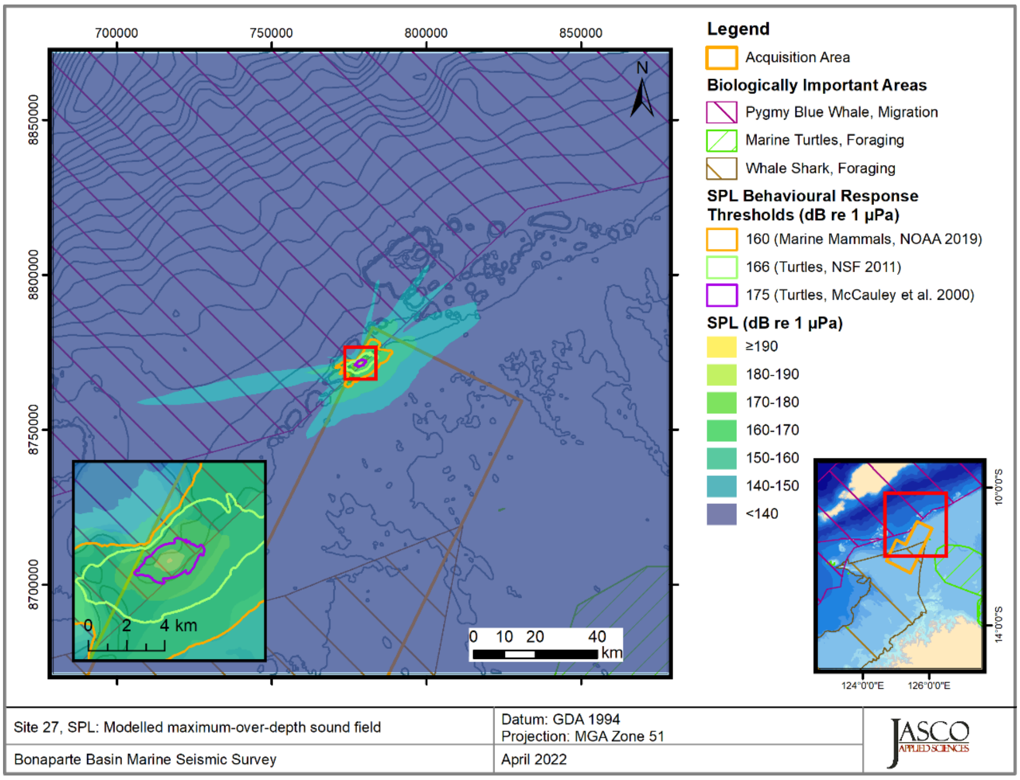

Figure 33. *Site 27, SPL, 3000 in³ source, tow azimuth 161°*: Sound level contour map of unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

5.2.2.2. Vertical Slices of Modelled Sound Fields

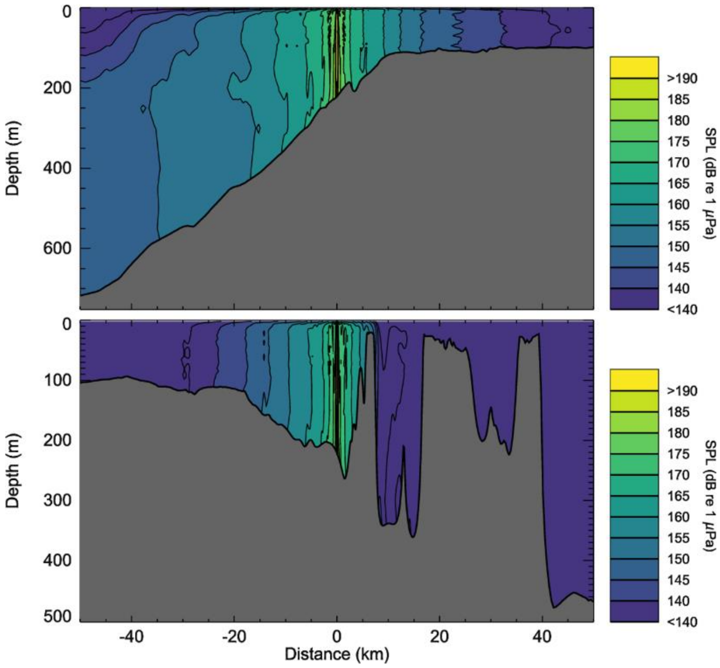

Figure 34. *Site 1, SPL, 3000 in³ source, tow azimuth 26*°: Sound level contours in vertical slice of the sound field , perpendicular to (broadside, top) and along the tow direction (endfire, bottom). The positive distance direction in each slice is 90° clockwise from the tow azimuth for broadside, and the tow azimuth for the endfire slice.

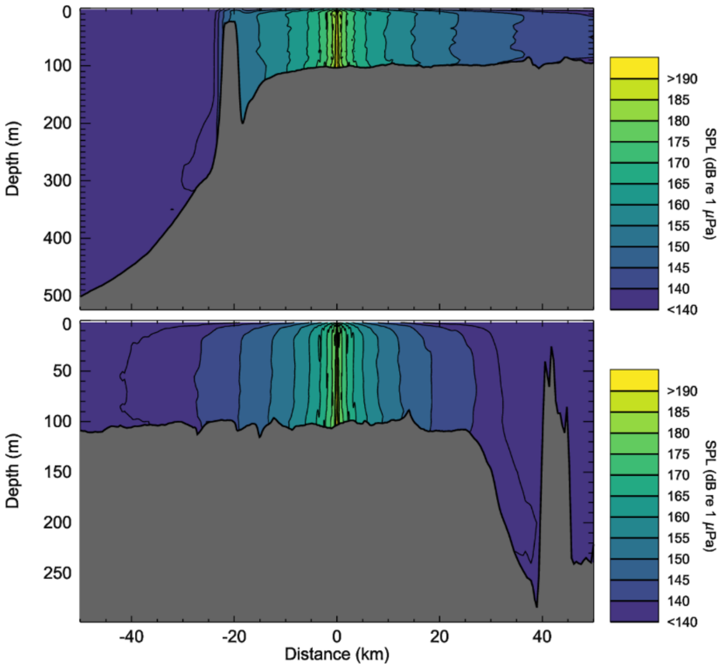

Figure 35. *Site 7, SPL, 3000 in³ source, tow azimuth 26*°: Sound level contours in vertical slice of the sound field , perpendicular to (broadside, top) and along the tow direction (endfire, bottom). The positive distance direction in each slice is 90° clockwise from the tow azimuth for broadside, and the tow azimuth for the endfire slice.

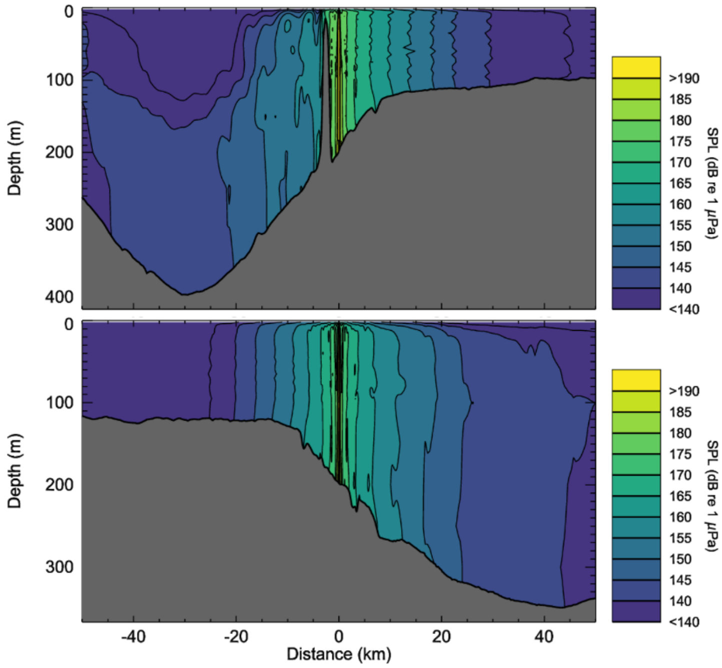

Figure 36. *Site 8, SPL, 3000 in^3 source, tow azimuth 26°*: Sound level contours in vertical slice of the sound field , perpendicular to (broadside, top) and along the tow direction (endfire, bottom). The positive distance direction in each slice is 90° clockwise from the tow azimuth for broadside, and the tow azimuth for the endfire slice.

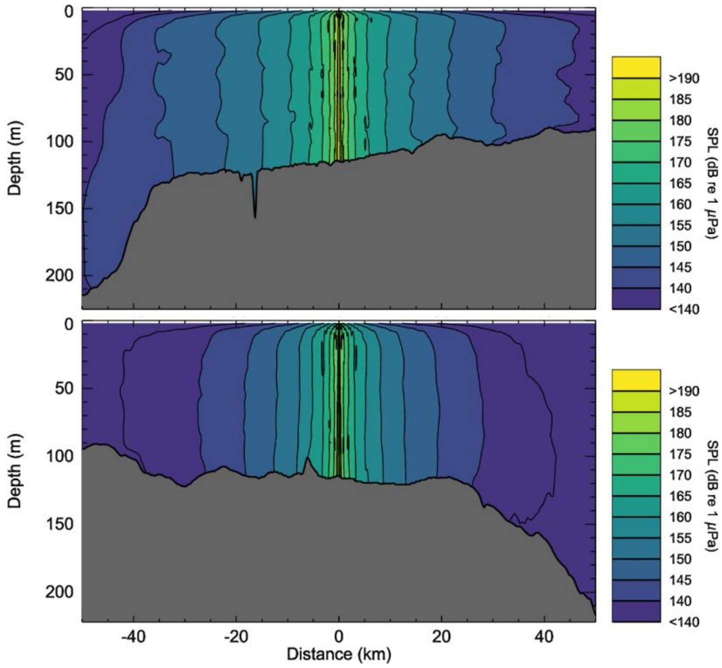

Figure 37. *Site 11, SPL, 3000 in^3 source, tow azimuth 26°*: Sound level contours in vertical slice of the sound field , perpendicular to (broadside, top) and along the tow direction (endfire, bottom). The positive distance direction in each slice is 90° clockwise from the tow azimuth for broadside, and the tow azimuth for the endfire slice.

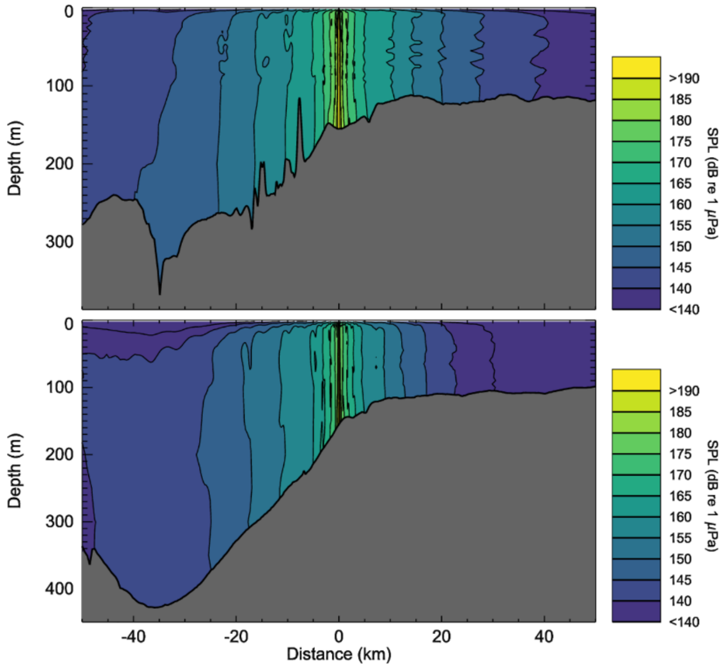

Figure 38. *Site 14, SPL, 3000 in³ source, tow azimuth 116°*: Sound level contours in vertical slice of the sound field , perpendicular to (broadside, top) and along the tow direction (endfire, bottom). The positive distance direction in each slice is 90° clockwise from the tow azimuth for broadside, and the tow azimuth for the endfire slice.

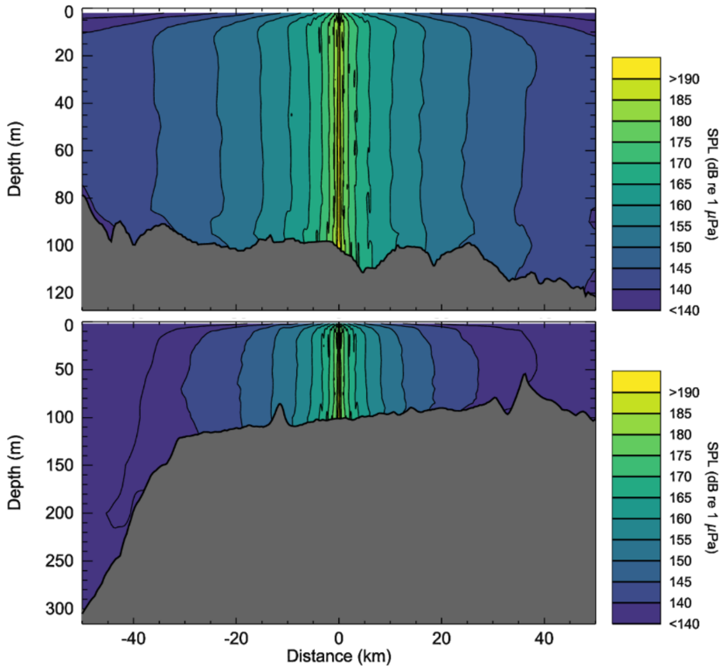

Figure 39. *Site 22, SPL, 3000 in³ source, tow azimuth 159°*: Sound level contours in vertical slice of the sound field , perpendicular to (broadside, top) and along the tow direction (endfire, bottom). The positive distance direction in each slice is 90° clockwise from the tow azimuth for broadside, and the tow azimuth for the endfire slice.

5.2.3. Particle Motion

Figures Figure 40–43 show modelled maximum particle acceleration as a function of horizontal range in four perpendicular directions from the centre of the 3000 in³ seismic source at water depths of 60, 75, 100, and 150 m. The modelling considered a resolution of 10 m, and a receiver positioned 5 cm off the seafloor. The maximum distance to a particle acceleration 37.57 ms^{-2} is predicted to occur at 6 and 10.5 m for water depths of 60 and 75 m, respectively, and is not predicted to occur at any other water depths considered.

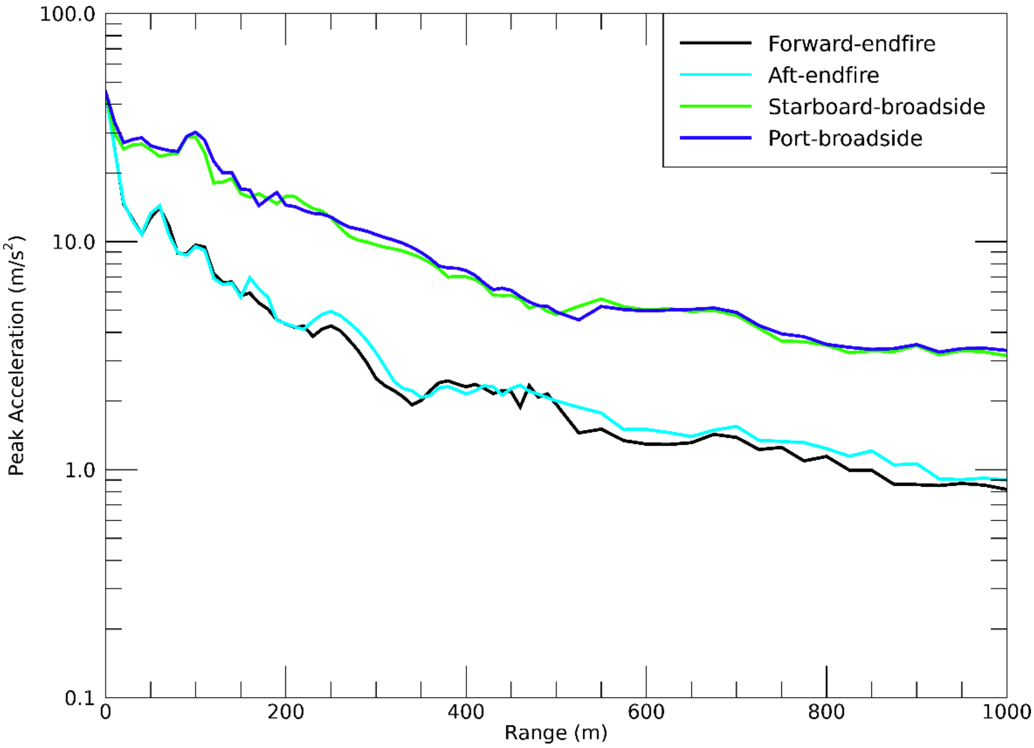

Figure 40. 3000 in^3 seismic source at 60 m water depth: Peak particle acceleration magnitude at the seafloor as a function of horizontal range from the centre of the seismic source along four directions.

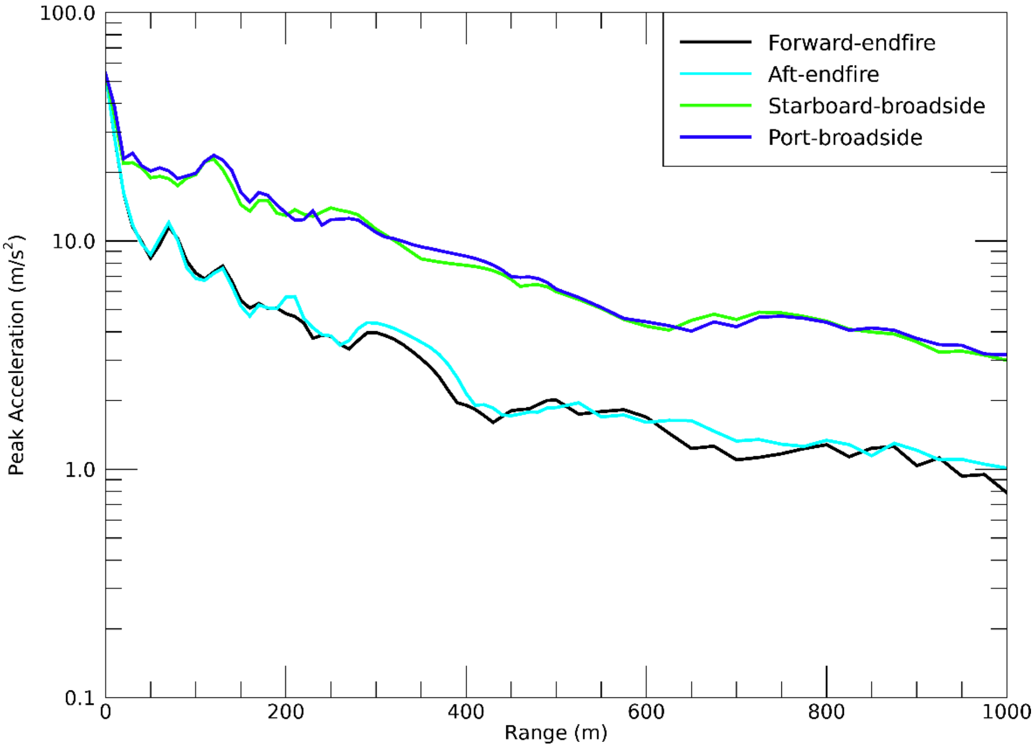

Figure 41. 3000 in^3 seismic source at 75 m water depth: Peak particle acceleration magnitude at the seafloor as a function of horizontal range from the centre of the seismic source along four directions.

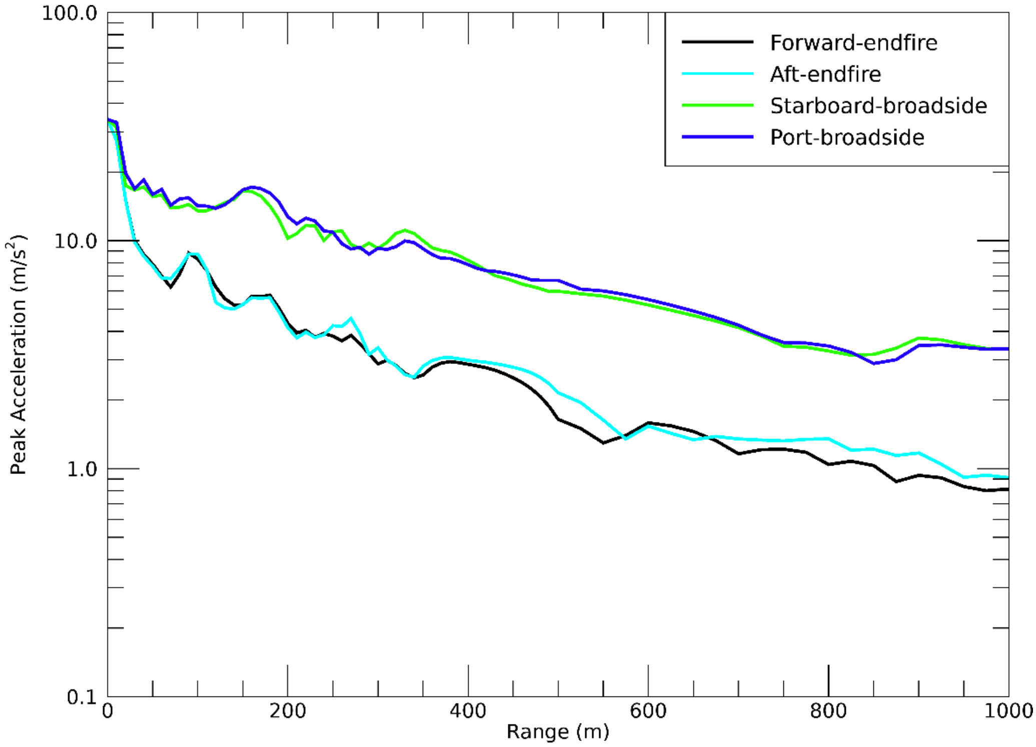

Figure 42. 3000 in³ seismic source at 100 m water depth: Peak particle acceleration magnitude at the seafloor as a function of horizontal range from the centre of the seismic source along four directions.

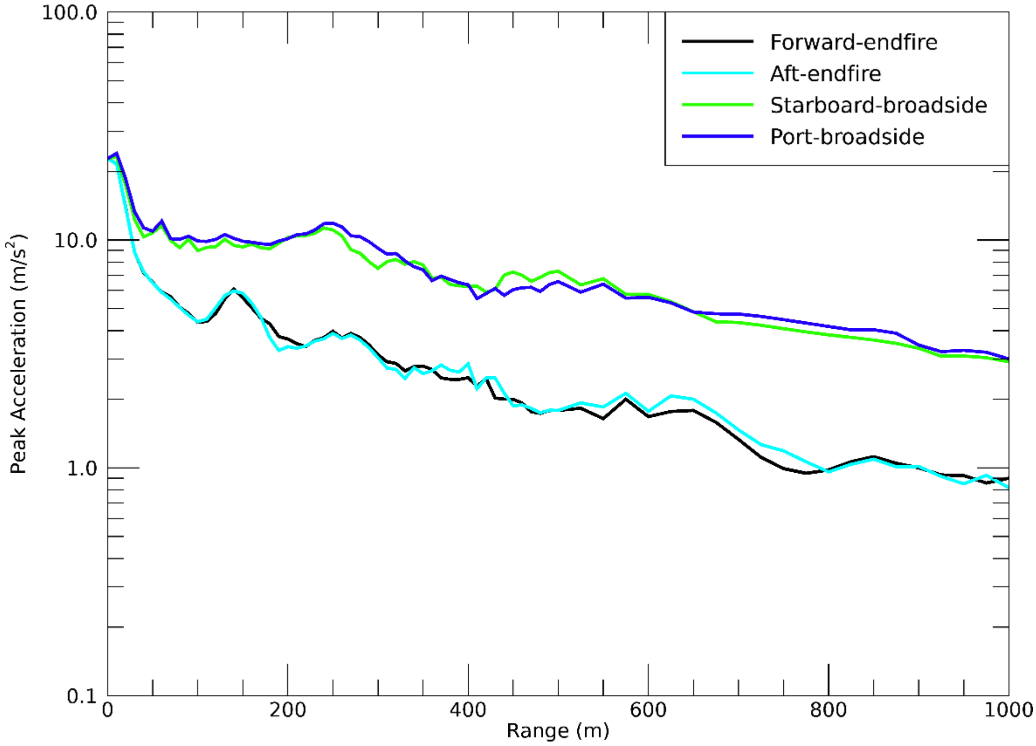

Figure 43. 3000 in³ seismic source at 150 m water depth: Peak particle acceleration magnitude at the seafloor as a function of horizontal range from the centre of the seismic source along four directions.

5.3. Multiple Source Fields

This section presents the sound fields in terms of SEL accumulated over 24 h of survey, for the modelled scenarios (Section 2). Frequency-weighted SEL_{24h} sound fields were used to estimate the maximum horizontal distances (R_{max}) to marine mammal and sea turtle PTS and TTS thresholds (listed in Table 20), and to estimate maximum distance and the area for injury and TTS guidelines for fish (Tables 21–24).

The SEL_{24h} sound fields are presented as contour maps in Figures 44–51. These figures present the unweighted SEL_{24h} in 10 dB steps, as well as the isopleths corresponding to thresholds or guidelines for which R_{max} is greater than 60 m.

5.3.1. Tabulated Results

Table 20. Maximum-over-depth distances (in km) to frequency-weighted 24 h sound exposure level (SEL_{24h}) based permanent threshold shift (PTS) and temporary threshold shift (TTS) for marine mammals Southall et al. (2019b) and sea turtles (Finneran et al. 2017) using the 3000 in^3 seismic source for all scenarios. Maximum extents are in the broadside direction.

Hearing group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
		R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)
PTS									
LF cetaceans	183	6.28	869	5.75	997	6.11	1173	6.84	1047
HF cetaceans	185	–	–	–	–	–	–	–	–
VHF cetaceans	155	0.08	3.04	0.08	3.64	0.08	3.58	0.08	3.48
Sea turtles	204	0.08	3.04	0.08	3.64	0.08	3.77	0.08	3.79
Sirenians	190	–	–	–	–	–	–	–	–
TTS									
LF cetaceans	168	40.6	7327	47.5	6076	45.0	6885	38.9	5588
HF cetaceans	170	0.08	1.81	0.08	2.15	0.08	2.29	0.07	2.12
VHF cetaceans	140	0.18	59.1	0.50	129	0.45	111	0.41	110
Sea turtles	189	1.82	479	5.75	759	6.11	691	5.37	585
Sirenians	175	0.08	2.55	0.08	2.63	0.08	2.90	0.08	2.67

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

Table 21. *Scenario 1*, Distances to 24 hour sound exposure level (SEL_{24h}) based fish criteria in the water column and at the seafloor for the 3000 in^3 seismic source.

Marine fauna group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Maximum-over-depth		Seafloor	
		R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)
Mortality and potential mortal injury					
I	219	0.08	3.04	*	*
II, fish eggs and fish larvae	210	0.08	3.04	*	*
III	207	0.08	3.04	*	*
Fish recoverable injury					
I	216	0.08	3.04	*	*
II, III	203	0.10	8.65	*	*
Fish temporary threshold shift (TTS)					
I, II, III	186	6.48	2290	6.48	2242

Fish I–No swim bladder; Fish II–Swim bladder not involved with hearing; Fish III–Swim bladder involved with hearing.
An asterisk indicates that the threshold was not reached.

Table 22. *Scenario 2*, Distances to 24 hour sound exposure level (SEL_{24h}) based fish criteria in the water column and at the seafloor for the 3000 in^3 seismic source.

Marine fauna group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Maximum-over-depth		Seafloor	
		R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)
Mortality and potential mortal injury					
I	219	0.08	3.18	*	*
II, fish eggs and fish larvae	210	0.08	3.64	*	*
III	207	0.08	3.64	*	*
Fish recoverable injury					
I	216	0.08	3.64	*	*
II, III	203	0.10	10.7	*	*
Fish temporary threshold shift (TTS)					
I, II, III	186	10.5	1460	9.31	1423

Fish I–No swim bladder; Fish II–Swim bladder not involved with hearing; Fish III–Swim bladder involved with hearing.
An asterisk indicates that the threshold was not reached.

Table 23. *Scenario 3*, Distances to 24 hour sound exposure level (SEL_{24h}) based fish criteria in the water column and at the seafloor for the 3000 in^3 seismic source.

Marine fauna group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Maximum-over-depth		Seafloor	
		R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)
Mortality and potential mortal injury					
I	219	0.08	3.44	*	*
II, fish eggs and fish larvae	210	0.08	3.76	*	*
III	207	0.08	3.77	*	*
Fish recoverable injury					
I	216	0.08	3.54	*	*
II, III	203	0.10	10.6	*	*
Fish temporary threshold shift (TTS)					
I, II, III	186	8.35	1686	8.16	1650

Fish I–No swim bladder; Fish II–Swim bladder not involved with hearing; Fish III–Swim bladder involved with hearing.
An asterisk indicates that the threshold was not reached.

Table 24. *Scenario 4*, Distances to 24 hour sound exposure level (SEL_{24h}) based fish criteria in the water column and at the seafloor for the 3000 in^3 seismic source.

Marine fauna group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Maximum-over-depth		Seafloor	
		R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)
Mortality and potential mortal injury					
I	219	0.08	3.38	*	*
II, fish eggs and fish larvae	210	0.08	3.79	*	*
III	207	0.08	3.79	*	*
Fish recoverable injury					
I	216	0.08	3.48	*	*
II, III	203	0.10	10.0	*	*
Fish temporary threshold shift (TTS)					
I, II, III	186	8.31	1548	7.63	1506

Fish I–No swim bladder; Fish II–Swim bladder not involved with hearing; Fish III–Swim bladder involved with hearing.
An asterisk indicates that the threshold was not reached.

5.3.2. Sound Level Contour Maps

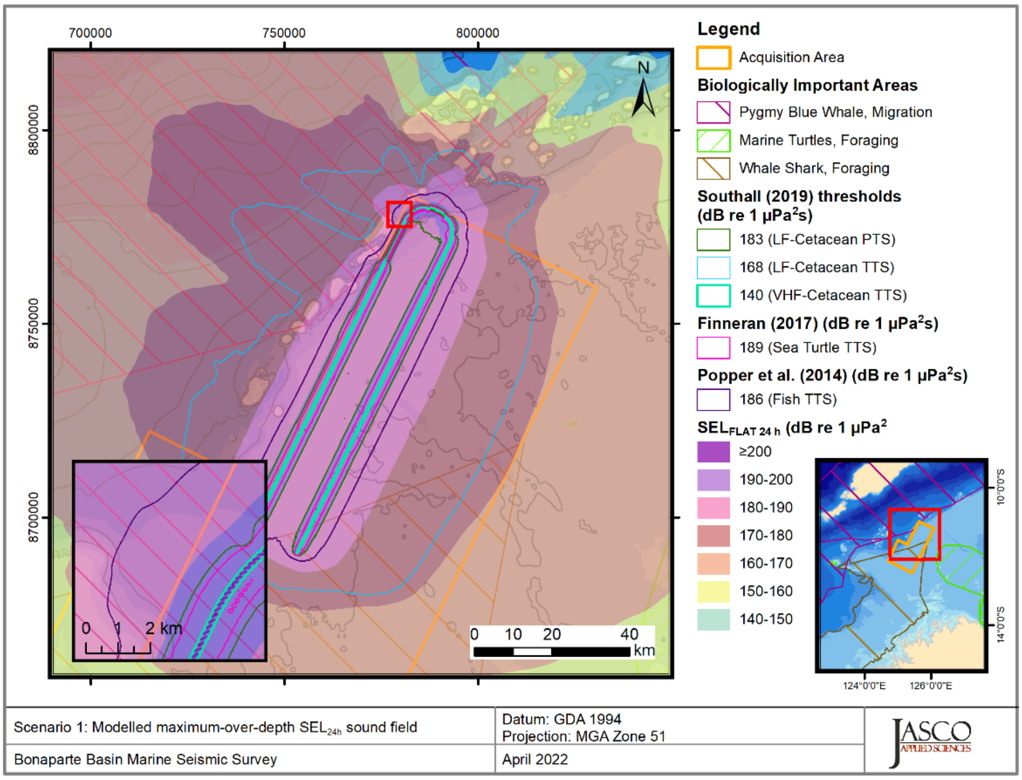

Figure 44. *Scenario 1*, sound level contour map of unweighted maximum-over-depth SEL_{24h} results, along with isopleths for cetaceans and fish. Thresholds omitted here were not reached or not large enough to display graphically. Refer to Table 20 for threshold distances.

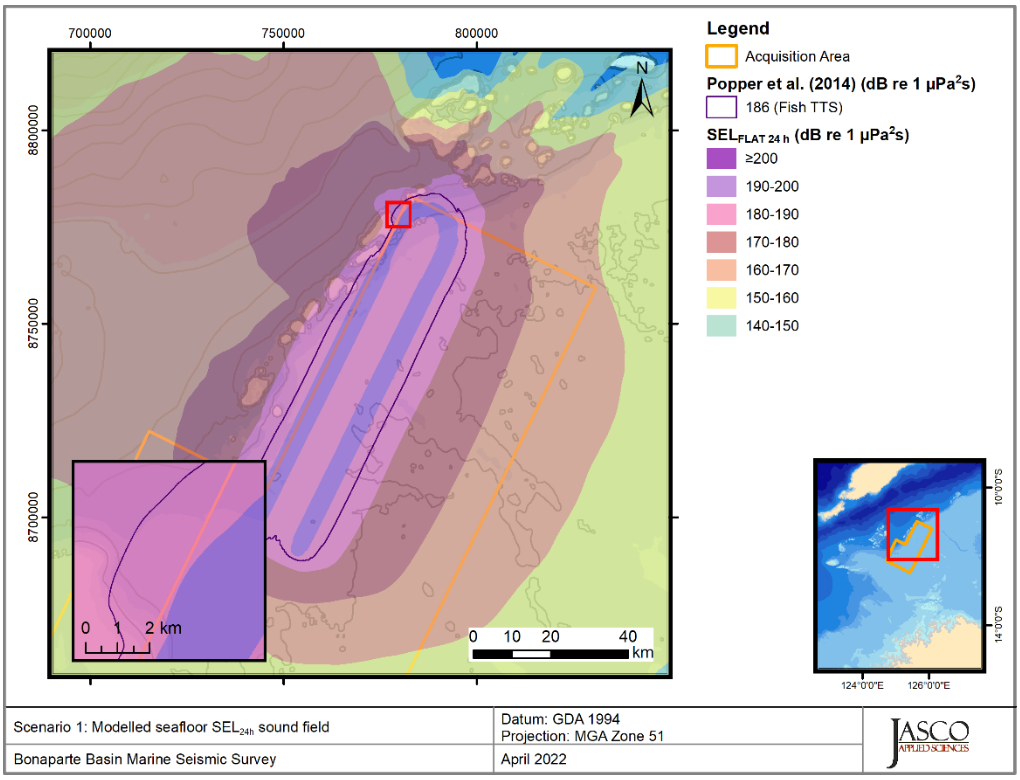

Figure 45. *Scenario 1*, sound level contour map of unweighted seafloor SEL_{24h} results along with the isopleth for fish temporary threshold shift (TTS). Thresholds omitted here were not reached or not large enough to display graphically. Refer to Tables 21–24 for threshold distances.

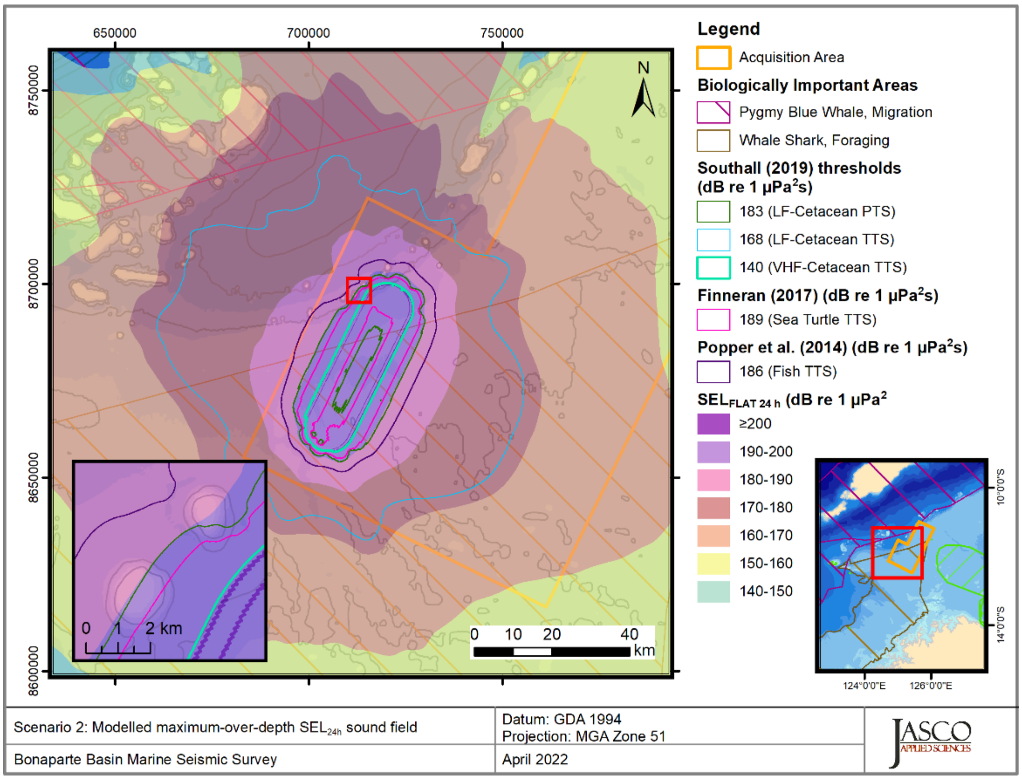

Figure 46. *Scenario 2*, sound level contour map of unweighted maximum-over-depth SEL_{24h} results, along with isopleths for cetaceans and fish. Thresholds omitted here were not reached or not large enough to display graphically. Refer to Table 20 for threshold distances.

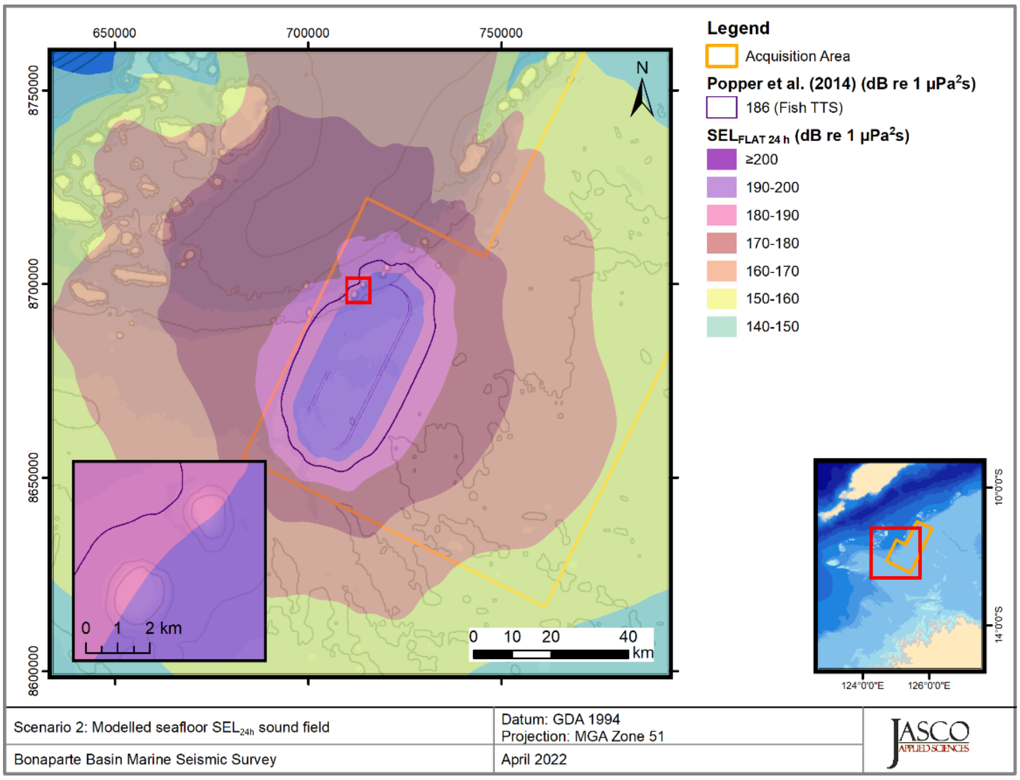

Figure 47. *Scenario 2*, sound level contour map of unweighted seafloor SEL_{24h} results along with the isopleth for fish temporary threshold shift (TTS). Thresholds omitted here were not reached or not large enough to display graphically. Refer to Tables 21–24 for threshold distances.

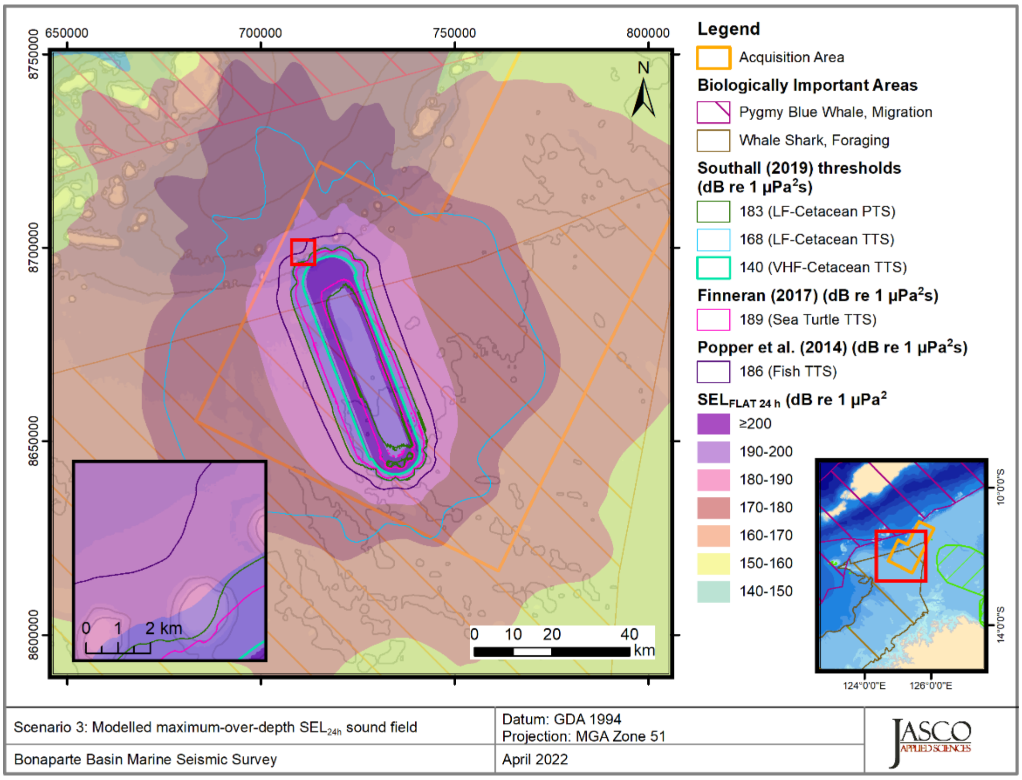

Figure 48. *Scenario 3*, sound level contour map of unweighted maximum-over-depth SEL_{24h} results, along with isopleths for cetaceans and fish. Thresholds omitted here were not reached or not large enough to display graphically. Refer to Table 20 for threshold distances.

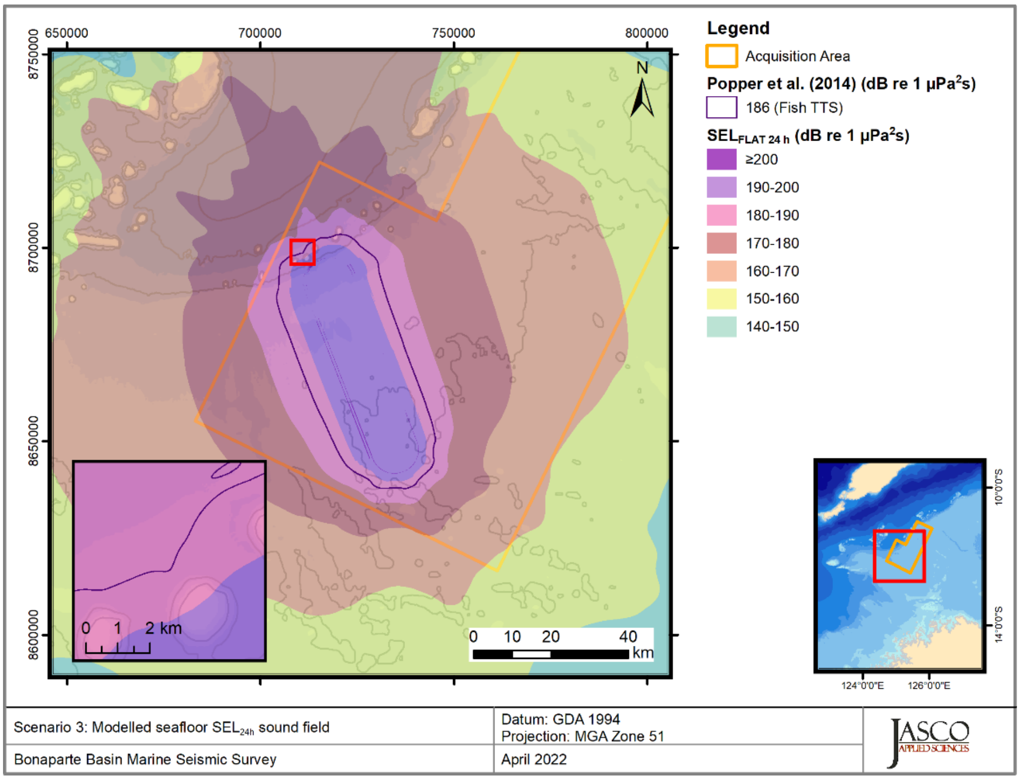

Figure 49. Scenario 3, sound level contour map of unweighted seafloor SEL24h results along with the isopleth for fish temporary threshold shift (TTS). Thresholds omitted here were not reached or not large enough to display graphically. Refer to Tables 21–24 for threshold distances.

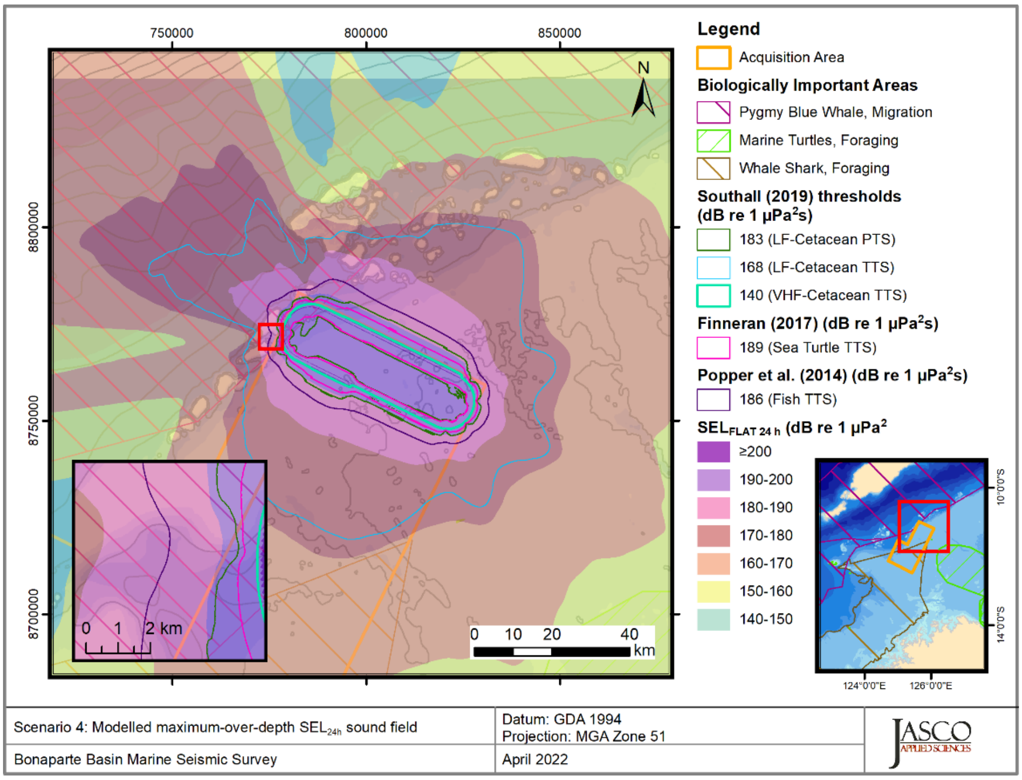

Figure 50. *Scenario 4*, sound level contour map of unweighted maximum-over-depth SEL_{24h} results, along with isopleths for cetaceans and fish. Thresholds omitted here were not reached or not large enough to display graphically. Refer to Table 20 for threshold distances.

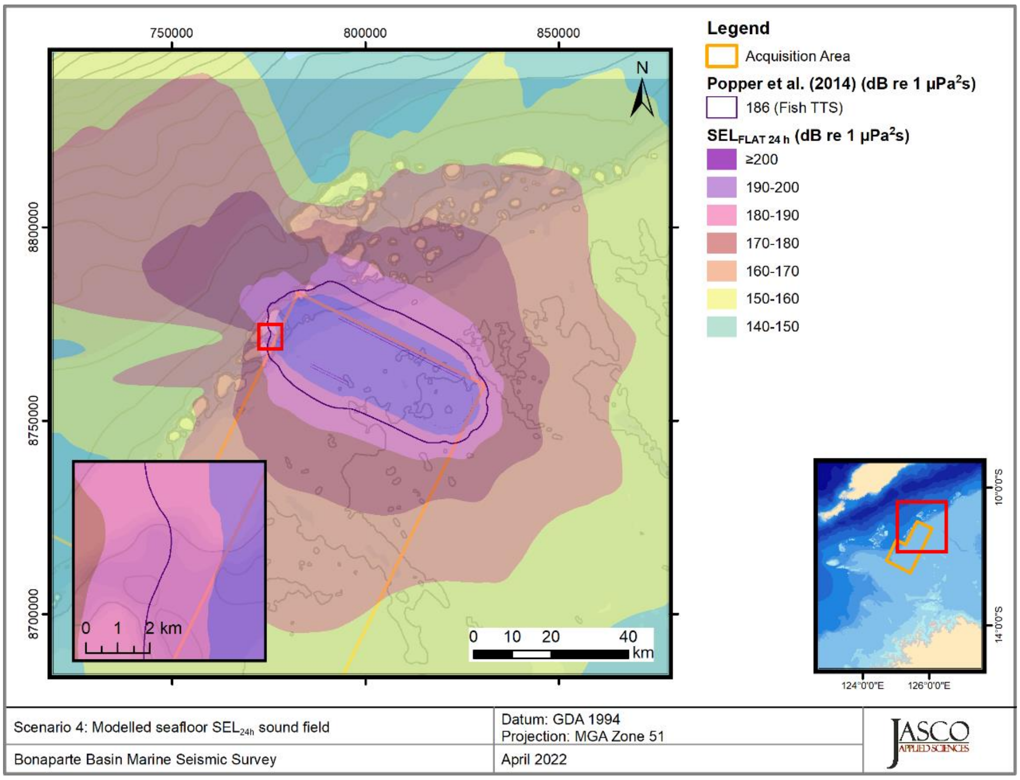

Figure 51. *Scenario 4*, sound level contour map of unweighted seafloor SEL24h results along with the isopleth for fish temporary threshold shift (TTS). Thresholds omitted here were not reached or not large enough to display graphically. Refer to Tables 21–24 for threshold distances.

5.4. Animal Movement Exposure Ranges

A summary of radial distances to exposure thresholds for migrating pygmy blue whales, along with probability of exposure for each modelled scenario (Section 2) are included below. Table 25 shows results for scenarios with animats restricted to the BIA, whilst Table 26 shows results for scenarios with unrestricted animat seeding. Results include $ER_{95\%}$ exposure ranges calculated for the 160 dB behavioural response threshold and SEL_{24h} thresholds for both TTS and PTS, and the probability of an animat being exposed above the threshold within the $ER_{95\%}$. Section 5.4.1 and 5.4.2 include histograms of CPA ranges to SEL_{24h} PTS, TTS, and the behavioural response threshold for all scenarios with results in Tables 25 and 26. Exposure ranges for TTS and PTS PK thresholds were not included in the exposure analysis since acoustic modelling predicted no PTS PK exceedance and ranges of less than 100 m for TTS PK (see Table 17).

Table 25. Summary of animat simulation results for pygmy blue whales with animats restricted to the BIA. The 95th percentile exposures ranges ($ER_{95\%}$) in km and probability of animats being exposed above threshold within the $ER_{95\%}$ (P_{exp} (%)) are provided. Dashes indicate no animats were exposed above threshold.

Threshold		Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	
Description	Threshold level (dB)	$ER_{95\%}$ (km)	P_{exp} (%)	$ER_{95\%}$ (km)	P_{exp} (%)	$ER_{95\%}$ (km)	P_{exp} (%)	$ER_{95\%}$ (km)	P_{exp} (%)	$ER_{95\%}$ (km)	P_{exp} (%)
PTS (SEL_{24h})[c]	183[a]	0.05	93	–	–	–	–	0.06	80	–	–
TTS (SEL_{24h})[c]	168[a]	14.00	63	–	–	–	–	11.70	58	–	–
Behavioural response (SPL)[d]	160[b]	11.47	86	–	–	–	–	11.42	85	–	–

[a] LF-weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa^2·s)
[b] SPL (L_p; dB re 1 µPa)
[c] Southall et al. (2019a) criteria for marine fauna.
[d] NOAA (2019) recommended unweighted behavioural threshold for marine mammals.

Table 26. Summary of animat simulation results for pygmy blue whales with unrestricted animat seeding. The 95th percentile exposures ranges ($ER_{95\%}$) in km and probability of animats being exposed above threshold within the $ER_{95\%}$ (P_{exp} (%)) are provided.

Threshold		Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	
Description	Threshold level (dB)	$ER_{95\%}$ (km)	P_{exp} (%)	$ER_{95\%}$ (km)	P_{exp} (%)	$ER_{95\%}$ (km)	P_{exp} (%)	$ER_{95\%}$ (km)	P_{exp} (%)	$ER_{95\%}$ (km)	P_{exp} (%)
PTS (SEL_{24h})[c]	183[a]	0.98	20	1.00	16	1.24	10	1.39	12	1.14	24
TTS (SEL_{24h})[c]	168[a]	15.04	75	14.75	82	17.11	75	14.57	70	16.99	71
Behavioural response (SPL)[d]	160[b]	9.74	93	9.22	95	9.51	96	9.73	89	9.32	95

[a] LF-weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa^2·s)
[b] SPL (L_p; dB re 1 µPa)
[c] Southall et al. (2019a) criteria for marine fauna.
[d] NOAA (2019) recommended unweighted behavioural threshold for marine mammals.

5.4.1. Exposure Range Histograms: BIA Restricted Seeding

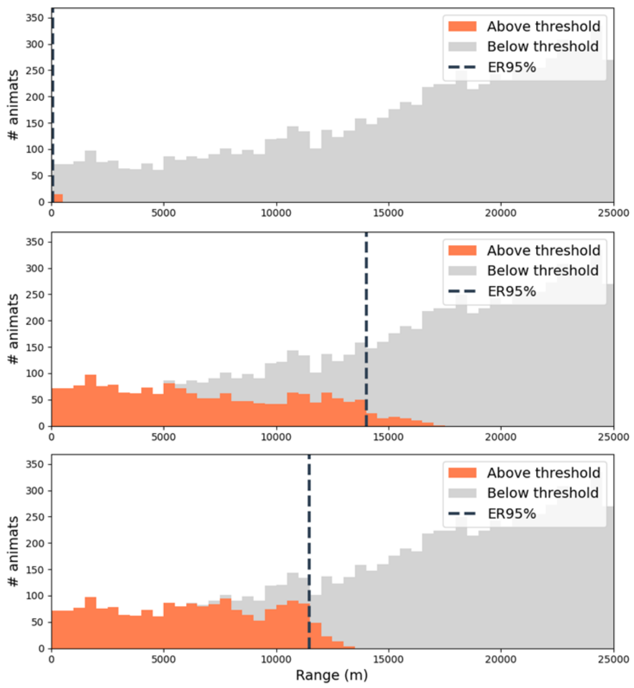

Figure 52. *Scenario 1, BIA restricted seeding*: CPA range histogram for animats, SEL_{24h} PTS threshold (top panel), SEL_{24h} TTS threshold (middle panel), SPL behavioural threshold (bottom panel). Bar colours indicate whether the animats exceeded the threshold.

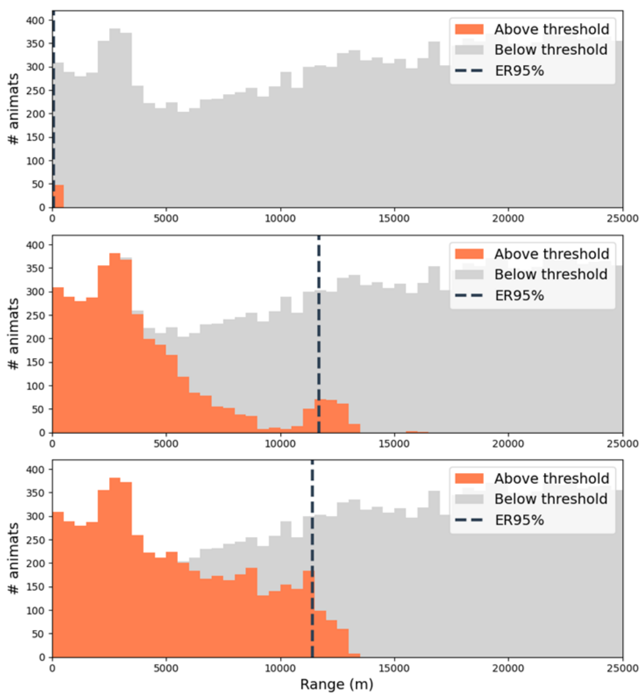

Figure 53. *Scenario 4, BIA restricted seeding*: CPA range histogram for animats, SEL_{24h} PTS threshold (top panel), SEL_{24h} TTS threshold (middle panel), SPL behavioural threshold (bottom panel). Bar colours indicate whether the animats exceeded the threshold.

5.4.2. Exposure Range Histograms: Unrestricted Seeding

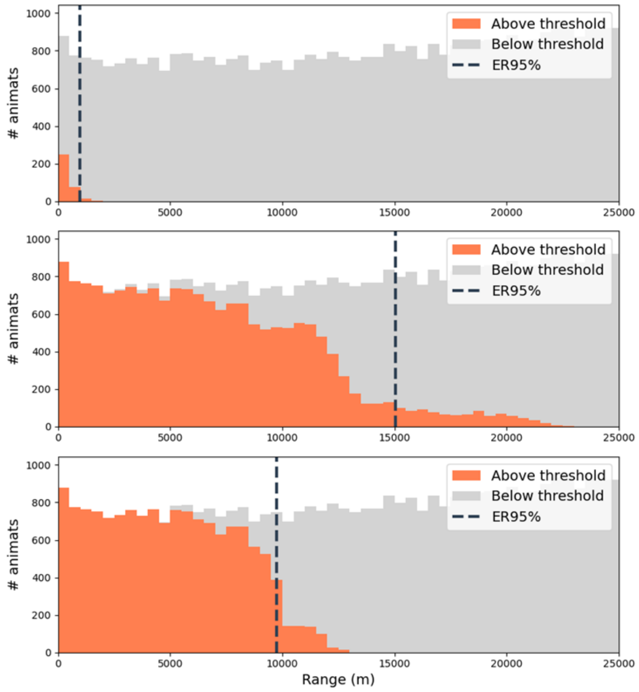

Figure 54. *Scenario 1, unrestricted seeding*: CPA range histogram for animats, SEL_{24h} PTS threshold (top panel), SEL_{24h} TTS threshold (middle panel), SPL behavioural threshold (bottom panel). Bar colours indicate whether the animats exceeded the threshold.

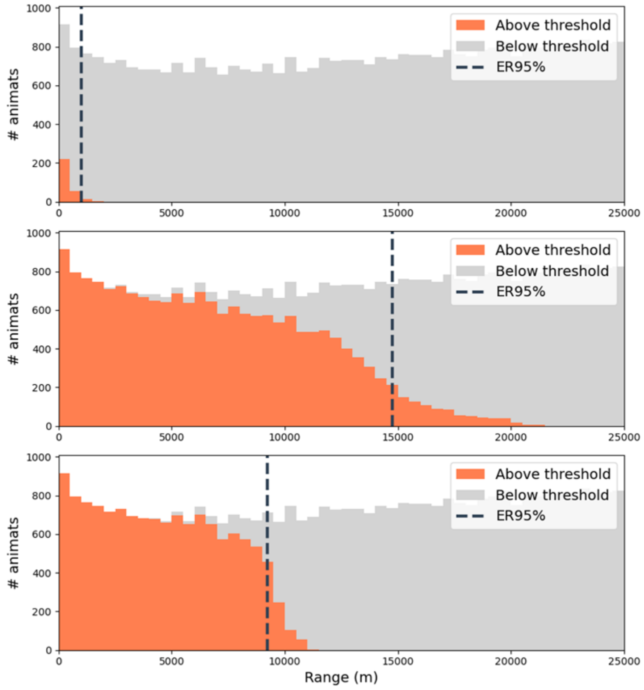

Figure 55. *Scenario 2, unrestricted seeding*: CPA range histogram for animats, SEL_{24h} PTS threshold (top panel), SEL_{24h} TTS threshold (middle panel), SPL behavioural threshold (bottom panel). Bar colours indicate whether the animats exceeded the threshold.

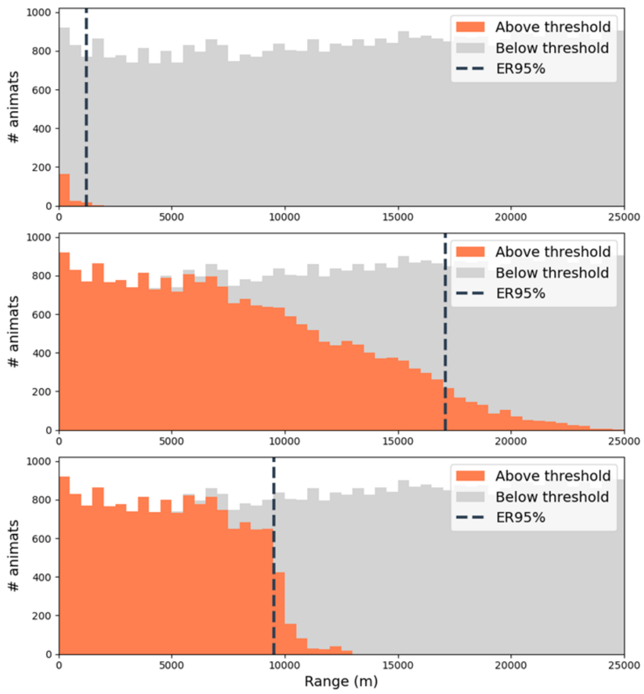

Figure 56. *Scenario 3, unrestricted seeding*: CPA range histogram for animats, SEL_{24h} PTS threshold (top panel), SEL_{24h} TTS threshold (middle panel), SPL behavioural threshold (bottom panel). Bar colours indicate whether the animats exceeded the threshold.

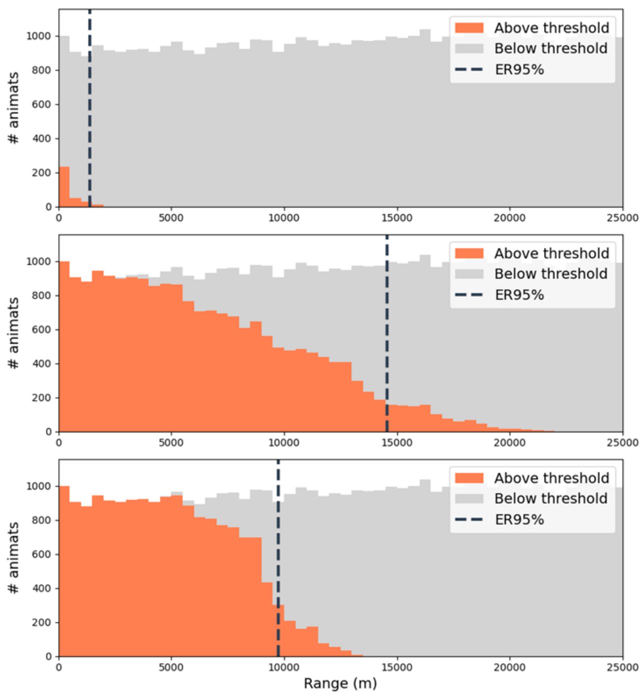

Figure 57. *Scenario 4, unrestricted seeding*: CPA range histogram for animats, SEL_{24h} PTS threshold (top panel), SEL_{24h} TTS threshold (middle panel), SPL behavioural threshold (bottom panel). Bar colours indicate whether the animats exceeded the threshold.

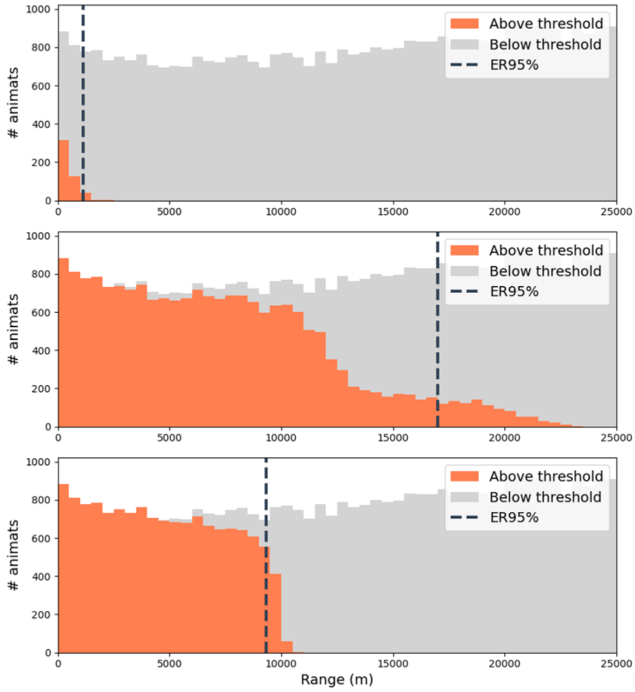

Figure 58. *Scenario 5, unrestricted seeding*: CPA range histogram for animats, SEL_{24h} PTS threshold (top panel), SEL_{24h} TTS threshold (middle panel), SPL behavioural threshold (bottom panel). Bar colours indicate whether the animats exceeded the threshold.

6. Discussion and Summary

The modelling study predicted underwater sound levels associated with the planned Schlumberger Bonaparte Basin MSS. The underwater sound field was modelled for a 3000 in^3 seismic source (Appendix B.2). An analysis of seasonal sound speed profiles and associated sensitivity analysis indicated that March was likely to be the month most conducive to sound propagation; as such it was selected to ensure a conservative estimation of distances to received sound level thresholds over the potential survey periods (Appendix D.3.2). Modelling also accounted for site-specific bathymetric variations (Appendix D.3.1) and local geoacoustic properties (Appendix D.3.3).

Most acoustic energy from a seismic source is output at lower frequencies, in the tens to hundreds of hertz. The modelled array had a pronounced broadside directivity for decidecade bands between ~100 to 400 Hz (Appendix B.3), which caused a noticeable axial bulge in the modelled acoustic footprints. The overall broadband (10-25000 Hz) unweighted per-pulse SEL and peak pressure source levels of the seismic source operating at 8 m depth are detailed in Table 8.

6.1. Per-Pulse Sound Fields

The modelled sites encompassed water depths from 95 to 211 m across one defined geological area. At all single impulse sites, the distances to identified isopleths were generally greater in the broadside direction. The array directionality and frequency content coupled with the bathymetry had a considerable effect on propagation at longer distances, with generally larger lobes of sound energy extending in the broadside direction where no shoals intersected the propagation path, as shown in most footprint maps in Section 5.2.2.1. The maps and vertical slice plots for the modelling sites closest to the shoals, such as Sites 1 and 2 (for Figures 7 and 8) demonstrate the truncation of isopleths due to steep slopes and shallowing waters in the vicinity of a shoal. Where shoals are present along a propagation path, they can block the propagation of acoustic energy. This can be observed in the footprint maps and cross-sections in Section 5.2.1. The steep bathymetric gradient (relative to the water depth) present for Sites 1 and 2, serves to strip propagating sound energy from the water column and enhance transmission into the seabed, resulting in an increase in loss as sound propagates upslope. The rate of loss is primarily dependent, the magnitude of the water depth change, the bathymetric gradient, and the geoacoustic properties of the seabed (Jensen et al. 2011). These parameters have been incorporated into the acoustic models to provide a realistic estimate of the received levels predictions.

Isopleth shapes are significantly influenced by the presence of shoals, with propagation in the direction of the pygmy blue whale BIA only supported between the gaps in the shoals. The vertical slice plots (Section 5.2.2.2) assist in demonstrating the influence of the bathymetry, source location and sound speed profile on the predicted sound field. Ranges to isopleths at the different sites therefore depend upon the transmission pathway to open water, as well as the depth of the water the source is operational in. Sources located in deeper water have a lower “cut-off frequency (f_c)” than sources in shallower water. The cut-off frequency is a single number that describes how much acoustic energy can propagate with minimal loss between then sea-surface and seafloor interfaces. For a given acoustic signal, frequencies below f_c are subject to higher loss compared to frequencies above the f_c (Jensen et al. 2011). For the considered modelled sites in waters between 95 and 221 m deep the cut off frequencies are approximately 20257 Hz. Deeper water has a lower f_c allowing more low-frequency energy to propagate when compared with shallower water on the continental shelf.

The bathymetry within survey area varied gradually from east to west across the shelf, with the highest rates of change in the north-west corner of the Operational Area, where the water depths increase as the continental shelf transitions into a deeper water slope environment. The combination of low-frequency content from the seismic source and the water depths within the survey area resulted in the sound field substantially interacting with the seabed. The maximum-over-depth sound footprint maps and vertical slice plots (Sections 5.2.2.1 and 5.2.2.2) assist in demonstrating the influence of the bathymetry and seabed composition on the sound field.

The distances to PK and PK-PK based criteria (Section 3.2 and 3.4) for fish, benthic crustaceans, and bivalves at the seafloor generally increased with increasing water depth (Tables 18-19). However, distances to these criteria did not always consistently change with increasing depth. In general, the number of modelled sites and water depths considered within the Operational Area provides a good representation of potential variability for seabed receptors. This includes the section of the Operational Area over the Sahul Shelf KEF, where results for sites with the appropriate depth can be applied.

6.2. Multiple Pulse Sound Fields

The accumulated SEL over 24 hours of seismic source operation was modelled considering four acoustic scenarios and five animal movement modelling scenarios, each with a realistic acquisition pattern, representative of the entire survey. The modelling predicted the accumulation of sound energy, considering the change in location and the azimuth of the source at each pulse point, which was used to assess possible injury in marine mammals and the SEL_{24h} based fish criteria. The results were presented as maps of the accumulated exposure levels and tabulated values of ranges to threshold levels and exposure areas for the given effects criteria (Section 3).

Continuous line acquisition proposed for this MSS involves the seismic source operating at full power on turns as well as the lines. The operation of the seismic source on the turns can create a focussing effect towards the centre of the curved track, which can result in the R_{max} and $R_{95\%}$ to occur at the focus of a turn as shown in the sound level contour maps in Section 5.3.2, rather than the perpendicular to the main survey lines.

The footprints and range maxima for all accumulated SEL thresholds are influenced by the seabed compositions along acquisition lines. The discussion above regarding ranges to isopleths also applies to the accumulated SEL calculations. The furthest ranges to thresholds for PTS and TTS were in the broadside direction, driven by the bathymetry.

The presented results for the line sections over the continental shelf, particularly on the eastern side, which is where the Sahul Shelf KEF is, are representative of the shape and extent of the sound fields expected to be present over the shelf for the line plan associated with the modelling scenario. This is due to the similarity of environmental parameters (SSP, bathymetry and geology). Therefore the presented results, although not specifically over the Sahul Shelf KEF, are applicable and representative.

6.3. Acoustic Results Summary

This section presents summary of the distances to the noise effect criteria applied in this study (Section 3) as relevant to the impact assessment. The effect criteria for impairment of marine mammals, fish and sea turtles use dual metrics (PK and SEL_{24h}), and the longest distance associated with either metric is required to be applied, and thus is presented in this summary.

The SEL_{24h} is a cumulative metric that reflects the dosimetric effect of noise levels within 24 h based on the assumption that an animal is consistently exposed to such noise levels at a fixed position. Where the corresponding SEL_{24h} radii are larger than those for peak pressure criteria, they often represent an unlikely worst-case scenario. More realistically, marine mammals, fish and sea turtles would not stay in the same location for 24 hours, but rather a shorter period, depending upon their behaviour, the proximity and movements of the source. Therefore, a reported radius for SEL_{24h} criteria does not mean that marine fauna travelling within this radius of the source will be impaired, but rather that an animal could be exposed to the sound level associated with impairment (either PTS or TTS) if it remained in that location for 24 h. A more realistic representation of the potential exposures was undertaken using animal movement modelling ('animat modelling'), with the results summarised separately below in Section 6.4.

A summary of predicted distances to criteria from acoustic modelling are presented below.

Marine mammals

Table 27 summarises the distances to criteria for marine mammals, note that these distances are primarily associated with the broadside aspect of the array. Results for PK are presented in Table 17, while SEL_{24h} results are in Table 20.

Table 27. Summary of maximum (R_{max}) horizontal distances (in km) from modelled sites or scenarios to behavioural response thresholds and temporary threshold shift (TTS) and permanent threshold shift (PTS) for marine mammals. Maximum extents are in the broadside direction of the 3000 in^3 seismic source.

Hearing group	Modelled distance to effect threshold (R_{max})		
	Behavioural response[1]	Impairment: TTS[2]	Impairment: PTS[2]
LF cetaceans	14.3 (SPL)	47.5 (SEL_{24h})	6.84 (SEL_{24h})
HF cetaceans		0.08 (SEL_{24h})	–
VHF cetaceans		0.92 (PK)	0.48 (PK)
Sirenians		0.08 (SEL_{24h})	–

Noise exposure criteria: [1] NOAA (2019) and [2] Southall et al. (2019b).
A dash indicates the threshold was not reached within the limits of the modelling resolution (20 m).

Sea turtles

Table 28 summarises the distances to criteria for sea turtles, with the results for behavioural thresholds presented in Tables 13–16 while SEL_{24h} results are in Table 20.

Table 28. Summary of horizontal distances (in km) to turtle behavioural response criteria, temporary threshold shift (TTS), and permanent threshold shift (PTS).

Hearing group	Modelled distance to effect threshold (R_{max})			
	Behavioural response[1]	Behavioural disturbance[1]	Impairment: TTS[2]	Impairment: PTS[2]
Sea Turtles	7.68 (SPL)	2.44 (SPL)	6.11 (SEL_{24h})	0.08 (SEL_{24h})

Noise exposure criteria: [1] McCauley et al. (2000) and [2] Finneran et al. (2017)

Fish, fish eggs, and fish larvae

- This modelling study assessed the ranges for quantitative criteria based on Popper et al. (2014) and considered both PK (seafloor and water column) and SEL_{24h} metrics associated with mortality and potential mortal injury as well as impairment in the following groups:
    - Fish without a swim bladder (also appropriate for sharks in the absence of other information),
    - Fish with a swim bladder that do not use it for hearing,
    - Fish that use their swim bladders for hearing,

- Fish eggs and fish larvae.

- Table 29 summarises distances to effect criteria for fish, fish eggs, and fish larvae along with the relevant metric. Results for PK are presented in Tables 17 and 18, whilst SEL_{24h} results are in Tables 21–24.

Table 29. Summary of maximum fish, fish eggs, and larvae injury and temporary threshold shift (TTS) onset distances for single impulse and 24 hour sound exposure level (SEL_{24h}) modelled scenarios.

Relevant hearing group	Effect criteria	Water column		Seafloor	
		Metric associated with longest distance to criteria	R_{max} (km)	Metric associated with longest distance to criteria	R_{max} (km)
Fish: No swim bladder	Recoverable injury	PK	0.130	PK	0.130
	TTS	SEL_{24h}	10.5	SEL_{24h}	9.31
Fish: Swim bladder not involved in hearing and Swim bladder involved in hearing	Recoverable injury	PK	0.20	PK	0.25
	TTS	SEL_{24h}	10.5	SEL_{24h}	9.31
Fish eggs, and larvae	Injury	PK	0.20	PK	0.25

Benthic invertebrates, Sponges, Coral, and Plankton

To assist with assessing the potential effects on these receptors, the following results were determined:

- Crustaceans: The sound level of 202 dB re 1 µPa PK-PK from Payne et al. (2008) which is representative of no effects, was considered for seafloor sound levels; the sound level was reached at ranges between 307 and 778 m for the 3000 in^3 source; results presented in Table 19.
- Bivalves: The distance where a particle acceleration of 37.57 ms^{-2} at the seafloor could occur was determined for comparing to results presented in Day et al. (2016a). This particle acceleration was reached at a maximum range of 6.0 and 10.5 m for water depths of 60 and 75 m; results presented in Section 5.2.3.
- Sponges and coral: The PK sound level at the seafloor directly underneath the seismic source was estimated at all modelled sites and compared to the sound level of 226 dB re 1 µPa PK for sponges and corals (Heyward et al. 2018); the threshold was reached at the range of 11 m for the 40 m water depth and was not reached at any of the other considered depths, as presented in Table 18.

6.4. Animal Movement Modelling

The estimated sound fields produced by source and propagation models for the planned Schlumberger Bonaparte Basin seismic survey were incorporated into a sound exposure model for pygmy blue whales to estimate the radial distance within which 95% of the exposure exceedances occur ($ER_{95\%}$), along with the probability that an animat with the closest point of approach within that distance would be exposed above the relevant threshold (P_{exp}).

For the exposure analysis, each of the five scenarios was run both with BIA-restricted animat seeding and unrestricted seeding. Of the five scenarios considered, only Scenarios 1 and 4 had partial overlap with the BIA. Because of the large distance between Scenarios 2, 3, and 5 and the BIA, no exposures above threshold are predicted for these scenarios for the BIA-restricted simulations, however the information can be used to define buffer zones to the BIA. Sections 6.4.1 and 6.4.2 summarise the PTS, TTS, and behavioural exposure range results, with the tabulated results presented in Tables 25 and 26.

6.4.1. PTS and TTS

Exposure ranges from animal movement modelling for PTS and TTS criteria are typically shorter than those predicted using acoustic propagation modelling because of the shorter dwell time of the moving animats. In all scenarios, for both BIA-restricted and unrestricted cases, PTS and TTS exposure ranges were substantially shorter than acoustic ranges to threshold.

Of the BIA-restricted seeding scenarios, only Scenarios 1 and 4 resulted in exposures above threshold, and therefore exposure ranges. The maximum $ER_{95\%}$ for SEL_{24h} thresholds was 14.0 km for TTS and 0.06 km for PTS. All of the unrestricted seeding scenarios resulted in TTS and PTS exposures above threshold. The maximum $ER_{95\%}$ for unrestricted scenarios was 17.11 km for TTS and 1.39 km for PTS. Exposure ranges are, on average, slightly longer for TTS and PTS for unrestricted vs BIA-restricted scenarios because unrestricted animats have more opportunities to be exposed to sound fields for a longer time, which effectively lengthens their dwell time.

The probability of exposure within $ER_{95\%}$ varied between 58 and 93% for BIA-restricted scenarios and 10-96% for unrestricted scenarios, indicating that some, but not all, animats exposed within the 95th percentile range were exposed above threshold. This is because animats can move in and out of the modelling range as well as their vertical position in the water column, thus potentially limiting the length of time they are within the exposure radius. For example, an animat might approach within the predicted exposure range but if they are traveling more quickly on average than other animats, they may not accumulate as much exposure, or they may be spending more time at depths with quieter sound levels.

6.4.2. Behavioural Effects

Exposure ranges ($ER_{95\%}$) for single exposure metrics, such as the SPL behavioural response criteria, are typically comparable to the predicted acoustic ranges. Acoustic ranges are conservatively calculated using the maximum-over-depth sound fields and assuming static receivers, while exposure ranges account for animats sampling the sound field vertically and horizontally based on species-specific diving parameters, so exposure ranges are generally slightly lower than the R_{max} acoustic ranges and in this case are fairly aligned with the $R_{95\%}$ acoustic ranges. The behavioural results from this study are consistent with this pattern. For the BIA restricted seeding scenarios, behavioural exposure ranges were similar, at 11.47 km and 11.42 km for Scenarios 1 and 4, respectively with the probabilities of exposure being 86% and 85%. For unrestricted scenarios, the exposure ranges varied minimally from 9.22–9.74 km. These are shorter, on average, than the exposure ranges for the BIA-restricted scenarios. This occurs because the unrestricted seeding allows more animats to get closer to source locations, thereby shifting the bulk of the distribution lower (e.g., Figure 57 vs. Figure 53).

Glossary

Unless otherwise stated in an entry, these definitions are consistent with ISO 80000-3 (2017).

1/3-octave

One third of an octave. *Note*: A one-third octave is approximately equal to one decidecade (1/3 oct ≈ 1.003 ddec).

1/3-octave-band

Frequency band whose bandwidth is one one-third octave. *Note*: The bandwidth of a one-third octave-band increases with increasing centre frequency.

A-weighting

Frequency-selective weighting for human hearing in air that is derived from the inverse of the idealized 40-phon equal loudness hearing function across frequencies.

absorption

The reduction of acoustic pressure amplitude due to acoustic particle motion energy converting to heat in the propagation medium.

attenuation

The gradual loss of acoustic energy from absorption and scattering as sound propagates through a medium.

auditory frequency weighting

The process of applying an auditory frequency weighting function. In human audiometry, C-weighting is the most commonly used function, an example for marine mammals are the auditory frequency weighting functions published by Southall et al. (2007).

auditory frequency weighting function

Frequency weighting function describing a compensatory approach accounting for a species' (or functional hearing group's) frequency-specific hearing sensitivity. Example hearing groups are low-, mid-, and high-frequency cetaceans, phocid and otariid pinnipeds.

azimuth

A horizontal angle relative to a reference direction, which is often magnetic north or the direction of travel. In navigation it is also called bearing.

bandwidth

The range of frequencies over which a sound occurs. Broadband refers to a source that produces sound over a broad range of frequencies (e.g., seismic airguns, vessels) whereas narrowband sources produce sounds over a narrow frequency range (e.g., sonar) (ANSI S1.13-2005 (R2010)).

bar

Unit of pressure equal to 100 kPa, which is approximately equal to the atmospheric pressure on Earth at sea level. 1 bar is equal to 10^5 Pa or 10^{11} µPa.

boxcar averaging

A signal smoothing technique that returns the averages of consecutive segments of a specified width.

broadband level

The total level measured over a specified frequency range.

broadside direction

Perpendicular to the travel direction of a source. Compare with endfire direction.

cetacean

Any animal in the order Cetacea. These are aquatic species and include whales, dolphins, and porpoises.

compressional wave

A mechanical vibration wave in which the direction of particle motion is parallel to the direction of propagation. Also called primary wave or P-wave.

conductivity-temperature-depth (CTD)

Measurement data of the ocean’s conductivity, temperature, and depth; used to compute sound speed and salinity.

decade

Logarithmic frequency interval whose upper bound is ten times larger than its lower bound (ISO 80000-3:2006).

decidecade

One tenth of a decade. *Note*: An alternative name for decidecade (symbol ddec) is “one-tenth decade”. A decidecade is approximately equal to one third of an octave (1 ddec ≈ 0.3322 oct) and for this reason is sometimes referred to as a “one-third octave”.

decidecade band

Frequency band whose bandwidth is one decidecade. *Note*: The bandwidth of a decidecade band increases with increasing centre frequency.

decibel (dB)

Unit of level used to express the ratio of one value of a power quantity to another on a logarithmic scale. Unit: dB.

duty cycle

The time when sound is periodically recorded by an acoustic recording system.

endfire direction

Parallel to the travel direction of a source. Also see **broadside direction**.

energy source level

A property of a sound source obtained by adding to the sound exposure level measured in the far field the propagation loss from the acoustic centre of the source to the receiver position. Unit: decibel (dB). Reference value: 1 μPa^{2}m^{2}s.

energy spectral density source level

A property of a sound source obtained by adding to the energy spectral density level of the sound pressure measured in the far field the propagation loss from the acoustic centre of the source to the receiver position. Unit: decibel (dB). Reference value: 1 μPa^{2}m^{2}s/Hz.

ensonified

Exposed to sound.

far field

The zone where, to an observer, sound originating from an array of sources (or a spatially distributed source) appears to radiate from a single point.

Fourier transform (or Fourier synthesis)

A mathematical technique which, although it has varied applications, is referenced in the context of this report as a method used in the process of deriving a spectrum estimate from time-series data (or the reverse process, termed the inverse Fourier transform). A computationally efficient numerical algorithm for computing the Fourier transform is known as fast Fourier transform (FFT).

flat weighting

Term indicating that no frequency weighting function is applied. Synonymous with unweighted.

frequency

The rate of oscillation of a periodic function measured in cycles-per-unit-time. The reciprocal of the period. Unit: hertz (Hz). Symbol: f. 1 Hz is equal to 1 cycle per second.

frequency weighting

The process of applying a frequency weighting function.

frequency-weighting function

The squared magnitude of the sound pressure transfer function. For sound of a given frequency, the frequency weighting function is the ratio of output power to input power of a specified filter, sometimes expressed in decibels. Examples include the following:

- *Auditory frequency weighting function*: compensatory frequency weighting function accounting for a species' (or functional hearing group's) frequency-specific hearing sensitivity.
- *System frequency weighting function*: frequency weighting function describing the sensitivity of an acoustic acquisition system, typically consisting of a hydrophone, one or more amplifiers, and an analogue to digital converter.

geoacoustic

Relating to the acoustic properties of the seabed.

harmonic

A sinusoidal sound component that has a frequency that is an integer multiple of the frequency of a sound to which it is related. For example, the second harmonic of a sound has a frequency that is double the fundamental frequency of the sound.

hearing group

Category of animal species when classified according to their hearing sensitivity and to the susceptibility to sound. Examples for marine mammals include very low-frequency (VLF) cetaceans, low-frequency (LF) cetaceans, mid-frequency (MF) cetaceans, high-frequency (HF) cetaceans, very high-frequency (VHF) cetaceans, otariid pinnipeds in water (OPW), phocid pinnipeds in water (PPW), sirenians (SI), other marine carnivores in air (OCA), and other marine carnivores in water (OCW) (NMFS 2018, Southall et al. 2019b). See **auditory frequency weighting functions**, which are often applied to these groups. Examples for fish include species for which the swim bladder is involved in hearing, species for which the swim bladder is not involved in hearing, and species without a swim bladder (Popper et al. 2014).

hearing threshold

The sound pressure level for any frequency of the hearing group that is barely audible for a given individual for specified background noise during a specific percentage of experimental trials.

hertz (Hz)

A unit of frequency defined as one cycle per second.

high-frequency (HF) cetacean

See **hearing group**.

intermittent sound

A sound whose level abruptly drops below the background noise level several times during an observation period.

impulsive sound

Qualitative term meaning sounds that are typically transient, brief (less than 1 second), broadband, with rapid rise time and rapid decay. They can occur in repetition or as a single event. Examples of impulsive sound sources include explosives, seismic airguns, and impact pile drivers.

isopleth

A line drawn on a map through all points having the same value of some quantity.

knot

One nautical mile per hour. Symbol: kn.

level

A measure of a quantity expressed as the logarithm of the ratio of the quantity to a specified reference value of that quantity. Examples include sound pressure level, sound exposure level, and peak sound pressure level. For example, a value of sound exposure level with reference to 1 μPa^2 s can be written in the form x dB re 1 μPa^2 s.

low-frequency (LF) cetacean

See **hearing group**.

median

The 50th percentile of a statistical distribution.

mid-frequency (MF) cetacean

See **hearing group**.

M-weighting

See **auditory frequency weighting function** (as proposed by Southall et al. 2007).

mysticete

A suborder of cetaceans that use baleen plates to filter food from water. Members of this group include rorquals (Balaenopteridae), right whales (Balaenidae), and grey whales (*Eschrichtius robustus*).

non-impulsive sound

Sound that is not an impulsive sound. A non-impulsive sound is not necessarily a continuous sound.

octave

The interval between a sound and another sound with double or half the frequency. For example, one octave above 200 Hz is 400 Hz, and one octave below 200 Hz is 100 Hz.

otariid

A common term used to describe members of the Otariidae, eared seals, commonly called sea lions and fur seals. Otariids are adapted to a semi-aquatic life; they use their large fore flippers for propulsion. Their ears distinguish them from phocids. Otariids are one of the three main groups in the superfamily Pinnipedia; the other two groups are phocids and walrus.

otariid pinnipeds in water (OPW)

See **hearing group**.

other marine carnivores in air (OCA)

See **hearing group**.

other marine carnivores in water (OCW)

See **hearing group**.

parabolic equation method

A computationally efficient solution to the acoustic wave equation that is used to model propagation loss. The parabolic equation approximation omits effects of back-scattered sound, simplifying the computation of propagation loss. The effect of back-scattered sound is negligible for most ocean-acoustic propagation problems.

peak sound pressure level (zero-to-peak sound pressure level)

The level ($L_{p,pk}$ or L_{pk}) of the squared maximum magnitude of the sound pressure (p_{pk}^2). Unit: decibel (dB). Reference value (p_0^2) for sound in water: 1 µPa^2.

$$L_{p,\mathrm{pk}} := 10 \log_{10}\left(p_{\mathrm{pk}}^2 / p_0^2\right) \mathrm{dB} \ = 20 \log_{10}\left(p_{\mathrm{pk}} / p_0\right) \mathrm{dB}$$

The frequency band and time window should be specified. Abbreviation: PK or L_{pk}.

peak-to-peak sound pressure

The difference between the maximum and minimum sound pressure over a specified frequency band and time window. Unit: pascal (Pa).

permanent threshold shift (PTS)

An irreversible loss of hearing sensitivity caused by excessive noise exposure. PTS is considered auditory injury.

phocid

A common term used to describe all members of the family Phocidae. These true/earless seals are more adapted to in-water life than are otariids, which have more terrestrial adaptations. Phocids use their hind flippers to propel themselves. Phocids are one of the three main groups in the superfamily Pinnipedia; the other two groups are otariids and walrus.

phocid pinnipeds in water (PPW)

See **hearing group**.

pinniped

A common term used to describe all three groups that form the superfamily Pinnipedia: phocids (true seals or earless seals), otariids (eared seals or fur seals and sea lions), and walrus.

point source

A source that radiates sound as if from a single point.

pressure, acoustic

The deviation from the ambient pressure caused by a sound wave. Also called sound pressure. Unit: pascal (Pa).

pressure, hydrostatic

The pressure at any given depth in a static liquid that is the result of the weight of the liquid acting on a unit area at that depth, plus any pressure acting on the surface of the liquid. Unit: pascal (Pa).

propagation loss (PL)

Difference between a source level (SL) and the level at a specified location, PL(x) = SL − L(x). Also see **transmission loss**.

received level

The level measured (or that would be measured) at a defined location. The type of level should be specified.

reference values

standard underwater references values used for calculating sound **levels**, e.g., the reference value for expressing sound pressure level in decibels is 1 μPa.

Quantity	Reference value
Sound pressure	1 μPa
Sound exposure	1 μPa^2 s
Sound particle displacement	1 pm
Sound particle velocity	1 nm/s
Sound particle acceleration	1 $\mu m/s^2$

rms

abbreviation for root-mean-square.

shear wave

A mechanical vibration wave in which the direction of particle motion is perpendicular to the direction of propagation. Also called a secondary wave or S-wave. Shear waves propagate only in solid media, such as sediments or rock. Shear waves in the seabed can be converted to compressional waves in water at the water-seabed interface.

sound

A time-varying disturbance in the pressure, stress, or material displacement of a medium propagated by local compression and expansion of the medium.

sound exposure

Time integral of squared sound pressure over a stated time interval. The time interval can be a specified time duration (e.g., 24 hours) or from start to end of a specified event (e.g., a pile strike, an airgun pulse, a construction operation). Unit: Pa^2 s.

sound exposure level

The level (L_E) of the sound exposure (E). Unit: decibel (dB). Reference value (E_0) for sound in water: 1 µPa^2 s.

$$L_E := 10\log_{10}(E/E_0)\,\mathrm{dB} \;= 20\log_{10}\left(E^{1/2}/E_0^{1/2}\right)\,\mathrm{dB}$$

The frequency band and integration time should be specified. Abbreviation: SEL.

sound exposure spectral density

Distribution as a function of frequency of the time-integrated squared sound pressure per unit bandwidth of a sound having a continuous spectrum. Unit: Pa^2 s/Hz.

sound field

Region containing sound waves.

sound intensity

Product of the sound pressure and the sound particle velocity. The magnitude of the sound intensity is the sound energy flowing through a unit area perpendicular to the direction of propagation per unit time.

sound particle acceleration

The rate of change of sound particle velocity. Unit: metre per second squared (m/s^2). Symbol: *a*.

sound particle motion

smallest volume of a medium that represents its mean physical properties.

sound particle displacement

Displacement of a material element caused by the action of sound, where a material element is the smallest element of the medium that represents the medium's mean density.

sound particle velocity

The velocity of a particle in a material moving back and forth in the direction of the pressure wave. Unit: metre per second (m/s). Symbol: *v*.

sound pressure

The contribution to total pressure caused by the action of sound.

sound pressure level (rms sound pressure level)

The level ($L_{p,\text{rms}}$) of the time-mean-square sound pressure (p^2_{rms}). Unit: decibel (dB). Reference value (p_0^2) for sound in water: 1 µPa^2.

$$L_{p,\text{rms}} := 10\log_{10}(p^2_{\text{rms}}/p_0^2)\ \text{dB}\ = 20\log_{10}(p_{\text{rms}}/p_0)\ \text{dB}$$

The frequency band and averaging time should be specified. Abbreviation: SPL or Lrms.

sound speed profile

The speed of sound in the water column as a function of depth below the water surface.

soundscape

The characterization of the ambient sound in terms of its spatial, temporal, and frequency attributes, and the types of sources contributing to the sound field.

source level (SL)

A property of a sound source obtained by adding to the sound pressure level measured in the far field the propagation loss from the acoustic centre of the source to the receiver position. Unit: decibel (dB). Reference value: 1 µPa^{2}m^2.

spectrum

An acoustic signal represented in terms of its power, energy, mean-square sound pressure, or sound exposure distribution with frequency.

surface duct

The upper portion of a water column within which the sound speed profile gradient causes sound to refract upward and therefore reflect off the surface resulting in relatively long-range sound propagation with little loss.

temporary threshold shift (TTS)

Reversible loss of hearing sensitivity. TTS can be caused by noise exposure.

thermocline

The depth interval near the ocean surface that experiences temperature gradients due to warming or cooling by heat conduction from the atmosphere and by warming from solar heating.

transmission loss (TL)

The difference between a specified level at one location and that at a different location, TL(x1,x2) = L(x1) − L(x2). Also see **propagation loss**.

unweighted

Term indicating that no frequency weighting function is applied. Synonymous with flat weighting.

very high-frequency (VHF) cetacean

See **hearing group**.

very low-frequency (VLF) cetacean

See **hearing group**.

wavelength

Distance over which a wave completes one cycle of oscillation. Unit: metre (m). Symbol: λ.

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Appendix A. Acoustic Metrics

A.1. Pressure Related Acoustic Metrics

Underwater sound pressure amplitude is measured in decibels (dB) relative to a fixed reference pressure of p_0 = 1 μPa. Because the perceived loudness of sound, especially pulsed sound such as from seismic airguns, pile driving, and sonar, is not generally proportional to the instantaneous acoustic pressure, several sound level metrics are commonly used to evaluate sound and its effects on marine life. Here we provide specific definitions of relevant metrics used in the accompanying report. Where possible, we follow the American National Standard Institute and International Organization for Standardization definitions and symbols for sound metrics (e.g., ISO 2017, ANSI R2013), but these standards are not always consistent.

The zero-to-peak sound pressure, or peak sound pressure (PK or $L_{p,pk}$; dB re 1 μPa), is the decibel level of the maximum instantaneous acoustic pressure in a stated frequency band attained by an acoustic pressure signal, $p(t)$:

$$L_{p,\mathrm{pk}} = 10\log_{10}\frac{\max|p^2(t)|}{p_0^2} = 20\log_{10}\frac{\max|p(t)|}{p_0} \quad \text{(A-1)}$$

PK is often included as a criterion for assessing whether a sound is potentially injurious; however, because it does not account for the duration of an acoustic event, it is generally a poor indicator of perceived loudness.

The peak-to-peak sound pressure (PK-PK or $L_{p,pk\text{-}pk}$; dB re 1 μPa) is the difference between the maximum and minimum instantaneous sound pressure, possibly filtered in a stated frequency band, attained by an impulsive sound, $p(t)$:

$$L_{p,\mathrm{pk\text{-}pk}} = 10\log_{10}\frac{[\max(p(t)) - \min(p(t))]^2}{p_0^2} \quad \text{(A-2)}$$

The sound pressure level (SPL or L_p; dB re 1 μPa) is the root-mean-square (rms) pressure level in a stated frequency band over a specified time window (T; s). It is important to note that SPL always refers to an rms pressure level and therefore not instantaneous pressure:

$$L_p = 10\log_{10}\left(\frac{1}{T}\int_T g(t)\,p^2(t)\,dt \Big/ p_0^2\right) \quad \text{(A-3)}$$

where $g(t)$ is an optional time weighting function. In many cases, the start time of the integration is marched forward in small time steps to produce a time-varying SPL function. For short acoustic events, such as sonar pulses and marine mammal vocalizations, it is important to choose an appropriate time window that matches the duration of the signal. For in-air studies, when evaluating the perceived loudness of sounds with rapid amplitude variations in time, the time weighting function $g(t)$ is often set to a decaying exponential function that emphasizes more recent pressure signals. This function mimics the leaky integration nature of mammalian hearing. For example, human-based fast time-weighted SPL ($L_{p,fast}$) applies an exponential function with time constant 125 ms. A related simpler approach used in underwater acoustics sets $g(t)$ to a boxcar (unity amplitude) function of width 125 ms; the results can be referred to as $L_{p,boxcar\ 125ms}$. Another approach, historically used to evaluate SPL of impulsive signals underwater, defines $g(t)$ as a boxcar function with edges set to the times corresponding to 5% and 95% of the cumulative square pressure function encompassing the duration of an impulsive acoustic event. This calculation is applied individually to each impulse signal, and the results are referred to as 90% SPL ($L_{p,90\%}$).

The sound exposure level (SEL or L_E; dB re 1 µPa²·s) is the time-integral of the squared acoustic pressure over a duration (T):

$$L_E = 10\log_{10}\left(\int_T p^2(t)\,dt \Big/ T_0 p_0^2\right) \quad \text{(A-4)}$$

where T_0 is a reference time interval of 1 s. SEL continues to increase with time when non-zero pressure signals are present. It is a dose-type measurement, so the integration time applied must be carefully considered for its relevance to impact to the exposed recipients.

SEL can be calculated over a fixed duration, such as the time of a single event or a period with multiple acoustic events. When applied to pulsed sounds, SEL can be calculated by summing the SEL of the N individual pulses. For a fixed duration, the square pressure is integrated over the duration of interest. For multiple events, the SEL can be computed by summing (in linear units) the SEL of the N individual events:

$$L_{E,N} = 10\log_{10}\sum_{i=1}^{N} 10^{\frac{L_{E,i}}{10}} \quad \text{(A-5)}$$

If applied, the frequency weighting of an acoustic event should be specified, as in the case of weighted SEL (e.g., $L_{E,LF,24h}$; see Appendix A.4) or auditory-weighted SPL ($L_{p,ht}$). The use of fast, slow, or impulse exponential-time-averaging or other time-related characteristics should also be specified.

A.1. Particle Acceleration and Velocity Metrics

Since sound is a mechanical wave, it can also be measured in terms of the vibratory motion of fluid particles. Particle motion can be measured in terms of three different (but related) quantities: displacement, velocity, or acceleration. Acoustic particle velocity is the time derivative of particle displacement, and likewise acceleration is the time derivative of velocity. For the present study, acoustic particle motion has been reported in terms of acceleration and velocity.

The particle velocity (v) is the physical speed of a particle in a material moving back and forth in the direction of the pressure wave. It can be derived from the pressure gradient and Euler's linearised momentum equation where ρ_0 is the density of the medium:

$$v = -\int \nabla p(t)dt/\rho_0 \quad \text{(A-6)}$$

The particle acceleration (a) is the rate of change of the velocity with respect to time, and it can be obtained from equation A-6 as:

$$a = \frac{dv}{dt} = -\frac{\nabla p(t)}{\rho_0} \quad \text{(A-7)}$$

Unlike sound pressure, particle motion is a vector quantity, meaning that it has both magnitude and direction: at any given point in space, acoustic particle motion has three different time-varying components (x, y, and z). Given the particle velocity in the x, y, and z, directions, v_x, v_y, and v_z, the particle velocity magnitude |v| is computed per the Pythagorean equation:

$$|v| = \sqrt{v_x + v_y + v_z} \quad \text{(A-8)}$$

The magnitude of particle acceleration is calculated similarly from the particle acceleration in the x, y, and z directions.

A.2. Decidecade Band Analysis

The distribution of a sound's power with frequency is described by the sound's spectrum. The sound spectrum can be split into a series of adjacent frequency bands. Splitting a spectrum into 1 Hz wide bands, called passbands, yields the power spectral density of the sound. This splitting of the spectrum into passbands of a constant width of 1 Hz, however, does not represent how animals perceive sound.

Because animals perceive exponential increases in frequency rather than linear increases, analysing a sound spectrum with passbands that increase exponentially in size better approximates real-world scenarios. In underwater acoustics, a spectrum is commonly split into decidecade bands, which are one tenth of a decade wide. They are approximately one third of an octave (base 2) wide and are therefore often referred to as 1/3-octave-bands. Each octave represents a doubling in sound frequency. The centre frequency of the ith band, $f_c(i)$, is defined as:

$$f_c(i) = 10^{\frac{i}{10}}\,\text{kHz} \tag{A-9}$$

and the low (f_{lo}) and high (f_{hi}) frequency limits of the ith decade band are defined as:

$$f_{lo,i} = 10^{\frac{-1}{20}} f_c(i) \quad \text{and} \quad f_{hi,i} = 10^{\frac{1}{20}} f_c(i) \tag{A-10}$$

The decidecade bands become wider with increasing frequency, and on a logarithmic scale the bands appear equally spaced (Figure A-1). The acoustic modelling spans from band 7 ($f_c\,(7)$ = 5 Hz) to band 44 ($f_c(44)$ = 25 kHz).

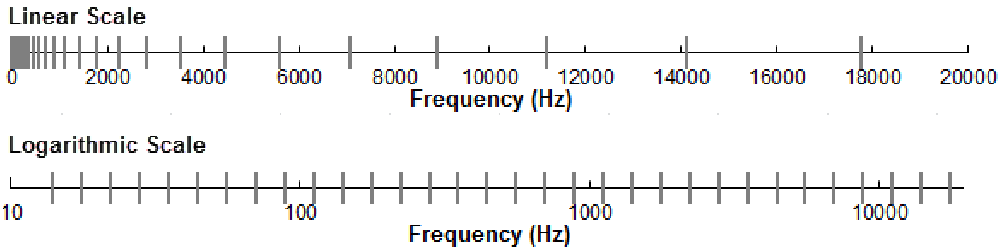

Figure A-1. Decidecade frequency bands (vertical lines) shown on a linear frequency scale and a logarithmic scale.

The sound pressure level in the ith band ($L_{p,i}$) is computed from the spectrum $S(f)$ between $f_{lo,i}$ and $f_{hi,i}$:

$$L_{p,i} = 10\log_{10} \int_{f_{lo,i}}^{f_{hi,i}} S(f)\,df \tag{A-11}$$

Summing the sound pressure level of all the bands yields the broadband sound pressure level:

$$\text{Broadband SPL} = 10\log_{10} \sum_i 10^{\frac{L_{p,i}}{10}} \tag{A-12}$$

Figure A-2 shows an example of how the decidecade band sound pressure levels compare to the sound pressure spectral density levels of an ambient noise signal. Because the decidecade bands are wider with increasing frequency, the decidecade band SPL is higher than the spectral levels at higher frequencies. Acoustic modelling of decidecade bands requires less computation time than 1 Hz bands and still resolves the frequency-dependence of the sound source and the propagation environment.

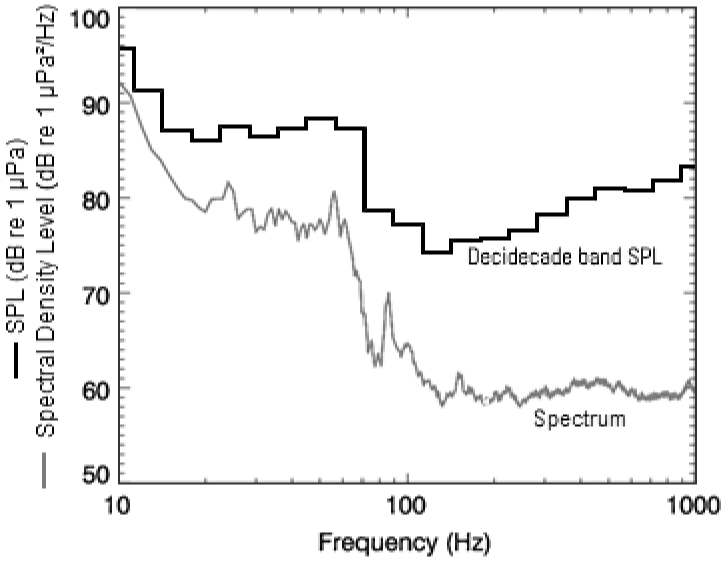

Figure A-2. Sound pressure spectral density levels and the corresponding decidecade band sound pressure levels of example ambient noise shown on a logarithmic frequency scale.

A.3. Marine Mammal Impact Criteria

It has been long recognised that marine mammals can be adversely affected by underwater anthropogenic noise. For example, Payne and Webb (1971) suggested that communication distances of fin whales are reduced by shipping sounds. Subsequently, similar concerns arose regarding effects of other underwater noise sources and the possibility that impulsive sources—primarily airguns used in seismic surveys—could cause auditory injury. This led to a series of workshops held in the late 1990s, conducted to address acoustic mitigation requirements for seismic surveys and other underwater noise sources (NMFS 1998, ONR 1998, Nedwell and Turnpenny 1998, HESS 1999, Ellison and Stein 1999). In the years since these early workshops, a variety of thresholds have been proposed for both injury and disturbance. The following sections summarize the recent development of thresholds; however, this field remains an active research topic.

A.3.1. Injury

In recognition of shortcomings of the SPL-only based injury criteria, in 2005 NMFS sponsored the Noise Criteria Group to review literature on marine mammal hearing to propose new noise exposure criteria. Some members of this expert group published a landmark paper (Southall et al. 2007) that suggested assessment methods similar to those applied for humans. The resulting recommendations introduced dual acoustic injury criteria for impulsive sounds that included peak pressure level thresholds and SEL_{24h} thresholds, where the subscripted 24h refers to the accumulation period for calculating SEL. The peak pressure level criterion is not frequency weighted whereas the SEL_{24h} is frequency weighted according to one of four marine mammal species hearing groups: low-, mid- and high-frequency cetaceans (LF, MF, and HF cetaceans, respectively) and Pinnipeds in Water (PINN). These weighting functions are referred to as M-weighting filters (analogous to the A-weighting filter for human; Appendix A.4). The SEL_{24h} thresholds were obtained by extrapolating measurements of onset levels of Temporary Threshold Shift (TTS) in belugas by the amount of TTS required to produce Permanent Threshold Shift (PTS) in chinchillas. The Southall et al. (2007) recommendations do not specify an exchange rate, which suggests that the thresholds are the same regardless of the duration of exposure (i.e., it implies a 3 dB exchange rate).

Wood et al. (2012) refined Southall et al.'s (2007) thresholds, suggesting lower injury values for LF and HF cetaceans while retaining the filter shapes. Their revised thresholds were based on TTS-onset levels in harbour porpoises from Lucke et al. (2009), which led to a revised impulsive sound PTS threshold for HF cetaceans of 179 dB re 1 µPa^2·s. Because there were no data available for baleen whales, Wood et al. (2012) based their recommendations for LF cetaceans on results obtained from MF cetacean studies. In particular they referenced Finneran and Schlundt (2010) research, which found mid-frequency cetaceans are more sensitive to non-impulsive sound exposure than Southall et al. (2007) assumed. Wood et al. (2012) thus recommended a more conservative TTS-onset level for LF cetaceans of 192 dB re 1 µPa^2·s.

As of present, an optimal approach is not apparent. There is consensus in the research community that an SEL-based method is preferable either separately or in addition to an SPL-based approach to assess the potential for injuries. In August 2016, after substantial public and expert input into three draft versions and based largely on the above-mentioned literature (NOAA 2013, 2015, 2016), NMFS finalised technical guidance for assessing the effect of anthropogenic sound on marine mammal hearing (NMFS 2016). The guidance describes injury criteria with new thresholds and frequency weighting functions for the five hearing groups described by Finneran and Jenkins (2012). The latest revision to this work was published in 2018; with the criteria defined in NMFS (2018). The latest criteria are from Southall et al. (2019b) which is applied in this report.

A.3.2. Behavioural response

Numerous studies on marine mammal behavioural responses to sound exposure have not resulted in consensus in the scientific community regarding the appropriate metric for assessing behavioural reactions. However, it is recognised that the context in which the sound is received affects the nature and extent of responses to a stimulus (Southall et al. 2007, Ellison and Frankel 2012, Southall et al. 2016).

For impulsive noise, NMFS currently uses step function thresholds of 160 dB re 1 µPa SPL (unweighted) to assess and regulate noise-induced behavioural impacts for marine mammals (NOAA 2018, NOAA 2019). The threshold for impulsive sound is derived from the High-Energy Seismic Survey (HESS) panel (HESS 1999) report that, in turn, is based on the responses of migrating mysticete whales to airgun sounds (Malme et al. 1984). The HESS team recognised that behavioural responses to sound may occur at lower levels, but significant responses were only likely to occur above a SPL of 140 dB re 1 µPa. Southall et al. (2007) found varying responses for most marine mammals between a SPL of 140 and 180 dB re 1 µPa, consistent with the HESS (1999) report, but lack of convergence in the data prevented them from suggesting explicit step functions.

A.4. Marine Mammal Frequency Weighting

The potential for noise to affect animals depends on how well the animals can hear it. Noises are less likely to disturb or injure an animal if they are at frequencies that the animal cannot hear well. An exception occurs when the sound pressure is so high that it can physically injure an animal by non-auditory means (i.e., barotrauma). For sound levels below such extremes, the importance of sound components at particular frequencies can be scaled by frequency weighting relevant to an animal's sensitivity to those frequencies (Nedwell and Turnpenny 1998, Nedwell et al. 2007).

A.4.1. Marine Mammal Frequency Weighting Functions

In 2015, a US Navy technical report by Finneran (2015) recommended new auditory weighting functions. The overall shape of the auditory weighting functions is similar to human A-weighting functions, which follows the sensitivity of the human ear at low sound levels. The new frequency-weighting function is expressed as:

$$G(f) = K + 10\log_{10}\left[\left(\frac{(f/f_{lo})^{2a}}{\left[1+(f/f_{lo})^2\right]^a\left[1+(f/f_{hi})^2\right]^b}\right)\right] \tag{A-13}$$

Finneran (2015) proposed five functional hearing groups for marine mammals in water: low-, mid- and high-frequency cetaceans (LF, MF, and HF cetaceans, respectively), phocid pinnipeds, and otariid pinnipeds. The parameters for these frequency-weighting functions were further modified the following year (Finneran 2016) and were adopted in NOAA's technical guidance that assesses acoustic impacts on marine mammals (NMFS 2018), and in the latest guidance by Southall (2019b). The updates did not affect the content related to either the definitions of frequency-weighting functions or the threshold values. Table A-1 lists the frequency-weighting parameters for each hearing group. Figure A-3 shows the resulting frequency-weighting curves.

Table A-1. Parameters for the auditory weighting functions used in this project as recommended by Southall et al. (2019b).

Hearing group	a	b	f_{lo} (Hz)	f_{hi} (kHz)	K (dB)
Low-frequency cetaceans (baleen whales)	1.0	2	200	19,000	0.13
High-frequency cetaceans (dolphins, plus toothed, beaked, and bottlenose whales)	1.6	2	8,800	110,000	1.20
Very-high-frequency cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* and *L. australis*)	1.8	2	12,000	140,000	1.36
Sirenians (Dugongs)	1.8	2	4,300	25,000	2.62

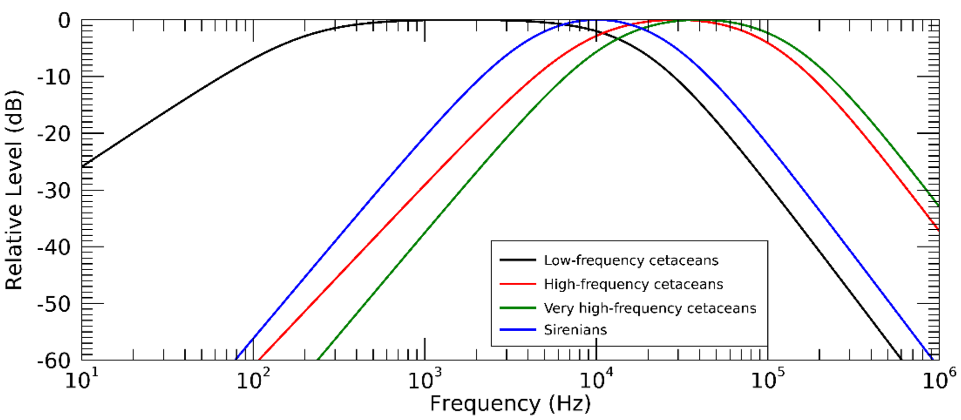

Figure A-3. Auditory weighting functions for functional marine mammal hearing groups used in this project as recommended by Southall et al. (2019b).

Appendix B. Acoustic Source Model

B.1. Airgun Array Source Model

The source levels and directivity of the seismic source were predicted with JASCO's Airgun Array Source Model (AASM). AASM includes low- and high-frequency modules for predicting different components of the seismic source spectrum. The low-frequency module is based on the physics of oscillation and radiation of airgun bubbles, as originally described by Ziolkowski (1970), that solves the set of parallel differential equations that govern bubble oscillations. Physical effects accounted for in the simulation include pressure interactions between airguns, port throttling, bubble damping, and generator-injector (GI) gun behaviour discussed by Dragoset (1984), Laws et al. (1990), and Landrø (1992). A global optimisation algorithm tunes free parameters in the model to a large library of airgun source signatures.

While airgun signatures are highly repeatable at the low frequencies, which are used for seismic imaging, their sound emissions have a large random component at higher frequencies that cannot be predicted using a deterministic model. Therefore, AASM uses a stochastic simulation to predict the high-frequency (800−25,000 Hz) sound emissions of individual airguns, using a data-driven multiple-regression model. The multiple-regression model is based on a statistical analysis of a large collection of high quality seismic source signature data recently obtained from the Joint Industry Program (JIP) on Sound and Marine Life (Mattsson and Jenkerson 2008). The stochastic model uses a Monte-Carlo simulation to simulate the random component of the high-frequency spectrum of each airgun in an array. The mean high-frequency spectra from the stochastic model augment the low-frequency signatures from the physical model, allowing AASM to predict airgun source levels at frequencies up to 25,000 Hz.

AASM produces a set of "notional" signatures for each array element based on:

- Array layout
- Volume, tow depth, and firing pressure of each airgun
- Interactions between different airguns in the array

These notional signatures are the pressure waveforms of the individual airguns at a standard reference distance of 1 m; they account for the interactions with the other airguns in the array. The signatures are summed with the appropriate phase delays to obtain the far-field source signature of the entire array in all directions. This far-field array signature is filtered into decidecade-bands to compute the source levels of the array as a function of frequency band and azimuthal angle in the horizontal plane (at the source depth), after which it is considered a directional point source in the far field.

A seismic array consists of many sources and the point source assumption is invalid in the near field where the array elements add incoherently. The maximum extent of the near field of an array (R_{nf}) is:

$$R_{\mathrm{nf}} < \frac{l^2}{4\lambda} \tag{B-1}$$

where λ is the sound wavelength and l is the longest dimension of the array (Lurton 2002, §5.2.4). For example, a seismic source length of l = 21 m yields a near-field range of 147 m at 2 kHz and 7 m at 100 Hz. Beyond this R_{nf} range, the array is assumed to radiate like a directional point source and is treated as such for propagation modelling.

The interactions between individual elements of the array create directionality in the overall acoustic emission. Generally, this directionality is prominent mainly at frequencies in the mid-range between tens of hertz to several hundred hertz. At lower frequencies, with acoustic wavelengths much larger than the inter-airgun separation distances, the directionality is small. At higher frequencies, the pattern of lobes is too finely spaced to be resolved and the effective directivity is less.

B.2. Seismic Source

The layout of the 3000 in^3 seismic sources used for modelling in this study is provided in Figure B-1. Details of the airgun parameters are provided in Tables B-1.

For the modelled array, the layout is presented in a nominal cartesian coordinate system. In this coordinate system the direction of vessel travel determines the relative position of the array elements as plotted and tabulated. The layout used for acoustic modelling was produced by transforming the coordinates of client supplied layouts such that the resultant layouts correspond to a vessel travel direction along the positive X-axis and the array is centred on the X-Y origin. When used with an acoustic model the positive X-axis in this nominal coordinate system aligns with the vessel tow direction or survey line azimuth.

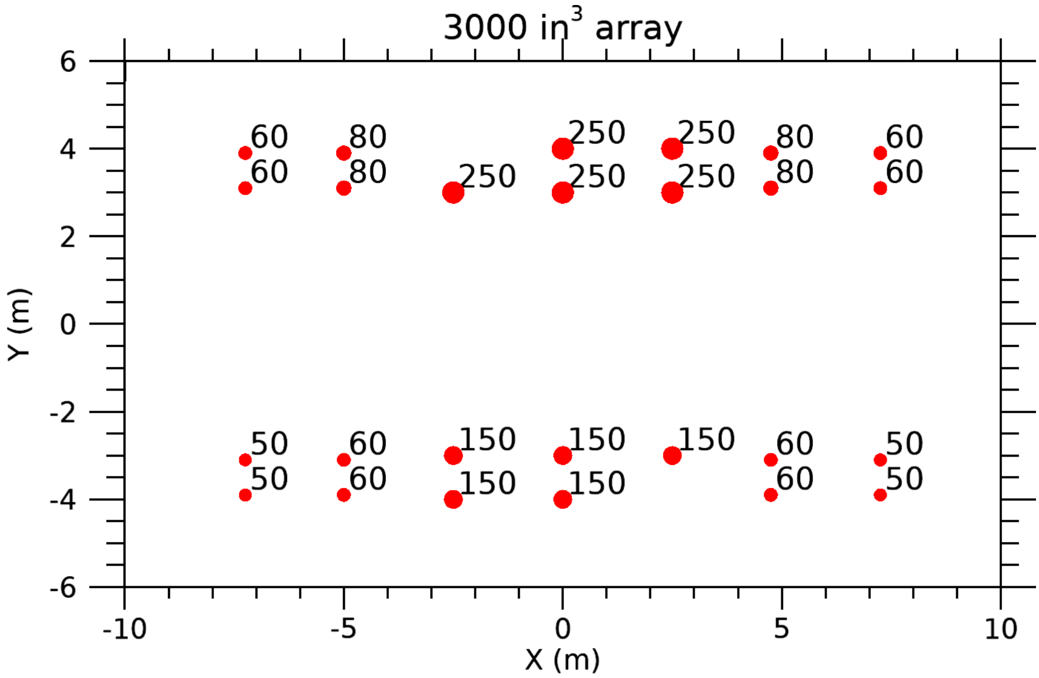

Figure B-1. Layout of the modelled 3000 in^3 seismic source where the plotted layout is such that the array is centred on the origin and vessel travel direction is in the positive x-direction. Tow depth is 8 m. The labels indicate the firing volume (in cubic inches) for each airgun. Also see Table B-1.

Table B-1. Layout of the modelled 3000 in^3 seismic source. Tow depth was 8 m. Firing pressure for all guns was 2000 psi. Greyed out values indicate spares. Also see Figure B-1.

String	Gun	*x* (m)	*y* (m)	*z* (m)	Vol (in^3)	String	Gun	*x* (m)	*y* (m)	*z* (m)	Vol (in^3)
1	1	7.25	-3.9	8	50	2	1	7.25	3.1	8	60
	2	7.25	-3.1	8	50		2	7.25	3.9	8	60
	3	4.75	-3.9	8	60		3	4.75	3.1	8	80
	4	4.75	-3.1	8	60		4	4.75	3.9	8	80
	5	2.5	-4	8	150		5	2.5	3	8	250
	6	2.5	-3	8	150		6	2.5	4	8	250
	7	0	-4	8	150		7	0	3	8	250
	8	0	-3	8	150		8	0	4	8	250
	9	-2.5	-4	8	150		9	-2.5	3	8	250
	10	-2.5	-3	8	150		10	-2.5	4	8	250
	11	-5	-3.9	8	60		11	-5	3.1	8	80
	12	-5	-3.1	8	60		12	-5	3.9	8	80
	13	-7.25	-3.9	8	50		13	-7.25	3.1	8	60
	14	-7.25	-3.1	8	50		14	-7.25	3.9	8	60

B.3. Array Source Levels and Directivity

Figure B-2 shows the broadside (perpendicular to the tow direction), endfire (parallel to the tow direction) and vertical overpressure signature and corresponding power spectrum levels for the 3000 in^3 seismic source (Appendix B.2). Horizontal decidecade-band source levels are shown as a function of band centre frequency and azimuth in Figures B-3.

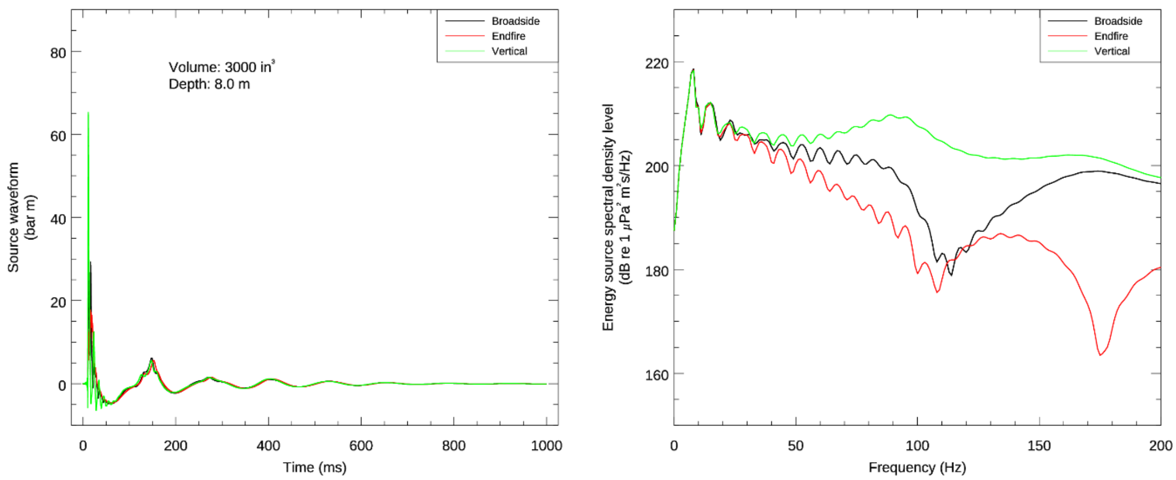

Figure B-2. Predicted source level details for the 3000 in^3 seismic source with an 8 m towed depth. (Left) the overpressure signature and (right) the power spectrum for in-plane horizontal (broadside), perpendicular (endfire), and vertical directions (no surface ghost).

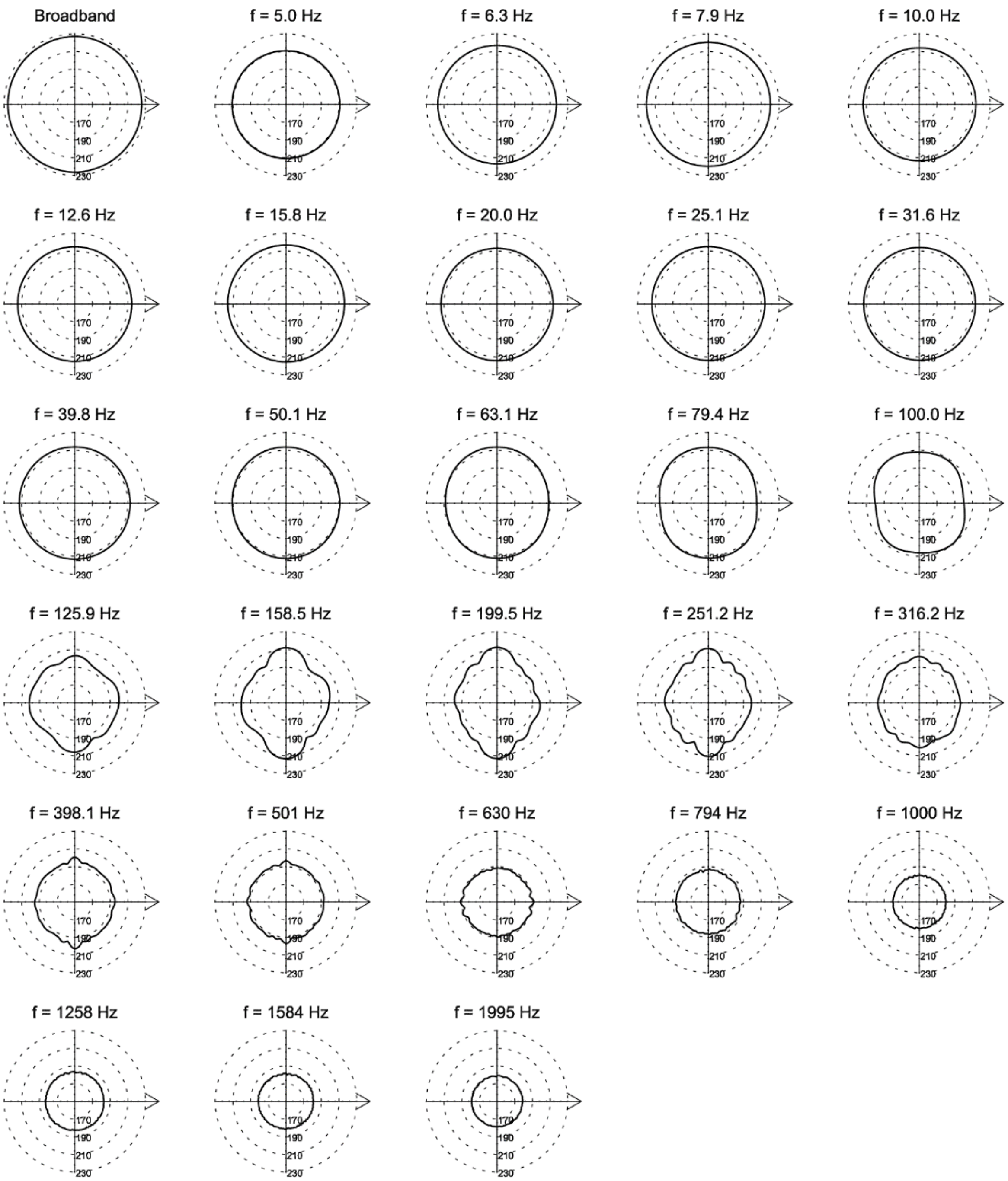

Figure B-3. Directionality of the predicted horizontal source levels for the 3000 in^3 seismic source, 5 Hz to 2 kHz. Source levels (in dB re 1 μPa^2·s m^2) are shown as a function of azimuth for the centre frequencies of the decidecade bands modelled; frequencies are shown above the plots. The perpendicular direction to the frame is to the right. Tow depth is 8 m (see Table B-1).

Appendix C. Sound Propagation Models

C.1. MONM-BELLHOP

Long-range sound fields were computed using JASCO's Marine Operations Noise Model (MONM). Compared to VSTACK, MONM less accurately predicts steep-angle propagation for environments with higher shear speed but is well suited for effective longer-range estimation. This model computes sound propagation at frequencies of 5 Hz to 1 kHz via a wide-angle parabolic equation solution to the acoustic wave equation (Collins 1993) based on a version of the US Naval Research Laboratory's Range-dependent Acoustic Model (RAM), which has been modified to account for a solid seabed (Zhang and Tindle 1995). MONM computes sound propagation at frequencies >1 kHz via the BELLHOP Gaussian beam acoustic ray-trace model (Porter and Liu 1994).

The parabolic equation method has been extensively benchmarked and is widely employed in the underwater acoustics community (Collins et al. 1996). MONM accounts for the additional reflection loss at the seabed, which results from partial conversion of incident compressional waves to shear waves at the seabed and sub-bottom interfaces, and it includes wave attenuations in all layers. MONM incorporates the following site-specific environmental properties: a bathymetric grid of the modelled area, underwater sound speed as a function of depth, and a geoacoustic profile based on the overall stratified composition of the seafloor.

This version of MONM accounts for sound attenuation due to energy absorption through ion relaxation and viscosity of water in addition to acoustic attenuation due to reflection at the medium boundaries and internal layers (Fisher and Simmons 1977). The former type of sound attenuation is significant for frequencies higher than 5 kHz and cannot be neglected without noticeably affecting the model results.

MONM computes acoustic fields in three dimensions by modelling transmission loss within two-dimensional (2-D) vertical planes aligned along radials covering a 360° swath from the source, an approach commonly referred to as N×2-D. These vertical radial planes are separated by an angular step size of $\Delta\theta$, yielding N = 360°/$\Delta\theta$ number of planes (Figure C-1).

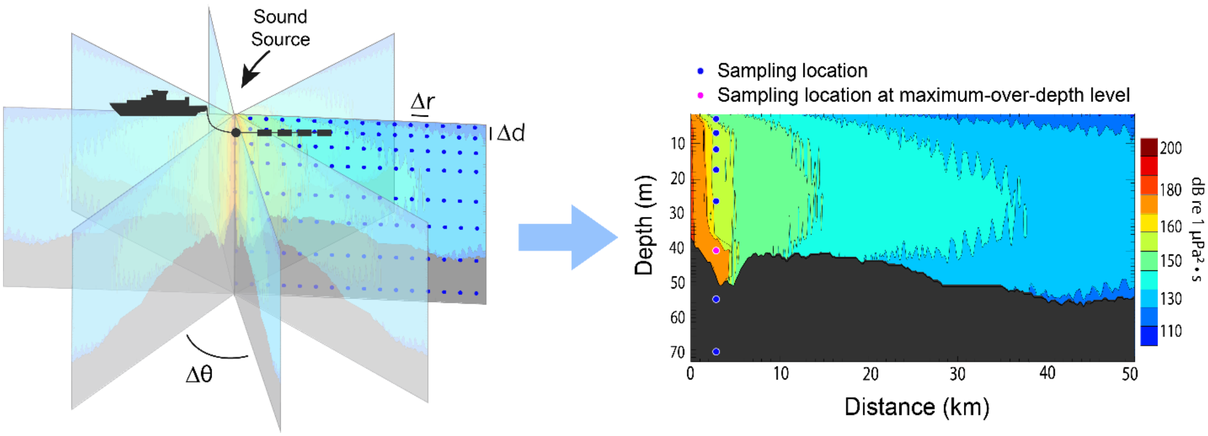

Figure C-1. The N×2-D and maximum-over-depth modelling approach used by MONM.

MONM treats frequency dependence by computing acoustic transmission loss at the centre frequencies of decidecade bands. Sufficiently many decidecade bands, starting at 5 Hz, are modelled to include most of the acoustic energy emitted by the source. At each centre frequency, the transmission loss is modelled within each of the N vertical planes as a function of depth and range from the source. The decidecade band received per-pulse SEL are computed by subtracting the band transmission loss values from the directional source level in that frequency band. Composite broadband received per-pulse SEL are then computed by summing the received decidecade band levels.

The received per-pulse SEL sound field within each vertical radial plane is sampled at various ranges from the source, generally with a fixed radial step size. At each sampling range along the surface, the sound field is sampled at various depths, with the step size between samples increasing with depth below the surface. The step sizes are chosen to provide increased coverage near the depth of the source and at depths of interest in terms of the sound speed profile. The maximum received per-pulse SEL at many sampling depths are taken over all samples within the water column, i.e., the maximum-over-depth received per-pulse SEL. These maximum-over-depth per-pulse SEL are presented as contours around the source.

C.2. Full Waveform Range-dependent Acoustic Model: FWRAM

For impulsive sounds from the seismic source, time-domain representations of the pressure waves generated in the water are required to calculate SPL and PK. Furthermore, the seismic source must be represented as a distributed source to accurately characterise vertical directivity effects in the near-field zone. For this study, synthetic pressure waveforms were computed using FWRAM, which is a time-domain acoustic model based on the same wide-angle parabolic equation (PE) algorithm as MONM. FWRAM computes synthetic pressure waveforms versus range and depth for range-varying marine acoustic environments, and it takes the same environmental inputs as MONM (bathymetry, water sound speed profile, and seafloor geoacoustic profile). Unlike MONM, FWRAM computes pressure waveforms via Fourier synthesis of the modelled acoustic transfer function in closely spaced frequency bands. FWRAM employs the array starter method to accurately model sound propagation from a spatially distributed source (MacGillivray and Chapman 2012).

Besides providing direct calculations of the PK and SPL, the synthetic waveforms from FWRAM can also be used to convert the SEL values from MONM to SPL.

C.3. Wavenumber Integration Model

Sound pressure levels near the seismic source were modelled using JASCO's VSTACK wavenumber integration model. VSTACK computes synthetic pressure waveforms versus depth and range for arbitrarily layered, range-independent acoustic environments using the wavenumber integration approach to solve the exact (range-independent) acoustic wave equation. This model is valid over the full angular range of the wave equation and can fully account for the elasto-acoustic properties of the sub-bottom. Wavenumber integration methods are extensively used in the field of underwater acoustics and seismology where they are often referred to as reflectivity methods or discrete wavenumber methods. VSTACK computes sound propagation in arbitrarily stratified water and seabed layers by decomposing the outgoing field into a continuum of outward-propagating plane cylindrical waves. Seabed reflectivity in the model is dependent on the seabed layer properties: compressional and shear wave speeds, attenuation coefficients, and layer densities. The output of the model can be post-processed to yield estimates of the SEL, SPL, and PK.

VSTACK accurately predicts steep-angle propagation in the proximity of the source, but it is computationally slow at predicting sound pressures at large distances due to the need for smaller wavenumber steps with increasing distance. Additionally, VSTACK assumes range-invariant bathymetry with a horizontally stratified medium (i.e., a range-independent environment) which is azimuthally symmetric about the source. VSTACK is thus best suited to modelling the sound field near the source.

C.3.1. Particle Motion

VSTACK was also used to compute estimates of particle acceleration and velocity at three sites for the 3000 in^3 seismic source. Particle motion waveforms were modelled, and pulse metrics were computed from the time-domain traces. VSTACK uses the wavenumber integration approach to solve the exact acoustic wave equation for arbitrarily layered range-independent acoustic environments.

The VSTACK model setup for the particle velocity scenarios was identical to that for the peak pressure scenarios (Section 5.2.1.2) in terms of source treatment, frequency range and environmental model. The particle acceleration and velocity waveforms were computed to a maximum distance of 1000 m in the broadside and endfire directions from the centre of the airgun array for a receiver 5 cm above the seafloor.

As discussed above in Appendix A.1, particle velocity (v) is the physical speed of a particle in a material. It can be derived from the pressure gradient and Euler's linearised momentum equation where ρ_0 is the density of the medium. Since the wavenumber integration kernel is a product of analytic expressions in terms of range and depth, VSTACK computes particle velocity by computing the spatial gradient of the pressure field analytically in the frequency domain. Fourier synthesis is applied to compute time series synthetic pressure and/or velocity waveforms at depth and range receivers by convolving the source waveforms with the impulse response of the waveguide. Particle velocity metrics at each receiver location were calculated from the modelled particle motion along three perpendicular axes (horizontal and along the source-receiver path, horizontal and perpendicular to the source-receiver path, and vertical).

The particle velocity results were converted to acceleration by time differentiation. The peak particle acceleration and velocity were calculated from the maximum of the predicted acceleration and velocity magnitude, defined as "peak magnitude" and are presented as plots of peak value versus range.

Appendix D. Methods and Parameters

This section the environmental parameters used in the propagation models.

D.1. Estimating Range to Thresholds Levels

Sound level contours were calculated based on the underwater sound fields predicted by the propagation models, sampled by taking the maximum value over all modelled depths above the sea floor for each location in the modelled region. The predicted distances to specific levels were computed from these contours. Two distances relative to the source are reported for each sound level: 1) R_{max}, the maximum range to the given sound level over all azimuths, and 2) $R_{95\%}$, the range to the given sound level after the 5% farthest points were excluded (see examples in Figure D-1).

The $R_{95\%}$ is used because sound field footprints are often irregular in shape. In some cases, a sound level contour might have small protrusions or anomalous isolated fringes. This is demonstrated in the image in Figure D-1(a). In cases such as this, where relatively few points are excluded in any given direction, R_{max} can misrepresent the area of the region exposed to such effects, and $R_{95\%}$ is considered more representative. In strongly asymmetric cases such as shown in Figure D-1(b), on the other hand, $R_{95\%}$ neglects to account for significant protrusions in the footprint. In such cases R_{max} might better represent the region of effect in specific directions. Cases such as this are usually associated with bathymetric features affecting propagation. The difference between R_{max} and $R_{95\%}$ depends on the source directivity and the non-uniformity of the acoustic environment.

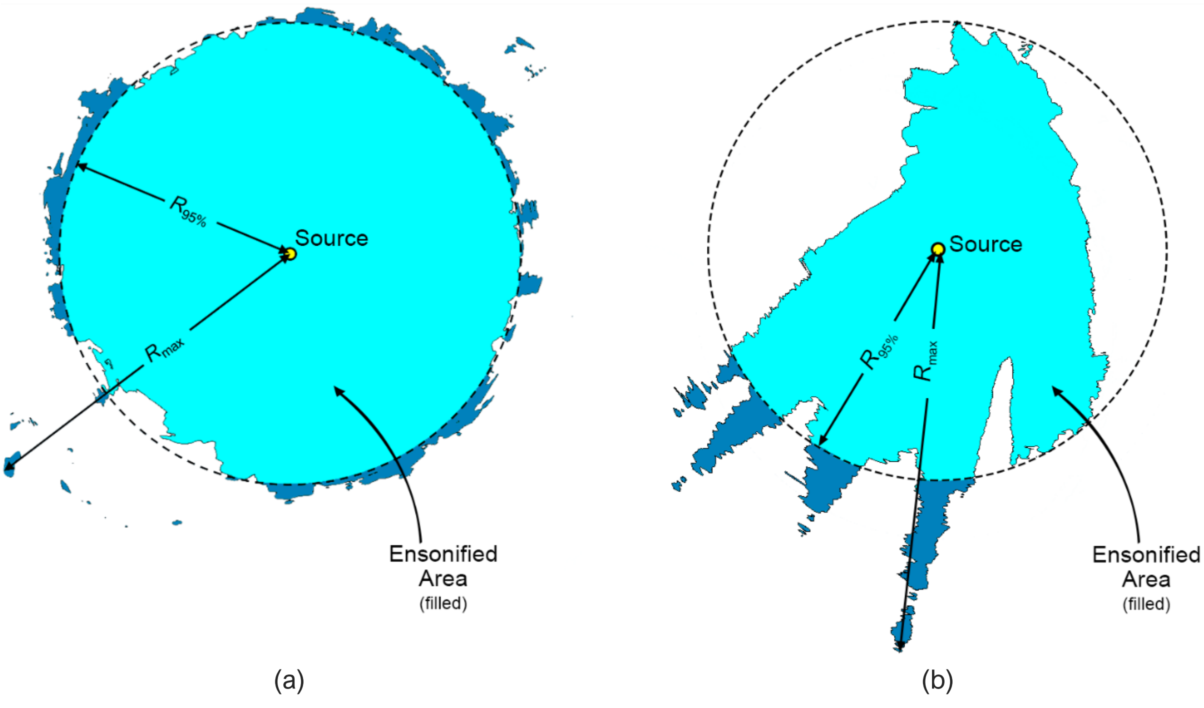

Figure D-1. Sample areas ensonified to an arbitrary sound level with R_{max} and $R_{95\%}$ ranges shown for two scenarios. (a) Largely symmetric sound level contour with small protrusions. (b) Strongly asymmetric sound level contour with long protrusions. Light blue indicates the ensonified areas bounded by $R_{95\%}$; darker blue indicates the areas outside this boundary which determine R_{max}.

D.2. Estimating SPL from Modelled SEL Results

The per-pulse SEL of sound pulses is an energy-like metric related to the dose of sound received over a pulse's entire duration. The pulse SPL on the other hand, is related to its intensity over a specified time interval. Seismic pulses typically lengthen in duration as they propagate away from their source, due to seafloor and surface reflections, and other waveguide dispersion effects. The changes in pulse length, and therefore the time window considered, affect the numeric relationship between SPL and SEL. This study has applied a fixed window duration to calculate SPL (T_{fix} = 125 ms; see Appendix A.1), as implemented in Martin et al. (2017b). Full-waveform modelling was used to estimate SPL, but this type of modelling is computationally intensive, and can be prohibitively time consuming when run at high spatial resolution over large areas.

For the current study, FWRAM (Appendix C.2) was used to model synthetic seismic pulses over the frequency range 5–1024 Hz. This was performed along all broadside and endfire radials at three sites. FWRAM uses Fourier synthesis to recreate the signal in the time domain so that both the SEL and SPL from the source can be calculated. The differences between the SEL and SPL were extracted for all ranges and depths that corresponded to those generated from the high spatial-resolution results from MONM. A 125 ms fixed time window positioned to maximize the SPL over the pulse duration was applied. The resulting SEL-to-SPL offsets were averaged in 0.02 km range bins along each modelled radial and depth, and the 90th percentile was selected at each range to generate a generalised range-dependent conversion function for each site. The range-dependent conversion function was applied to predicted per-pulse SEL results from MONM to model SPL values. Figures D-2 to D-3 show the conversion offsets for Sites 1, 7, 13, 16, 26, and 30 for the 3000 in^3 array; the spatial variation is caused by changes in the received airgun pulse as it propagates from the source. The conversion to SPL from SEL was conducted considering the water depth and seabed geology at a given modelled site.

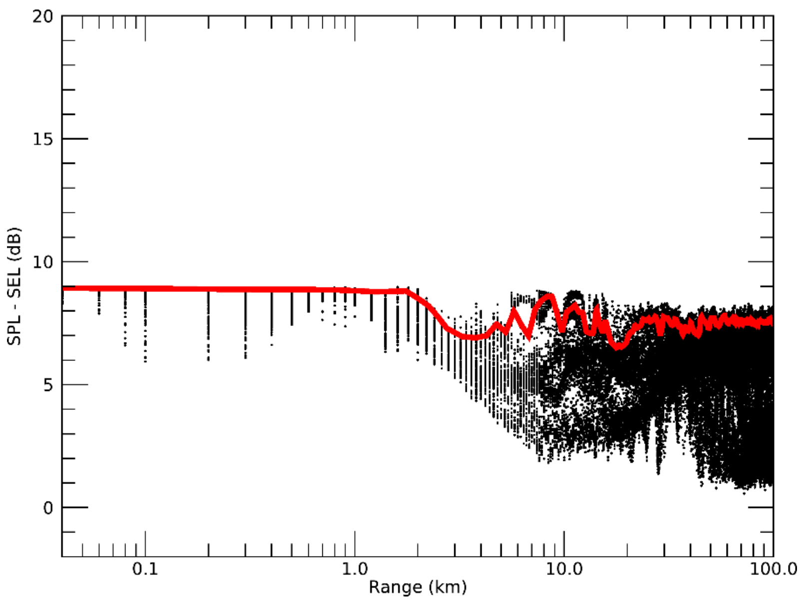

Figure D-2. *Site 1*: Range-and-depth-dependent conversion offsets for converting sound exposure level (SEL) to sound pressure level (SPL) for seismic pulses. Slices are shown for the 3000 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

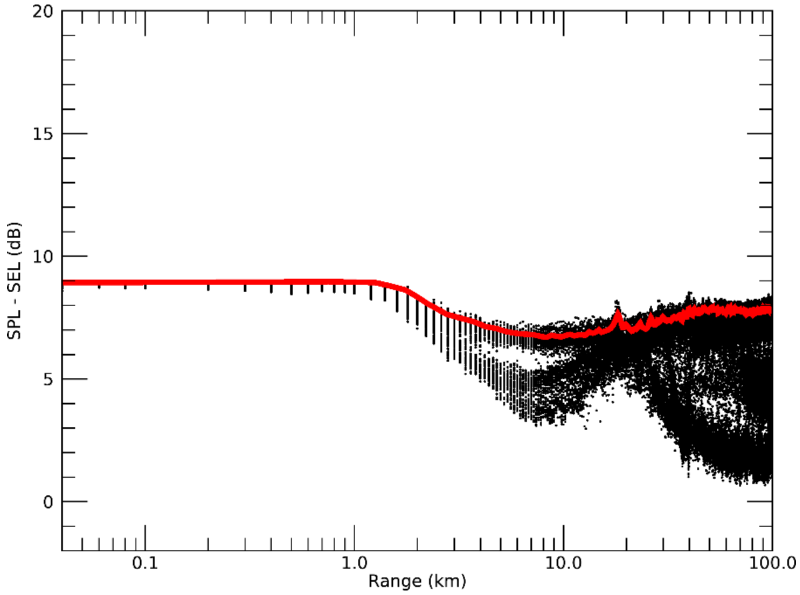

Figure D-3. *Site 7*: Range-and-depth-dependent conversion offsets for converting sound exposure level (SEL) to sound pressure level (SPL) for seismic pulses. Slices are shown for the 3000 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

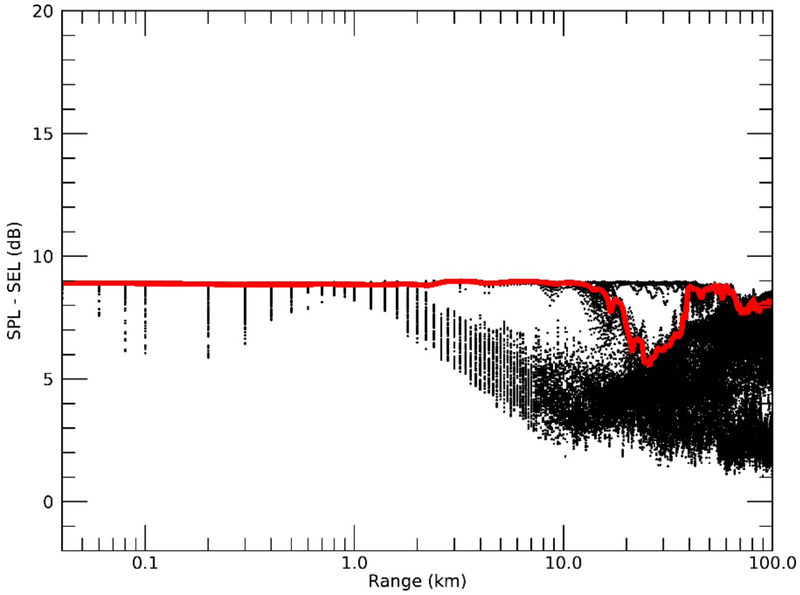

Figure D-4. *Site 8*: Range-and-depth-dependent conversion offsets for converting sound exposure level (SEL) to sound pressure level (SPL) for seismic pulses. Slices are shown for the 3000 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

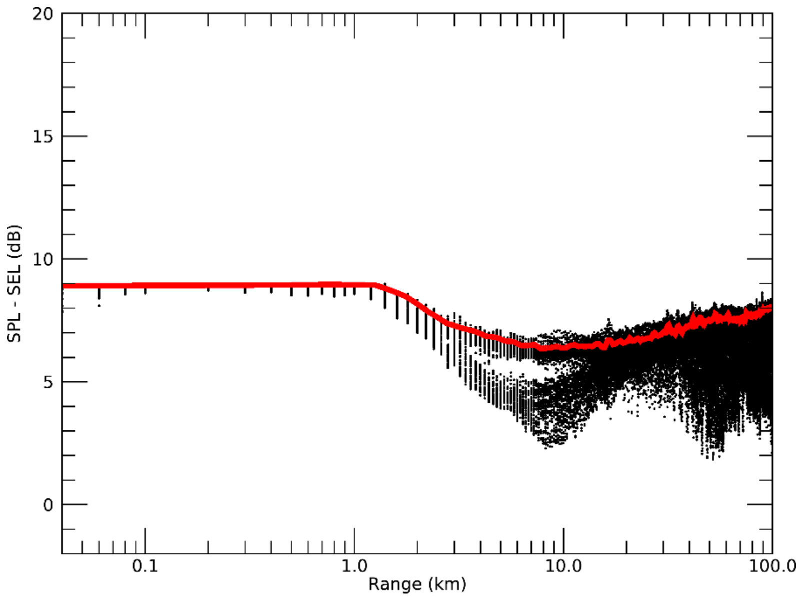

Figure D-5. *Site 11*: Range-and-depth-dependent conversion offsets for converting sound exposure level (SEL) to sound pressure level (SPL) for seismic pulses. Slices are shown for the 3000 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

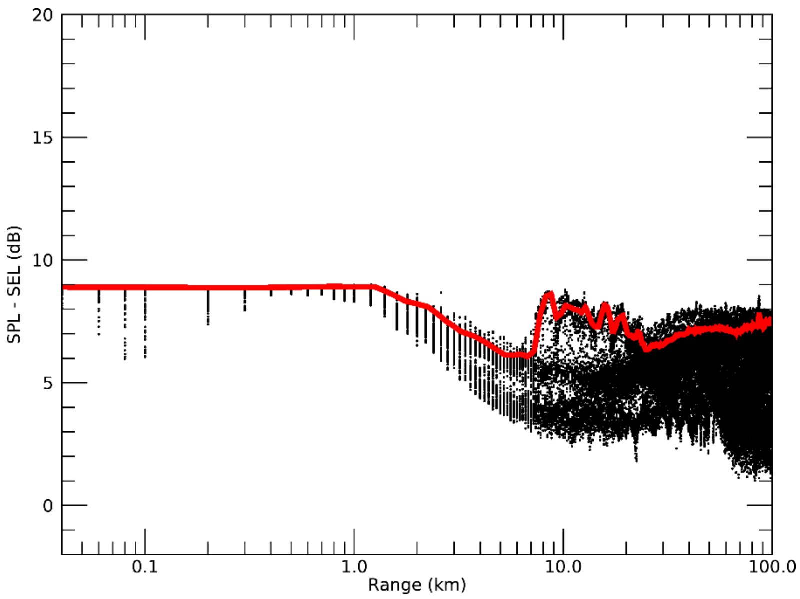

Figure D-6. *Site 14*: Range-and-depth-dependent conversion offsets for converting sound exposure level (SEL) to sound pressure level (SPL) for seismic pulses. Slices are shown for the 3000 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

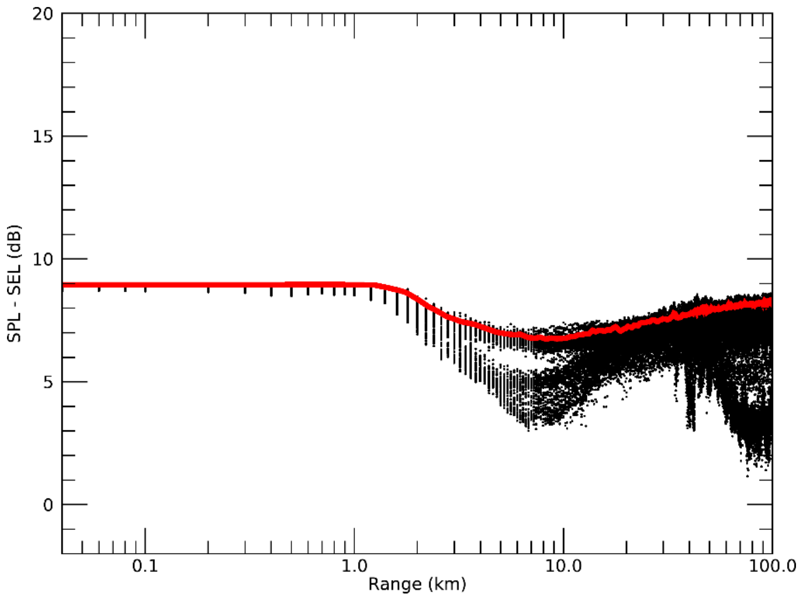

Figure D-7. *Site 22*: Range-and-depth-dependent conversion offsets for converting sound exposure level (SEL) to sound pressure level (SPL) for seismic pulses. Slices are shown for the 3000 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

D.3. Environmental Parameters

D.3.1. Bathymetry

Water depths throughout the modelled area were extracted from Australian Bathymetry and Topography Grid, a 9 arc-second grid rendered for Australian waters (Whiteway 2009). Bathymetry data was extracted and re-gridded onto a Map Grid of Australia (MGA) coordinate projection (Zone 51) with a regular grid spacing of 250 × 250 m to generate the bathymetry in Figure D-8.

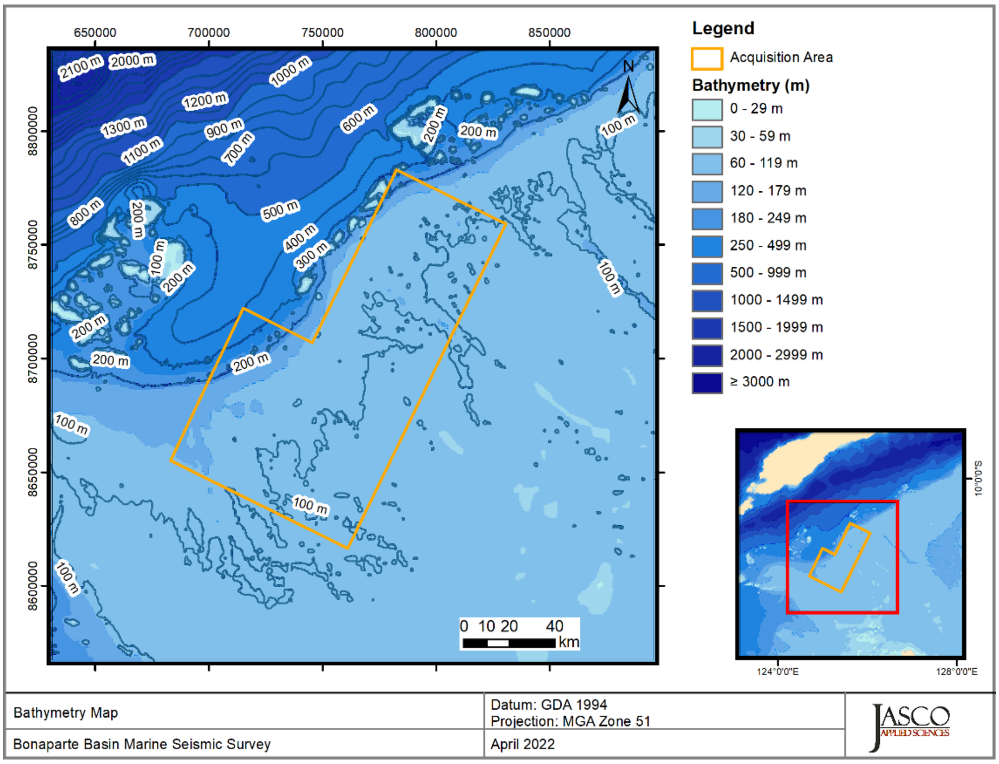

Figure D-8. Bathymetry map of the modelling area for the Bonaparte Basin Marine Seismic Survey.

D.3.2. Sound speed profile

The sound speed profiles for the modelled sites were derived from temperature and salinity profiles from the US Naval Oceanographic Office's Generalized Digital Environmental Model V 3.0 (GDEM; Teague et al. 1990, Carnes 2009). GDEM provides an ocean climatology of temperature and salinity for the world's oceans on a latitude-longitude grid with 0.25° resolution, with a temporal resolution of one month, based on global historical observations from the US Navy's Master Oceanographic Observational Data Set (MOODS). The climatology profiles include 78 fixed depth points to a maximum depth of 6800 m (where the ocean is that deep). The GDEM temperature-salinity profiles were converted to sound speed profiles according to Coppens (1981).

Mean monthly sound speed profiles were derived from the GDEM profiles within a 100 km box radius encompassing all modelled sites. The March sound speed profile is expected to be most favourable to longer-range sound propagation during the proposed survey time frame. As such, March was selected for sound propagation modelling to ensure precautionary estimates of distances to received sound level thresholds. Figure D-9 shows the resulting profile used as input to the sound propagation modelling.

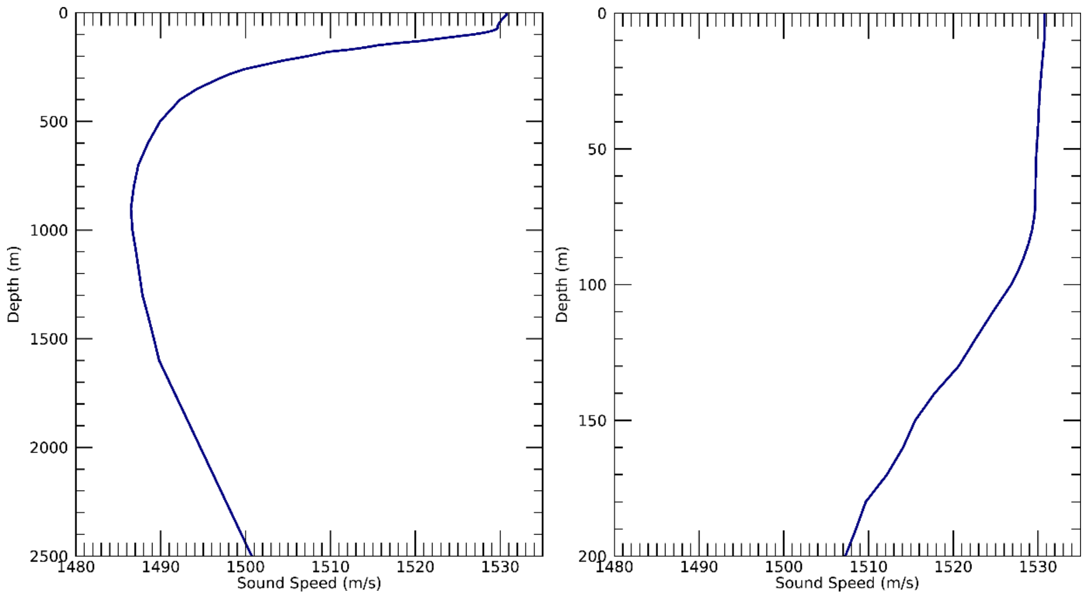

Figure D-9. The sound speed profile (March) used for the modelling showing the entire water column (left) and the top 200 m within the profile (right). Profiles are calculated from temperature and salinity profiles from GDEM V 3.0 (GDEM; Teague et al. 1990, Carnes 2009).

D.3.3. Geoacoustics

Geoacoustic parameters used for modelling at all sites were derived from sedimentary grain size measurements from the Australian Government's Marine Sediments (MARS) database (Heap 2009). There are no deep drill core samples available for the region. On average, the surficial grain size indicates silty sand is present throughout the modelled area, and this includes the banks of the shoals, particularly those on the continental shelf (Heyward et al. 1997). Representative grain sizes were used in the grain-shearing model proposed by Buckingham (2005) to estimate the geoacoustic parameters required by the sound propagation models. Table D-1 lists the geoacoustic parameters used for modelling for all sites.

The geology used for the modelling is based on the geology under the modelled sites, rather than the geology of locations the active source was not passing over (the tops of the shoals off the continental shelf). When the seismic source is next to the shoal, and thus typically over the banks / slope of the banks of the shoal, the source is over the softer sediment (Heyward et al. 1997). The shoals are not rock, they are variable sediment, and the western shoals in the region are typically more covered in silt and silty sand, which is often linked to lower biota levels (Heyward et al. 1997). The shoals which are under the primary lines are typically covered in silty sandy substratum, which is also the predominate geology of the region (Heyward et al. 1997, Heap 2009).

Whilst the shallow sections of the shoals located off the edge of the continental shelf are often rubble, once off the shallowest section / the pinnacle, the dominate substrate is once again sandy silt. The tops of smaller pinnacles are often partly buried by sediment indicating both ongoing dynamic sedimentary processes and environmental gradients (Heyward et al. 1997). Whilst there is likely carbonate bank underlying this, the extend is likely localised, with sediment built up on the sides of the bank, and thus the carbonate is localised.

As the modelling primarily considered the geology under the active source, the shallowest shoal tops off the edge of the continental shelf, and their regions of localised rubble with underlying carbonate was not considered as a geology because it wasn't appropriate or representative of the broader region. The silty sand likely to be present on the shoals on the continental shelf is incorporated into the geoacoustic profile considered in the modelling.

Table D-1. Geoacoustic profile for all modelling sites.

Depth below seafloor (m)	Predicted lithology	Density (g/cm^3)	Compressional wave		Shear wave	
			Speed (m/s)	Attenuation (dB/λ)	Speed (m/s)	Attenuation (dB/λ)
0–10	Sandy silt to increasing in compaction and lithification with depth	2.02	1633–1815	0.08–0.76	344	3.65
10–20			1815–1875	0.76–0.94		
20–40			1875–1953	0.94–1.16		
40–60			1953–2010	1.16–1.30		
60–80			2010–2057	1.30–1.40		
80–100			2057–2097	1.40–1.49		
100-200			2097–2248	1.49–1.77		
200-500			2248-2525	1.77-2.16		

D.4. Animal Movement and Exposure Modelling

Animal movement and exposure modelling considers the movement of both sound sources (if mobile) and animals over time. Acoustic source and propagation modelling are used to generate 3-D sound fields that vary as a function of distance to source, depth, and azimuth. Sound sources are modelled at representative sites and the resulting sound fields are assigned to source locations using the minimum Euclidean distance. The sound received by an animal at any given time depends on its location relative to the source. Because the true locations of the animals within the sound fields are unknown, realistic animal movements are simulated using repeated random sampling of various behavioural parameters. The Monte Carlo method of simulating many animals within the operations area is used to estimate the sound exposure history of the population of simulated animals (animats).

Monte Carlo methods provide a heuristic approach for determining the probability distribution function (PDF) of complex situations, such as animals moving in a sound field. The probability of an event's occurrence is determined by the frequency with which it occurs in the simulation. The greater the number of random samples, in this case the more simulated animats, the better the approximation of the PDF. Animats are randomly placed, or seeded, within the simulation boundary at a specified density (animats/km^2). Higher densities provide a finer PDF estimate resolution but require more computational resources. To ensure good representation of the PDF, the animat density is set as high as practical allowing for computation time. The animat density is much higher than the real-world density to ensure good representation of the PDF. The resulting PDF is scaled using the real-world density.

Several models for marine mammal movement have been developed (Ellison et al. 1987, Frankel et al. 2002, Houser 2006). These models use an underlying Markov chain to transition from one state to another based on probabilities determined from measured swimming behaviour. The parameters may represent simple states, such as the speed or heading of the animal, or complex states, such as likelihood of participating in foraging, play, rest, or travel. Attractions and aversions to variables like anthropogenic sounds and different depth ranges can be included in the models.

The JASCO Animal Simulation Model Including Noise Exposure (JASMINE) was based on the open-source marine mammal movement and behaviour model (3MB, Houser 2006) and used to predict the exposure of animats to sound arising from the anthropogenic activities. Animats are programmed to behave like the species likely to be present in the survey area. The parameters used for forecasting realistic behaviours (e.g., diving, foraging, aversion, surface times, etc.) are determined and interpreted from marine species studies (e.g., tagging studies) where available, or reasonably extrapolated from related species. An individual animat's modelled sound exposure levels are summed over the total simulation duration to determine its total received energy, and then compared to the assumed threshold criteria.

JASMINE uses the same animal movement algorithms as 3MB (Houser, 2006), but has been extended to be directly compatible with JASCO's Marine Operations Noise Model (MONM) and Full Waveform Range-dependent Acoustic Model acoustic field predictions, for inclusion of source tracks, and importantly for animats to change behavioural states based on time and space dependent modelled variables such as received levels for aversion behaviour, although aversion was not considered in this study.

D.4.1. Animal Movement Parameters

JASMINE uses previously measured behaviour to forecast behaviour in new situations and locations. The parameters used for forecasting realistic behaviour are determined (and interpreted) from marine species studies (e.g., tagging studies). Each parameter in the model is described as a probability distribution. When limited or no information is available for a species parameter, a Gaussian or uniform distribution may be chosen for that parameter. For the Gaussian distribution, the user determines the mean and standard deviation of the distribution from which parameter values are drawn. For the uniform distribution, the user determines the maximum and minimum distribution from which parameter values are drawn. When detailed information about the movement and behaviour of a species are available, a user-created distribution vector, including cumulative transition probabilities, may be used (referred to here as a vector model; Houser 2006). Different sets of parameters can be defined for different behaviour states. The probability of an animat starting out in or transitioning into a given behaviour state can in turn be defined in terms of the animat's current behavioural state, depth, and the time of day. In addition, each travel parameter and behavioural state has a termination function that governs how long the parameter value or overall behavioural state persists in simulation.

The parameters used in JASMINE describe animal movement in both the vertical and horizontal planes. The parameters relating to travel in these two planes are briefly described below.

Travel sub-models

- **Direction**– determines an animat's choice of direction in the horizontal plane. Sub-models are available for determining the heading of animats, allowing for movement to range from strongly biased to undirected. A random walk model can be used for behaviours with no directional preference, such as feeding and playing. In a random walk, all bearings are equally likely at each parameter transition time step. A correlated random walk can be used to smooth the changes in bearing by using the current heading as the mean of the distribution from which to draw the next heading. An additional variant of the correlated random walk is available that includes a directional bias for use in situations where animals have a preferred absolute direction, such as migration. A user-defined vector of directional probabilities can also be input to control animat heading. For more detailed discussion of these parameters, see Houser (2006) and Houser and Cross (1999).
- **Travel rate**–defines an animat's rate of travel in the horizontal plane. When combined with vertical speed and dive depth, the dive profile of the animat is produced.

Dive sub-models

- **Ascent rate**–defines an animat's rate of travel in the vertical plane during the ascent portion of a dive.

- **Descent rate**–defines an animat's rate of travel in the vertical plane during the descent portion of a dive.
- **Depth**–defines an animat's maximum dive depth.
- **Reversals**–determines whether multiple vertical excursions occur once an animat reaches the maximum dive depth. This behaviour is used to emulate the foraging behaviour of some marine mammal species at depth. Reversal-specific ascent and descent rates may be specified.
- **Surface interval**–determines the duration an animat spends at, or near, the surface before diving again.

D.4.2. Exposure Integration Time

The interval over which acoustic exposure (L_E) should be integrated and maximal exposure (L_p) determined is not well defined. Both Southall et al. (2007) and the NMFS (2018) recommend a 24 h baseline accumulation period, but state that there may be situations where this is not appropriate (e.g., a high-level source and confined population). Resetting the integration after 24 h can lead to overestimating the number of individual animals exposed because individuals can be counted multiple times during an operation. The type of animal movement engine used in this study simulates realistic movement using swimming behaviour collected over relatively short periods (hours to days) and does not include large-scale movement such as migratory circulation patterns. For this study, a representative 24-hour period was simulated.

Ideally, a simulation area is large enough to encompass the entire range of a population so that any animal that could approach the source during an operation is included. However, there are limits to the simulation area, and computational overhead increases with area. For practical reasons, the simulation area is limited. In the simulation, every animat that reaches a border is replaced by another animat entering at the opposing border—e.g., an animat crossing the northern border of the simulation is replaced by one entering the southern border at the same longitude. When this action places the animat in an inappropriate water depth, the animat is randomly placed on the map at a depth suited to its species definition. The exposures of all animats (including those leaving the simulation and those entering) are kept for analysis. This approach maintains a consistent animat density and allows for longer integration periods with finite simulation areas.

D.4.3. Seeding Density and Scaling

Seeding density refers to the spatial sample rate, in units of animats/km^2, used in the simulation. It is not related to the real-world animal density, but rather is a model parameter that controls the how samples are drawn from the model space. The minimum required seeding density for any given project depends on several factors such as bathymetry, source characteristics, and the behavioural profile of the animats, with the main constraint being computation time and resources. Seeding density is adjusted as needed based on model conditions specific to a project or project area.

In the present study, the exposure criteria for continuous sounds were used to determine the number of animats exceeding exposure thresholds. To generate statistically reliable probability density functions, all simulations were seeded with an animat density of 4 animat/km^2 over the entire simulation area. The modelling results are not related to real-world animal densities and the number of real-world animals potentially exposed was not calculated.

Appendix E. Model Validation Information

Predictions from JASCO's Airgun Array Source Model (AASM) and propagation models (MONM, FWRAM and VSTACK) have been validated against experimental data from a number of underwater acoustic measurement programs conducted by JASCO globally, including the United States and Canadian Artic, Canadian and southern United States waters, Greenland, Russia and Australia (Hannay and Racca 2005, Aerts et al. 2008, Funk et al. 2008, Ireland et al. 2009, O'Neill et al. 2010, Warner et al. 2010, Racca et al. 2012a, Racca et al. 2012b, Matthews and MacGillivray 2013, Martin et al. 2015, Racca et al. 2015, Martin et al. 2017a, Martin et al. 2017b, Warner et al. 2017, MacGillivray 2018, McPherson et al. 2018, McPherson and Martin 2018).

In addition, JASCO has conducted measurement programs associated with a significant number of anthropogenic activities which have included internal validation of the modelling (including McCrodan et al. 2011, Austin and Warner 2012, McPherson and Warner 2012, Austin and Bailey 2013, Austin et al. 2013, Zykov and MacDonnell 2013, Austin 2014, Austin et al. 2015, Austin and Li 2016, Martin and Popper 2016).

APPENDIX B

Oil Spill Trajectory Modelling Report

OIL SPILL TRAJECTORY MODELLING ARISING FROM A VESSEL COLLISION IN THE BONAPARTE BASIN

Report prepared for Schlumberger Australia Pty Ltd:

Version	Date	Status	Approved by
RevA	01/03/2022	Draft for internal review	Zyngfogel
RevB	04/03/2022	Draft for client review	McComb
RevC	07/03/2022	Updated draft	Zyngfogel
Rev0	09/03/2022	Updated and approved for release	Zyngfogel

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1. INTRODUCTION

Schlumberger Australia Pty Ltd has commissioned an assessment of the oceanic dispersal and beaching potential in the unlikely event of a spill event resulting from vessel collision during Bonaparte MC3D survey. The operational area (OA) is in the Bonaparte Basin, located in Commonwealth waters adjacent to Western Australia (Figure 1.1).

In this study, a stochastic approach has been adopted to define the statistical probabilities related to oil trajectory, dispersion, diffusion, weathering, and beaching patterns. To achieve this, we simulated the occurrence of 100 realistic spill events from three locations within the OA, randomly distributed over the previous decade. The results from these simulations were collated and used to generate statistics and probabilities for an impact assessment.

This report is structured as follows. A description of the oil spill modelling methodology is provided in Section 2. In Section 3, we present the results of the modelling and provide an interpretation of the results. The findings are summarised in Section 4, and the references cited are listed in the final Section 5.

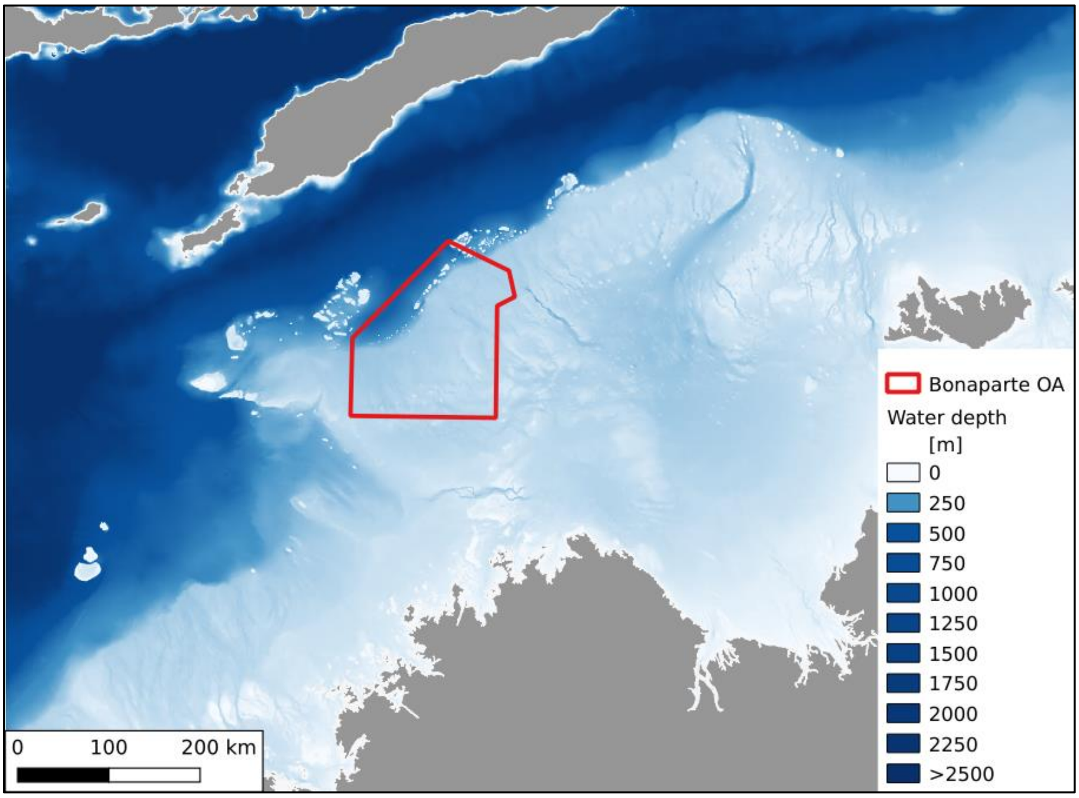


Figure 1.1 Location of the Bonaparte MC3D operational area (OA) in Western Australia.

2. METHODOLOGY

2.1. Spill scenario

The spill scenario under this assessment has the following attributes:

- Release of marine gas oil (MGO).
- Release at three locations within the OA.
- Continuous release of 1000 m^3 over six hours at sea level.

For this scenario, a total of 100 spill events were simulated at each of the three locations at random times over a contemporary decade (2010-2019).

2.2. Spill location

For the purpose of this simulation exercise, three hypothetical spill locations were chosen within the OA (Fig. 2.1, Table 2.1). To guide the site selection, AIS vessel traffic data from 2019 was plotted over the OA; highlighting the regions with highest traffic. On the basis of AIS density and geographic spread, three hypothetical spill locations (A, B, and C) were selected - allowing for maximum distance between the spill locations in order to capture the effect of variation in environmental factors on the spill outcomes.

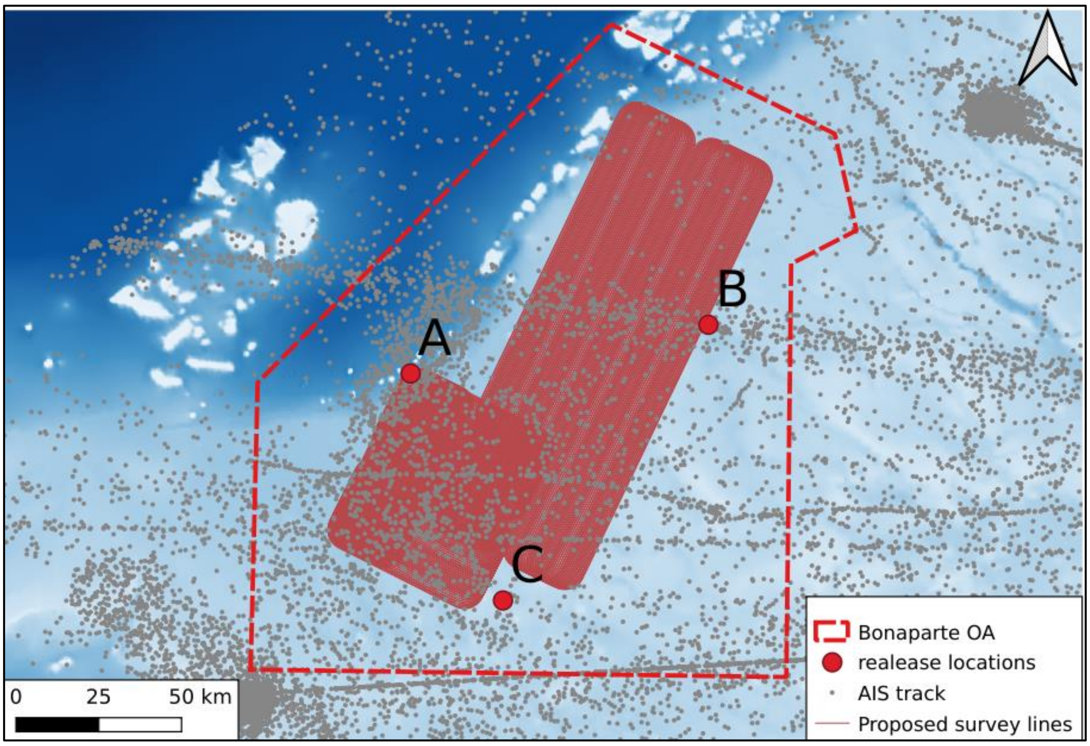


Figure 2.1 Position of the three locations chosen within the Bonaparte OA.

Table 2.1 Coordinates of the three spill locations used in this study.

Site	Longitude	Latitude
A	124° 59’ 42.0” E	11° 45 57.6” S
B	125° 49’ 22.8” E	11° 37 58.8” S
C	125° 15’ 7.2” E	12° 23 2.4” S

2.3. Spill product

The fuel for the survey vessel will either be marine diesel oil (MDO) or marine gas oil (MGO), with the latter having greater environmental persistence following a spill. Accordingly, the more conservative approach has been adopted for this study, with MGO being selected as the spill product. Marine Gas Oil (MGO) has specific and well documented characteristics which influence its persistence in the marine environment after a spill event (see Hellstrom et al, 2017):

- Density of 852 kg/m^3 and a kinematic viscosity of 3 cP at 15°C.
- Total wax content of 0.8% by mass with no significant emulsifying properties.
- Low pour point for both fresh oil and 250°C+ residue (<-36 °C)
- Low viscosity for both fresh oil and 250°C+ residue (< 20 mPa·s at 2 °C)
- Intermediate evaporative loss (30.6 vol. % at 250 °C),
- Relatively high natural dispersion in breaking wave conditions and poor natural dispersion in non-breaking wave (swell) conditions

2.4. Oceanographic and atmospheric conditions

The following environmental datasets were used in the oil spill modelling:

- Surface (10 m elevation) wind fields were prescribed from the ERA5 reanaylsis product, provided by the European Centre for Medium Range Weather Forecasting (ECMWF, 2019). ERA5 combines vast amounts of specifically curated historical observations with state-of-the-art 4D-Var data assimilation to produce a hindcast of unprecedented quality. These gridded data have a spatial resolution of 31 km spatial and temporal resolution of 1 hourly.

- The wave conditions were defined from a validated global WW3 wave hindcast supplied by Oceanum Ltd. This product is a 3-hourly dataset at 0.5-degree resolution, using the ERA5 wind field as boundary condition.

- Residual velocities and water column properties were defined from the global 1/12-degree reanalysis products released by the EU-funded Copernicus Project.

- Tidal velocities were sourced from a downscaled spectral solution from the OTIS (Oregon State University Tidal Inversion Software) assimilated barotropic model.

Rose plots for the seasonal and annual conditions for winds and surface currents are presented in Figures 2.2 and 2.3.

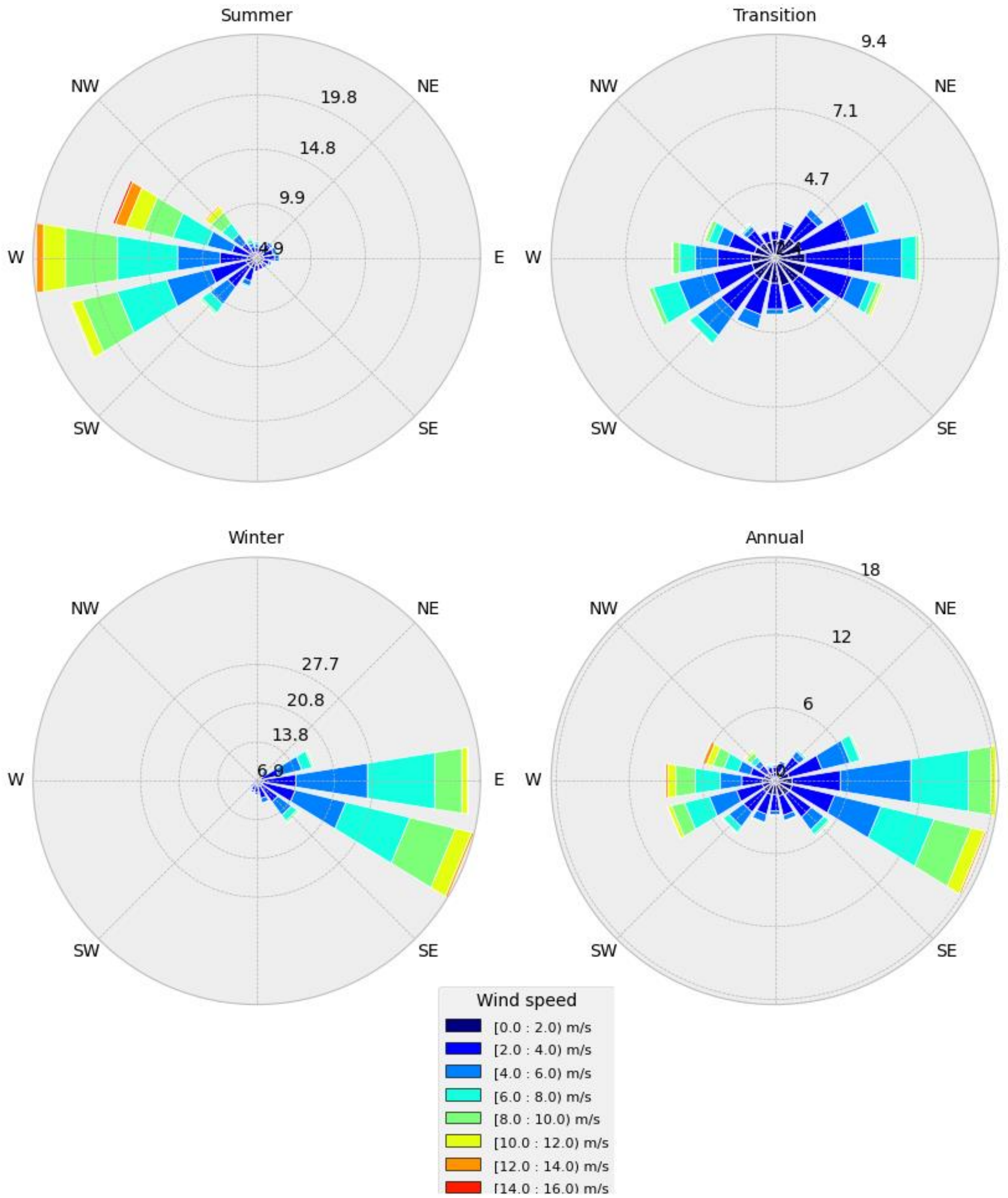


Figure 2.2 Annual and seasonal wind roses at the center of the OA, from hindcast data 2008-2017. Note the wind directional convention is ‘coming from’.

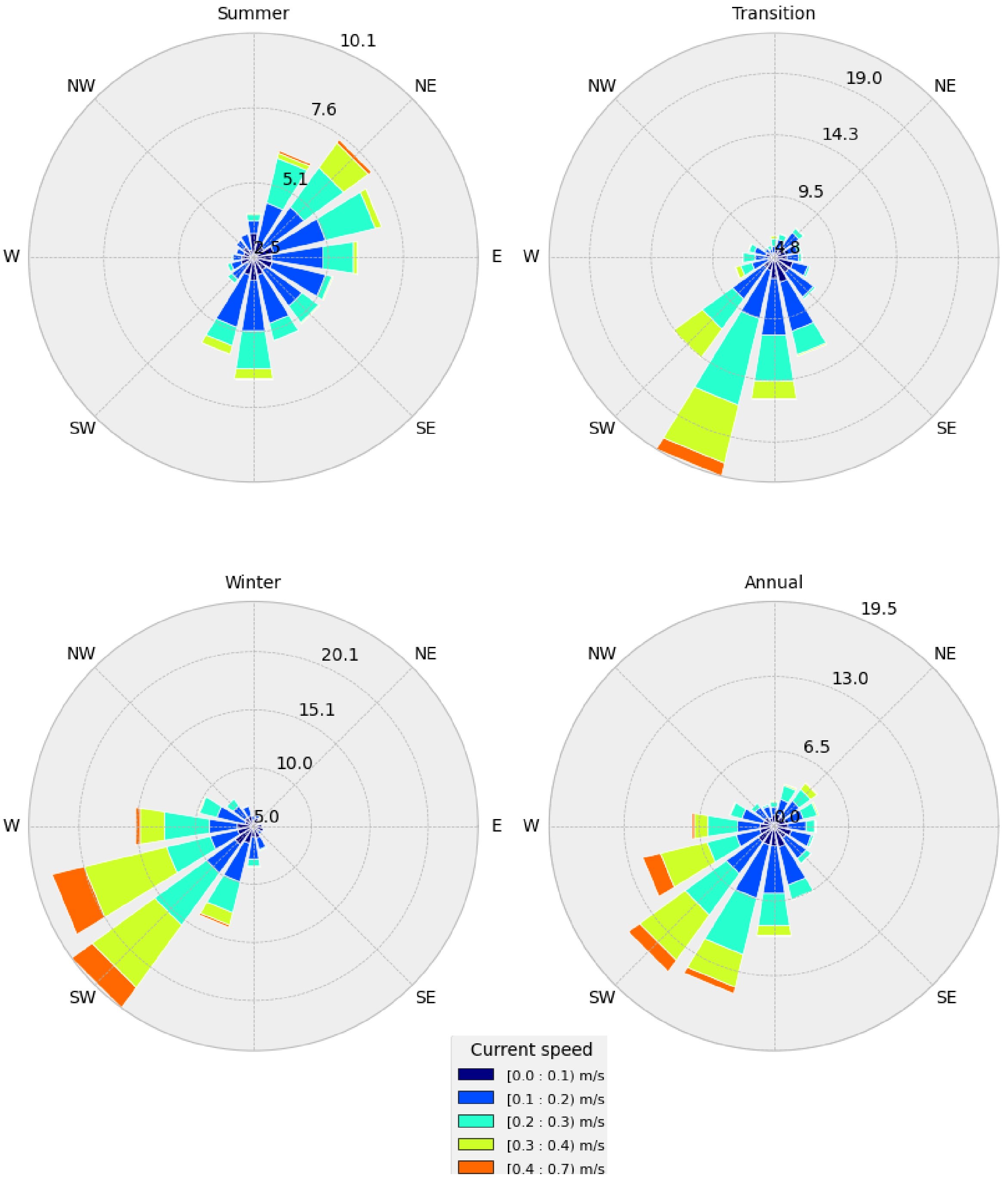


Figure 2.3 Annual and seasonal current roses for the sea surface (tidal and non-tidal) at the center of the OA, from hindcast data 2008-2017. Note the current directional convention is 'going to'.

2.5. Oil spill modelling framework

The OpenOil simulation framework was used to model the weathering dispersal, and trajectory of the spill. This module is part of the OpenDrift project[1] which is an open-source code base with considerable community input and ongoing peer review. Full technical details of the model are reported by Dagestad *et al*. (2018), and the key model settings used in the present study are provided in Table 2.2

Note, this OpenOil version has been modified to include dissolution process. As a result, the evaporation and dissolution process are based on the pseudo-component approach. This method is used in oil spill models such as OSCAR, and SIMAP (Keramea *et al*., 2021).

Table 2.2 OpenOil model settings.

Parameter	**Value applied**
Windage	2%
Horizontal diffusion	1.0 m^2/s
Stokes drift	from wave model
Vertical diffusion coefficient	Variable based on Large *et al*. 1994
Model time step	900 s
Particles per spill	7200
Duration of each spills	6 hours
Duration of each simulation	90 days
Droplet size distribution	Li et al. (2017)
Entrainment rate	Li et al. (2017)
Oil density	852 kg/m^3 at 13 degC
Oil dynamic viscosity	3 cP at 15 degC
Shoreline	Sticky, no re-float

2.6. Processing of results

Each model simulation was post-processed to derive oil concentrations and statistical representations. For each timestep of every run, a bi-directional weighted histogram was calculated using the particles in the surface layer or particles that had beached. Concentrations were calculated from 10 x 10 km cells, with the histogram of values was normalized by the area of the cell to derive results in g/m^2 or ppb. For the beached concentrations, each histogram of values was divided by the length of coast and an assumed beach width of 100 m to define the results in g/m^2.

[1] https://github.com/OpenDrift/opendrift

From the histogram timeseries, the following statistics were calculated (see footnote[2]):

- Maximum extent in which the surface concentration lies above a certain threshold for a minimum duration of 1 hour. Calculated for each run at low, moderate, and high thresholds of 1, 10 and 50 g/m^2, respectively.

- Maximum extent in which entrained hydrocarbon concentration persists beyond a certain threshold for at least an hour. Calculated for each run at depths of 0 to 10 m and 10 to 20 m for low and moderate thresholds of 10 and 100 ppb, respectively.

- Maximum extent in which dissolved hydrocarbon concentration persists beyond a certain threshold for at least an hour. Calculated for each run at depths of 0 to 10 m for low, moderate, and high thresholds concentrations of 10, 50 and 400 ppb, respectively

- Beaching risk – defined as the probability for each 10 x 10 km cell of shoreline to accumulate MGO at low, moderate, and high thresholds concentrations of 10 g, 100 g, 1000 g per m^2, respectively.

- Total oil on the beach - for each run the mass of oil entering a 10 x 10 km cell is summed and presented as the maximum.

[2] These exposure values are based on the NOPSEMA Environment Bulletin (April 2019).

3. RESULTS

3.1. Stochastic simulation

The set of 100 randomly selected spills over an historical decade provides a robust dataset to define the statistics of spill trajectory, beaching along the shore, and expected mass budgets of any spilled MGO.

The characteristics of MGO is that oil will quickly disperse under wave action but tends to persist as a surface slick during calm weather. On the sea surface, strong winds will increase the rate of evaporation, while the wave conditions associated with these winds also act to mix and disperse the oil into the upper layers of the ocean. Consequently, the day-to-day weather conditions strongly influence the mass budget of MGO throughout the simulations.

3.1.1. Results for annual conditions

For the annual conditions, Figure 3.1 to Figure 3.4 present mapped statistics derived from all 100 simulations and demonstrate the extent of the Environment that May Be Affected (EMBA). The EMBA exhibits a South-West / North-East axis with an extension toward the Joseph Bonaparte Gulf. Some 79% of the runs exceed 1 g/m^2 on the surface and 100% of the runs exceed the 10-ppb threshold in the water column (Table 3.1). However, no concentration was found to exceed the highest thresholds (see footnote[2] above). In Table 3.2, the maximum concentrations of spilled MGO over 1 to 60 days are presented, with statistics provided for the surface, entrained, and beached fractions.

Beaching is defined as any particles reaching the coastline (defined as the mean high water spring level), and a sticky shoreline has been imposed in the model so there is no re-floating by tide. In Figure 3.5, we show the locations where beaching occurred with a concentration exceeding 10 g/m^2. The results from 100 simulations indicate the highest chance of beaching occurs around Ashmore Reef, Cartier Island, the Joseph Bonaparte Gulf and North Kimberley coast. Beaching quantities are presented as g per m^2 (Figure 3.5, right plots).

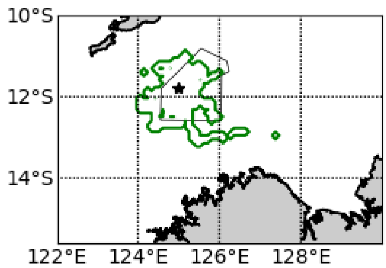


Figure 3.1 Annual zone of maximum surface exposure above 1 g/m^2 (green) for spills from locations A (left), B (middle) and C (right).

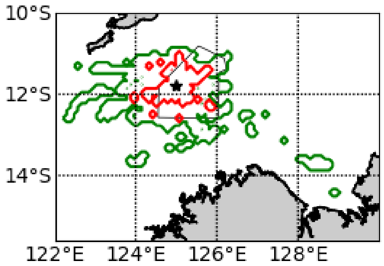


Figure 3.2 Annual zone of maximum entrained MGO (0 to 10 m) above 10 g/m^2 (green) and 100 g/m^2 (red) for spills from locations A (left), B (middle) and C (right).

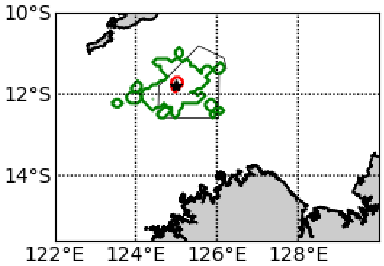


Figure 3.3 Annual zone of maximum entrained MGO (10 to 20 m) above 10 g/m^2 (green) and 100 g/m^2 (red) for spills from locations A (left), B (middle) and C (right).

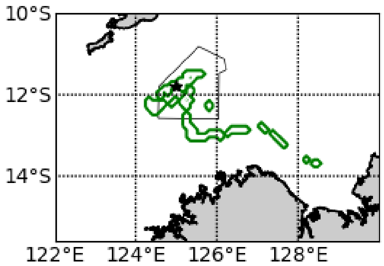


Figure 3.4 Annual zone of maximum dissolved (0 to 10 m) exposure above 10 g/m^2 (green) for spills from location A (left), B (middle) and C (right).

Table 3.1 Annual probability (in %) of MGO reaching each defined threshold. The low and moderate surface thresholds for surface MGO are 1 and 10 g/m^{2,} respectively. The low and moderate concentration thresholds for entrained MGO is 10 and 100 ppb, respectively. The low and moderate concentration thresholds for dissolved MGO are 10 and 50 ppb, respectively.

	Release location A		Release location B		Release location C	
	Low	**Moderate**	**Low**	**Moderate**	**Low**	**Moderate**
Surface	77	0	79	0	78	0
Entrained 0-10 m	100	99	100	95	100	97
Entrained 10-20 m	77	15	79	8	80	6
Dissolved	9	0	12	0	10	0
Beached	6	0	7	0	9	0

Table 3.2 Annual maximum concentration of MGO after 1, 2, 7, 15, 30, 40 and 60 days.

	Release	1 day	2 days	7 days	15 days	30 days	40 days	60 days
Surface [g.m^2]	**A**	6.96	6.29	5.19	2.47	2.26	1.07	0.14
	B	6.96	6.20	4.82	3.28	1.56	0.52	0.03
	C	7.00	6.36	4.97	2.95	1.84	1.45	0.06
Entrained 0 to 10 m [ppb]	**A**	559.97	425.48	247.57	59.36	39.61	25.31	2.29
	B	501.82	365.20	255.71	74.44	57.98	10.60	0.38
	C	545.75	413.84	211.45	45.78	43.24	20.89	1.11
Entrained 10 to 20 m [ppb]	**A**	100.42	86.31	43.38	16.80	1.29	0.48	0.21
	B	101.81	66.91	47.07	9.84	3.09	0.59	0.07
	C	87.05	68.60	30.39	11.91	2.40	0.52	0.17
Dissolved 0 to 10 m [ppb]	**A**	1.71	3.86	8.64	10.09	12.95	9.46	3.70
	B	1.73	3.90	7.87	9.03	14.78	7.09	8.16
	C	2.06	3.77	7.92	9.04	12.86	15.19	2.80
Beached [g.m^2]	**A**	0.00	0.00	0.00	0.00	23.93	24.90	24.91
	B	0.00	0.00	0.00	0.00	1.90	47.28	52.72
	C	0.00	0.00	0.00	0.00	48.79	48.79	75.15

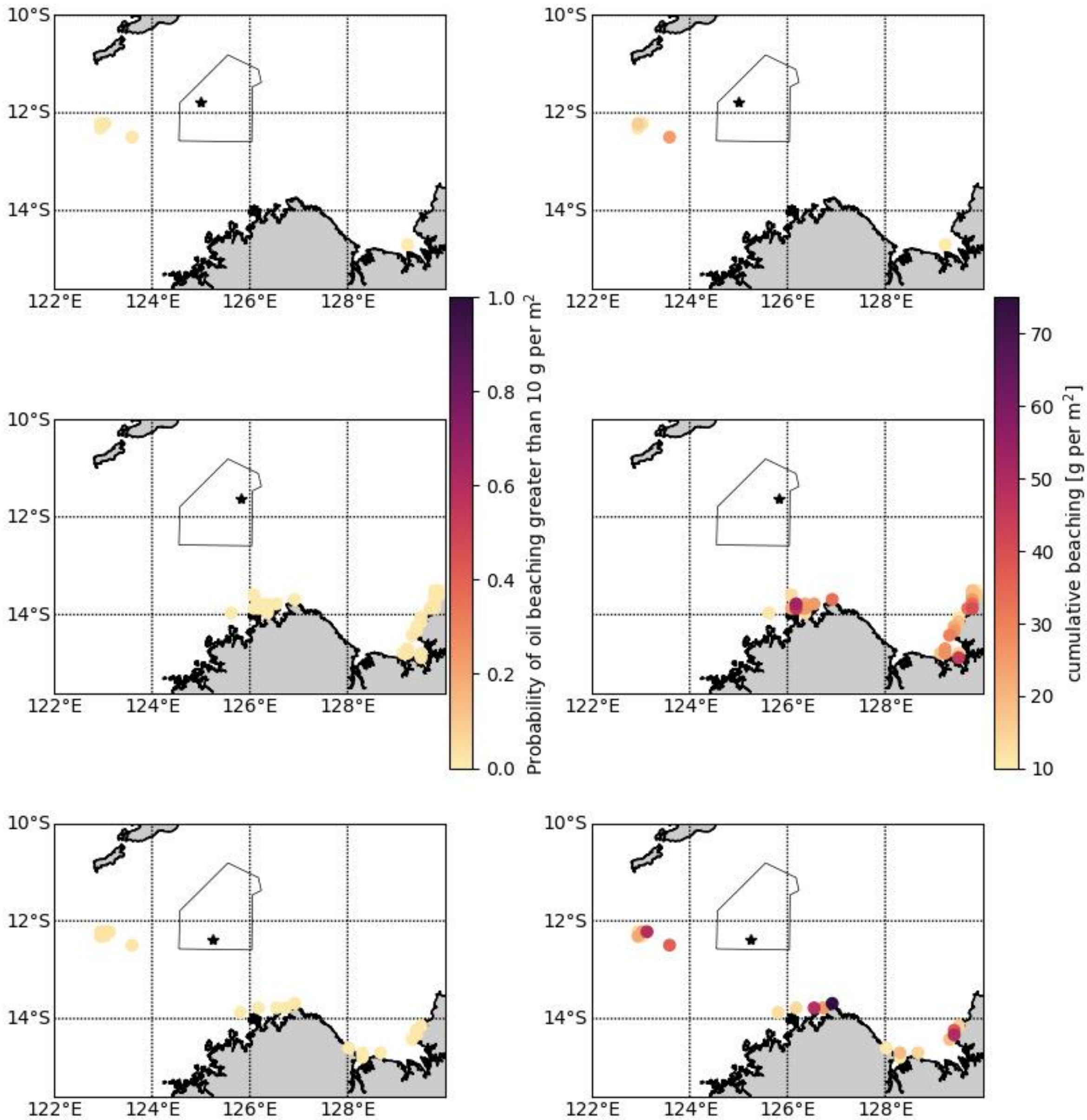


Figure 3.5 Annual probability of MGO to beach (left) and maximum beached MGO concentrations for spills from locations A (top), B (middle) and C (bottom). Note, a probability of 1 represents a 100 % chance of MGO beaching above 10 g/m^2.

The annual maximum probability that each threshold is exceeded from each release location (A, B, C) is provided in Tables 3.3 – 3.5. Here, potential sensitive receptors within the EMBA have been provided by SLR Consulting Limited. The locations and areas listed in these tables are denoted in Appendix One.

Table 3.3 Annual maximum probability (in %) of potential sensitive receptors reaching specific concentration thresholds due to a spill at location A.

	Release location A						
	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved	Beached
Potential Sensitive Receptor	**1 g.m^2**	**10 ppb**	**100 ppb**	**10 ppb**	**100 ppb**	**10 ppb**	**10 g.m^2**
Heywood Shoal	0	1	0	0	0	0	0
Eugene McDermott Shoal	0	0	0	0	0	0	0
Vulcan Shoal	1	0	0	0	0	0	0
Barracouta Shoal	0	5	0	0	0	0	0
Woodbine Bank	0	2	0	0	0	0	0
Hibernia Reef	0	1	0	0	0	0	0
Fantome Shoal	10	18	5	7	0	0	0
Sahul Bank	76	97	88	67	15	7	0
Margaret Harries Bank	0	0	0	0	0	0	0
Gale Bank	1	2	0	0	0	1	0
Van Cloon Shoal	0	0	0	0	0	0	0
Flat Top Bank	0	0	0	0	0	0	0
Penguin Shoal	1	1	0	0	0	1	0
Bassett-Smith Shoal	0	0	0	0	0	0	0
Holothuria Bank	1	0	0	0	0	1	0
Long Reef	0	0	0	0	0	0	0
Johnson Bank	0	2	0	0	0	0	0

Kimberley AMP (Multiple Use Zone VI)	1	2	0	0	0	0	0
Cartier Island AMP (Sanctuary Zone Ia)	0	1	0	0	0	0	2
Ashmore Reef AMP (Recreational Use Zone IV)	0	0	0	0	0	0	0
Ashmore Reef AMP (Sanctuary Zone Ia)	0	1	0	0	0	0	3
Oceanic Shoals AMP (Multiple Use Zone VI)	1	6	0	2	0	1	0
Joseph Bonaparte Gulf AMP (Special Purpose Zone VI)	0	0	0	0	0	0	0
Joseph Bonaparte Gulf AMP (Multiple Use Zone VI)	0	1	0	0	0	0	0
Pinnacles of the Bonaparte Basin KEF	0	0	0	0	0	0	0
Carbonate bank and terrace system of the Sahul Shelf KEF	16	31	13	15	0	4	0
Ashmore Reef, Cartier Island and surrounding Commonwealth waters KEF	0	3	0	1	0	0	5
Continental Slope Demersal Fish Communities KEF	0	5	0	0	0	0	3
Ancient coastline at 125 m depth contour KEF	0	2	0	0	0	0	0
Dolphin BIAs	0	0	0	0	0	0	0
Pygmy Blue Whale BIA	44	55	37	35	1	1	3
Seabird BIAs	3	15	1	2	0	1	5
Marine Reptile BIAs	1	9	0	1	0	1	6
Dugong BIAs	0	0	0	0	0	0	0
Whale Shark BIA	46	71	48	44	4	7	0
North Kimberley Marine Park	0	0	0	0	0	0	0
Joseph Bonaparte Gulf SE Coastline	0	0	0	0	0	0	1

Table 3.4 Annual maximum probability (in %) of potential sensitive receptors reaching specific concentration thresholds due to a spill at location B.

	Release location B						
	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved	Beached
Potential Sensitive Receptor	**1 g.m^2**	**10 ppb**	**100 ppb**	**10 ppb**	**100 ppb**	**10 ppb**	**10 g.m^2**
Heywood Shoal	0	0	0	0	0	0	0
Eugene McDermott Shoal	0	1	0	0	0	0	0
Vulcan Shoal	0	0	0	0	0	0	0
Barracouta Shoal	0	0	0	0	0	0	0
Woodbine Bank	0	0	0	0	0	0	0
Hibernia Reef	0	0	0	0	0	0	0
Fantome Shoal	0	2	0	0	0	0	0
Sahul Bank	7	15	4	8	0	0	0
Margaret Harries Bank	0	2	0	0	0	0	0
Gale Bank	2	6	2	0	0	2	0
Van Cloon Shoal	0	0	0	0	0	0	0
Flat Top Bank	0	1	0	0	0	0	0
Penguin Shoal	0	0	0	0	0	0	0
Bassett-Smith Shoal	0	0	0	0	0	0	0
Holothuria Bank	0	0	0	0	0	0	1
Long Reef	0	0	0	0	0	0	0
Johnson Bank	0	0	0	0	0	0	0

Kimberley AMP (Multiple Use Zone VI)	0	2	0	0	0	0	0
Cartier Island AMP (Sanctuary Zone Ia)	0	0	0	0	0	0	0
Ashmore Reef AMP (Recreational Use Zone IV)	0	0	0	0	0	0	0
Ashmore Reef AMP (Sanctuary Zone Ia)	0	0	0	0	0	0	0
Oceanic Shoals AMP (Multiple Use Zone VI)	37	58	39	35	0	10	0
Joseph Bonaparte Gulf AMP (Special Purpose Zone VI)	0	1	0	0	0	0	0
Joseph Bonaparte Gulf AMP (Multiple Use Zone VI)	0	2	0	0	0	0	0
Pinnacles of the Bonaparte Basin KEF	5	8	2	1	0	4	0
Carbonate bank and terrace system of the Sahul Shelf KEF	79	100	89	74	8	12	0
Ashmore Reef and Cartier Island and surrounding Commonwealth waters KEF	0	0	0	0	0	0	0
Continental Slope Demersal Fish Communities KEF	0	0	0	0	0	0	0
Ancient coastline at 125 m depth contour KEF	0	0	0	0	0	0	0
Dolphin BIAs	0	0	0	0	0	0	1
Pygmy Blue Whale BIA	3	9	2	6	0	0	0
Seabird BIAs	2	11	0	2	0	1	1
Marine Reptile BIAs	37	55	32	29	0	8	2
Dugong BIAs	0	0	0	0	0	0	0
Whale Shark BIA	77	91	77	69	8	4	0
North Kimberley Marine Park	0	1	0	0	0	0	1
Joseph Bonaparte Gulf SE Coastline	0	0	0	0	0	0	6

Table 3.5 Annual maximum probability (in %) of potential sensitive receptors reaching specific concentration thresholds due to a spill at location C.

	Release location C						
	Surface	Entrained 0-10m		Entrained 10-20m		Dissolved	Beached
Potential Sensitive Receptor	**1 g.m^2**	**10 ppb**	**100 ppb**	**10 ppb**	**100 ppb**	**10 ppb**	**10 g.m^2**
Heywood Shoal	0	0	0	0	0	0	0
Eugene McDermott Shoal	2	3	1	1	0	1	0
Vulcan Shoal	0	3	0	3	0	0	0
Barracouta Shoal	1	4	2	2	0	0	0
Woodbine Bank	0	3	0	1	0	0	0
Hibernia Reef	0	0	0	0	0	0	0
Fantome Shoal	0	3	0	0	0	0	0
Sahul Bank	0	4	0	0	0	0	0
Margaret Harries Bank	0	0	0	0	0	0	0
Gale Bank	8	9	1	0	0	2	0
Van Cloon Shoal	4	5	0	0	0	2	0
Flat Top Bank	0	0	0	0	0	0	0
Penguin Shoal	2	1	0	0	0	1	0
Bassett-Smith Shoal	1	2	0	0	0	1	0
Holothuria Bank	0	1	0	0	0	0	1
Long Reef	0	0	0	0	0	0	0
Johnson Bank	0	3	0	2	0	0	0

Kimberley AMP (Multiple Use Zone VI)	2	4	0	0	0	1	0
Cartier Island AMP (Sanctuary Zone Ia)	0	3	0	0	0	0	2
Ashmore Reef AMP (Recreational Use Zone IV)	0	2	0	0	0	0	0
Ashmore Reef AMP (Sanctuary Zone Ia)	0	2	0	2	0	0	3
Oceanic Shoals AMP (Multiple Use Zone VI)	17	25	8	9	0	6	0
Joseph Bonaparte Gulf AMP (Special Purpose Zone VI)	0	1	0	0	0	0	0
Joseph Bonaparte Gulf AMP (Multiple Use Zone VI)	0	3	0	0	0	1	0
Pinnacles of the Bonaparte Basin KEF	2	5	0	2	0	2	0
Carbonate bank and terrace system of the Sahul Shelf KEF	78	99	91	73	6	9	0
Ashmore Reef and Cartier Island and surrounding Commonwealth waters KEF	0	4	0	2	0	0	4
Continental Slope Demersal Fish Communities KEF	0	4	0	2	0	0	4
Ancient coastline at 125 m depth contour KEF	1	2	0	0	0	0	0
Dolphin BIAs	0	2	0	0	0	0	2
Pygmy Blue Whale BIA	0	8	0	3	0	0	3
Seabird BIAs	12	26	3	5	0	4	7
Marine Reptile BIAs	14	27	5	9	0	6	5
Dugong BIAs	0	2	0	2	0	0	0
Whale Shark BIA	78	99	93	76	6	4	0
North Kimberley Marine Park	0	2	0	0	0	0	3
Joseph Bonaparte Gulf SE Coastline	0	0	0	0	0	0	2

3.1.2. Results for the summer conditions

Spill scenarios which started during summer months (December, January and February) were sub-selected from the database of 100 simulations.

The lowest surface threshold of 1 g per m^2 was reached by up to 72% of the runs. MGO concentrations of 10 ppb were found between 0 and 20 m depths in at least 96% of the runs (Table 3.6). The plume followed the summer wind pattern and spread towards the North-East (Figure 3.6 to Figure 3.9). The maximum surface concentration was 8 g/m^2, and the 1 g/m^2 threshold was exceeded for up to 24 days after the start of the spill, extending up to 168 km from the release site. The maximum entrained concentration within 0 to 10 m depth was 702 ppb and the 10-ppb threshold was exceeded over the first 32 days.

There were no beaching events with exposures exceeding 10 g/m^2.

Table 3.6 Summer probability (in %) of MGO reaching defined thresholds. The low and moderate surface thresholds for surface MGO are 1 and 10 g/m^2, respectively. The low and moderate concentration thresholds for entrained MGO is 10 and 100 ppb, respectively. The low and moderate concentration thresholds for dissolved MGO are 10 and 50 ppb, respectively.

	Release location A		**Release location B**		**Release location C**	
Threshold	**Low**	**Moderate**	**Low**	**Moderate**	**Low**	**Moderate**
Surface	64	0	72	0	72	0
Entrained 0-10 m	100	100	100	96	100	100
Entrained 10-20 m	96	8	100	8	100	4
Dissolved	4	0	8	0	8	0

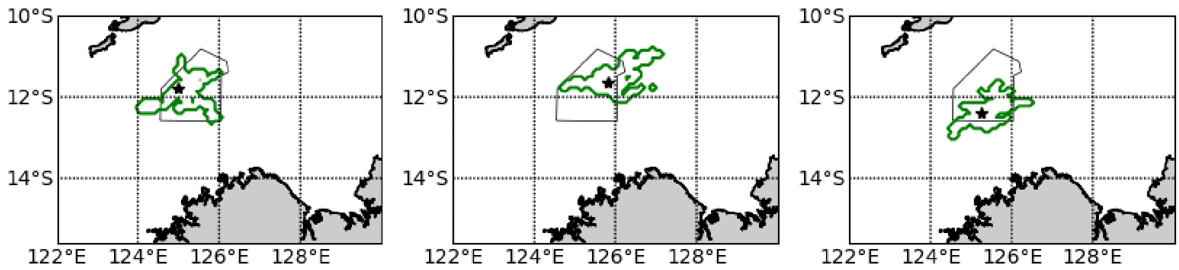


Figure 3.6 Zone of maximum surface exposure above 1 g/m^2 (green) during summer for spills from location A (left), B (middle) and C (right).

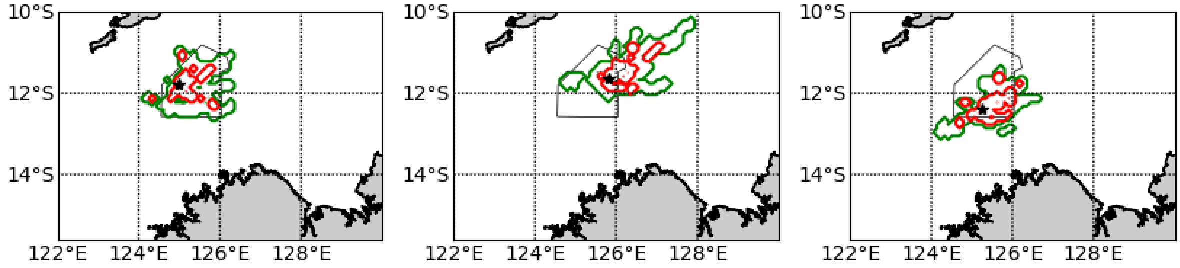


Figure 3.7 Zone of maximum entrained (0 to 10 m) exposure above 10 g/m^2 (green) and 100 g/m^2 (red) during summer for spills from location A (left), B (middle) and C (right).

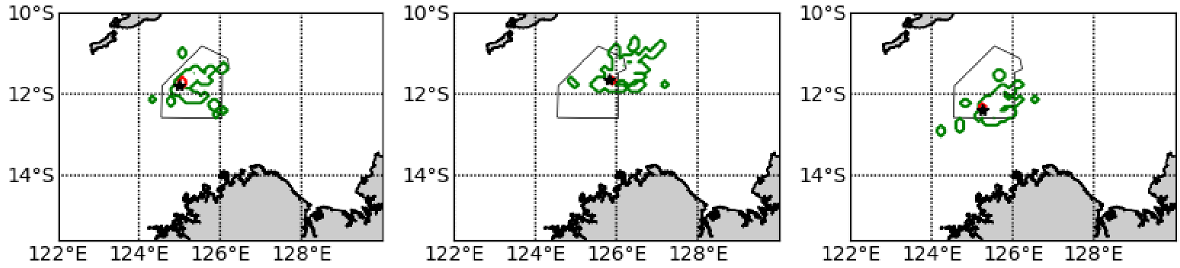


Figure 3.8 Zone of maximum entrained (10 to 20 m) exposure above 10 g/m^2 (green) and 100 g/m^2 (red) during summer for spills from location A (left), B (middle) and C (right).

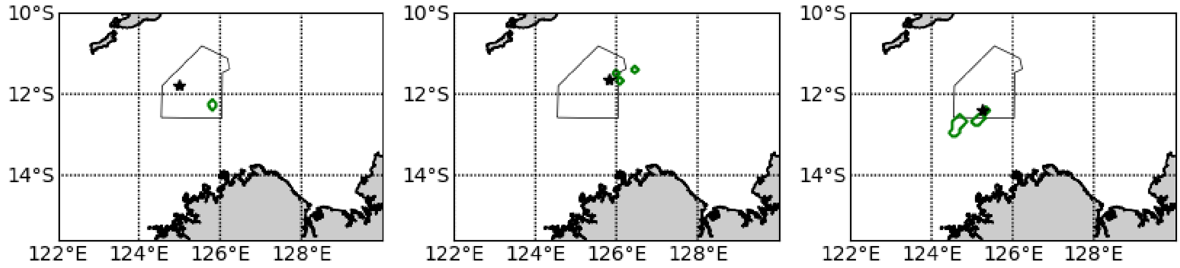


Figure 3.9 Zone of maximum dissolved (0 to 10 m) exposure above 10 g/m^2 (green) during summer for spills from location A (left), B (middle) and C (right).

Table 3.7 Summer maximum concentration of MGO after 1, 2, 7, 15,30, 40 and greater than 60 days.

	Location	1 day	2 days	7 days	15 days	30 days	40 days	>60 days
Surface [g.m^2]	**A**	6.82	6.15	4.71	1.69	0.29	0.00	0.04
	B	6.85	5.87	4.70	1.58	0.72	0.00	0.03
	C	6.99	6.19	4.83	2.38	0.84	0.00	0.01
Entrained 0 to 10 m [ppb]	**A**	500.70	278.76	247.57	59.36	4.64	0.01	0.00
	B	425.93	345.67	255.71	74.44	6.24	0.13	0.01
	C	384.44	257.52	211.45	45.78	17.84	0.00	0.00
Entrained 10 to 20 m [ppb]	**A**	96.35	45.30	43.38	6.26	0.63	0.00	0.00
	B	96.90	62.56	47.07	7.58	1.12	0.06	0.00
	C	83.25	52.08	26.67	3.08	0.78	0.00	0.00
Dissolved 0 to 10 m [ppb]	**A**	1.33	3.86	7.27	7.49	3.75	1.45	1.51
	B	1.18	3.90	7.87	7.66	5.10	2.66	1.72
	C	1.31	3.77	6.98	9.04	8.29	4.19	2.46
Beached [g.m^2]	**A**	0.00	0.00	0.00	0.00	0.00	0.03	3.06
	B	0.00	0.00	0.00	0.00	0.00	0.08	1.63
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.96

3.1.3. Results for the transitional conditions

Spill scenarios which started during the transition months (March, September, October and November) were sub-selected from the database of 100 simulations.

The lowest surface threshold of 1 g per m^2 was reached in all the runs (Table 3.8) and MGO concentrations of 10 ppb were found between 0 and 20 m depths in at least 31 % of the runs. During the transitional months, the plume is more influenced by ocean currents than wind, and the spread is therefore oriented towards the South-East (Figure 3.10 to Figure 3.13). The maximum surface concentration was 8 g/m^2, and the 1 g/m^2 threshold persisted for 43 days and extended up to 350 km from the release site. The maximum entrained concentration in 0 to 10 m water depths was 663 ppb and the 10-ppb threshold was exceeded over the first 50 days.

The highest shoreline loading was 75.15 g/m^2. Beaching is most likely to occur in the Kimberley area, Joseph Bonaparte Gulf (7%) and Ashmore area (3%). The minimum time between the spill start and beaching is 16 days.

Table 3.8 Probability (in %) of MGO reaching each defined threshold during the transitional months. The low and moderate surface thresholds for surface MGO are 1 and 10 g/m^2, respectively. The low and moderate concentration thresholds for entrained MGO is 10 and 100 ppb, respectively. The low and moderate concentration thresholds for dissolved MGO are 10 and 50 ppb, respectively.

	Release location A		**Release location B**		**Release location C**	
Threshold	**Low**	**Moderate**	**Low**	**Moderate**	**Low**	**Moderate**
Surface	100	0	100	0	97	0
Entrained 0-10 m	100	97	100	90	100	90
Entrained 10-20 m	31	10	38	3.45	38	3
Dissolved	24	0	34	0	24	0
Beached	17	0	21	0	17	0

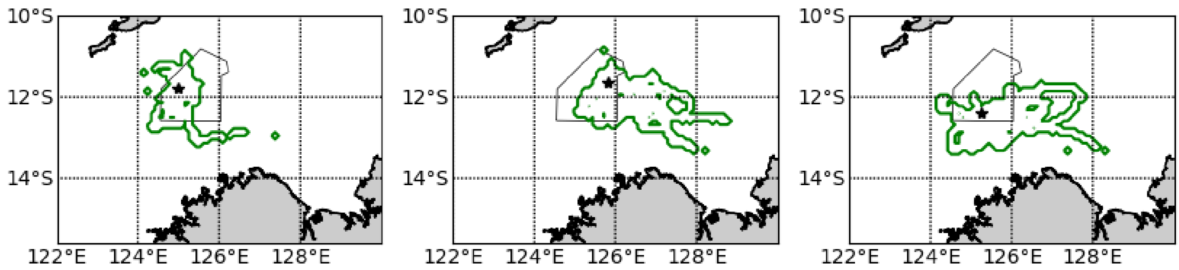


Figure 3.10 Zone of maximum surface exposure above 1 g/m² (green) during the transitional months for spills from location A (left), B (middle) and C (right).

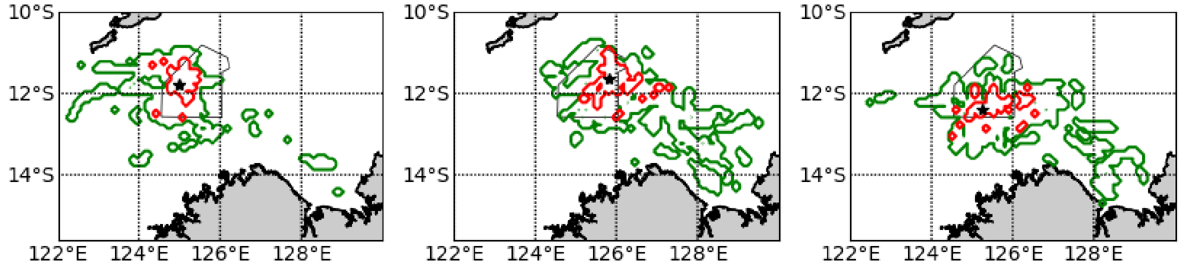


Figure 3.11 Zone of maximum entrained (0 to 10 m) exposure above 10 g/m² (green) and 100 g/m² (red) during the transitional months for spills from location A (left), B (middle) and C (right).

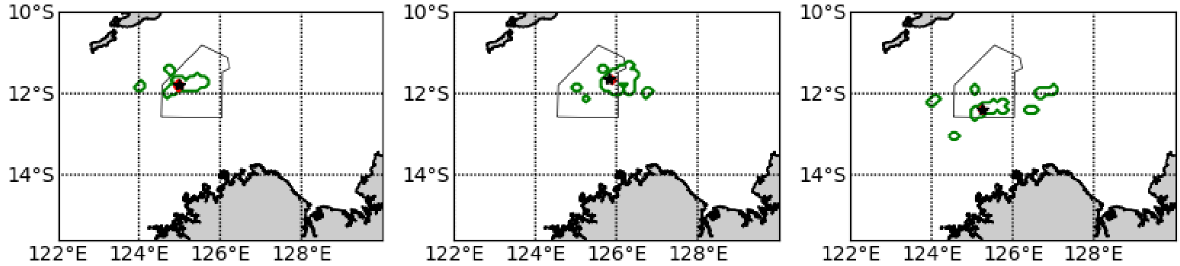


Figure 3.12 Zone of maximum entrained (10 to 20 m) exposure above 10 g/m² (green) and 100 g/m² (red) during the transitional months for spills from location A (left), B (middle) and C (right).

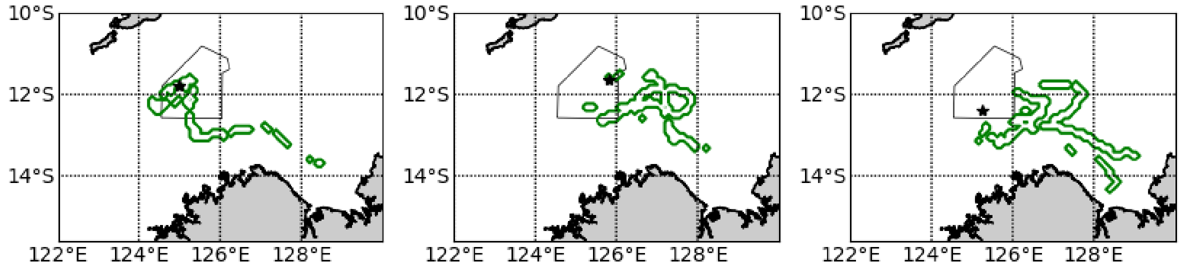


Figure 3.13 Zone of maximum dissolved (0 to 10 m) exposure above 10 g/m² (green) during the transitional months for spills from location A (left), B (middle) and C (right).

Table 3.9 Maximum concentration of MGO after 1, 2, 7, 15, 30, 40 and greater than 60 days during the transitional months.

	Location	1 day	2 days	7 days	15 days	30 days	40 days	>60 days
Surface [g/m^2]	**A**	6.93	6.29	4.61	2.47	2.26	1.07	0.00
	B	6.94	6.20	4.46	2.89	1.56	0.52	0.01
	C	7.00	6.33	4.97	2.95	1.84	1.45	0.02
Entrained 0 to 10 m [ppb]	**A**	540.66	425.48	153.18	47.40	39.61	5.62	0.13
	B	501.82	333.20	107.50	43.23	57.98	7.74	0.20
	C	545.75	413.84	96.61	40.13	43.24	12.69	0.62
Entrained 10 to 20 m [ppb]	**A**	92.53	63.76	8.53	8.22	1.22	0.48	0.03
	B	89.62	55.74	6.71	4.24	3.09	0.59	0.05
	C	71.50	47.60	5.61	4.68	2.40	0.50	0.12
Dissolved 0 to 10m [ppb]	**A**	1.48	3.76	8.64	10.09	12.95	9.46	2.34
	B	1.57	3.88	5.94	9.03	14.78	7.09	2.41
	C	2.06	3.68	7.92	8.93	12.86	15.19	2.80
Beached [g/m^2]	**A**	0.00	0.00	0.00	0.00	9.88	9.95	16.46
	B	0.00	0.00	0.00	0.00	0.50	47.28	52.72
	C	0.00	0.00	0.00	0.00	15.71	15.71	75.15

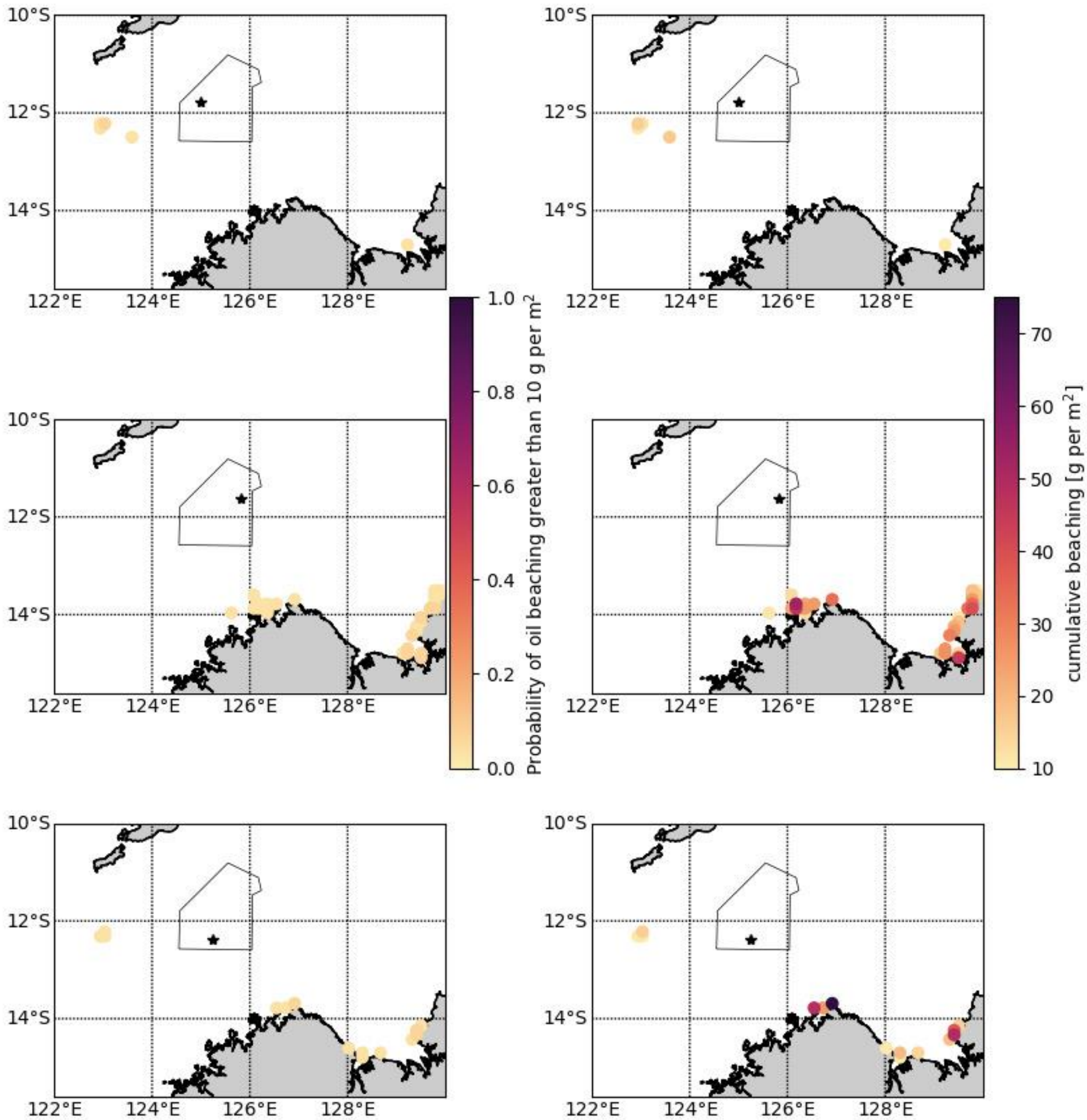


Figure 3.14 Probability for oil beaching (left) and maximum beached MGO concentration during the transitional months for spills from location A (top), B (middle) and C (bottom). Note, a probability of 1 represents 100% chance of oil beaching above 10 g/m^2.

3.1.4. Results for the winter conditions

Spill scenarios which started during winter months (April, May, June, July and August) were sub-selected from the database of 100 simulations.

The lowest surface threshold of 1 g per m^2 was reached in 69% of the runs (Table 3.10) and MGO concentrations of 10 ppb were found between 0 and 20 m depths in at least 93 % of the runs The plume follows the winter wind pattern and spread towards the South-West (Figure 3.15 to Figure 3.18). The maximum surface concentration was 8 g/m^2, and the 1 g/m^2 threshold persisted for up to 22 days and extended some 180 km from the release site. The maximum entrained concentration in 0 to 10 m water depth was 677 ppb and the 10-ppb threshold was exceeded over the first 27 days.

The highest shoreline loading was 48.79 g/m^2. Beaching is most likely to occur in and around Ashmore Reef and on Cartier Island (6% probability) and North Kimberley coast (2%). The minimum time between spill start and beaching is 16 days.

Table 3.10 Winter probability (in %) of MGO reaching each defined threshold. The low and moderate surface thresholds for surface MGO are 1 and 10 g/m^2, respectively. The low and moderate concentration thresholds for entrained MGO is 10 and 100 ppb, respectively. The low and moderate concentration thresholds for dissolved MGO are 10 and 50 ppb, respectively.

	Release location A		Release location B		Release location C	
Threshold	**Low**	**Moderate**	**Low**	**Moderate**	**Low**	**Moderate**
Surface	70	0	70	0	70	0
Entrained 0-10 m	100	100	100	98	100	100
Entrained 10-20 m	96	22	93	11	96	9
Dissolved	2	0	0	0	2	0
Beached	2	0	2	0	9	0

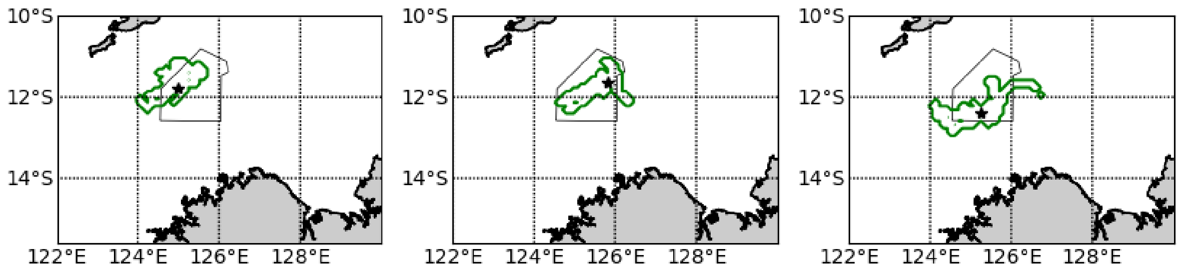


Figure 3.15 Winter zone of maximum surface exposure above 1 g/m^2 (green) for spills from location A (left), B (middle) and C (right).

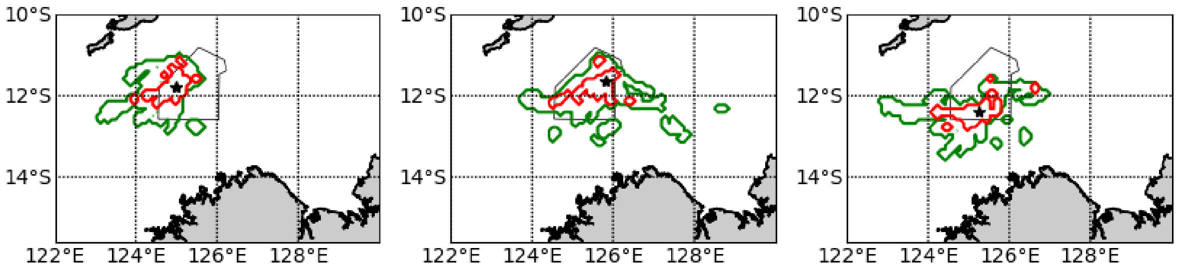


Figure 3.16 Winter zone of maximum entrained (0 to 10 m) exposure above 10 g/m^2 (green) and 100 g/m^2 (red) for spills from location A (left), B (middle) and C (right).

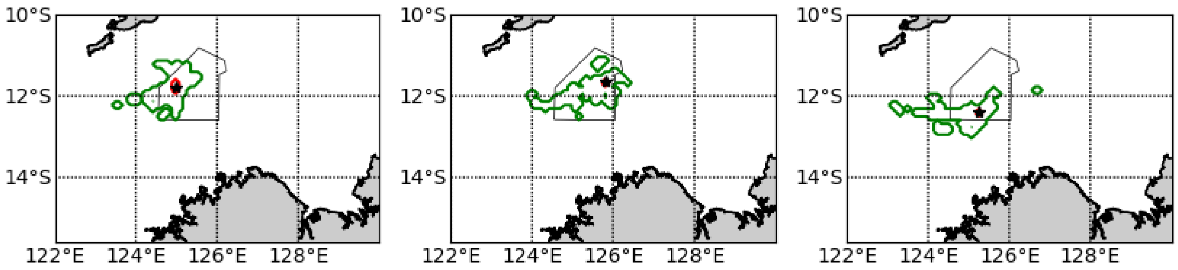


Figure 3.17 Winter zone of maximum entrained (10 to 20m) exposure above 10 g/m^2 (green) and 100 g/m^2 (red) for spills from location A (left), B (middle) and C (right).

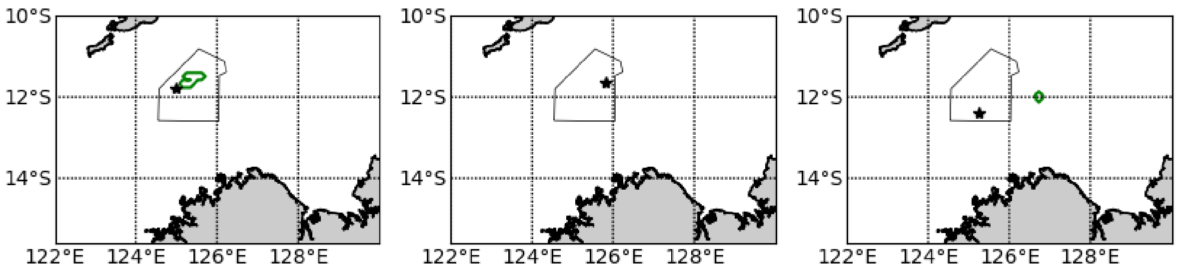


Figure 3.18 Winter zone of maximum dissolved (0 to 10m) exposure above 10 g/m^2 (green) for spills from location A (left), B (middle) and C (right).

Table 3.11 Winter maximum concentration of MGO after 1,2,7,15,30,40 and greater than 60 days.

	Location	1 day	2 days	7 days	15 days	30 days	40 days	>60 days
Surface [g.m^2]	**A**	6.96	6.20	5.19	2.00	0.49	0.37	0.14
	B	6.96	6.10	4.82	3.28	0.55	0.21	0.03
	C	6.57	6.36	4.93	2.71	0.62	0.19	0.06
Entrained 0 to 10m [ppb]	**A**	559.97	404.95	75.64	49.06	5.71	25.31	2.29
	B	499.14	365.20	50.60	36.29	5.38	10.60	0.38
	C	500.53	327.86	56.55	32.31	7.09	20.89	1.11
Entrained 10 to 20 m [ppb]	**A**	100.42	86.31	19.44	16.80	1.29	0.33	0.21
	B	101.81	66.91	17.84	9.84	2.94	0.32	0.07
	C	87.05	68.60	30.39	11.91	0.87	0.52	0.17
Dissolved 0 to 10 m [ppb]	**A**	1.71	3.07	6.54	7.90	5.01	4.24	3.70
	B	1.73	2.98	6.31	8.05	4.84	4.75	8.16
	C	1.57	3.39	6.22	6.59	5.89	3.66	2.17
Beached [g/m^2]	**A**	0.00	0.00	0.00	0.00	23.93	24.90	24.91
	B	0.00	0.00	0.00	0.00	1.90	3.37	14.63
	C	0.00	0.00	0.00	0.00	48.79	48.79	48.79

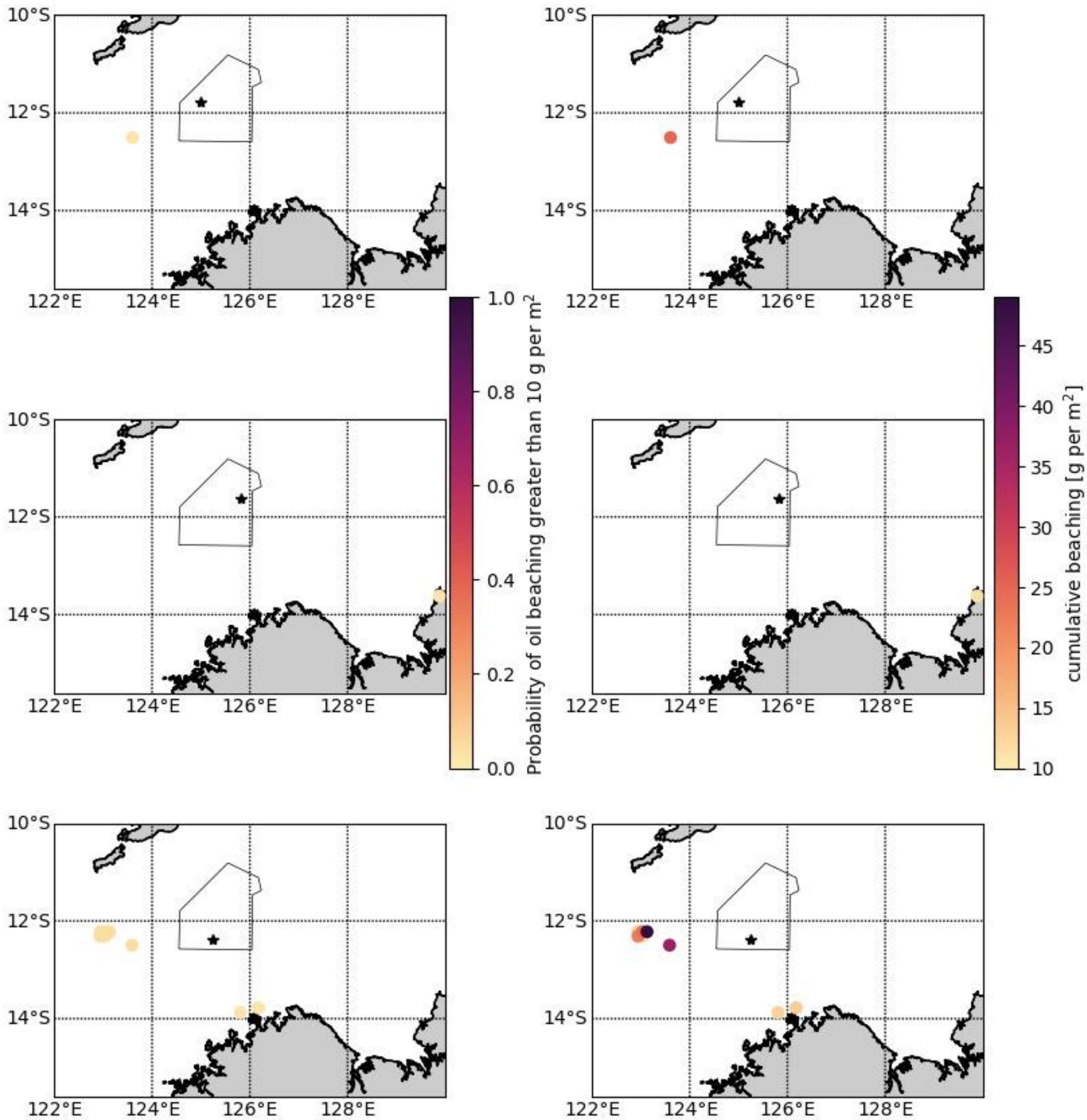


Figure 3.19 Winter probability for oil beaching (left) and maximum beached MGO concentration for spills from location A (top), B (middle) and C (bottom). Note, a probability of 1 represents 100 % chance of oil beaching above 10 g/m^2.

3.2. Worst-case beaching simulation

The worst-case beaching outcome identified from the 100 random simulations occurred from a spill that started on 22nd October 2012, which gave rise to a shoreline loading of up to 75 g/m^2 of MGO on the coast. Due to the calm weather at this time of the year, there is less dispersal of the oil and the transport vectors align toward the Kimberley coast. In total, some 13% of the spilled volume was beached. The trajectory is shown on Figure 3.20, which displays the maximum surface, entrained and dissolved concentration from the 90-day simulation.

Localised concentrations of up to 75 g/m^2 were observed in the simulation, while the average was 2.7 g/m^2. In total, some 115 tonnes (i.e., 136 m^3) of MGO were beached. The fate and mass budget for the event is provided as a time series graph in Figure 3.22.

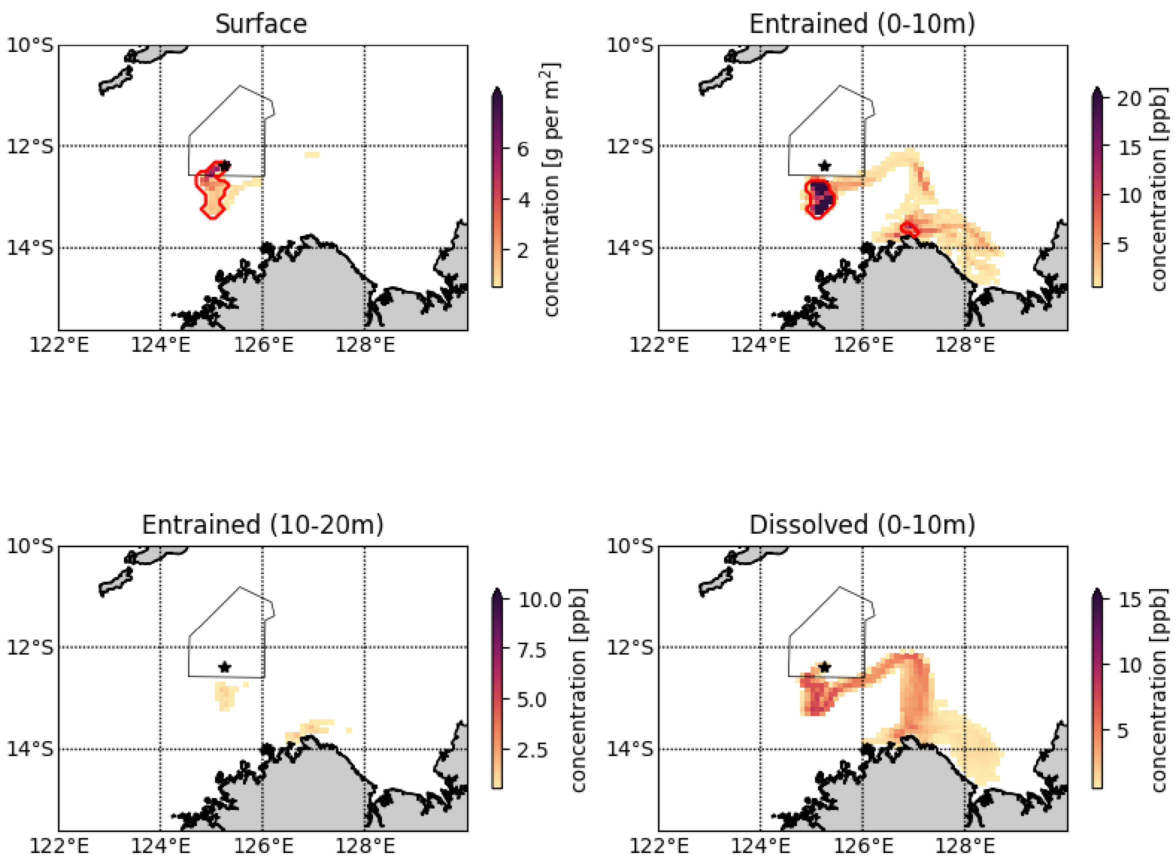


Figure 3.20 The maximum surface, entrained and dissolved concentration during the worst-case scenario simulated beaching event. The red contour illustrates the lowest threshold for each concentration.

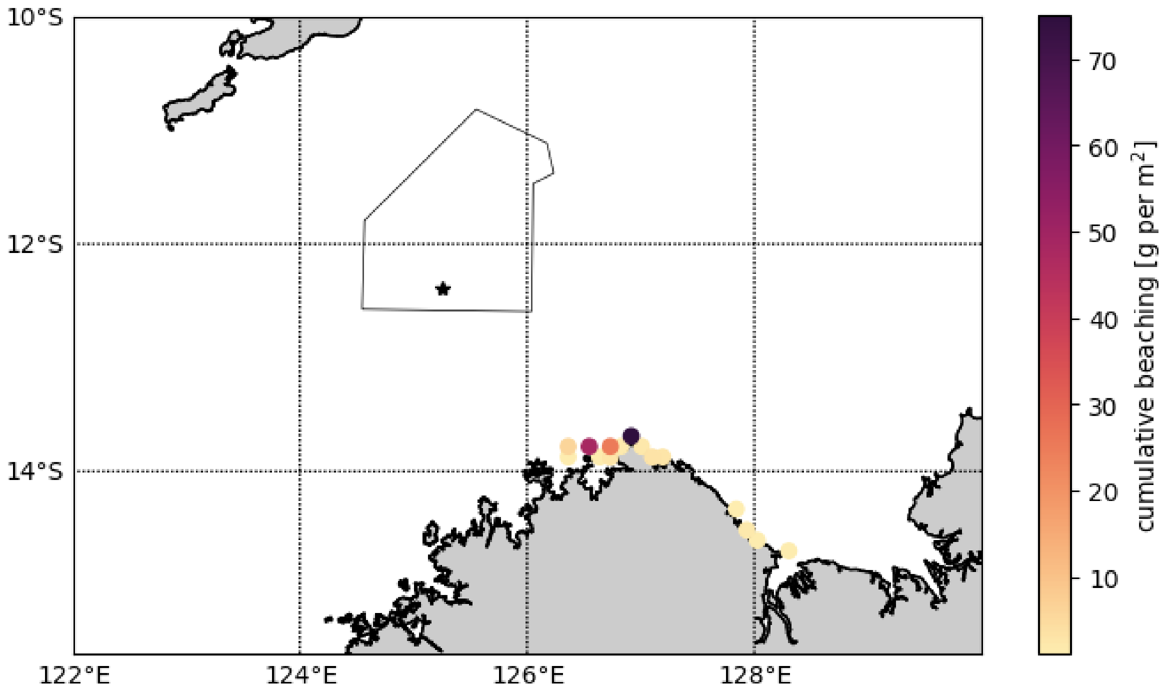
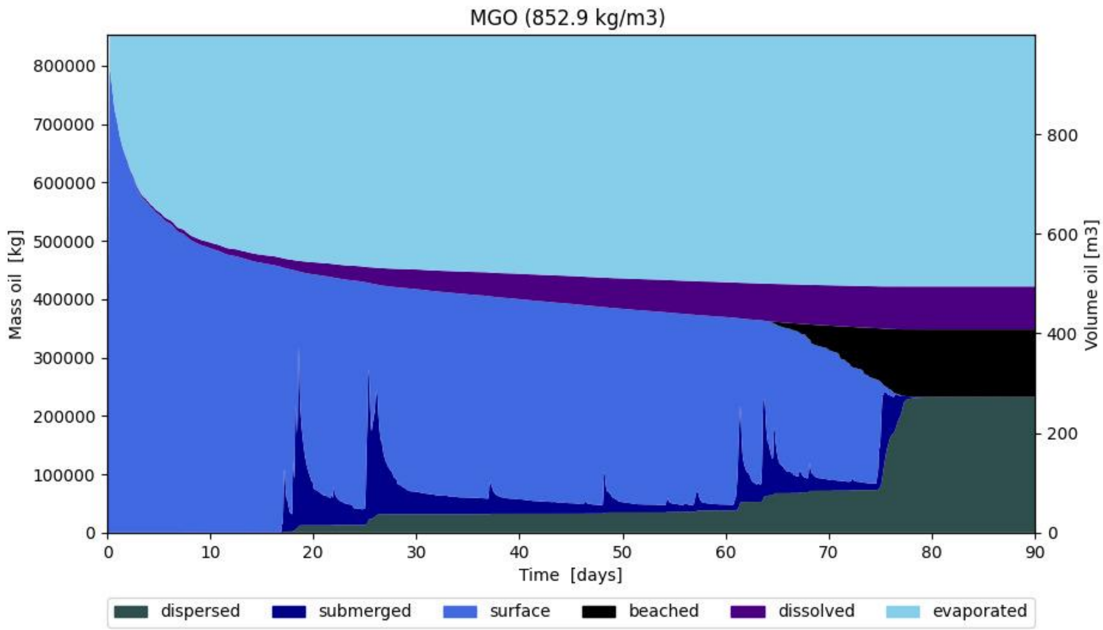


Figure 3.21 Total concentration of MGO (in g/m^2) beached during the worst-case scenario.



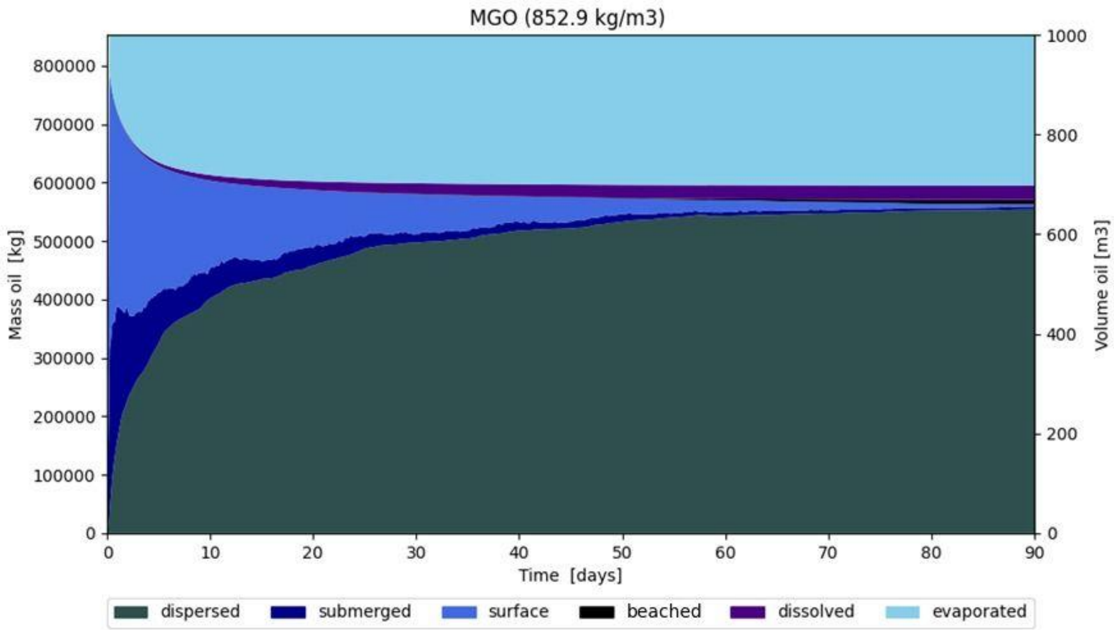


Figure 3.22 Timeseries representing the fate and mass budget of the October 2012 spill event from location C (top) and the average from all the simulations (bottom).

4. SUMMARY

A stochastic approach was undertaken to define the statistical probabilities related to oil trajectory, dispersion, weathering, and beaching patterns arising from a spill due to a vessel collision during Bonaparte MC3D survey in the Bonaparte Basin. A numerical particle model was used to simulate oil spills for 100 randomly selected dates over a decade. Historical hindcasts of the wave, wind, and ocean current conditions were used to drive the numerical model.

The simulated spill scenario was a surface release of 1,000 m^3 of MGO over a 6-hour period. Each spill was tracked by the model for 90 days, and the results used to form a database of 100 events which were analysed to derive statistics on the fate and mass budgets, plus the probability of occurrence for specific impacts.

The results show that the fate of spilled MGO in the Bonaparte Basin is highly dependent on the wind and wave climate. During the transitional months (March, September, October and November) winds and waves are relatively calm and the fuel persists on sea surface for a long period of time than other seasons. There is less dispersion within the water column and more surface trajectory toward Joseph Bonaparte Gulf. During the winter months (April, May, June, July and August) the plume tends to spread toward the South-West (i.e., Ashmore reef and Cartier Island), whereas during the summer months (December, January, February) the plume trajectory is predominantly directed toward the North-East.

On average, around 1.7% of the spilled volume can be expected to beach during an event at location B and less than 1% at locations A and C. The worst-case outcome from the simulations resulted in 13% of the spilled volume beaching on the North Kimberley Coast. Overall, on an annual basis, the location with the highest chance of oil beaching is Joseph Bonaparte Gulf (6%), followed by the Ashmore Reef and Cartier Island area (5%) and North Kimberley coast (3%). The minimum times for the beaching concentration to reach 10 g/m^2 is 40 days for the Kimberley coast and 18 days for Ashmore Reef.

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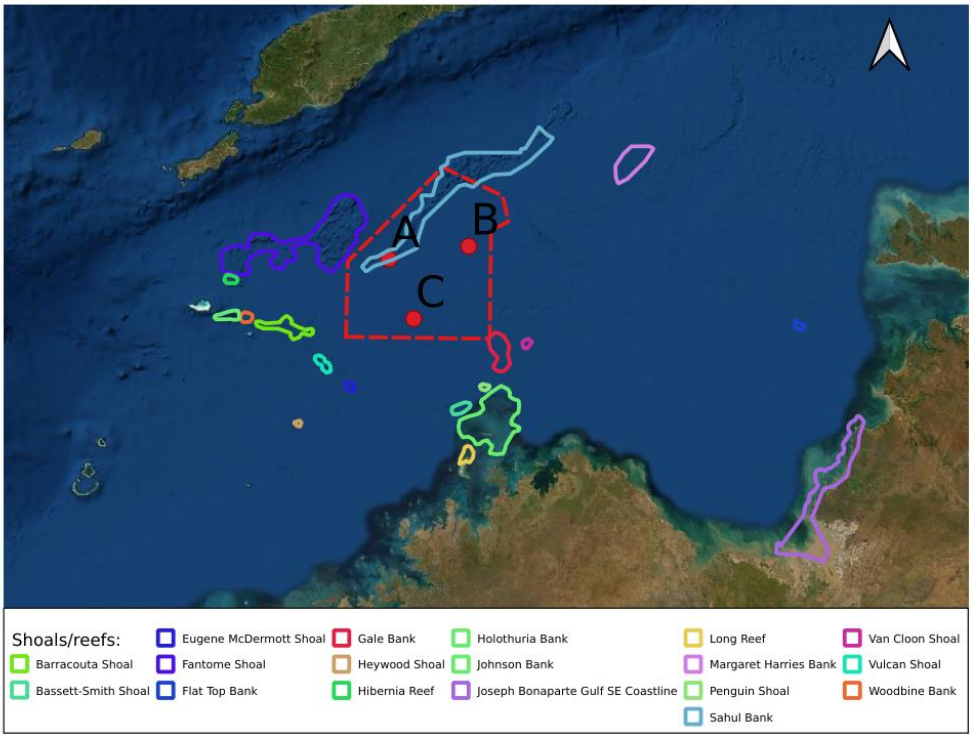
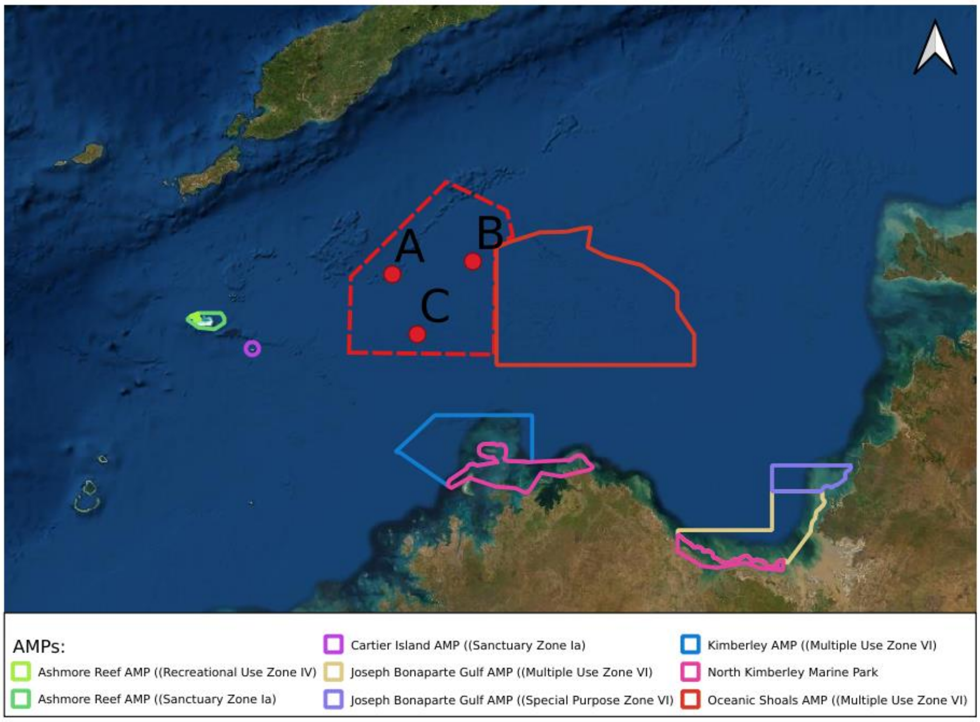
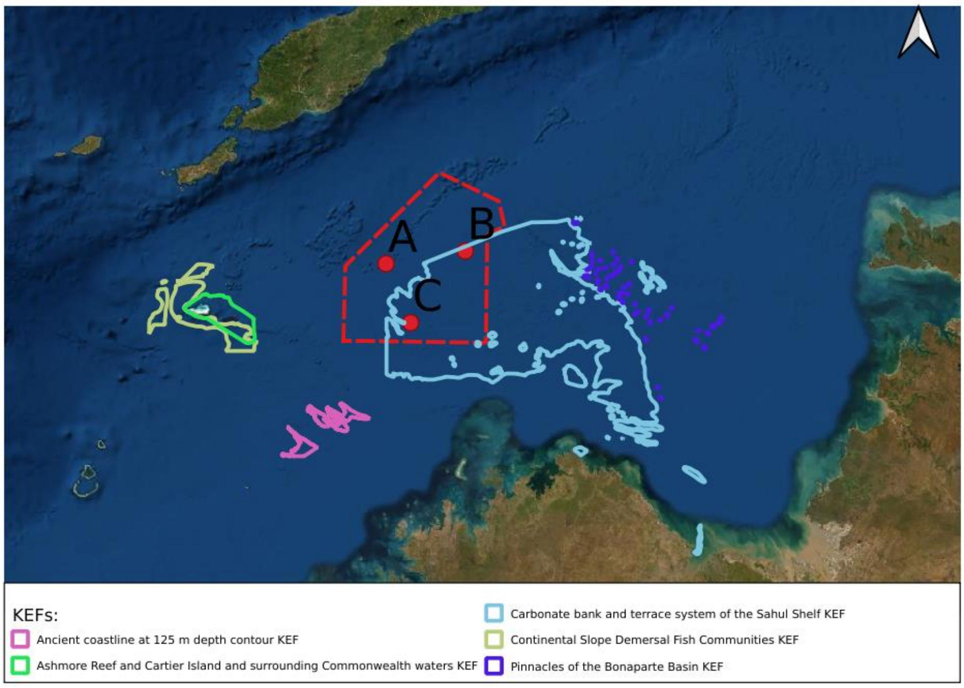
APPENDIX ONE



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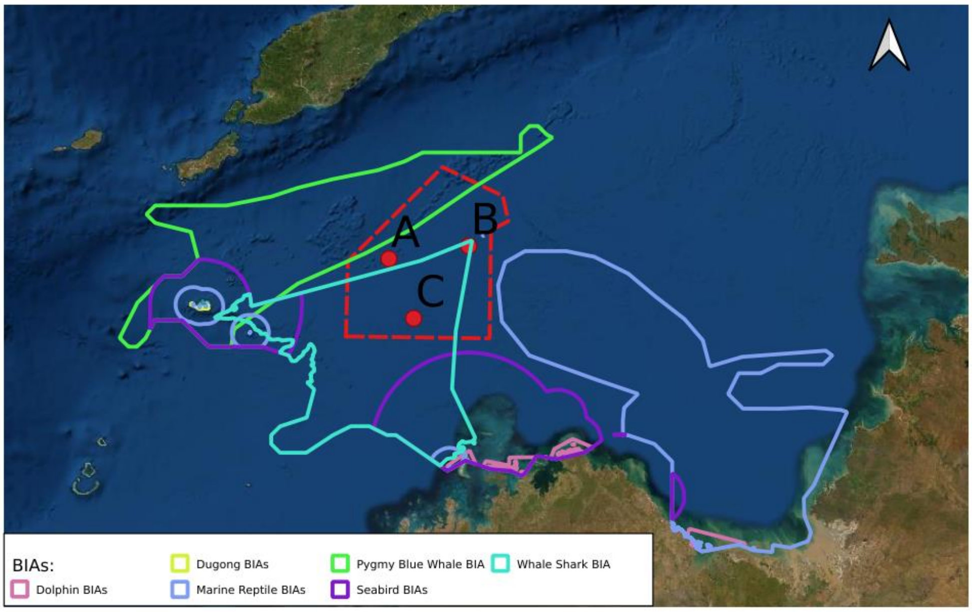
KEFs:
Ancient coastline at 125 m depth contour KEF
Ashmore Reef and Cartier Island and surrounding Commonwealth waters KEF
Carbonate bank and terrace system of the Sahul Shelf KEF
Continental Slope Demersal Fish Communities KEF
Pinnacles of the Bonaparte Basin KEF


A
B
C
BIAs:
Dolphin BIAs
Dugong BIAs
Marine Reptile BIAs
Pygmy Blue Whale BIA
Seabird BIAs
Whale Shark BIA

APPENDIX C

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. Please see the caveat for interpretation of information provided here.

Report created: 03-Mar-2022

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance (Ramsar	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	3
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	48
Listed Migratory Species:	72

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	4
Commonwealth Heritage Places:	1
Listed Marine Species:	120
Whales and Other Cetaceans:	27
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	8
Habitat Critical to the Survival of Marine Turtles:	2

Extra Information

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

State and Territory Reserves:	7
Regional Forest Agreements:	None
Nationally Important Wetlands:	2
EPBC Act Referrals:	110
Key Ecological Features (Marine):	7
Biologically Important Areas:	45
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

National Heritage Places [Resource Information]

Name	State	Legal Status
Natural		
The West Kimberley	WA	Listed place

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity
Ashmore reef national nature reserve	Within Ramsar site
Ord river floodplain	Within 10km of Ramsar site

Commonwealth Marine Area [Resource Information]

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

Feature Name
EEZ and Territorial Sea
Extended Continental Shelf
Extended Continental Shelf

Listed Threatened Species [Resource Information]

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

Scientific Name	Threatened Category	Presence Text
BIRD		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat likely to occur within area
Geophaps smithii blaauwi Partridge Pigeon (western) [66501]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area
FISH		
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to occur within area
MAMMAL		
Antechinus bellus Fawn Antechinus [344]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat may occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Mesembriomys gouldii gouldii Black-footed Tree-rat (Kimberley and mainland Northern Territory), Djintamoonga, Manbul [87618]	Endangered	Species or species habitat may occur within area
Petrogale concinna canescens Nabarlek (Top End) [87606]	Endangered	Species or species habitat may occur within area
Petrogale concinna monastria Nabarlek (Kimberley) [87607]	Endangered	Species or species habitat known to occur within area
Phascogale pirata Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat likely to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Trichosurus vulpecula arnhemensis Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat likely to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARK		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Breeding known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Sternula albifrons Little Tern [82849]		Foraging, feeding or related behaviour known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Mobula birostris as Manta birostris		
Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni		
Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus		
Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis		
Australian Humpback Dolphin [87942]		Foraging, feeding or related behaviour known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		

Scientific Name	Threatened Category	Presence Text
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat likely to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State
Defence	
Defence - MT GOODWIN RADAR SITE [70063]	NT
Unknown	
Commonwealth Land - [52276]	ACI
Commonwealth Land - [52278]	ACI
Commonwealth Land - [52277]	ACI

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Ashmore Reef National Nature Reserve	EXT	Listed place

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Acrocephalus orientalis		
Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area overfly marine area
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous minutus		
Black Noddy [824]		Breeding known to occur within area
Anous stolidus		
Common Noddy [825]		Breeding known to occur within area
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Anseranas semipalmata		
Magpie Goose [978]		Species or species habitat may occur within area overfly marine area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna pacifica as Puffinus pacificus		
Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Arenaria interpres		
Ruddy Turnstone [872]		Species or species habitat likely to occur within area
Bubulcus ibis as Ardea ibis		
Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris alba		
Sanderling [875]		Species or species habitat likely to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area overfly marine area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Calidris tenuirostris		
Great Knot [862]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat known to occur within area
Cecropis daurica as Hirundo daurica		
Red-rumped Swallow [80610]		Species or species habitat may occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans		
Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus		
Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area overfly marine area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat likely to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat likely to occur within area
Onychoprion anaethetus as Sterna anaethetus Bridled Tern [82845]		Breeding known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat likely to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat likely to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato)		
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area
Sterna dougallii		
Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons as Sterna albifrons		
Little Tern [82849]		Foraging, feeding or related behaviour known to occur within area
Sula dactylatra		
Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster		
Brown Booby [1022]		Breeding known to occur within area
Sula sula		
Red-footed Booby [1023]		Breeding known to occur within area
Thalasseus bengalensis as Sterna bengalensis		
Lesser Crested Tern [66546]		Breeding known to occur within area
Thalasseus bergii as Sterna bergii		
Greater Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area
Fish		
Bhanotia fasciolata		
Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		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

Scientific Name	Threatened Category	Presence Text
Trachyrhamphus longirostris		
Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
Dugong dugon		
Dugong [28]		Breeding known to occur within area
Reptile		
Acalyptophis peronii		
Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis		
Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii		
Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii		
Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama		
Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Aipysurus fuscus		
Dusky Seasnake [1119]		Species or species habitat known to occur within area
Aipysurus laevis		
Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii		
Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Chitulia inornata as Hydrophis inornatus Plain Seasnake [87379]		Species or species habitat may occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli Small-headed Seasnake [75601]		Species or species habitat may occur within area
Lapemis curtus as Lapemis hardwickii Spine-bellied Seasnake [83554]		Species or species habitat may occur within area
Leioselasma coggeri as Hydrophis coggeri Black-headed Sea Snake, Slender-necked Seasnake [87373]		Species or species habitat may occur within area
Leioselasma pacifica as Hydrophis pacificus Large-headed Seasnake, Pacific Seasnake [87378]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni Northern Mangrove Seasnake [1090]		Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima as Kogia simus Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Orcaella heinsohni as Orcaella brevirostris Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Foraging, feeding or related behaviour known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks

[Resource Information]

Park Name	Zone & IUCN Categories
Joseph Bonaparte Gulf	Multiple Use Zone (IUCN VI)
Kimberley	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Ashmore Reef	Recreational Use Zone (IUCN IV)
Ashmore Reef	Sanctuary Zone (IUCN Ia)
Cartier Island	Sanctuary Zone (IUCN Ia)
Joseph Bonaparte Gulf	Special Purpose Zone (IUCN VI)
Oceanic Shoals	Special Purpose Zone (Trawl) (IUCN VI)

Habitat Critical to the Survival of Marine Turtles

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur

Scientific Name	Behaviour	Presence
Dec - Jan		
Chelonia mydas		
Green Turtle [1765]	Nesting	Known to occur

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Balanggarra	Indigenous Protected Area	WA
Keep River	Proposed National Parks Act park or park addition	NT
Marri-Jabin (Thamurrurr - Stage 1)	Indigenous Protected Area	NT
Niiwalarra Islands	National Park	WA
North Kimberley	Marine Park	WA
Pelican Island	Nature Reserve	WA
Uunguu	Indigenous Protected Area	WA

Nationally Important Wetlands [Resource Information]

Wetland Name	State
Ashmore Reef	EXT
Moyle Floodplain and Hyland Bay System	NT

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
275 km gas pipeline from Wadeye to existing Darwin gas pipeline	2006/2930	Controlled Action	Post-Approval
Audacious Oil Field Standalone Development	2001/407	Controlled Action	Completed
Australia-ASEAN Power Link	2020/8818	Controlled Action	Proposed Decision
Blacktip Project - Wharf Construction	2007/3293	Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Bonaparte Liquified Natural Gas Project	2011/6141	Controlled Action	Post-Approval
Decommissioning of Buffalo Oil Field	2003/984	Controlled Action	Post-Approval
Decommissioning of Challis Oilfield	2003/942	Controlled Action	Post-Approval
Development of Blacktip Gas Field	2003/1180	Controlled Action	Post-Approval
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval
Montara 4, 5, and 6 Oil Production Wells, and Montara 3 Gas Re-Injection Well	2002/755	Controlled Action	Post-Approval
Prelude Floating Liquefied Natural Gas Facility and Gas Field Development	2008/4146	Controlled Action	Post-Approval
Project Sea Dragon stage 1 prawn aquaculture project, NT	2015/7527	Controlled Action	Post-Approval
PTTEP AA Floating LNG Facility	2011/6025	Controlled Action	Completed
Trans-territory Gas Pipeline	2003/1186	Controlled Action	Completed
Not controlled action			
2D seismic survey, exploration permit NT/P67	2004/1587	Not Controlled Action	Completed
2D Seismic Survey in Permit Areas WA-318-P & WA-319-P, near Cape Londonderry	2004/1687	Not Controlled Action	Completed
Adele Trend TQ3D Seismic Survey	2001/252	Not Controlled Action	Completed
AEC International Hydrocarbon Well Puffin 6	2000/36	Not Controlled Action	Completed
Audacious-3 oil drilling well	2003/1042	Not Controlled Action	Completed
Backpacker-1 Offshore Hydrocarbon Exploration Well	2001/300	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Buffalo In-Fill Production Wells	2001/475	Not Controlled Action	Completed
Controlled Source Electromagnetic 2D Survey	2009/4980	Not Controlled Action	Completed
Controlled Source Electromagnetic Survey	2010/5434	Not Controlled Action	Completed
Coot-1 hydrocarbon exploration well, Permit Area AC/L2 or AC/L3	2001/296	Not Controlled Action	Completed
Crux-A and Crux-B appraisal wells, Petroleum Permit Area AC/P23	2006/2748	Not Controlled Action	Completed
Crux gas-liquids development in permit AC/P23	2006/3154	Not Controlled Action	Completed
Drilling of 12 Hydrocarbon Exploration Wells, Permit Area WA-371-P	2006/3005	Not Controlled Action	Completed
Drilling of exploration well Audacious-1 in AC/P17	2000/5	Not Controlled Action	Completed
Drilling of Marina-1 Exploration Well	2007/3586	Not Controlled Action	Completed
Echuca Shoals-2 Exploration of Appraisal Well	2006/3020	Not Controlled Action	Completed
Exploration Drilling in AC/P17, AC/P18 and AC/P24	2001/359	Not Controlled Action	Completed
Exploration Well AC/P23	2001/234	Not Controlled Action	Completed
Marine Survey for the Australia-ASEAN Power Link AAPL	2020/8714	Not Controlled Action	Completed
Montara-3 Offshore Hydrocarbon Exploration Well Permit Area AC/RL3	2001/489	Not Controlled Action	Completed
Nexus Drilling Program NT-P66	2007/3745	Not Controlled Action	Completed
P30 Hydrocarbon Exploration Well	2001/293	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Puffin Oil wells 7, 8 & 9 development	2005/2336	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Saucepan 1 Exploration Well ACP23	2000/2	Not Controlled Action	Completed
Skua and Swift Oilfields	2006/3195	Not Controlled Action	Completed
Strumbo-1 Gas Exploration Well Permit Area WA-288-P	2002/884	Not Controlled Action	Completed
Thresher-1 Well	2000/84	Not Controlled Action	Completed
Not controlled action (particular manner)			
2 (3D) Marine Seismic Surveys	2009/4994	Not Controlled Action (Particular Manner)	Completed
2D and 3D Seismic Survey	2011/6197	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D Seismic Survey WA-405-P	2009/5104	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D Seismic Survey WA-405-P	2008/4133	Not Controlled Action (Particular Manner)	Post-Approval
2D Marine Seismic Survey	2009/4728	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey of Braveheart,Kurrajong,Sunshine and Crocodile	2006/2917	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey within permit area WA-318-P	2007/3879	Not Controlled Action (Particular Manner)	Post-Approval
2D or 3D Marine Seismic Survey in Petroleum Permit Area AC/P35	2009/4864	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Marine Survey	2001/363	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
2D Seismic survey	2009/5076	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey in permit areas WA-274P and WA-281P	2004/1521	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey in WA Permit Area TP/22 and Commonwealth Permit Area WA-280-P	2005/2100	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey	2009/4681	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey	2008/4437	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey, Permit AC/P 23	2005/2364	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, petroleum exploration permit AC/P33	2006/2918	Not Controlled Action (Particular Manner)	Post-Approval
3D seismic survey of AC/P4, AC/P17 and AC/P24	2006/2857	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey WA-406-P Bonaparte Basin	2007/3904	Not Controlled Action (Particular Manner)	Post-Approval
AC/P37 3D Seismic Survey Ashmore Cartier	2007/3774	Not Controlled Action (Particular Manner)	Post-Approval
Auralandia 3D marine seismic survey	2011/5961	Not Controlled Action (Particular Manner)	Post-Approval
Blacktip Gas Project Yelcherr Beach Wharf Construction	2007/3537	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Bonaparte 2D & 3D marine seismic survey	2011/5962	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Seismic and Bathymetric Survey	2012/6295	Not Controlled Action (Particular Manner)	Post-Approval
Braveheart 2D Infill Marine Seismic Survey 100km offshore	2008/4442	Not Controlled Action (Particular Manner)	Post-Approval
Braveheart 2D Marine Seismic Survey	2005/2322	Not Controlled Action (Particular Manner)	Post-Approval
Canis 3D Marine Seismic Survey	2008/4492	Not Controlled Action (Particular Manner)	Post-Approval
Cartier East and Cartier West 3D Marine Seismic Surveys	2009/5230	Not Controlled Action (Particular Manner)	Post-Approval
Caswell MC3D Marine Seismic Survey	2012/6594	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	Not Controlled Action (Particular Manner)	Post-Approval
Dillon South-1 Exploration Well Drilling - AC/P4, Territory of Ashmore/Cartier	2013/6849	Not Controlled Action (Particular Manner)	Post-Approval
Drilling of Audacious-5 appraisal well	2008/4327	Not Controlled Action (Particular Manner)	Post-Approval
Drilling of Exploration & Appraisal Wells Braveheart-1 & Cornea-3	2009/5160	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Drilling of two appraisal wells	2011/5840	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling Campaign, Browse Basin, WA-341-P, AC-P36 and WA-343-P	2013/6898	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling in Permit Areas WA-402-P & WA-403-P	2010/5297	Not Controlled Action (Particular Manner)	Post-Approval
Fishburn2D Marine Seismic Survey	2012/6659	Not Controlled Action (Particular Manner)	Post-Approval
Floyd 3D and Chisel 3D Seismic Surveys	2011/6220	Not Controlled Action (Particular Manner)	Post-Approval
Gold 2D Marine Seismic Survey Permit Areas WA375P and WA376P	2009/4698	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
Malita West 3D Seismic Survey WA-402-P and WA-403-P	2007/3936	Not Controlled Action (Particular Manner)	Post-Approval
Marine Environmental Survey 2012	2012/6310	Not Controlled Action (Particular Manner)	Post-Approval
Nova 3D Seismic Survey	2013/6825	Not Controlled Action (Particular Manner)	Post-Approval
NT/P77 3D Marine Seismic Survey	2009/4683	Not Controlled Action (Particular Manner)	Post-Approval
NT/P80 2010 2D Marine Seismic Survey	2010/5487	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Octantis 3D Marine Seismic Survey, Permit Area AC/P41 off northern Western Australia	2007/3369	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval
Petrel MC2D Marine Seismic Survey	2010/5368	Not Controlled Action (Particular Manner)	Post-Approval
Removal of Potential Unexploded Ordnance within NAXA	2012/6503	Not Controlled Action (Particular Manner)	Post-Approval
Sandalford 3D Seismic Survey	2012/6261	Not Controlled Action (Particular Manner)	Post-Approval
Santos Petrel-7 Offshore Appraisal Drilling Programme (Bonaparte Basin)	2011/5934	Not Controlled Action (Particular Manner)	Post-Approval
Schild Phase 11 MC3D Marine Seismic Survey, Browse Basin	2013/6894	Not Controlled Action (Particular Manner)	Post-Approval
Searcher bathymetry & geochemical seismic survey, Brawse Basin,Timor Sea,WA	2013/6980	Not Controlled Action (Particular Manner)	Post-Approval
Sonar and Acoustic Trials	2001/345	Not Controlled Action (Particular Manner)	Post-Approval
Songa Venus Drilling and Testing Operations	2009/5122	Not Controlled Action (Particular Manner)	Post-Approval
Songa Venus Drilling Programme, Bonaparte Basin	2009/4990	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Sunshine Infill 2D and Mimosa 2D Marine Seismic Surveys	2009/4699	Not Controlled Action (Particular Manner)	Post-Approval
Thoar 3D Marine Seismic Survey	2010/5668	Not Controlled Action (Particular Manner)	Post-Approval
Tiffany 3D Seismic Survey	2010/5339	Not Controlled Action (Particular Manner)	Post-Approval
Tow West Atlas wreck from present location to boundary of EEZ	2010/5652	Not Controlled Action (Particular Manner)	Post-Approval
Ursa 3D Marine Seismic Survey	2008/4634	Not Controlled Action (Particular Manner)	Post-Approval
Vampire 2D Non Exclusive Seismic Survey, WA	2010/5543	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Zeppelin 3D Seismic Survey	2011/6148	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
2D Marine Seismic Survey	2008/4623	Referral Decision	Completed
Nova 3D Seismic Survey, WA 442-NT/P81, Joseph Bonaparte Gulf	2013/6820	Referral Decision	Completed
Puffin South-West Development of Oil Reserves	2007/3834	Referral Decision	Completed
Seismic Data Acquisition, Browse Basin	2010/5475	Referral Decision	Completed

Key Ecological Features [Resource Information]

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

Name	Region
Ancient coastline at 125 m depth contour	North-west
Ashmore Reef and Cartier Island and surrounding Commonwealth waters	North-west
Carbonate bank and terrace system of the Sahul Shelf	North-west
Carbonate bank and terrace system of the Van Diemen Rise	North
Continental Slope Demersal Fish Communities	North-west
Pinnacles of the Bonaparte Basin	North-west
Pinnacles of the Bonaparte Basin	North

Biologically Important Areas

Scientific Name	Behaviour	Presence
Dolphins		
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Breeding	Known to occur
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Calving	Known to occur
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Foraging (high density prey)	Known to occur
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Resting	Known to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Foraging	Known to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Foraging	Likely to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Foraging (high density prey)	Known to occur

Scientific Name	Behaviour	Presence
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Significant habitat	Known to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Significant habitat - unknown behaviour	Likely to occur
Dugong		
Dugong dugon Dugong [28]	Breeding	Known to occur
Dugong dugon Dugong [28]	Calving	Known to occur
Dugong dugon Dugong [28]	Foraging	Known to occur
Dugong dugon Dugong [28]	Foraging (high density seagrass beds)	Known to occur
Dugong dugon Dugong [28]	Nursing	Known to occur
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Likely to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Likely to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Chelonia mydas Green Turtle [1765]	Mating	Likely to occur

Scientific Name	Behaviour	Presence
Chelonia mydas Green Turtle [1765]	Nesting	Likely to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Likely to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Foraging	Known to occur
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting	Likely to occur
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Seabirds		
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Fregata ariel Lesser Frigatebird [1012]	Breeding	Known to occur
Fregata minor Greater Frigatebird [1013]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Phaethon lepturus White-tailed Tropicbird [1014]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sternula albifrons sinensis Little Tern [82850]	Breeding	Known to occur
Sternula albifrons sinensis Little Tern [82850]	Resting	Known to occur
Sula leucogaster Brown Booby [1022]	Breeding	Known to occur
Sula sula Red-footed Booby [1023]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur

Caveat

1 PURPOSE

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

The report contains the mapped locations of:

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

2 DISCLAIMER

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

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

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

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

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

4 LIMITATIONS

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

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

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

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

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

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

Acknowledgements

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

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

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

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

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EPBC Act Protected Matters Report

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

Report created: 04-Mar-2022

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	22
Listed Migratory Species:	35

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	65
Whales and Other Cetaceans:	23
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	40
Key Ecological Features (Marine):	1
Biologically Important Areas:	5
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

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

Feature Name
EEZ and Territorial Sea
Extended Continental Shelf

Listed Threatened Species [Resource Information]

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

Scientific Name	Threatened Category	Presence Text
BIRD		
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically 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
FISH		
Thunnus maccoyii		
Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat likely to occur within area
MAMMAL		

Scientific Name	Threatened Category	Presence Text
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
SHARK		
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki		
Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	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
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat may occur within area
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

Scientific Name	Threatened Category	Presence Text
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat likely to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	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
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

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
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

Scientific Name	Threatened Category	Presence Text
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area
Fish		
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus 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

Scientific Name	Threatened Category	Presence Text
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		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
Reptile		

Scientific Name	Threatened Category	Presence Text
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Lapemis curtus as Lapemis hardwickii Spine-bellied Seasnake [83554]		Species or species habitat may occur within area
Leioselasma coggeri as Hydrophis coggeri Black-headed Sea Snake, Slender-necked Seasnake [87373]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Pelamis platurus		
Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans [Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera 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	Migration route known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis		
Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata		
Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus		
Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus		
Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps		
Pygmy Sperm Whale [57]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Kogia sima as Kogia simus Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
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

Current Scientific Name	Status	Type of Presence
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Oceanic Shoals	Multiple Use Zone (IUCN VI)

Extra Information

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Audacious Oil Field Standalone Development	2001/407	Controlled Action	Completed
Australia-ASEAN Power Link	2020/8818	Controlled Action	Proposed Decision
Decommissioning of Challis Oilfield	2003/942	Controlled Action	Post-Approval
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval
Montara 4, 5, and 6 Oil Production Wells, and Montara 3 Gas Re-Injection Well	2002/755	Controlled Action	Post-Approval
PTTEP AA Floating LNG Facility	2011/6025	Controlled Action	Completed
Not controlled action			
Audacious-3 oil drilling well	2003/1042	Not Controlled Action	Completed
Controlled Source Electromagnetic 2D Survey	2009/4980	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Controlled Source Electromagnetic Survey	2010/5434	Not Controlled Action	Completed
Coot-1 hydrocarbon exploration well, Permit Area AC/L2 or AC/L3	2001/296	Not Controlled Action	Completed
Drilling of exploration well Audacious-1 in AC/P17	2000/5	Not Controlled Action	Completed
Exploration Drilling in AC/P17, AC/P18 and AC/P24	2001/359	Not Controlled Action	Completed
Marine Survey for the Australia-ASEAN Power Link AAPL	2020/8714	Not Controlled Action	Completed
Montara-3 Offshore Hydrocarbon Exploration Well Permit Area AC/RL3	2001/489	Not Controlled Action	Completed
Not controlled action (particular manner)			
2 (3D) Marine Seismic Surveys	2009/4994	Not Controlled Action (Particular Manner)	Completed
2D and 3D Seismic Survey	2011/6197	Not Controlled Action (Particular Manner)	Post-Approval
2D Marine Seismic Survey	2009/4728	Not Controlled Action (Particular Manner)	Post-Approval
2D or 3D Marine Seismic Survey in Petroleum Permit Area AC/P35	2009/4864	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Marine Survey	2001/363	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic survey	2009/5076	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, petroleum exploration permit AC/P33	2006/2918	Not Controlled Action (Particular Manner)	Post-Approval
3D seismic survey of AC/P4, AC/P17 and AC/P24	2006/2857	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
3D Seismic Survey WA-406-P Bonaparte Basin	2007/3904	Not Controlled Action (Particular Manner)	Post-Approval
Auralandia 3D marine seismic survey	2011/5961	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte 2D & 3D marine seismic survey	2011/5962	Not Controlled Action (Particular Manner)	Post-Approval
Cartier East and Cartier West 3D Marine Seismic Surveys	2009/5230	Not Controlled Action (Particular Manner)	Post-Approval
Dillon South-1 Exploration Well Drilling - AC/P4, Territory of Ashmore/Cartier	2013/6849	Not Controlled Action (Particular Manner)	Post-Approval
Drilling of Audacious-5 appraisal well	2008/4327	Not Controlled Action (Particular Manner)	Post-Approval
Drilling of two appraisal wells	2011/5840	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval
Sandalford 3D Seismic Survey	2012/6261	Not Controlled Action (Particular Manner)	Post-Approval
Songa Venus Drilling and Testing Operations	2009/5122	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Thoar 3D Marine Seismic Survey	2010/5668	Not Controlled Action (Particular Manner)	Post-Approval
Tow West Atlas wreck from present location to boundary of EEZ	2010/5652	Not Controlled Action (Particular Manner)	Post-Approval
Ursa 3D Marine Seismic Survey	2008/4634	Not Controlled Action (Particular Manner)	Post-Approval
Vampire 2D Non Exclusive Seismic Survey, WA	2010/5543	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Zeppelin 3D Seismic Survey	2011/6148	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
2D Marine Seismic Survey	2008/4623	Referral Decision	Completed

Key Ecological Features [Resource Information]

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

Name	Region
Carbonate bank and terrace system of the Sahul Shelf	North-west

Biologically Important Areas

Scientific Name	Behaviour	Presence
Marine Turtles		
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur
Seabirds		
Fregata ariel Lesser Frigatebird [1012]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur

Caveat

1 PURPOSE

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

The report contains the mapped locations of:

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

2 DISCLAIMER

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

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

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

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

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

4 LIMITATIONS

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

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

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

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

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

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

Acknowledgements

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

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

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

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

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APPENDIX D

Seabirds Potentially Occurring in OA

EPBC Act List of Threatened Seabirds Potentially Occurring within the OA and/or Wider EMBA

Common Name(s) Scientific Name	Protection Status	Distribution, Habitat and Life Stages	Presence within the OA and EMBA
THREATENED – 17 observed within EMBA and 4 within OA			
Bar-tailed Godwit (Northern Siberian) *Limosa lapponica menzbieri*	CE	• The bar-tailed godwit has been recorded in the coastal areas of all Australian states. The bar-tailed godwit is found mainly in coastal habitats such as large intertidal sandflats, estuaries, inlets, coastal lagoons and bays. • At the subspecies level, *Limosa lapponica baueri* is listed as Vulnerable and *Limosa lapponica menzbieri* is listed as Critically Endangered under the BCA (DoEE, 2022).	Species KNOWN to occur within EMBA Given the preferred coastal habitat, the species is unlikely to be present in the OA. Higher population densities may be encountered in the coastal waters of the EMBA.
Far Eastern Curlew *Numenius madagascariensis*	CE M	• This species does not breed in Australia, rather in the Northern Hemisphere during summer, between May and June. They start to depart early March and begin to arrive back in late July. • During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coastal habitats (DoEE, 2022).	Species KNOWN to occur within EMBA Species MAY occur within OA Given the distribution of this coastal wetland bird species, the survey is likely to encounter low numbers of this species in the OA. Higher population densities may be encountered in the coastal waters of the EMBA.
Great Knot *Calidris tenuirostris*	CE M	• The Great Knot breeds in northeast Siberia and far northeast Russia and migrates along the East Asia-Australasian Flyway to overwinter in the southern hemisphere. • The species occurs almost exclusively along the coast during migration and the non-breeding season. It prefers sheltered coastal habitats. (DEPWS, 2022a).	Species LIKELY to occur within EMBA Given the preferred coastal habitat, the species is unlikely to be present in the OA. Higher population densities may be encountered in the coastal waters of the EMBA.

Common Name(s) Scientific Name	Protection Status	Distribution, Habitat and Life Stages	Presence within the OA and EMBA
Curlew Sandpiper *Calidris ferruginea*	CE M	• Within Australia, curlew sandpipers occur around the coasts while also being widespread inland, though in smaller numbers (DoEE, 2022). • The curlew sandpiper does not breed in Australia, the breeding areas are mainly restricted to the Arctic. • The species move into certain areas in Australia during northward migration in April, and migrate out of Australia during May. They start returning to the area in August and throughout September (Chatto, 2003).	Species KNOWN to occur within EMBA Species MAY occur within OA Given the preferred coastal habitat, the species is unlikely to be present in the OA. Higher population densities may be encountered in the coastal waters of the EMBA.
Gouldian Finch *Erythrura gouldiae*	E	• The Gouldian Finch is mostly distributed within the NT and the Kimberley. • Gouldian Finches occupy two different regions of the terrestrial landscape on an annual cycle. Between February and October, they breed and occupy wooded hills with hollow-bearing gum trees. • In the wet season, Gouldian Finches move from the hills into lowland drainages, mainly inland but can also be found near the coast (DEPWS, 2022b).	Species LIKELY to occur within EMBA Given the preferred terrestrial habitat, the species is unlikely to be present in the OA. The species may be encountered in low numbers in the coastal waters of the EMBA.
Abbott's Booby *Papasula abbotti*	E	• Abbott's Booby breeds only on Christmas Island in the eastern Indian Ocean. The at-sea distribution of Abbott's Booby is poorly known. • During the breeding season, the species is thought to forage over oceanic waters northeast of Christmas Island to Indonesia. However, during the chick-rearing period, Abbott's Booby parents forage mostly within 100 km of Christmas Island. • The only record from the NT of Abbott's Booby is an exhausted individual that was found in a suburban to Darwin in January 2017. (DEPWS, 2022c)	Species MAY occur within EMBA Given the preferred habitat on and around the Christmas Island habitat, the species is unlikely to be present in the OA. Considering there is only one record in coastal waters of the northwestern Australia, the species is unlikely to be present within the EMBA.

Common Name(s) Scientific Name	Protection Status	Distribution, Habitat and Life Stages	Presence within the OA and EMBA
Australian Painted Snipe *Rostratula australis*	E	• The Australian painted snipe has been recorded at wetlands in all states of Australia, however the species has been recorded less frequently at a smaller number of more scattered locations farther west in South Australia, the NT and WA. • The species generally inhabits shallow terrestrial freshwater wetlands, including lakes, swamps and claypans. • The species mostly breed every two years and breed in response to wetland conditions rather than during a particular season (DoEE, 2022).	Species LIKELY to occur within EMBA Given the preferred coastal habitat, the species is unlikely to be present in the OA. Higher population densities may be encountered in the coastal waters of the EMBA.
Lesser Sand Plover *Charadrius mongolus*	E M	• The Lesser Sand Plover breeds during the northern summer in central Asia and eastern Russia and migrate along the East Asian-Australasian flyway to overwinter in East Asia, South-East Asia, New Guinea, and Australia. • The species occur almost exclusively along the coast, where they forage on sheltered intertidal mudflats and sandflats, sandy beaches, estuaries and mangroves. (DEPWS, 2022d).	Species LIKELY to occur within EMBA Given the preferred coastal habitat, the species is unlikely to be present in the OA. Higher population densities may be encountered in the coastal waters of the EMBA.
Red Knot *Calidris canutus*	E M	• The red knot is common in all the main suitable habitats around the coast of Australia, very large numbers are regularly recorded in northern Australia. • In Australasia, the red knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts coral reefs. • The red knot is migratory, breeding in the high Artic and moving south to non-breeding between 58° N and 50 °S. • Peak numbers of this species in the NWMR and NMR are usually between September and October. (DoEE, 2022).	Species KNOWN to occur within EMBA Species MAY occur within OA Red knots are recorded in large numbers along the coastal strip from Fog Bay to Peron Island North. Given the range and distribution of this species, the survey is likely to encounter low numbers of this species in the OA. Higher population densities may be encountered in the nearshore waters of the EMBA.

Common Name(s) Scientific Name	Protection Status	Distribution, Habitat and Life Stages	Presence within the OA and EMBA
Grey Falcon *Falco hypoleucos*	V	• The Grey Falcon is found throughout much of the arid and semi-arid zones of Australia, and has been recorded in all Australian mainland states and territories. • Grey Falcons live in areas of sparsely timbered lowland plains, The species occurs in low densities and usually only one or two individuals are seen. • Grey Falcons use nests built by other bird species and nesting has been recorded from June to November. (DEPWS, 2022e).	Species LIKELY to occur within EMBA. Given the preferred terrestrial habitat, the species is unlikely to be present in the OA. The species may be encountered in low numbers in the coastal waters of the EMBA.
Australian Lesser Noddy *Anous tenuirostris melanops*	V	• The Australian lesser noddy is endemic to Australia and nests on the Houtman Abrolhos Islands and, possibly, Ashmore Reef. The species remain near breeding islands throughout the year (DoEE, 2022). • The species usually occupies coral-limestone islands and occasionally occurs on shingle or sandy beaches. • The breeding season is protracted, extending from August to April; however this can vary year to year (Higgins and Davies, 1996). • The Australian lesser noddy may forage out at sea or in seas close to breeding islands and fringing reefs (Johnstone and Storr, 1998).	Breeding KNOWN to occur within EMBA Species MAY occur within OA Given the preferred habitat, the species is unlikely to be present in the OA. Higher population densities may be encountered in the EMBA.
Bar-tailed Godwit, (Western Alaskan) *Limosa lapponica baueri*	V	• Bar-tailed godwit breeds during the norther summer in west Alaska and northeast Siberia and overwinters mostly in northern and eastern Australia and New Zealand. • Bar-tailed Godwits have been reported along almost the entire coastline in NT and WA, including all major islands. The species is one of the more frequently recorded and abundant shorebird species. • Godwits usually congregate in flocks, rarely far from the coast. They forage on intertidal mudflats or in shallow water (DEPWS, 2022f).	Species MAY occur within EMBA Given the preferred habitat, the species is unlikely to be present in the OA. Higher population densities may be encountered in the EMBA.

Common Name(s) Scientific Name	Protection Status	Distribution, Habitat and Life Stages	Presence within the OA and EMBA
Partridge Pigeon (western) *Geophaps smithii blaauwi*	V	• Two subspecies are recognised, western and eastern Partridge pigeon. The Partridge Pigeon occurs across the Top of the NT and Kimberley. • The species occur principally in lowland eucalypt open forests and woodlands. The species nests and forages on the ground. • Partridge Pigeons are largely sedentary, although they may make local-scale movements (up to 5-10 km) in response to seasonal variations in water and food availability (DoEE, 2022).	Species LIKELY to occur within EMBA Given the preferred terrestrial habitat, the species is unlikely to be present in the OA. The species may be encountered in low numbers by the coastal waters of the EMBA.
Red Goshawk *Erythrotriorchis radiatus*	V	• The red goshawk occurs across much of northern Australia, from near Broome in the southwest Kimberley to southeastern Queensland. • The red goshawk hunts mainly for medium-sized birds. Territory size is typically very large (up to 200 km^2). • The preferred habitat is tall open eucalypt forest and riparian areas. (DEPWS, 2022g.	Species LIKELY to occur within EMBA Given the preferred terrestrial habitat, the species is unlikely to be present in the OA. The species may be encountered in low numbers by the coastal waters of the EMBA.
Masked Owl (northern) *Tyto novaehollandiae kimberli*	V	• The Masked Owl is distributed widely across northern Australia, from the Kimberley region, across the NT to Cape York Peninsula and far-north Queensland. • The Masked Owl occurs mainly in tall open eucalypt forests and breed in large tree hollows, which usually form in large rainforest trees (DEPWS, 2022h).	Species LIKELY to occur within EMBA Given the preferred terrestrial habitat, the species is unlikely to be present in the OA. The species may be encountered in low numbers by the coastal waters of the EMBA.
Crested Shrike-tit (northern) *Falcunculus frontatus whitei*	V	• The Crested Shrike-tit is distributed in the Kimberley region and Top End. Although large areas of the distribution remain poorly surveyed. • The Crested Shrike-tit typically occurs in open woodlands dominated by Eucalyptus and forage in the canopy of trees. • The subspecies is monogamous, resident and territorial. Breeding occurs over the wet season, between October and March (DEPWS, 2022i).	Species LIKELY to occur within EMBA Given the preferred terrestrial habitat, the species is unlikely to be present in the OA. The species may be encountered in low numbers by the coastal waters of the EMBA.

Common Name(s) Scientific Name	Protection Status	Distribution, Habitat and Life Stages	Presence within the OA and EMBA
Greater Sand Plover *Charadrius leschenaultii*	V M	• The Greater Sand Plover breeds during the northern summer in eastern and central Asia. Only this subspecies migrates to Australia along the East Asian-Australasian flyway. • The Greater Sand Plover occurs along most coastlines in Australia, but is more common in the north. • These non-breeding birds occur almost exclusively along the coast, favouring sheltered beaches, tidal lagoons, rocky islands and coral reefs (DEPWS, 2022j).	Species KNOWN to occur within EMBA Given the preferred costal habitat, the species is unlikely to be present in the OA. Higher population densities may be encountered in the EMBA.

Note: EPBC Act Status: CE = Critically Endangered, E= Endangered V= Vulnerable, M= Migratory

EPBC Act List of Migratory Seabirds Potentially Occurring within the OA and/or Wider EMBA in addition to Species connected to BIAs in the region

Common Name(s) Scientific Name	Protection Status	Distribution, Habitat and Life Stages	Presence Within the OA and EMBA
MIGRATORY – 14 observed within EMBA and 8 within OA			
Great Frigatebird *Fregata minor*	M	• Great frigatebirds are found in tropical waters globally. The species breeds on small, remote tropical islands, in mangroves or bushes and occasionally on bare ground. • Breeding is known to occur between May to August (DoEE, 2022). • A breeding and foraging BIA has been identified at Ashmore Reef and Cartier Island, located approximately 50 km west from the OA (**Figure 24**).	Breeding KNOWN to occur within EMBA Species MAY occur within OA Given the distribution of the species and preferred habitat, this species may be present in the OA in low numbers. Higher population densities may be encountered in the coastal waters of the EMBA.
White-tailed Tropicbird *Phaethon lepturus*	M	• The white-tailed tropicbird breeds all year round on islands throughout the tropics of the northern Indian Ocean, including Ashmore Reef and Rowley Shoals off the northern coast of WA (Johnstone and Storr, 1998; Marchant and Higgins, 1993; DoEE, 2022). • The white-tailed tropicbird is a rather scarce breeding species at Ashmore Reef, and it is estimated that up to two pairs nest within the reserve each year (Clarke, 2010). • The species are surface foragers that occasionally take shallow dives (Marchant and Higgins, 1990). • A breeding and foraging BIA has been identified at Ashmore Reef, located approximately 60 km west from the OA (**Figure 24**).	Breeding KNOWN to occur within EMBA Species LIKELY to occur within OA Given the distribution of the species and preferred habitat, this species may be present in the OA in low numbers. Higher population densities may be encountered in the coastal waters of the EMBA, particularly in waters surrounding Ashmore Reef.
Lesser Frigatebird *Fregata ariel*	M	• The lesser frigatebird is usually seen in tropical or warmer waters off northern WA, NT, QLD and northern NSW. The species forages in the NMR and breeds in areas adjacent to the region (Marchant and Higgins, 1990). • The species is usually pelagic and often found far from land, but is also found in inshore areas (Marchant and Higgins, 1990). • The lesser frigatebird breeds between May-December in mangroves or bushes (Birdlife, 2022). • The closest breeding BIA of this species is located approximately 17 km south of the OA (**Figure 24**).	Breeding KNOWN to occur within EMBA Species LIKELY to occur within OA Given the distribution of the species and preferred habitat, this species may be present in the OA and EMBA in low numbers.

Common Name(s) Scientific Name	Protection Status	Distribution, Habitat and Life Stages	Presence Within the OA and EMBA
Roseate Tern *Sterna dougallii*	M	• In WA, the species is regularly recorded north from Mandurah to Eighty Mile Beach, in the Pilbara Region. Along the Kimberley coastline, the subspecies occurs at scattered sites, north to the Bonaparte Archipelago and possibly further. • The roseate tern occurs in coastal and marine areas. The species inhabits rocky and sandy beaches, coral reefs and offshore habitats. • Breeding in WA occurs in two periods, with peak months for laying April to November (DoEE, 2022). • The closest breeding BIA of this species is located approximately 125 km southeast of the OA) (**Figure 24**).	Breeding KNOWN to occur within EMBA Given the preferred coastal habitat, the species is unlikely to be present in the OA. Higher population densities may be encountered in the coastal waters of the EMBA.
Little Tern *Sternula albifrons*	M	• The little tern is widespread in Australia, with breeding sites widely distributed. • The little tern is a coastal seabird, which usually forages in very shallow brackish water. • Breeding is thought to occur in June, July and October. The little tern usually forages close to breeding colonies. (DoEE, 2022). • The closest breeding BIA to the OA is on the coastline of the Kimberley (approximately 156 km south of the OA). Little tern also has a resting BIA (Ashmore Reef) located approximately 146 km west of the OA (**Figure 24**).	Species KNOWN to occur within EMBA Given the preferred coastal habitat and migration pattern, this species may be present in the OA and EMBA in low numbers or isolated individuals/ groups.
Red-footed Booby *Sula sula*	M	• The red-footed booby is found worldwide, essentially confined to tropical waters in the Atlantic, Indian and Pacific Oceans (DoEE, 2022). • The species nests on offshore islands and a recent re-established breeding colony is found at Ashmore Reef (Clarke, 2010). Breeding takes place all year round. • Adult red-footed booby's have been detected up to 125 km from the nearest breeding islands during foraging (Clarke, 2010). • The closest breeding BIA to the OA for the red-footed booby is on Ashmore Reef (approximately 50 km west of the OA) (**Figure 24**).	Breeding KNOWN to occur within EMBA Given the distribution of the species and preferred habitat, this species may be present in the OA in low numbers. Higher population densities is likely be encountered in the coastal waters of the EMBA, particularly in waters surrounding Ashmore Reef.

Common Name(s) Scientific Name	Protection Status	Distribution, Habitat and Life Stages	Presence Within the OA and EMBA
Wedge-tailed Shearwater *Ardenna pacifica*	M	• The wedge-tailed shearwater is widespread across the Indian and Pacific Oceans. • In Australia, the species breeds between August-March on the east and west coasts of Australia and on offshore islands (DoEE, 2022). • The closest breeding BIA to the OA for the Wedge-tailed Shearwater is on Ashmore Reef (approximately 56 km west of the OA) (**Figure 24**). • The BIA supports a small colony of breeding wedge-tailed shearwaters, with an estimated 30 active burrows in 2002 (Swan, 2005).	Breeding KNOWN to occur within EMBA Given the distribution of the species and preferred habitat, this species may be present in the OA in low numbers. Higher population densities is likely be encountered in the coastal waters of the EMBA, particularly in waters surrounding Ashmore Reef.
Brown booby *Sula leucogaster*	M	• The brown booby occurs throughout all tropical oceans (DSEWPC, 2012c). In Australia, the brown booby is found in WA, around the coast of the NT, in Queensland and with occasional reports further south in New South Wales and Victoria. • The Brown booby uses both marine and terrestrial habitat. In the northwest WA, Brown boobies are most abundant off-shore (DoEE, 2022). • The species nests all year round on cliffs and steep slopes, beaches, and coral rubble. The species typically leaves breeding islands when not breeding, in search of better foraging grounds (DoEE, 2022). • The closest breeding BIA to the OA for the Brown Bobby is located approximately 114 km west of the OA (**Figure 24**).	Breeding KNOWN to occur within EMBA Given the preferred coastal habitat, the species is unlikely to be present in the OA. Higher population densities may be encountered in the coastal waters of the EMBA.

Common Name(s) Scientific Name	Protection Status	Distribution, Habitat and Life Stages	Presence Within the OA and EMBA
Greater Crested Tern *Thalasseus bergii*	M	• The greater crested tern is widespread and numerous along the NT coastline, with 20 breeding colonies reported (DSEWPC, 2012c). • The species shows a preference for nesting on offshore islands, coral reefs and sandy or rocky coastal islets (DSEWPC, 2012c). • The colony on Seagull Island supports a BIA of approximately 60,000 greater crested terns (Woinarski *et al.*, 2003), (approximately 87 km southeast of the OA) (**Figure 24**), which is thought to be the largest breeding colony of this species and of international significance. • The species forages in a range of habitats including lagoons, coral reefs, bays, estuaries, in mangrove swamps and in offshore and pelagic waters (DSEWPC, 2012c). • The breeding period for the greater crested term is March to July (Chatto, 2001).	Breeding KNOWN to occur within EMBA Given the widespread distribution, this species may be present in the OA in low numbers or isolated individuals/groups. Higher population densities may be encountered in the coastal waters of the EMBA.
Lesser crested tern *Sterna bengalensis*	Not listed	• The lesser crested tern inhabits tropical and sub-tropical sandy and coral coasts and estuaries. • In Australia, lesser crested terns are found on coasts and in coastal waters, primarily in the north. The species occurs around most of the NT. • The species breeds between September-December on low-lying islands, coral flats, sandbanks and flat sandy beaches. A lesser crested tern breeding BIA is located 87 km southeast of the OA. (**Figure 24**). • Lesser crested terns forage in the surf and over offshore waters in areas of reef and deeper shelf waters (DSEWPC, 2012c).	Breeding KNOWN to occur within EMBA Given the preference for habitat and breeding grounds within the EMBA, this species may be present in the OA and is likely to be present within EMBA.

Common Name(s) Scientific Name	Protection Status	Distribution, Habitat and Life Stages	Presence Within the OA and EMBA
Common Noddy *Anous stolidus*	M	• In Australia, the common noddy occurs mainly in the ocean off the QLD coast, but the species also occurs off the northwest and central WA coast. • During the breeding season, the common noddy usually occurs on or near islands. When not at the nest, individuals will forage in the surrounding waters. The seasonality of breeding varies greatly between sites. • During the non-breeding period, the species occurs in groups throughout the pelagic zone (DoEE, 2022).	Breeding KNOWN to occur within EMBA Species MAY occur within OA Given the wide distribution of the species and preferred habitat, the species may be present in low numbers in the OA and higher population densities may be encountered in the EMBA.
Sharp-tailed Sandpiper *Calidris acuminata*	M	• The Sharp-tailed Sandpiper breeds in the short Siberian summer (June to August) and spends the non-breeding season in Australia, in both inland and coastal locations. The species migrates from Australia in March/April. • In WA, they are widely distributed and in NT, the most important area is the area from Darwin to Murgenella Creek and the Port McArthur. • In Australasia, the species prefers muddy edges of shallow fresh or brackish wetlands (DoEE, 2022).	Species KNOWN to occur within EMBA Species MAY occur within OA Given the wide distribution of this species and the migratory pattern, it is likely this species will be encountered in low numbers within the OA and EMBA.
Streaked Shearwater *Calonectris leucomelas*	M	• The streaked shearwater breeds in Asia and migrates to the waters between Papua New Guinea and Australia. The species occurs frequently in northern Australia from October to March, (Marchant and Higgins 1990). • Whilst the species does not breed in Australia, it is known to forage in the NMR (DoEE, 2022).	Species KNOWN to occur within EMBA Species LIKELY to occur within OA Given the distribution of the species and preferred habitat, the species may be present in low numbers in the OA and EMBA during the October - May period.
Common Sandpiper *Actitis hypoleucos*	M	• The common sandpiper breeds in Eurasia and moves south for the boreal winter, individuals usually arrive in WA from July onwards. • Distributed along all coastlines of Australia and many areas inland, the common sandpiper is widespread in small numbers. • Generally, the species forages in shallow water and on bare soft mud at the edges of wetlands (DoEE, 2022).	Species KNOWN to occur within EMBA Species MAY occur within OA Given the distribution of the species and preferred habitat, this species may be present in the OA in low numbers. Higher population densities may be encountered in the coastal waters of the EMBA.

Common Name(s) Scientific Name	Protection Status	Distribution, Habitat and Life Stages	Presence Within the OA and EMBA
Pectoral Sandpiper *Calidris melanotos*	M	• The Pectoral Sandpiper breeds in the high Arctic. Wintering in small numbers in Southeast Asia, Australia, and New Zealand in Australasia. • The species is found at coastal areas as lagoons, estuaries, lakes, floodplains and wetlands. • In WA, the species is rarely recorded. In NT, the species habitat likely occurs along the coast of Darwin, which is 260 km away from the OA (DoEE, 2022).	Species MAY occur within EMBA and OA Given the wide distribution and migration pattern, this species may be present in the OA and EMBA in low numbers or isolated individuals/groups.

EPBC Act List of Migratory Seabirds Potentially Occurring within the Wider EMBA

Common Name(s) (*Scientific Name*)	Presence within the EMBA
MIGRATORY - 23 observed within EMBA	
Ruddy Turnstone (*Arenaria interpres)*	Species LIKELY to occur within area
Osprey (*Pandion haliaetus)*	Breeding KNOWN to occur within area
Rufous Fantail (*Rhipidura rufifrons)*	Species LIKELY to occur within area
Common Greenshank (*Tringa nebularia)*	Species LIKELY to occur within area
Barn Swallow (*Hirundo rustica)*	Species KNOWN to occur within area
Sanderling (*Calidris alba)*	Species LIKELY to occur within area
Bridled Tern (*Onychoprion anaethetus)*	Breeding KNOWN to occur within area
Caspian Tern (*Hydroprogne caspia)*	Breeding KNOWN to occur within area
Fork-tailed Swift (*Apus pacificus)*	Species LIKELY to occur within area
Grey Wagtail (*Motacilla cinerea)*	Species KNOWN to occur within area
Bar-tailed Godwit (Northern Siberian) (*Limosa lapponica* menzbier)	Species KNOWN to occur within area
Whimbrel (*Numenius phaeopus)*	Species LIKELY to occur within area
Masked Booby (*Sula dactylatra)*	Breeding KNOWN to occur within area
Yellow Wagtail (*Motacilla flava)*	Species KNOWN to occur within area
Grey Plover (*Pluvialis squatarola)*	Species LIKELY to occur within area
Black-tailed Godwit (*Limosa limosa)*	Species LIKELY to occur within area
Asian Dowitcher (*Limnodromus semipalmatus)*	Species KNOWN to occur within area
Oriental Pratincole (*Glareola maldivarum)*	Species MAY occur within area
Red-tailed Tropicbird (*Phaethon rubricauda)*	Breeding KNOWN to occur within area
Oriental Plover (*Charadrius veredus)*	Species MAY occur within area
Oriental Cuckoo (*Cuculus optatus)*	Species KNOWN to occur within area
Oriental Reed-Warbler (*Acrocephalus orientalis)*	Species KNOWN to occur within area
Red-rumped Swallow (*Cecropis daurica)*	Species MAY occur within area

APPENDIX E

List of Relevant Persons

Relevant Persons Engaged	
1	Indonesian Government
2	National Offshore Petroleum Titles Administrator
3	Department of Foreign Affairs and Trade
4	Department of Agriculture, Water and the Environment – Fisheries, Biosecurity & Marine Parks
5	Department Infrastructure, Transport, Regional Development and Communications and the Arts
6	Australian Maritime Safety Authority
7	Australian Hydrographic Office
8	Geoscience Australia
9	Parks Australia
10	The Director of National Parks
11	Australian Institute of Marine Science
12	WA Marine Science Institution
13	WA Department of Parks and Wildlife
14	WA Department of Mines, Industry Regulation and Safety
15	WA Department of Transport
16	Kimberly Port Authority; Port of Wyndham
17	Conservation Council of Western Australia
18	Centre for Whale Research
19	The Wilderness Society
20	Australian Fisheries Management Authority
21	Commonwealth Fisheries Association
22	Department of Primary Industries and Regional Development
23	Western Australia Department of Fisheries
24	Australian Fisheries Management Authority - Northern Prawn Fishery
25	Australian Fisheries Management Authority - North West Slope Trawl Fishery
26	Australian Fisheries Management Authority - Western Tuna and Billfish Fishery
27	Australian Fisheries Management Authority - Southern Bluefin Tuna
28	Mackerel Managed Fishery - all license holders
29	Northern Demersal Scalefish Managed Fishery (NDSF) – all license holders
30	Marine Aquarium Fishery license holders
31	Specimen Shell Managed Fishery license holders
32	Kimberley Prawn Fishery license holder
33	Western Australian Fishing Industry Council
34	Western Australian Game Fishing Association
35	Australian Southern Bluefin Tuna Industry Association
36	Australia Fisheries Trade Association
37	Recfishwest
38	Coral Expeditions
39	Marine Tourism WA

Relevant Persons Engaged	
40	Kimberley Marine Tourism Association
41	BKB Holidays Travel Agency
42	Kimberley Land Council
43	Northern Land Council
44	Department of Biodiversity, Conservation and Attractions
45	Carnarvon Energy - WA523-P, AC/P63
46	Inpex Browse - AC/P66, AC/RL4
47	Finder- AC/P61
48	Santos - AC/P69, AC/P50, AC/P67
49	PTEP Australasia - AC/RL12, AC/RL7, AC/RL/6, AC/P54, AC/RL10, AC/L3
50	Melbana Energy AC/P70
51	Balanggarra Aboriginal Corporation
52	Wunambal Gaambera Aboriginal Corporation
53	Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation
54	Northern Territory Seafood Council
55	Shire of Wyndham-East Kimberley
56	Victoria Daly Regional Council
57	West Daly Regional Council
58	Tiwi Land Council
59	Department of Agriculture, Fisheries and Forestry (DAFF) – formerly the Department of Agriculture, Water and the Environment
60	Petrofac
61	Australian Communications and Media Authority
62	Vocus Group
63	BW Digital
64	Inligo Networks
65	Department of Infrastructure, Planning and Logistics
66	Department of Defence
67	Northern Prawn Industry Association
68	Norther Territory Department of Industry Tourism and Trade – Fisheries
69	Tuna Australia
70	Northern Territory Guided Fishery Industry Association
71	Western Skipjack Tuna Fishery Concession Holders
72	Northwest Slope Trawl Fishery Concession Holders
73	Northern Prawn Fishery Concession Holders
74	Bengal Energy
75	Ministry of Agriculture and Fisheries of Timor Leste
76	Indonesian Ministry for Marine Affairs and Fisheries (Directorate of Surveillance of Maritime and Fisheries Resources)
77	Indonesian Ministry for Maritime Affairs and Investment (Directorate of Border Delimitation)

APPENDIX F

Full Unedited Relevant Person Correspondence

Sensitive information – content removed.

APPENDIX G

Meeting Minutes and Memos

Sensitive information – content removed.

APPENDIX H

Information Packs and Public Notification

Bonaparte Basin Marine Seismic Survey

Schlumberger proposes to undertake a three-dimensional (3D) marine seismic survey in Bonaparte Basin, in Commonwealth waters adjacent to Western Australia (**WA**). The operational area is 25,827 km^2 located 300 km northwest of Port Warrender (Western Australia), 260 km northwest of Ashmore Island (Western Australia). Water depths in the survey area are in the range of 100m (**Figure 1**). Planned seismic acquisition activity within this operational area will cover approximately 12,000 km^2 – details of extent and position of survey lines are currently being finalised.

Coordinates for the Operational Area are outlined in **Table 1**. In developing the Operational Area, a 15 km buffer has been applied around the proposed survey area in most cases.

The Bonaparte MC3D MSS may commence as early as September 2022 and will be completed before 30 June 2024. Up to a maximum of 10,000 km^2 may be acquired per calendar year between 2022 and 2024. It is estimated to take approximately 120 and 190 days to acquire 12,000 km^2 (including contingency time for potential vessel or equipment down time and adverse weather conditions). The precise timing of the survey is subject to NOPSEMA's acceptance of the environment plan (EP), weather conditions, vessel availability and other operational considerations, and will take into account the seasonality of environmental sensitivities, where practicable.

PROPOSED ACTIVITY

Offshore seismic surveying is used to improve the understanding of subsurface geology in marine environments.

During 3D marine surveys, seismic data is acquired using a purpose-built seismic survey vessel towing an acoustic source array and a multi cable hydrophone array, also known as a streamer array. Streamers are towed with a tail buoy, radar reflectors and lights to mark the end of the array. The streamers will be up to 8 km long to adequately record the necessary information.

Both the source and streamers are towed beneath the surface, (**Figure 2**). Acoustic energy from the source array is detected by the streamer array and recorded onboard the vessel. The recorded signals are then processed to provide information about geological formations below the seabed.

When recording the data, the seismic vessel traverses the survey area along a series of predetermined sail lines at a speed of approximately 4-5 knots (7-9 km/h). The level of acoustic emissions can be adjusted to provide low-power 'soft start' or 'fauna alert' procedures, at any point during the survey or maintenance operations.

To minimise survey duration, geophysical data will be acquired 24 hours a day. Each 3D pass (swath) is about 140 kilometres long and will take approximately 32 hours to complete. Data for a pre-determined swath only needs to be acquired once, and the survey vessel will not need to collect data in that area again.

A support vessel will work with the seismic vessel to assist in communicating with other vessels that have entered the area of operations and to support the overall operations, such as providing food and supplies.

There is ongoing extensive planning for the proposed survey through the EP development, with feedback being incorporated to minimize potential for disturbance to the surrounding environment. All efforts will be made to ensure the survey's primary objectives can be achieved safely and efficiently, whilst avoiding peak fishing activity in the area.

COMMUNICATION COMMITMENTS

Schlumberger is committed to maintaining regular communication with all relevant stakeholders throughout the duration of the survey and works with communities in a transparent manner.

As part of this continuous consultation, Schlumberger invites feedback on the proposed activities. Details of all consultation received will be provided to the National Offshore Petroleum Safety and Environment Management Authority (**NOPSEMA**) in accordance with EP procedures.

Due to the nature of seismic survey operations, the timing and location of the activity are prone to minor changes. To ensure clarity, Schlumberger commits to notifying stakeholders of survey schedule, finalized survey location and vessel details as they are confirmed. This will be supported with the supply of 48-hour operational detail lookahead plans, with notification being provided to relevant stakeholders during operations. If you wish to receive these notifications, or specific information regarding this survey, please advise in response to this package as soon as possible.

Following submission of the EP to NOPSEMA, stakeholder engagement will continue throughout the EP review period and survey acquisition to ensure everyone is kept informed and to minimise potential for disruption to any ongoing activities in the area.

ENVIRONMENTAL PERFORMANCE

Schlumberger is committed to working with all interested parties to ensure risks are identified and reduced to as low as reasonably practicable before activities begin. Latest technology in underwater sound transmission modelling will be used to understand emitted sound levels for the survey across the operational area. This will include detailed impact assessments and the adoption of appropriate mitigation measures that will be documented in the EP.

Early analysis of Flora and Fauna sensitivities in the Operational area have been undertaken and has enabled the proposed survey to incorporate mitigations as a result of the potential environmental concerns and sensitivities. Blue whales, whale sharks and turtles in particular have been identified in the early analysis as being some of the key sensitivities in the area and the EP will focus on these species to minimise disturbance as a result of the seismic activities.

There will be two dedicated Marine Mammal Observers (**MMOs**) onboard who will monitor precaution zones, observation zones, and low power zones during daylight hours in accordance with the Environment Protection and Biodiversity Conservation Act. There will also be Passive Acoustic Monitoring (**PAM**) 24 hours a day to monitor for whales in the vicinity of the survey vessel. Mitigation measures will be implemented to minimize any potential for disturbance to whales during the survey.

NOPSEMA reviews each project-specific EP in accordance with the requirements of the Offshore Petroleum Greenhouse Gas (Environment) Regulations 2009 before any approvals to the proposed seismic survey can be made.

Schlumberger has a reputation for implementing high standards of environmental protection in environmentally sensitive areas to mitigate and minimise impacts on the surrounding marine environment and stakeholders and will implement these procedures for the duration of this proposed survey.

YOUR FEEDBACK

As indicated above, Schlumberger is seeking feedback regarding this proposed activity before making a formal submission to NOPSEMA. The proposed survey is subject to Commonwealth Government regulatory approval and any feedback will be communicated to NOPSEMA, as required under Commonwealth legislation. We intend to lodge the EP to NOPSEMA shortly so please get in touch if you have any questions or comments.

Schlumberger intends to keep all stakeholders fully informed during the course of project planning and execution. However, if you would like to comment on the survey or would like additional information based on this preliminary factsheet please contact us as soon as possible. If you would like to meet with us to discuss the survey further or raise any concerns you have in relation to your activities in the area, please get in touch with me at the contact details below.

Best regards,
Kunal Mishra

Schlumberger Australia Pty Ltd:
Level 5, 10 Telethon Avenue
Perth WA, 6000(08) 9420 4800
Email: environment@slb.com

Schlumberger

Figure 1: Location map of operational area

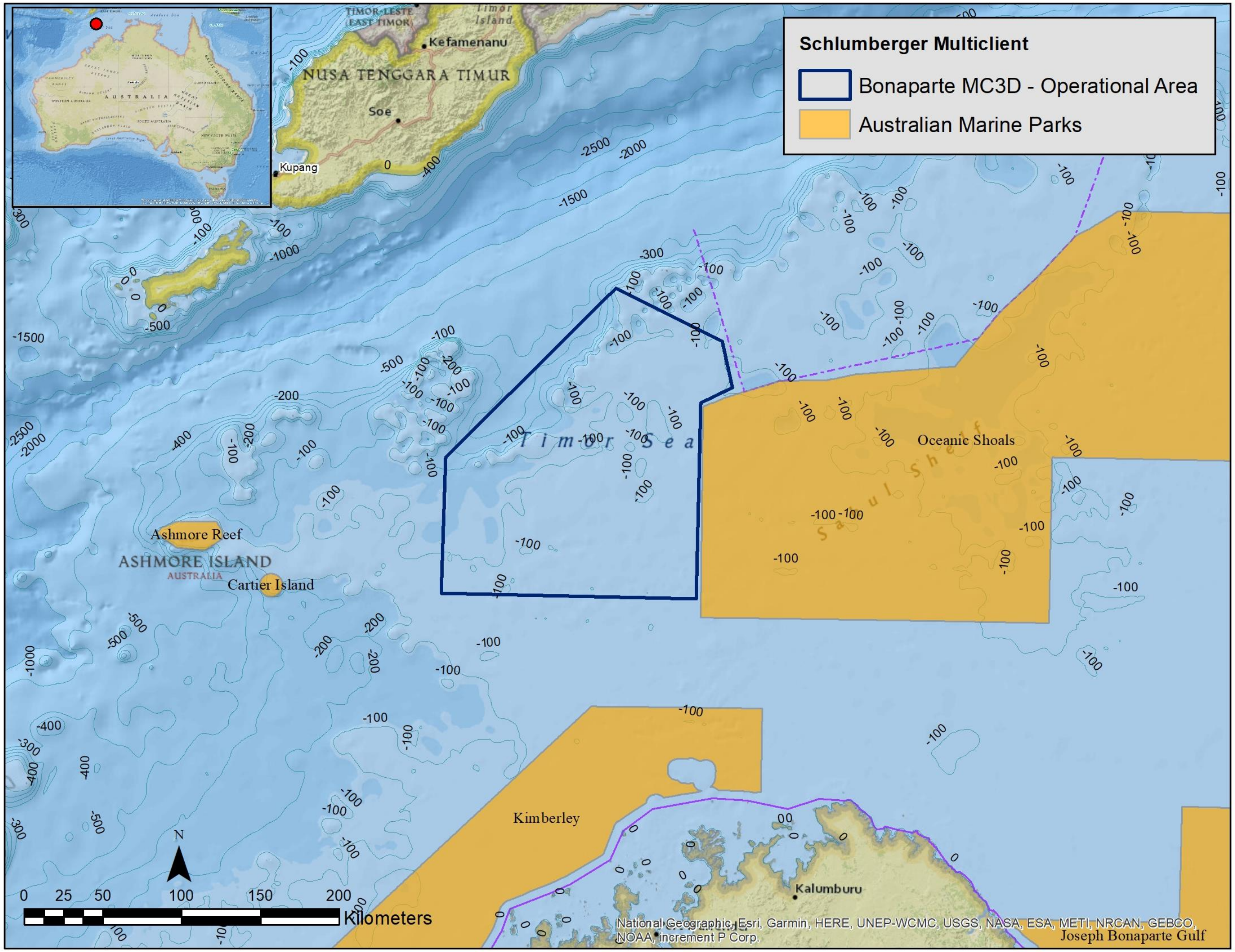
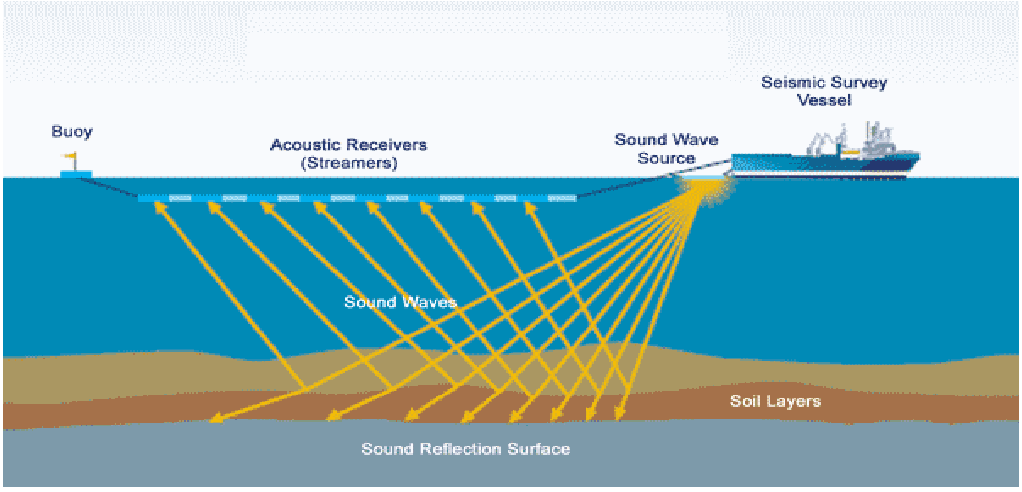


Table 1: Coordinates of the Operational Area (UTM Zone 51S)

S No	X	Y
1	668353.2981	8609707.23
2	670973.134	8696076.658
3	714112.3176	8738881.308
4	779108.1235	8803487.052
5	846839.3232	8769762.117
6	853120.6772	8740481.172
7	833166.8606	8730614.315
8	830319.4782	8606042.698
9	668353.2981	8609707.23

Figure 2: Schematic of typical Seismic geophysical survey



BONAPARTE BASIN MARINE SEISMIC SURVEY

Schlumberger proposes to undertake a three-dimensional (3D) marine seismic survey in Bonaparte Basin. The operational area is located 300 km northwest of Port Warrender and 260 km northwest of Ashmore Island, with water depths in the range of 100m (**Figure 1**). Planned seismic acquisition will cover approximately 8,000 km^2 and take three months to acquire.

Coordinates for the Operational Area are outlined in **Table 1** and also attached in an excel spreadsheet.

The Bonaparte seismic survey is likely to commence in December 2022; however, the precise timing of survey commencement is subject to NOPSEMA's acceptance of the environment plan.

PROPOSED ACTIVITY

Offshore seismic surveying is used to improve the understanding of subsurface geology in marine environments. During 3D marine surveys, seismic data is acquired using a purpose-built seismic survey vessel towing an acoustic source array and a multi cable hydrophone array, also known as a streamer array. Streamers are towed with a tail buoy, radar reflectors and lights to mark the end of the array. The streamers will be up to 8 km long to adequately record the necessary information.

Both the source and streamers are towed beneath the surface, (**Figure 2**). Acoustic energy from the source array is detected by the streamer array and recorded onboard the vessel. The recorded signals are then processed to provide information about geological formations below the seabed.

The seismic vessel will traverse the survey area along a series of predetermined sail lines at a speed of approximately 4-5 knots (7-9 km/h).

To minimise survey duration, geophysical data will be acquired 24 hours a day. Each 3D pass (swath) is about 140 kilometres long and will take approximately 32 hours to complete. Data for a pre-determined swath only needs to be acquired once, and the survey vessel will not need to collect data in that area again.

Two support vessels will work with the seismic vessel to assist in communicating with other vessels that have entered the area of operations and to support the overall operations, such as providing food and supplies.

COMMUNICATION COMMITMENTS

Schlumberger is committed to maintaining regular communication with all relevant stakeholders (i.e. commercial fishers/licence holders) throughout the duration of the survey.

Due to the nature of seismic survey operations, the timing and location of the activity are prone to minor changes. To ensure clarity, Schlumberger commits to notifying commercial fishers of survey schedule, finalized survey location and vessel details as they are confirmed prior to survey commencement. This will be supported with the supply of 48-hour operational detail lookahead plans which will be supplied each day and detail the location plan for the survey vessels for the upcoming 2 days, this notification will be provided to all relevant and affected stakeholders during operations. If you wish to receive these notifications, or specific information regarding this survey, please let me know at the contact details provided below, or WAFIC.

ENVIRONMENTAL PERFORMANCE & CONTROLS

Schlumberger is committed to working with all interested parties to ensure risks are identified and reduced to as low as reasonably practicable before activities begin. Schlumberger has a reputation for implementing high standards of environmental protection in environmentally sensitive areas to mitigate and minimise impacts on the surrounding marine environment and stakeholders and will implement these procedures for the duration of this proposed survey.

Control measures that will be implemented to minimise impact on commercial fishers include: provision of 48 hour look-aheads (distributed every 24 hours) and ongoing engagement, notice to mariners will be issued, markings (lights/radar reflector) on tail buoys so the extent of the gear can be determined, and support vessels will be present throughout the survey to support communications with any fishers in the area where the vessel may be heading. In addition, a compensation mechanism will be in place to address loss or damage to fishing gear as a direct result of the survey.

YOUR FEEDBACK

Schlumberger is seeking any feedback or questions you have regarding this proposed activity. If you can please send any comments or questions back through to Carli at WAFIC that would be appreciated, or alternatively you can contact Schlumberger directly with the contact information provided below.

Schlumberger intends to keep all commercial fishers fully informed during the course of project planning and execution. However, if you would like to comment on the survey or would like additional information based on this preliminary factsheet please contact us as soon as possible. If you would like to meet with us to discuss the survey further or raise any concerns you have in relation to your activities in the area, please get in touch with me at the contact details below.

Best regards,
Kevin Moran

Schlumberger Australia Pty Ltd:
Level 5, 10 Telethon Avenue
Perth WA, 6000(08) 9420 4800
Email: environment@slb.com

Schlumberger

Figure 1: Location map of operational area

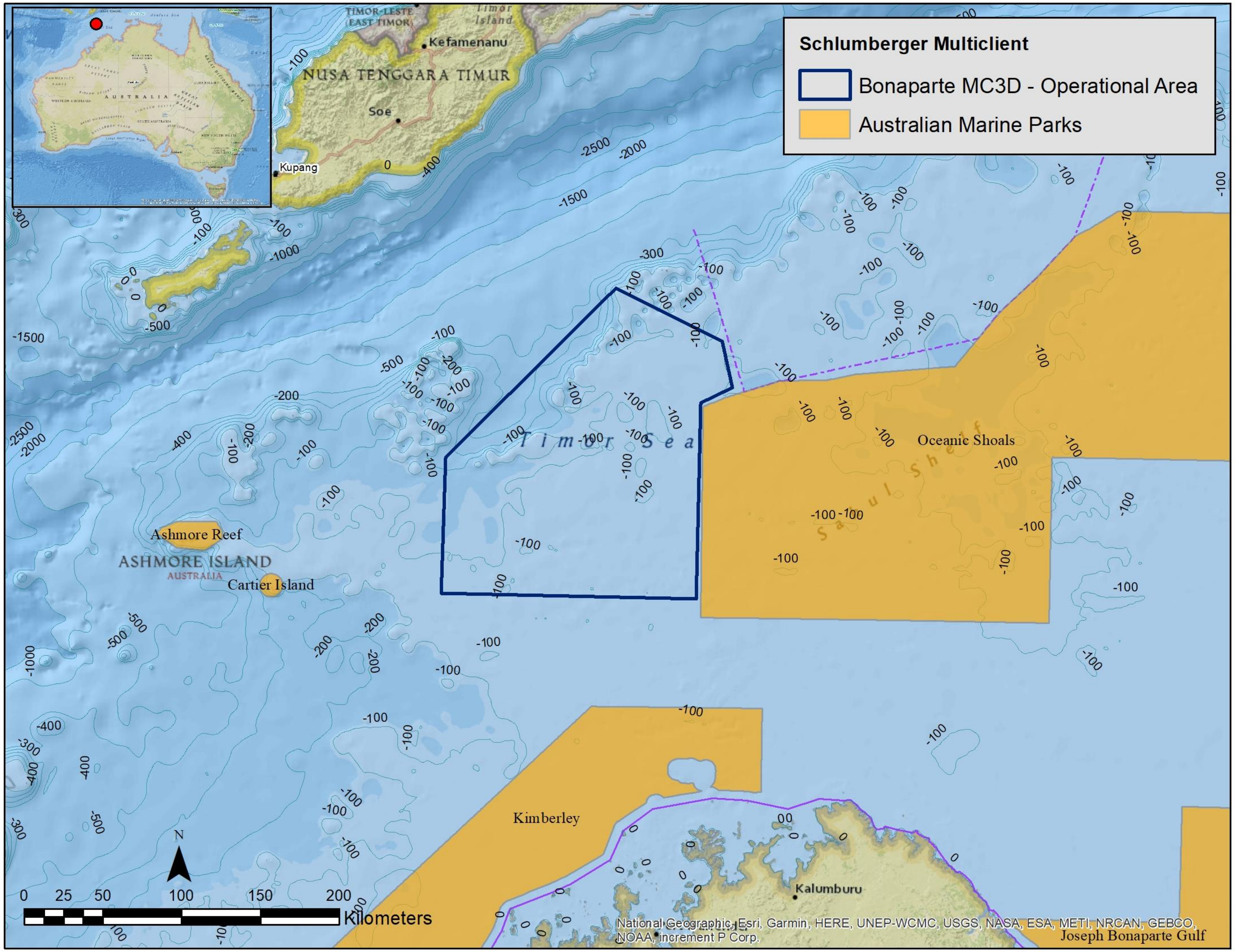
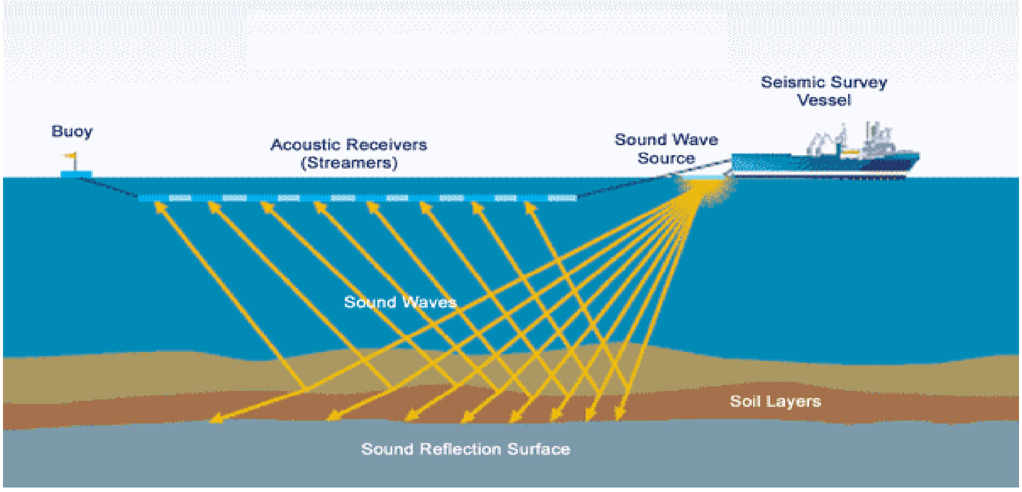


Table 1: Coordinates of the Operational Area (UTM Zone 51S)

S No	Longtitude	Latitude
1	124.5496968	-12.57192338
2	124.5692117	-11.79101655
3	124.9622977	-11.4016772
4	125.5525263	-10.81338971
5	126.1746019	-11.11219182
6	126.2349821	-11.37596856
7	126.0533229	-11.46702672
8	126.0398771	-12.59225658
9	124.5496968	-12.57192338

Figure 2: Schematic of typical Seismic geophysical survey



Marine Survey Notice

Schlumberger proposes to undertake a marine geophysical survey in Commonwealth waters approximately 200km northwest of Port Warrender, Western Australia (WA). An environment plan has been submitted to NOPSEMA for assessment.

NOPSEMA has completed their check of the environment plan and continued public comment is welcome. The proposed survey is subject to Commonwealth Government regulatory approval and any feedback will be communicated to NOPSEMA, as required under Commonwealth legislation. If you would like further information, please refer to the NOPSEMA Environment Plan summary and also the notification on SLB website **https://info.nopsema.gov.au/environment_plans/590/show_public**

https://www.slb.com/about/who-we-are/our-global-footprint/slb-australia-new-zealand-and-papua-new-guinea

For more info, please email environment@slb.com

4685829

Careers

Jobs

General Vacancies

Roller Operator Position

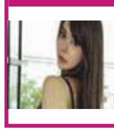
Remote Roadworks Roller Operator position available,
person will also be expected to perform associated general duties, non-smoker preferred, WZ2 & WZ3
license would be an advantage, contact Doug
0428383396

Adults

Adult & Escort Services

Jessica Erotic Massage
3/61 Driver avenue
Palmerston
Pretty Mimi.
0410 381 362

KIKI



100% New to Darwin
Pretty, Slim
In/out calls
0409 277 072

Adult Relaxation

♥KOBE♥
♥EROTIC MASSAGE♥
Erotic massage.
7/41 Sadgroves Cr, Winnellie.
New Gals in Town
0439 533 338

PALMERSTON
ABBY
Pretty
& Friendly
0426 852 886

Notices

Public Notices

Palmerston Golf & Country Club

Notice is hereby given that the Annual General Meeting of the Association will be held at the club, Cnr University Ave & Dwyer Cres, Driver NT commencing at 5.30pm on Thursday 24th November 2022.
Business:
1. To confirm the minutes of the last preceding Annual General Meeting held on Thursday 28 October 2021;
2. to receive reports from:
(a) the board;
(b) the auditor, and
(c) the General Manager of the association, receiving reports from the year ending 30 June 2022;
3. Appoint Auditor for 2022-2023

Dated: 27 October 2022
Mark Plunkett
Public Officer of the Association

Notices

Public Notices

Cazalys Palmerston Club Inc

Notice is hereby given that the Annual General Meeting of the Association will be held at 10 Temple Terrace, Palmerston NT commencing at 5.30pm on Tuesday 29 November 2022.
Business:
1. To confirm the minutes of the last preceding Annual General Meeting held on Tuesday 26 October 2021;
2. to receive reports from:
(a) the board;
(b) the auditor, and
(c) the General Manager of the association, receiving reports from the year ending 30 June 2022;
3. Appoint Auditor for 2022-2023

Dated: 27 October 2022
Mark Plunkett
Public Officer of the Association

MARINE SURVEY NOTICE

Schlumberger proposes to undertake a marine geophysical survey in Commonwealth waters approximately 200km northwest of Port Warrender, Western Australia (WA). An environment plan has been submitted to NOPSEMA for assessment.

NOPSEMA has completed their check of the environment plan and continued public comment is welcome. The proposed survey is subject to Commonwealth Government regulatory approval and any feedback will be communicated to NOPSEMA, as required under Commonwealth legislation. If you would like further information, please refer to the NOPSEMA Environment Plan summary and also the notification on slb website
https://info.nopsema.gov.au/environment_plans/590/show_public

https://www.slb.com/about/who-we-are/our-global-footprint/slb-australia-new-zealand-and-papua-new-guinea

General Notices

Notice of Annual General Meeting of Members of The Maritime Union of Australia Division NT Divisional Branch Construction, Forestry, Maritime, Mining and Energy Union

The Annual General Meeting of The Maritime Union of Australia Division, NT Divisional Branch, will be held on Friday 2 December, 2022 commencing at 9am at Pint Club, 165 Abala Road, Marrara.

All available members are required to attend.

For further information, please contact NT Divisional Branch Secretary Andrew Burford on 0409714150.

Meetings

ANNUAL GENERAL MEETING

NT Stolen Generations Aboriginal Corporation Annual General Meeting
Date: Wednesday 23rd November 2022
Venue: St Marys 110 Abala Road, Marrara, NT 0812
Time: 5.00 p.m. to 6.30pm
AGENDA
1. Attendance/Apologies
2. Proxies
3. Minutes of 2021 Annual General Meeting
4. Chairperson's Report
5. Acting CEO's Report
6. Financial Audit Report for 2021-2022
7. Election of Board Directors
8. Appointment of Auditor
9. Other Business
Nomination forms for the position of Board Director must be received by the Corporation no later than COB on Thursday 10th November 2022. Proxy nominations must be lodged with the Corporation at least 48 hours before the meeting. For further information, please contact Jessica Parnell on 8947 9171

Tributes

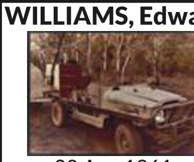
Deaths

LIDDLE, Jean Anne

Jean Liddle (Nanny) was a loving wife, mother, grandmother and aunt.
Jean passed away peacefully in Adelaide on 24th October, 2022, surrounded by her husband Geoff, her children and grandchildren.

Aged 77 years, Jean lived a full life committed to family, full of love and kindness.

WILLIAMS, Edward



20 Aug 1961
14 Oct 2022
'Bull catcher'

For our beloved Brother, Uncle, Grandfather, Great Grandfather.

Words can't express or measure our loss of you our 5 Star.
We give thanks to having you in our family - for the care you provided to Dad and Mum / Papa and Nanna / and generations of family.

Memories will always linger, so not saying goodbye forever but so long for now.

From Corinthians 1 Chapter 13 Verse 13- In a word there are three things that last forever: faith, hope and love;
but the greatest of them all is love.

Forever in our hearts.
Rest in Peace.

Your Family

Funeral Directors & Services

Simplicity Funerals NT
Helping Families Honour Lives

- Sensitive, dignified and affordable funeral arrangements
- Accomodating all faiths, cultural & religious traditions
- Specialising in interstate and overseas repatriations
- Prearranged & prepaid funeral planning & advice
- Proudly serving the Territory for over 35 years

Phone: 8941 1633 (24 Hours)
6 Presley St. STUART PARK

AUSTRALIAN FUNERAL DIRECTORS ASSOCIATION

Bonaparte Basin Marine Seismic Survey

SLB proposes to undertake a three-dimensional (3D) marine seismic survey in Bonaparte Basin, in Commonwealth waters adjacent to Western Australia (**WA**). The operational area is located 300 km northwest of Port Warrender (Western Australia) and 140 km east of Ashmore Island (Western Australia). Water depths in the survey area are in the range of 100m (**Figure 1**). Planned seismic acquisition activity within this operational area will cover approximately 12,000 km² – details of extent and position of survey lines are currently being finalised.

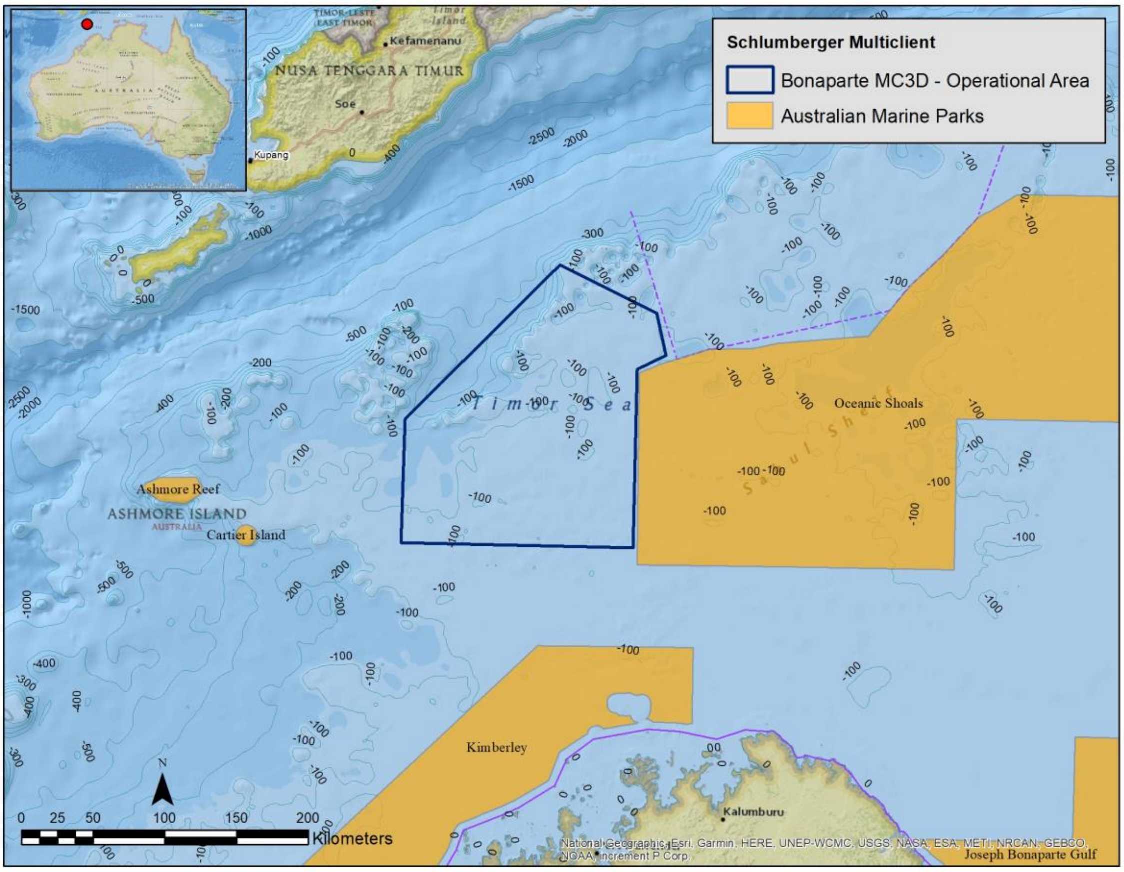


Figure 1: Location map of operational area

What is a Marine Seismic Survey?

Marine Seismic Surveys (MSS) are carried out to image and investigate geological rock layer structures beneath the sea floor (in some cases up to 8km depth) using a compressed air mechanism to release a pulse of sound energy (from the acoustic sources) into the water column directed vertically downwards. As the sound waves pass through the rock layers below the seabed, each layer reflects the sound energy back to the surface. This reflected sound energy is recorded in cables (streamers) being towed behind the seismic vessel (up to 8km long) that contain listening hydrophones.

Both the acoustic source and streamers are towed beneath the surface, (**Figure 2**). Acoustic energy from the source array is detected by the streamer array and the information is then recorded onboard the vessel. The recorded signals are processed to provide information about geological formations below the seabed within the surveyed area.
When recording the data, the seismic vessel traverses the survey area along a series of predetermined sail lines at a speed of approximately 4-5 knots (7-9 km/h). The level of acoustic emissions can be adjusted to provide low-power 'soft start' or 'fauna alert' procedures, at any point during the survey or maintenance operations. This allows the noise levels to be slowly increased which enables any marine mammals or fish who do not like the noise source to move away.

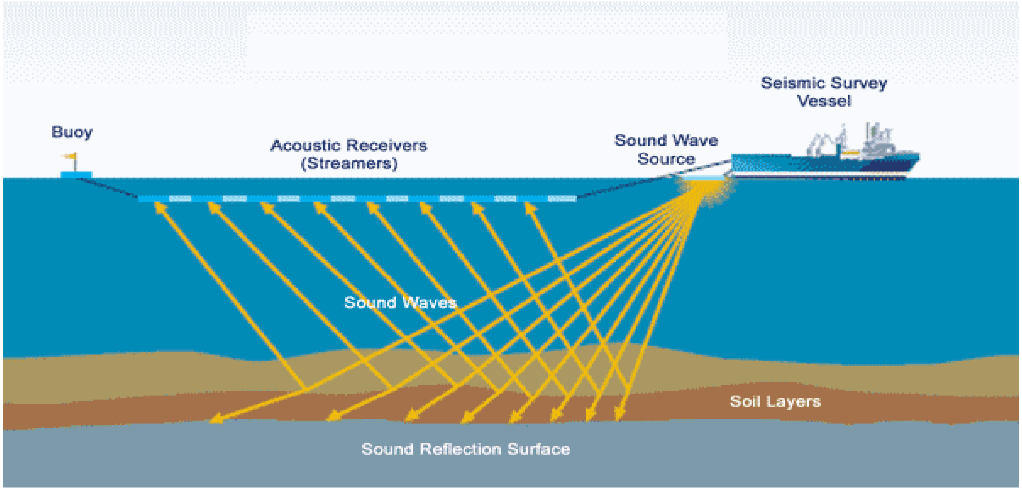


Figure 2: Schematic of typical Seismic geophysical survey

Environmental performance

SLB is committed to working with all interested parties to ensure risks are identified and reduced to as low as reasonably practicable before activities begin.

Accidental fuel oil spill dispersion modelling

As part of the environmental planning and approval process SLB have conducted a modeling study to ascertain the level of potential impact should an accident occur with the seismic vessel resulting in a fuel oil spill from its fuel tank. The resultant dispersion of fuel from modeling was used to determine the environment that may be affected (EMBA). As a result of the modelling, the outputs suggest that should a collision occur and the vessel's hull is ruptured and the entire contents of the vessel's fuel tanks are breached, fuel could reach inshore areas as shown by the green EMBA polygon in Figure 3. It should be noted that the inputs into the fuel spill modeling were extremely conservative and fuel spills from Seismic vessels are highly unlikely due to extensive controls and operational procedures and would be considered an extremely low likelihood of occurring. In addition, no incidents have occurred in Australian waters to date that would result in a spill of the extent that was modelled from a seismic survey vessel.

We are contacting you because our assessment of values and sensitivities within the EMBA shows there is overlap with areas of Native Title Determination, as shown in Figure 3. Therefore, we would like to understand the following:

- Do you have any functions, interests or activities that may be affected by the proposed activities to be carried out under the environment plan?
- Do you have any "sea country" rights that may be affected by the proposed activities to be carried out under the environment plan?
- Do you want to meet with SLB to discuss the proposed activities to be carried out under the environmental plan?

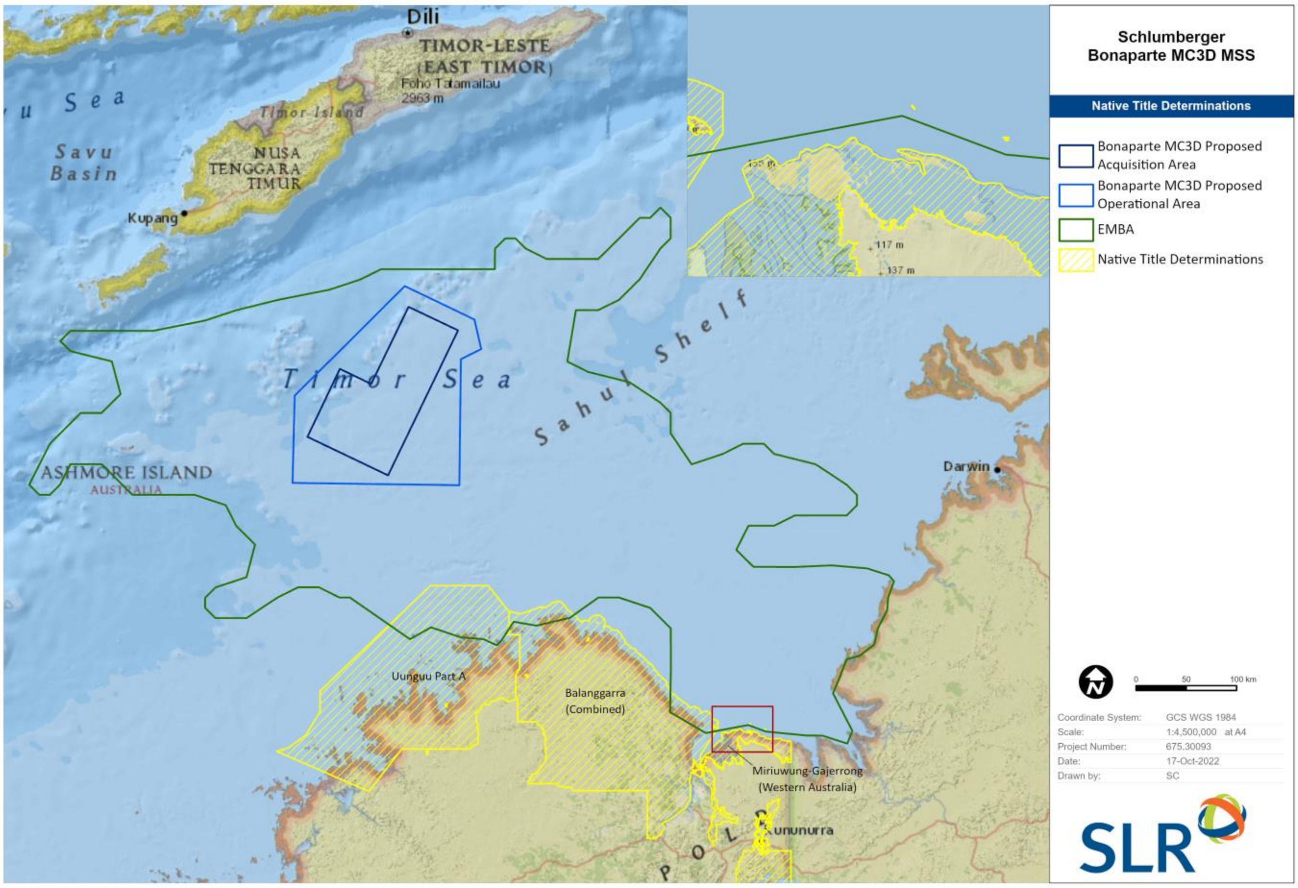


Figure 3: Native Title Determinations overlapping the EMBA

Modern seismic vessels mitigate the risk of fuel spills via physical design features such as double hull configuration and having multiple fuel tanks of reduced size instead of one large fuel tank. The vessel that will be contracted for this project will have these features and has worked in Australian waters previously.

The seismic vessel provider has safety procedures in place and documented actions to take if an incident were to occur. As a subcontractor of SLB, the vessel provider also has to comply with SLB's rigorous QHSE standards and commitments made within the Environment Plan which forms part of the regulatory approval process. At least one support vessel will work alongside the seismic vessel during the survey and will assist in communicating with other vessels that may have entered the area of operations to support safe navigation.

Sensitivities to seismic activities

Early analysis of biological sensitivities in the Operational area has been undertaken through the development of the Environment Plan. Blue whales, whale sharks and turtles, in particular, have been identified as being some of the key sensitivities in the area and the Environment Plan has focused on introducing additional control measures to minimise disturbance to these fauna as a result of the proposed seismic activities.

For example, there will be two dedicated Marine Mammal Observers (**MMOs**) onboard the survey vessel and also the support vessel who will visually monitor precaution zones and observation zones during daylight hours in accordance with the Environment Protection and Biodiversity Conservation Act. There will also be Passive Acoustic Monitoring (**PAM**) operating 24 hours a day to acoustically detect any marine mammals in the vicinity of the survey vessel. Mitigation measures such as restricting survey operations in certain areas during the migration season, extended shut down zones, soft start procedures and adaptive management procedures (such as relocation should more whales be detected in an area than is expected) will be implemented to minimize any potential for disturbance to whales during the survey.

SLB has a reputation for implementing high standards of environmental protection in environmentally sensitive areas to mitigate and minimise impacts on the surrounding marine environment and stakeholders and will implement these procedures for the duration of this proposed survey.

Communication commitments

SLB is committed to maintaining regular communication with all relevant stakeholders throughout the duration of the survey and works with communities in a transparent manner. This will be supported with the supply of 48-hour operational detail lookahead plans which will be distributed every 24 hours, with notification being provided to relevant stakeholders during operations. If you wish to receive these notifications, or specific information regarding this survey, please advise as soon as possible.

Your feedback

As part of our continuous consultation, SLB invites feedback on the proposed activities. As described above, we would like to understand any concerns you may have, or particular sensitivities within the area that may be affected by the survey operations or within the EMBA area, so that these can be discussed and incorporated into the suite of control measures if/where required. Details of all consultation received will be provided to the National Offshore Petroleum Safety and Environment Management Authority (**NOPSEMA**) in accordance with Environment Plan procedures; however, any information you provide can be kept confidential from the public domain but will be made available to NOPSEMA.

SLB intends to keep all stakeholders fully informed during the course of project planning and execution. However, if you would like to comment on the survey or would like additional information based on this preliminary factsheet, please contact us as soon as possible. If you would like to meet with us to discuss the survey further or raise any concerns you have in relation to your activities in the area, please get in touch with me via the contact details below.

Best regards,
Kevin Moran

SLB Australia Pty Ltd:
Level 5, 10 Telethon Avenue
Perth WA, 6000(08) 9420 4800
Email: environment@slb.com

Schlumberger

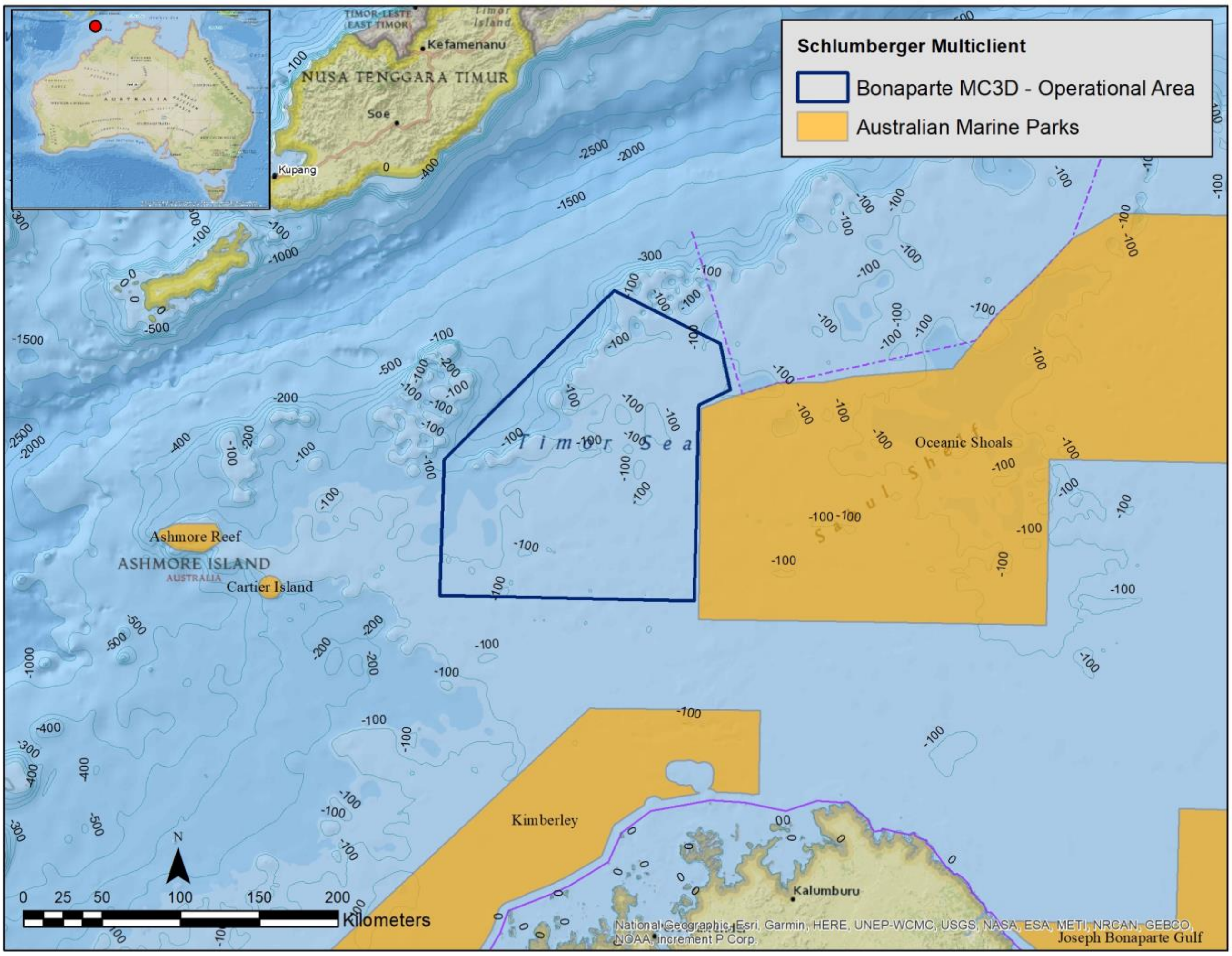
BONAPARTE BASIN MARINE SEISMIC SURVEY

Schlumberger proposes to undertake a three-dimensional (3D) marine seismic survey in Bonaparte Basin. The operational area is located 300 km northwest of Port Warrender and 260 km northwest of Ashmore Island, with water depths in the range of 100m (**Figure 1**). Planned seismic acquisition will cover approximately 8,000 km^2 and take three months to acquire.

Coordinates for the Operational Area are outlined in **Table 1** and also attached in an excel spreadsheet.

The Bonaparte seismic survey is likely to commence in May 2023 however, the precise timing of survey commencement is subject to NOPSEMA's acceptance of the environment plan.

Figure 1: Location map of operational area



PROPOSED ACTIVITY

Offshore seismic surveying is used to improve the understanding of subsurface geology in marine environments. During 3D marine surveys, seismic data is acquired using a purpose-built seismic survey vessel towing an acoustic source array and a multi cable hydrophone array, also known as a streamer array. Streamers are towed with a tail buoy, radar reflectors and lights to mark the end of the array. The streamers will be up to 8 km long to adequately record the necessary information.

Table 1: Coordinates of the Operational Area (UTM Zone 51S)

S No	Longtitude	Latitude
1	124.5496968	-12.57192338
2	124.5692117	-11.79101655
3	124.9622977	-11.4016772
4	125.5525263	-10.81338971
5	126.1746019	-11.11219182
6	126.2349821	-11.37596856
7	126.0533229	-11.46702672
8	126.0398771	-12.59225658
9	124.5496968	-12.57192338

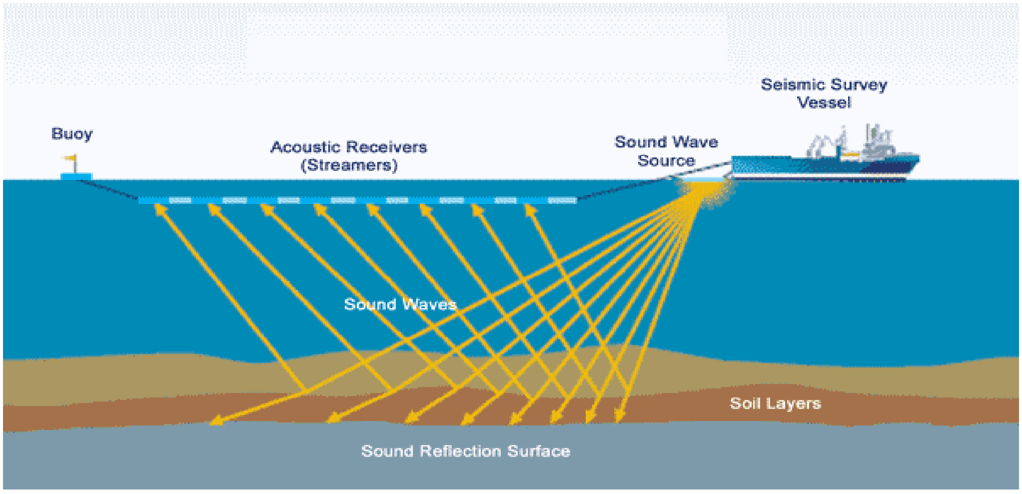
Both the source and streamers are towed beneath the surface, (**Figure 2**). Acoustic energy from the source array is detected by the streamer array and recorded onboard the vessel. The recorded signals are then processed to provide information about geological formations below the seabed.

The seismic vessel will traverse the survey area along a series of predetermined sail lines at a speed of approximately 4-5 knots (7-9 km/h).

To minimise survey duration, geophysical data will be acquired 24 hours a day. Each 3D pass (swath) is about 140 kilometres long and will take approximately 32 hours to complete. Data for a pre-determined swath only needs to be acquired once, and the survey vessel will not need to collect data in that area again.

Two support vessels will work with the seismic vessel to assist in communicating with other vessels that have entered the area of operations and to support the overall operations, such as providing food and supplies.

Figure 2: Schematic of typical Seismic geophysical survey



COMMUNICATION COMMITMENTS

Schlumberger is committed to maintaining regular communication with all relevant stakeholders (i.e. commercial fishers/licence holders) throughout the duration of the survey.

Due to the nature of seismic survey operations, the timing and location of the activity are prone to minor changes. To ensure clarity, Schlumberger commits to notifying commercial fishers of survey schedule, finalized survey location and vessel details as they are confirmed prior to survey commencement. This will be supported with the supply of 48-hour operational detail lookahead plans which will be supplied each day and detail the location plan for the survey vessels for the upcoming 2 days, this notification will be provided to all relevant and affected stakeholders during operations. If you wish to receive these notifications, or specific information regarding this survey, please let me know at the contact details provided below.

ENVIRONMENTAL PERFORMANCE & CONTROLS

Schlumberger is committed to working with all interested parties to ensure risks are identified and reduced to as low as reasonably practicable before activities begin. Schlumberger has a reputation for implementing high standards of environmental protection in environmentally sensitive areas to mitigate and minimise impacts on the surrounding marine environment and stakeholders and will implement these procedures for the duration of this proposed survey.

Control measures that will be implemented to minimise impact on commercial fishers include: provision of 48 hour look-aheads (distributed every 24 hours) and ongoing engagement, notice to mariners will be issued, markings (lights/radar reflector) on tail buoys so the extent of the gear can be determined, and support vessels will be present throughout the survey to support communications with any fishers in the area where the vessel may be heading. In addition, a compensation mechanism will be in place to address loss or damage to fishing gear and reduced catch as a direct result of the survey activity.

YOUR FEEDBACK

Schlumberger is seeking any feedback or questions you have regarding this proposed activity. If you can please send any comments or questions to Schlumberger directly via the contact information provided below.

Schlumberger intends to keep all commercial fishers fully informed during the course of project planning and execution. However, if you would like to comment on the survey or would like additional information based on this preliminary factsheet please contact us as soon as possible. If you would like to meet with us to discuss the survey further or raise any concerns you have in relation to your activities in the area, please get in touch with me at the contact details below.

Finally, please note that you may also request any information provided during consultation not be published within the EP.

Best regards,
Kevin Moran

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Perth WA, 6000(08) 9420 4800
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BONAPARTE BASIN MARINE SEISMIC SURVEY

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Coordinates for the Operational Area are outlined in **Table 1** and also attached in an excel spreadsheet.

The Bonaparte seismic survey is likely to commence in May 2023; however, the precise timing of survey commencement is subject to NOPSEMA's acceptance of the environment plan.

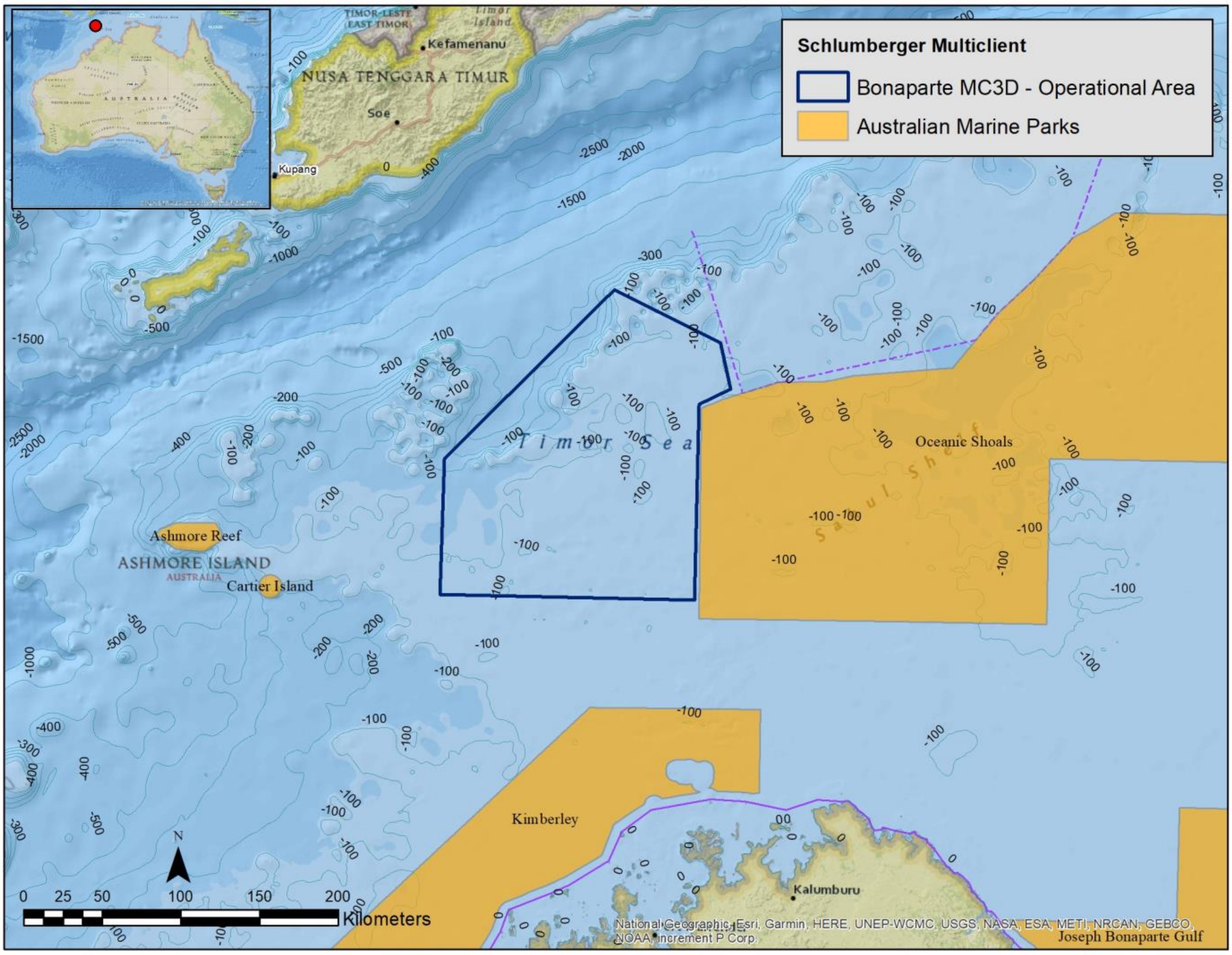

Figure 1: Location map of operational area

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PROPOSED ACTIVITY

Offshore seismic surveying is used to improve the understanding of subsurface geology in marine environments. During 3D marine surveys, seismic data is acquired using a purpose-built seismic survey vessel towing an acoustic source array and a multi cable hydrophone array, also known as a streamer array. Streamers are towed with a tail buoy, radar reflectors and lights to mark the end of the array. The streamers will be up to 8 km long to adequately record the necessary information.

Both the source and streamers are towed beneath the surface, (**Figure 2**). Acoustic energy from the source array is detected by the streamer array and recorded onboard the vessel. The recorded signals are then processed to provide information about geological formations below the seabed.

The seismic vessel will traverse the survey area along a series of predetermined sail lines at a speed of approximately 4-5 knots (7-9 km/h).

To minimise survey duration, geophysical data will be acquired 24 hours a day. Each 3D pass (swath) is about 140 kilometres long and will take approximately 32 hours to complete. Data for a pre-determined swath only needs to be acquired once, and the survey vessel will not need to collect data in that area again.

Two support vessels will work with the seismic vessel to assist in communicating with other vessels that have entered the area of operations and to support the overall operations, such as providing food and supplies.

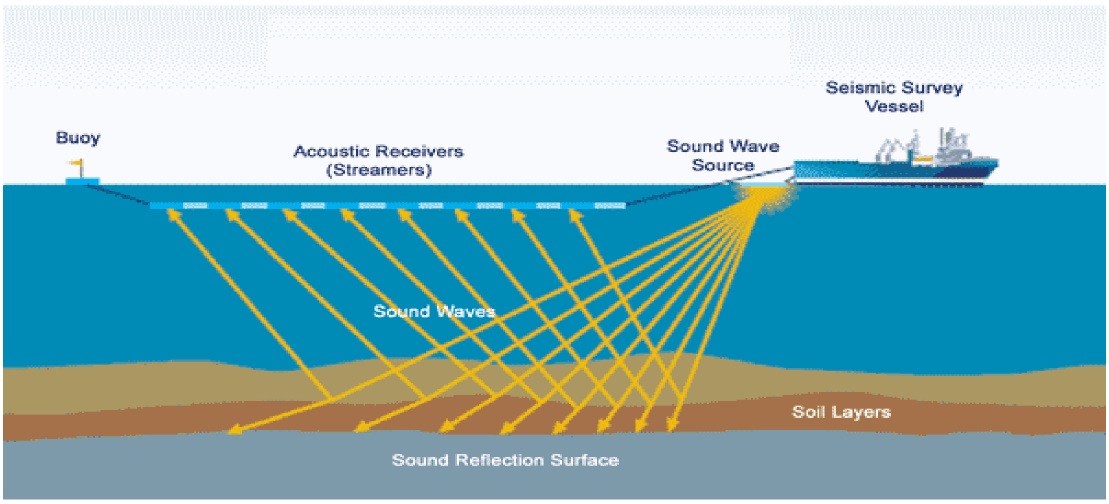

Figure 2: Conceptual diagram of marine seismic survey

ACCIDENTAL FUEL OIL SPILL DISPERSION MODELLING

As part of the environmental planning and approval process SLB have conducted a modeling study to ascertain the level of potential impact should an accident occur with the seismic vessel resulting in a fuel oil spill from its fuel tank. The resultant dispersion of fuel from modelling was used to determine the environment that may be affected (EMBA). As a result of the modelling, the outputs suggest that should a collision occur and the vessel's hull is ruptured and the entire contents of the vessel's fuel tanks are breached, fuel could reach inshore areas as shown by the green EMBA polygon in **Figure 3**. It should be noted that the inputs into the fuel spill modelling were extremely conservative and fuel spills from Seismic vessels are highly unlikely due to extensive controls and operational procedures and would be considered an extremely low likelihood of occurring. In addition, no incidents have occurred in Australian waters to date that would result in a spill of the extent that was modelled from a seismic survey vessel.

We are contacting you because our assessment of values and sensitivities within the EMBA shows there is overlap with areas of commercial fishing activity, as shown in **Figure 3.**

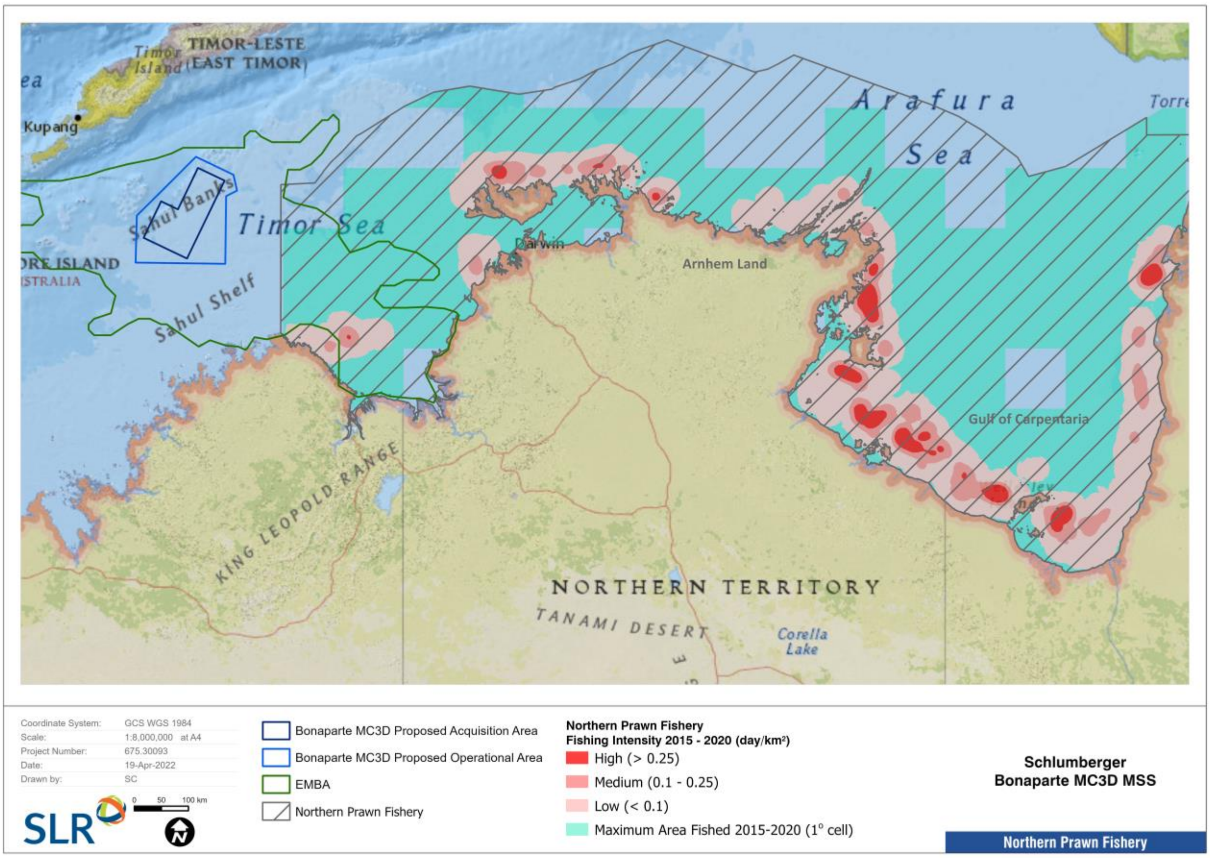

Figure 3 : Northern Prawn Fishery Effort within the EMBA (2015 -2022)

Modern seismic vessels mitigate the risk of fuel spills via physical design features such as double hull configuration and having multiple fuel tanks of reduced size instead of one large fuel tank. The vessel that will be contracted for this project will have these features and has worked in Australian waters previously.

The seismic vessel provider has safety procedures in place and documented actions to take if an incident were to occur. As a subcontractor of SLB, the vessel provider also has to comply with SLB's rigorous QHSE standards and commitments made within the Environment Plan which forms part of the regulatory approval process. At least one support vessel will work alongside the seismic vessel during the survey and will assist in communicating with other vessels that may have entered the area of operations to support safe navigation.

In the highly unlikely event of a spill SLB, the occurrence of which is unheard of in the industry, SLB will notify the Northern Territory Department of Industry, Tourism and Trade as soon as reasonably practicable. In addition, a compensation mechanism will be in place to address loss or damage to fishing gear and catch as a direct result of the survey.

COMMUNICATION COMMITMENTS

Schlumberger is committed to maintaining regular communication with all relevant stakeholders (i.e. commercial fishers/licence holders) throughout the duration of the survey.

Due to the nature of seismic survey operations, the timing and location of the activity are prone to minor changes. To ensure clarity, Schlumberger commits to notifying commercial fishers of survey schedule, finalized survey location and vessel details as they are confirmed prior to survey commencement. This will be supported with the supply of 48-hour operational detail lookahead plans which will be supplied each day and detail the location plan for the survey vessels for the upcoming 2 days, this notification will be provided to all relevant and affected stakeholders during operations. If you wish to receive these notifications, or specific information regarding this survey, please let me know at the contact details provided below.

ENVIRONMENTAL PERFORMANCE & CONTROLS

Schlumberger is committed to working with all interested parties to ensure risks are identified and reduced to as low as reasonably practicable before activities begin. Schlumberger has a reputation for implementing high standards of environmental protection in environmentally sensitive areas to mitigate and minimise impacts on the surrounding marine environment and stakeholders and will implement these procedures for the duration of this proposed survey.

Control measures that will be implemented to minimise impact on commercial fishers include: provision of 48 hour look-aheads (distributed every 24 hours) and ongoing engagement, notice to mariners will be issued, markings (lights/radar reflector) on tail buoys so the extent of the gear can be determined, and support vessels will be present throughout the survey to support communications with any fishers in the area where the vessel may be heading. In addition, a compensation mechanism will be in place to address loss or damage to fishing gear as a direct result of the survey.

YOUR FEEDBACK

Schlumberger is seeking any feedback or questions you have regarding this proposed activity. If you can please send any comments or questions back through the contact information provided below, that would be appreciated.

Schlumberger intends to keep all commercial fishers fully informed during the course of project planning and execution. However, if you would like to comment on the survey or would like additional information based on this preliminary factsheet please contact us as soon as possible. If you would like to meet with us to discuss the survey further or raise any concerns you have in relation to your activities in the area, please get in touch with me at the contact details below.

Finally, please note that you may also request any information provided during consultation not be published within the EP.

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Schlumberger proposes to undertake a three-dimensional (3D) marine seismic survey in Bonaparte Basin, in Commonwealth waters adjacent to Western Australia (**WA**). The operational area is 25,827 km^2 located 300 km northwest of Port Warrender (Western Australia), 260 km northwest of Ashmore Island (Western Australia). Water depths in the survey area are in the range of 100m (**Figure 1**). Planned seismic acquisition activity within this operational area will cover approximately 12,000 km^2 – details of extent and position of survey lines are currently being finalised.

Coordinates for the Operational Area are outlined in **Table 1**. In developing the Operational Area, a 15 km buffer has been applied around the proposed survey area in most cases.

The Bonaparte seismic survey is likely to commence in May 2023 however, the precise timing of survey commencement is subject to NOPSEMA's acceptance of the environment plan. Up to a maximum of 10,000 km^2 may be acquired per calendar year. It is estimated to take approximately 120 and 190 days to acquire 12,000 km^2 (including contingency time for potential vessel or equipment down time and adverse weather conditions). The precise timing of the survey is subject to NOPSEMA's acceptance of the environment plan (EP), weather conditions, vessel availability and other operational considerations, and will take into account the seasonality of environmental sensitivities, where practicable.

PROPOSED ACTIVITY

Offshore seismic surveying is used to improve the understanding of subsurface geology in marine environments.

During 3D marine surveys, seismic data is acquired using a purpose-built seismic survey vessel towing an acoustic source array and a multi cable hydrophone array, also known as a streamer array. Streamers are towed with a tail buoy, radar reflectors and lights to mark the end of the array. The streamers will be up to 8 km long to adequately record the necessary information.

Both the source and streamers are towed beneath the surface, (**Figure 2**). Acoustic energy from the source array is detected by the streamer array and recorded onboard the vessel. The recorded signals are then processed to provide information about geological formations below the seabed.

When recording the data, the seismic vessel traverses the survey area along a series of predetermined sail lines at a speed of approximately 4-5 knots (7-9 km/h). The level of acoustic emissions can be adjusted to provide low-power 'soft start' or 'fauna alert' procedures, at any point during the survey or maintenance operations.

To minimise survey duration, geophysical data will be acquired 24 hours a day. Each 3D pass (swath) is about 140 kilometres long and will take approximately 32 hours to complete. Data for a pre-determined swath only needs to be acquired once, and the survey vessel will not need to collect data in that area again.

Two support vessels will work with the seismic vessel to assist in communicating with other vessels that have entered the area of operations and to support the overall operations, such as providing food and supplies.

COMMUNICATION COMMITMENTS

Schlumberger is committed to maintaining regular communication with all relevant stakeholders throughout the duration of the survey and works with communities in a transparent manner.

As part of this continuous consultation, Schlumberger invites feedback on the proposed activities. Details of all consultation received will be provided to the National Offshore Petroleum Safety and Environment Management Authority (**NOPSEMA**) in accordance with EP procedures.

Due to the nature of seismic survey operations, the timing and location of the activity are prone to minor changes. To ensure clarity, Schlumberger commits to notifying stakeholders of survey schedule, finalized survey location and vessel details as they are confirmed. This will be supported with the supply of 48-hour operational detail lookahead plans, with notification being provided to relevant stakeholders during operations. If you wish to receive these notifications, or specific information regarding this survey, please advise in response to this package as soon as possible.

Following submission of the EP to NOPSEMA, stakeholder engagement will continue throughout the EP review period and survey acquisition to ensure everyone is kept informed and to minimise potential for disruption to any ongoing activities in the area.

ENVIRONMENTAL PERFORMANCE

Schlumberger is committed to working with all interested parties to ensure risks are identified and reduced to as low as reasonably practicable before activities begin. Latest technology in underwater sound transmission modelling will be used to understand emitted sound levels for the survey across the operational area. This will include detailed impact assessments and the adoption of appropriate mitigation measures that will be documented in the EP.

Early analysis of Flora and Fauna sensitivities in the Operational area have been undertaken and has enabled the proposed survey to incorporate mitigations as a result of the potential environmental concerns and sensitivities. Blue whales, whale sharks and turtles in particular have been identified in the early analysis as being some of the key sensitivities in the area and the EP will focus on these species to minimise disturbance as a result of the seismic activities.

There will be two dedicated Marine Mammal Observers (**MMOs**) onboard who will monitor precaution zones, observation zones, and low power zones during daylight hours in accordance with the Environment Protection and Biodiversity Conservation Act. There will also be Passive Acoustic Monitoring (**PAM**) 24 hours a day to monitor for whales in the vicinity of the survey vessel. Mitigation measures will be implemented to minimize any potential for disturbance to whales during the survey.

NOPSEMA reviews each project-specific EP in accordance with the requirements of the Offshore Petroleum Greenhouse Gas (Environment) Regulations 2009 before any approvals to the proposed seismic survey can be made.

Schlumberger has a reputation for implementing high standards of environmental protection in environmentally sensitive areas to mitigate and minimise impacts on the surrounding marine environment and stakeholders and will implement these procedures for the duration of this proposed survey.

YOUR FEEDBACK

As indicated above, Schlumberger is seeking feedback regarding this proposed activity before making a formal submission to NOPSEMA. The proposed survey is subject to Commonwealth Government regulatory approval and any feedback will be communicated to NOPSEMA, as required under Commonwealth legislation. We intend to lodge the EP to NOPSEMA shortly so please get in touch if you have any questions or comments.

Schlumberger intends to keep all stakeholders fully informed during the course of project planning and execution. However, if you would like to comment on the survey or would like additional information based on this preliminary factsheet please contact us as soon as possible. If you would like to meet with us to discuss the survey further or raise any concerns you have in relation to your activities in the area, please get in touch with me at the contact details below.

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Figure 1: Location map of operational area

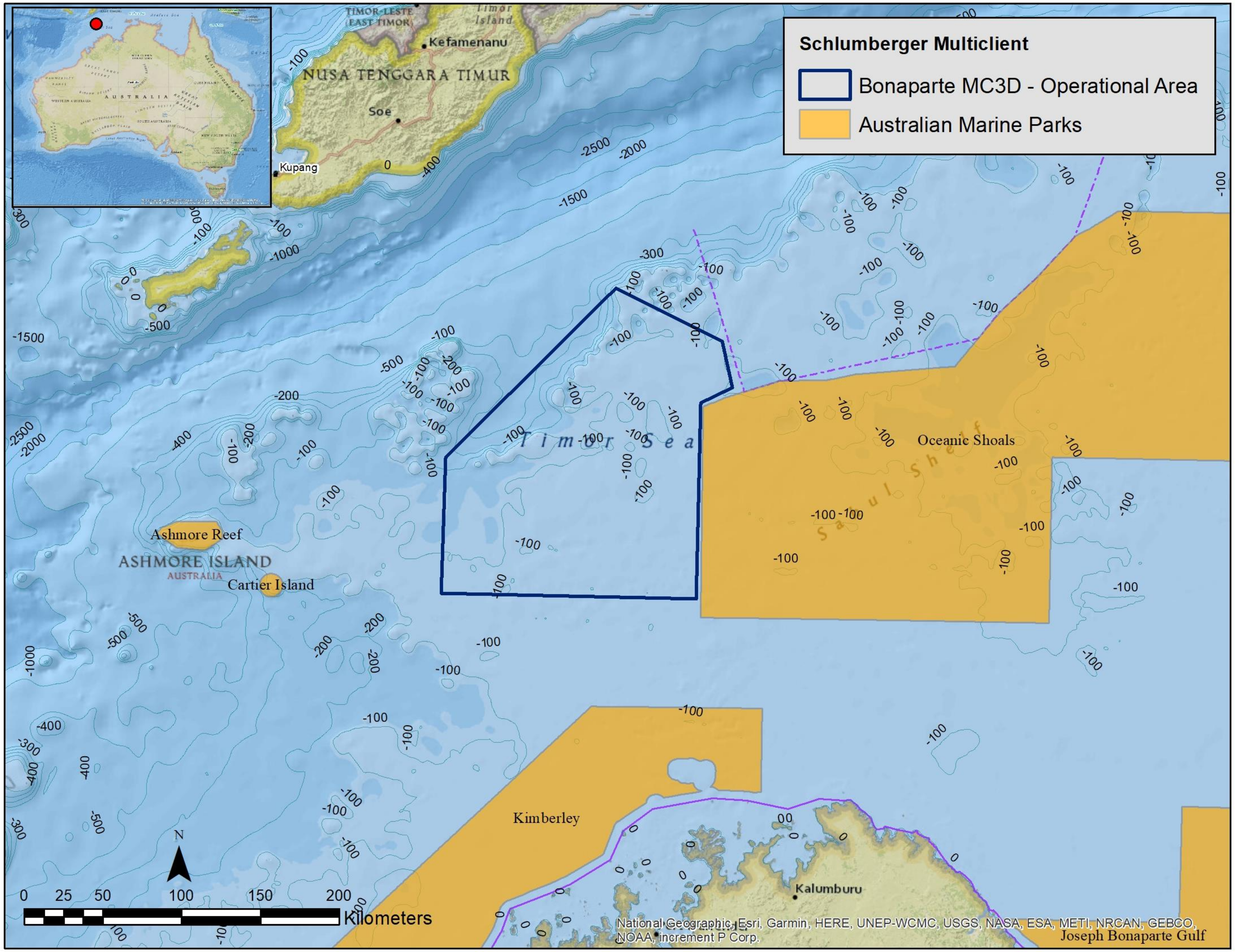
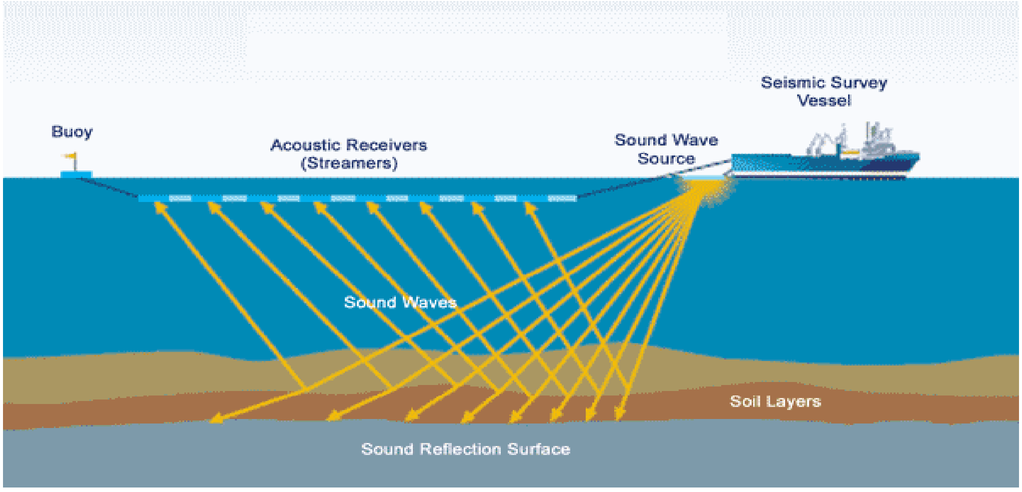


Table 1: Coordinates of the Operational Area (UTM Zone 51S)

S No	X	Y
1	668353.2981	8609707.23
2	670973.134	8696076.658
3	714112.3176	8738881.308
4	779108.1235	8803487.052
5	846839.3232	8769762.117
6	853120.6772	8740481.172
7	833166.8606	8730614.315
8	830319.4782	8606042.698
9	668353.2981	8609707.23

Figure 2: Schematic of typical Seismic geophysical survey



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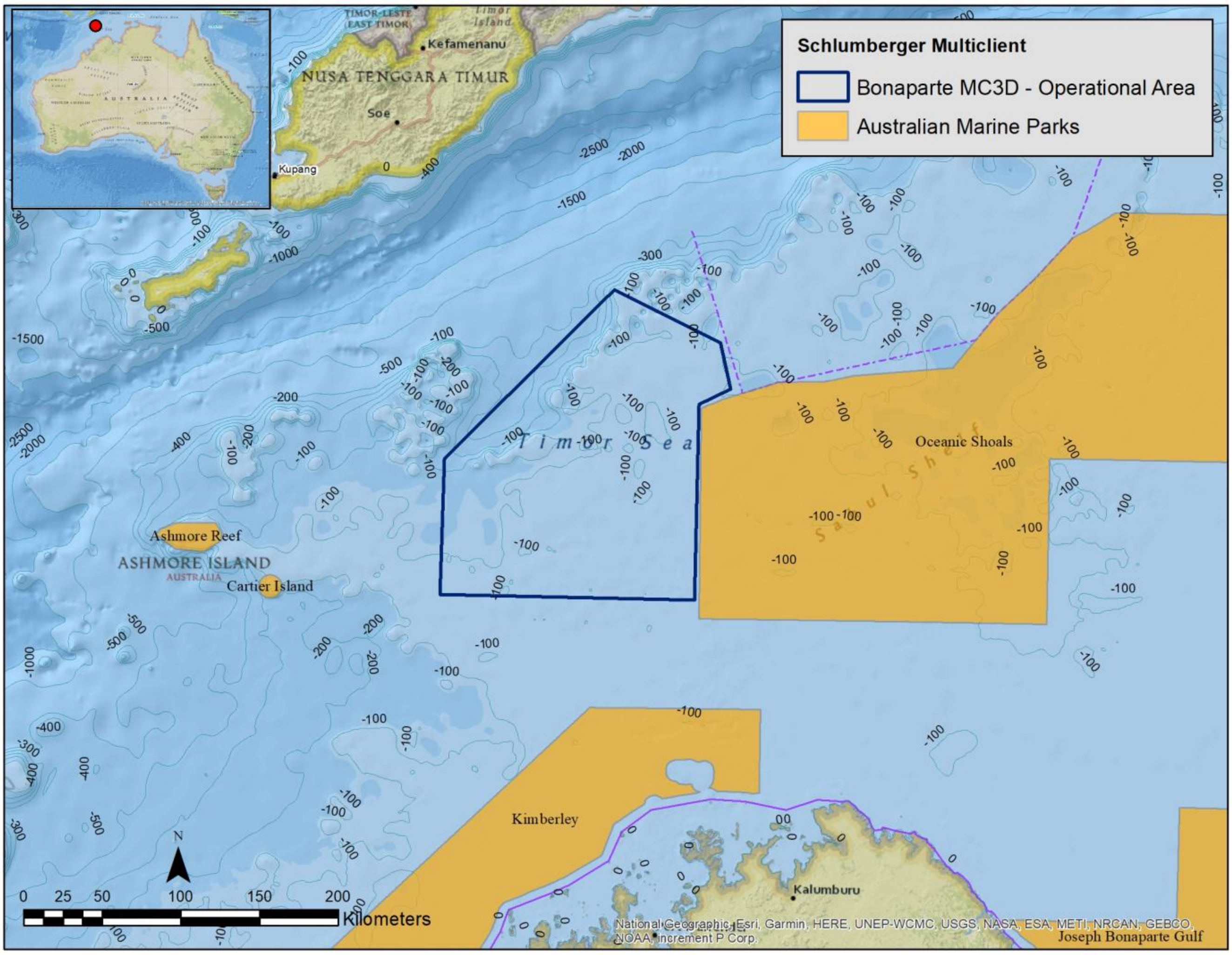
The Bonaparte seismic survey is likely to commence in 2024, however, the precise timing of survey commencement is subject to NOPSEMA's acceptance of the environment plan.



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The seismic vessel will traverse the survey area along a series of predetermined sail lines at a speed of approximately 4-5 knots (7-9 km/h).

To minimise survey duration, geophysical data will be acquired 24 hours a day. Each 3D pass (swath) is about 140 kilometres long and will take approximately 32 hours to complete. Data for a pre-determined swath only needs to be acquired once, and the survey vessel will not need to collect data in that area again.

Two support vessels will work with the seismic vessel to assist in communicating with other vessels that have entered the area of operations and to support the overall operations, such as providing food and supplies.

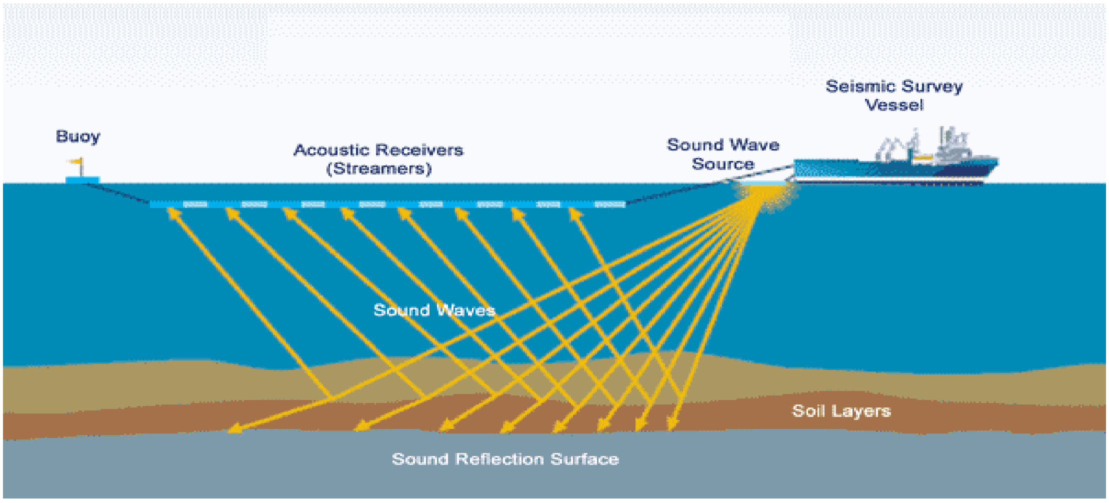

Figure 2: Conceptual diagram of marine seismic survey

ACCIDENTAL FUEL OIL SPILL DISPERSION MODELLING

As part of the environmental planning and approval process, SLB have conducted a modelling study to ascertain the level of potential impact should an accident occur with the Seismic Vessel resulting in a fuel oil (diesel) spill from it's fuel tank. The resultant dispersion of fuel from modelling was used to determine the environment that may be affected (EMBA).

The results of the modelling indicate that, should a collision occur, and the vessel's hull is ruptured, and the entire contents of the vessel's fuel tanks are breached, fuel could reach inshore areas as shown by the green EMBA polygon in **Figure 3** below. It should be noted that the inputs into the fuel spill modelling were extremely conservative and fuel spills from seismic vessels are highly unlikely due to the use of extensive controls and operational procedures. In addition, out of the many seismic surveys that have been conducted in Australia to date, a spill of this nature or rupture of a survey vessel's hull has never occurred.

We have undertaken a desktop fishery assessment within the EMBA using data extracted from ABARES and have identified that no recent North West Slope Trawl Fishery activities overlap with the EMBA or Operational Area, as shown in **Figure 3**. However, we are contacting you given your entitlements to fish within the North West Slope Trawl Fishery Area to see if you have any questions or concerns over what is being proposed and whether you are satisfied with the information we have provided.

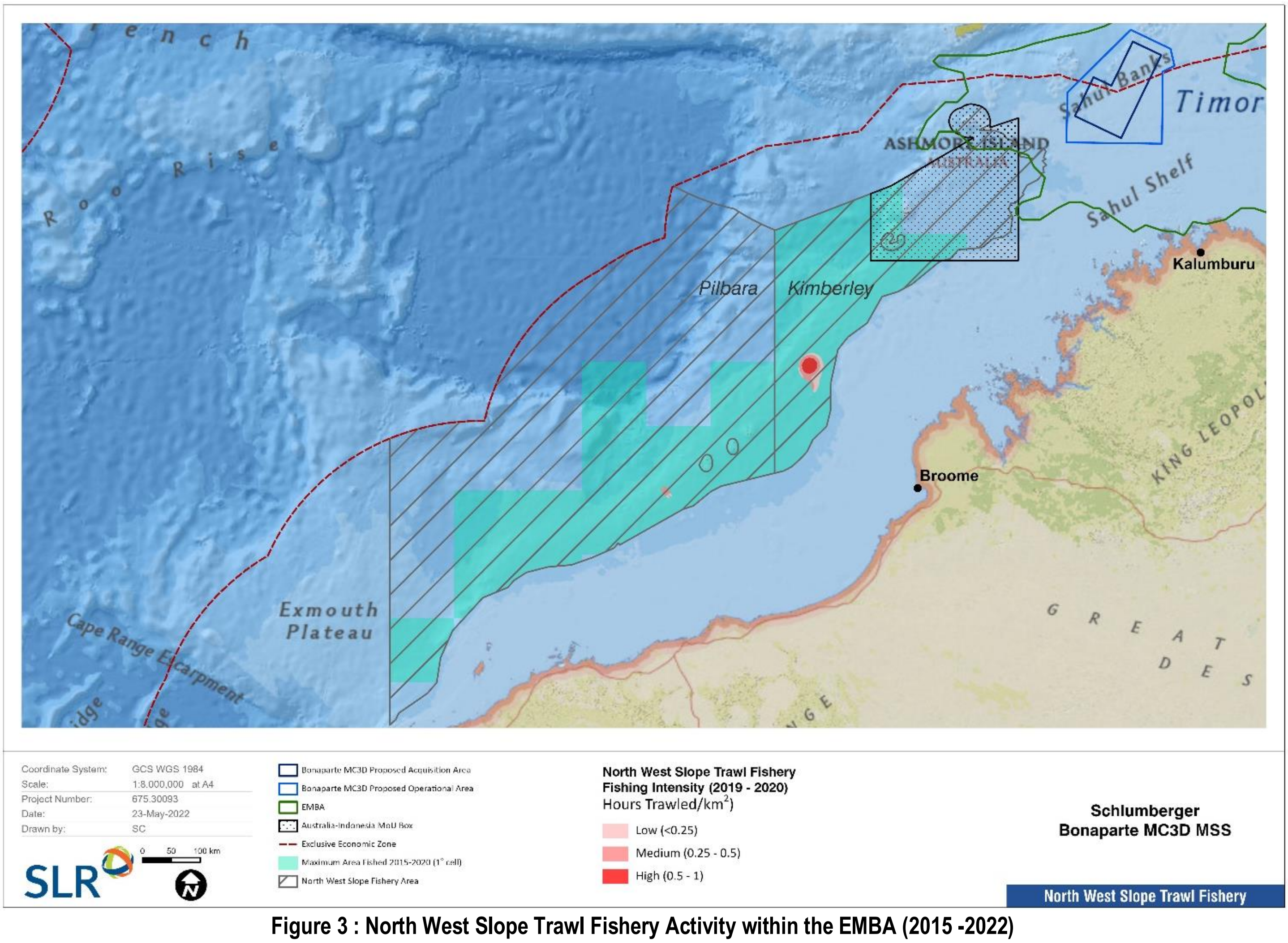

Figure 3 : North West Slope Trawl Fishery Activity within the EMBA (2015 -2022)

Modern seismic vessels mitigate the risk of fuel spills via physical design features such as double hull configuration and having multiple fuel tanks of reduced size instead of one large fuel tank. The vessel that will be contracted for this project will have these features and has worked in Australian waters previously.

The seismic vessel provider has safety procedures in place and documented actions to take if an incident were to occur. As a subcontractor of SLB, the vessel provider also has to comply with SLB's rigorous QHSE standards and commitments made within the Environment Plan which forms part of the regulatory approval process. At least one support vessel will work alongside the seismic vessel during the survey and will assist in communicating with other vessels that may have entered the area of operations to support safe navigation.

In the highly unlikely event of a spill SLB, the occurrence of which is unheard of in the industry, SLB will notify the NOPSEMA as soon as reasonably practicable. In addition, a compensation mechanism will be in place to address loss or damage to fishing gear and catch as a direct result of the survey.

COMMUNICATION COMMITMENTS

Schlumberger is committed to maintaining regular communication with all relevant stakeholders (i.e. commercial fishers/licence holders) throughout the duration of the survey.

Due to the nature of seismic survey operations, the timing and location of the activity are prone to minor changes. To ensure clarity, Schlumberger commits to notifying commercial fishers of survey schedule, finalized survey location and vessel details as they are confirmed prior to survey commencement. This will be supported with the supply of 48-hour operational detail lookahead plans which will be supplied each day and detail the location plan for the survey vessels for the upcoming 2 days, this notification will be provided to all relevant and affected stakeholders during operations. If you wish to receive these notifications, or specific information regarding this survey, please let me know at the contact details provided below.

ENVIRONMENTAL PERFORMANCE & CONTROLS

Schlumberger is committed to working with all interested parties to ensure risks are identified and reduced to as low as reasonably practicable before activities begin. Schlumberger has a reputation for implementing high standards of environmental protection in environmentally sensitive areas to mitigate and minimise impacts on the surrounding marine environment and stakeholders and will implement these procedures for the duration of this proposed survey.

Control measures that will be implemented to minimise impact on commercial fishers include: provision of 48 hour look-aheads (distributed every 24 hours) and ongoing engagement, notice to mariners will be issued, markings (lights/radar reflector) on tail buoys so the extent of the gear can be determined, and support vessels will be present throughout the survey to support communications with any fishers in the area where the vessel may be heading. In addition, a compensation mechanism will be in place to address loss or damage to fishing gear as a direct result of the survey.

YOUR FEEDBACK

Schlumberger is seeking any feedback or questions you have regarding this proposed activity. If you can please send any comments or questions back through the contact information provided below, that would be appreciated.

Schlumberger intends to keep all commercial fishers fully informed during the course of project planning and execution. However, if you would like to comment on the survey or would like additional information based on this preliminary factsheet please contact us as soon as possible. If you would like to meet with us to discuss the survey further or raise any concerns you have in relation to your functions, interests or activities in the area, please get in touch with me at the contact details below.

Finally, please note that you may also request any information provided during consultation not be published within the EP.

Best regards,
Kevin Moran

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Perth WA, 6000(08) 9420 4800
Email: environment@slb.com

Schlumberger

BONAPARTE BASIN MARINE SEISMIC SURVEY

Schlumberger proposes to undertake a three-dimensional (3D) marine seismic survey in Bonaparte Basin. The operational area is located 300 km northwest of Port Warrender and 260 km northwest of Ashmore Island, with water depths in the range of 100m (**Figure 1**). Planned seismic acquisition will cover approximately 12,000 km^2 and take approximately three months to acquire.

Coordinates for the Operational Area are outlined in **Table 1** and also attached in an excel spreadsheet.

The Bonaparte seismic survey is likely to commence in 2024, however, the precise timing of survey commencement is subject to NOPSEMA's acceptance of the environment plan.

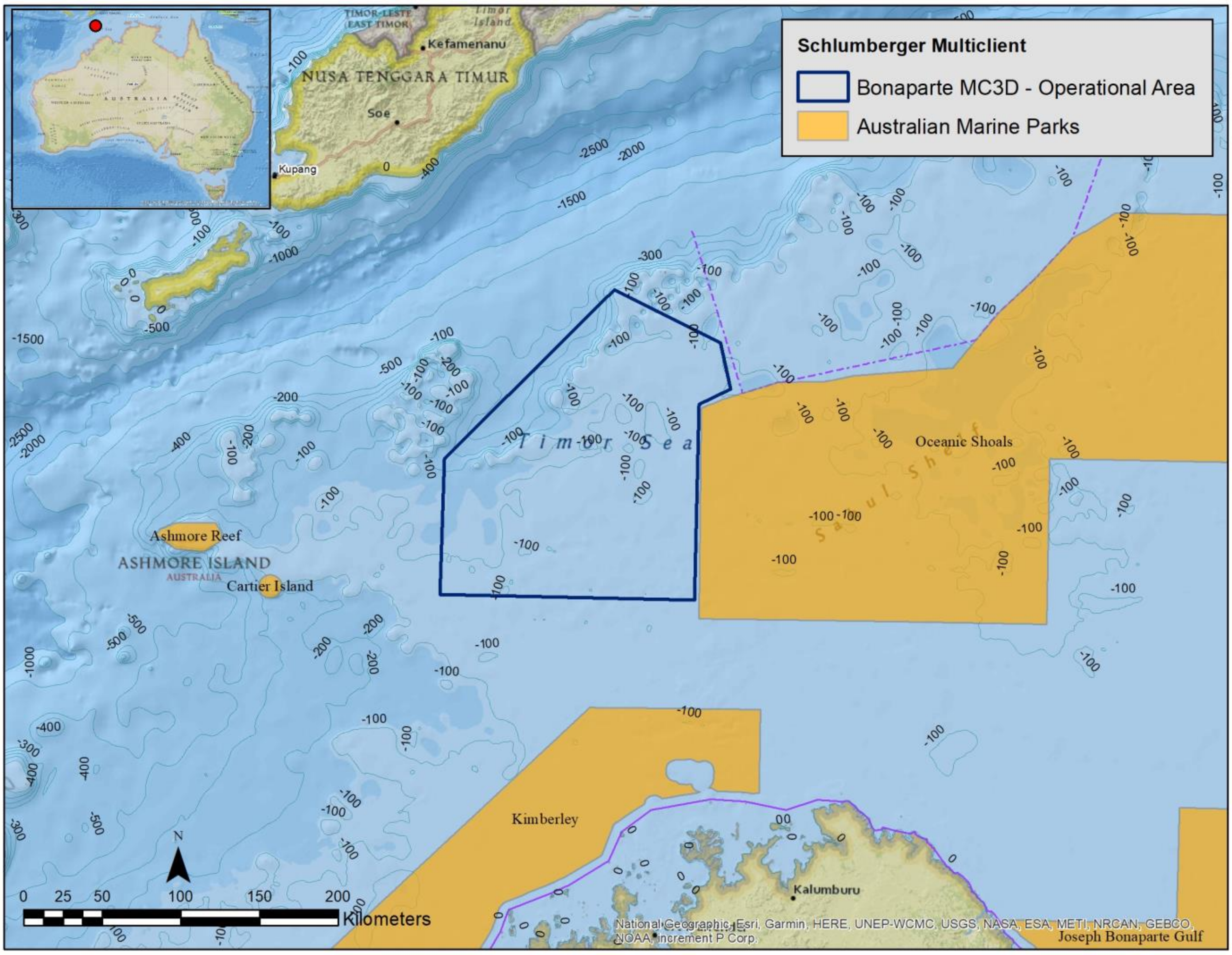

Figure 1: Location map of operational area

Table 1: Coordinates of the Operational Area (UTM Zone 51S)

S No	Longtitude	Latitude
1	124.5496968	-12.57192338
2	124.5692117	-11.79101655
3	124.9622977	-11.4016772
4	125.5525263	-10.81338971
5	126.1746019	-11.11219182
6	126.2349821	-11.37596856
7	126.0533229	-11.46702672
8	126.0398771	-12.59225658
9	124.5496968	-12.57192338

PROPOSED ACTIVITY

Offshore seismic surveying is used to improve the understanding of subsurface geology in marine environments. During 3D marine surveys, seismic data is acquired using a purpose-built seismic survey vessel towing an acoustic source array and a multi cable hydrophone array, also known as a streamer array. Streamers are towed with a tail buoy, radar reflectors and lights to mark the end of the array. The streamers will be up to 8 km long to adequately record the necessary information.

Both the source and streamers are towed beneath the surface, (**Figure 2**). Acoustic energy from the source array is detected by the streamer array and recorded onboard the vessel. The recorded signals are then processed to provide information about geological formations below the seabed.

The seismic vessel will traverse the survey area along a series of predetermined sail lines at a speed of approximately 4-5 knots (7-9 km/h).

To minimise survey duration, geophysical data will be acquired 24 hours a day. Each 3D pass (swath) is about 140 kilometres long and will take approximately 32 hours to complete. Data for a pre-determined swath only needs to be acquired once, and the survey vessel will not need to collect data in that area again.

Two support vessels will work with the seismic vessel to assist in communicating with other vessels that have entered the area of operations and to support the overall operations, such as providing food and supplies.

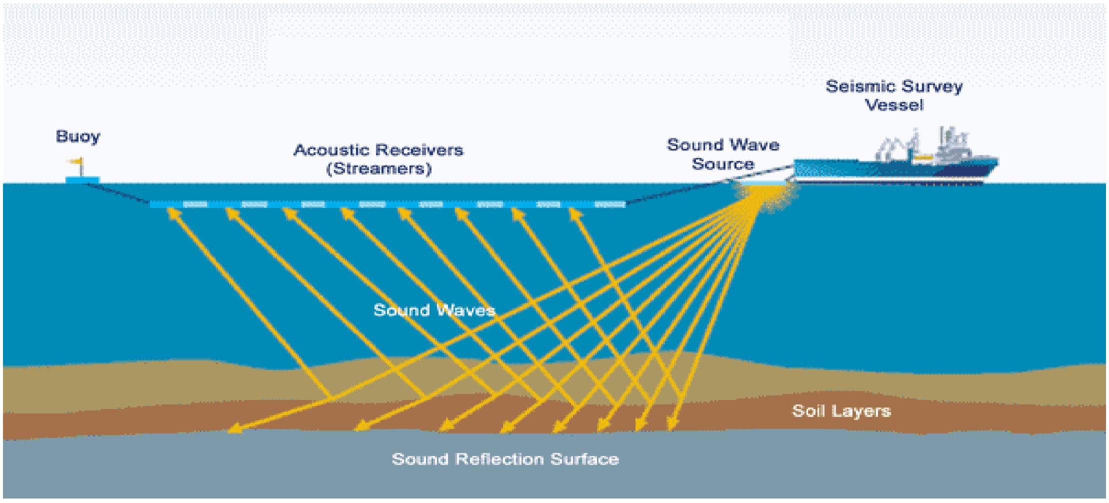

Figure 2: Conceptual diagram of marine seismic survey

ACCIDENTAL FUEL OIL SPILL DISPERSION MODELLING

As part of the environmental planning and approval process, SLB have conducted a modelling study to ascertain the level of potential impact should an accident occur with the Seismic Vessel resulting in a fuel oil (diesel) spill from it's fuel tank. The resultant dispersion of fuel from modelling was used to determine the environment that may be affected (EMBA).

The results of the modelling indicate that, should a collision occur, and the vessel's hull is ruptured, and the entire contents of the vessel's fuel tanks are breached, fuel could reach inshore areas as shown by the green EMBA polygon in **Figure 3** below. It should be noted that the inputs into the fuel spill modelling were extremely conservative and fuel spills from seismic vessels are highly unlikely due to the use of extensive controls and operational procedures. In addition, out of the many seismic surveys that have been conducted in Australia to date, a spill of this nature or rupture of a survey vessel's hull has never occurred.

We are contacting you because our assessment of values and sensitivities within the EMBA shows there is overlap with areas of commercial fishing activity, as shown in **Figure 3**. We have undertaken a desktop fishery assessment within the EMBA using data extracted from ABARES and have identified that recent Northern Prawn Fishery activities overlap with the EMBA but not the Operational Area, as shown in **Figure 3**. Hence, we would like to have further discussions with you to see if you have any questions or concerns over what is being proposed and whether you are satisfied with the information we have provided.

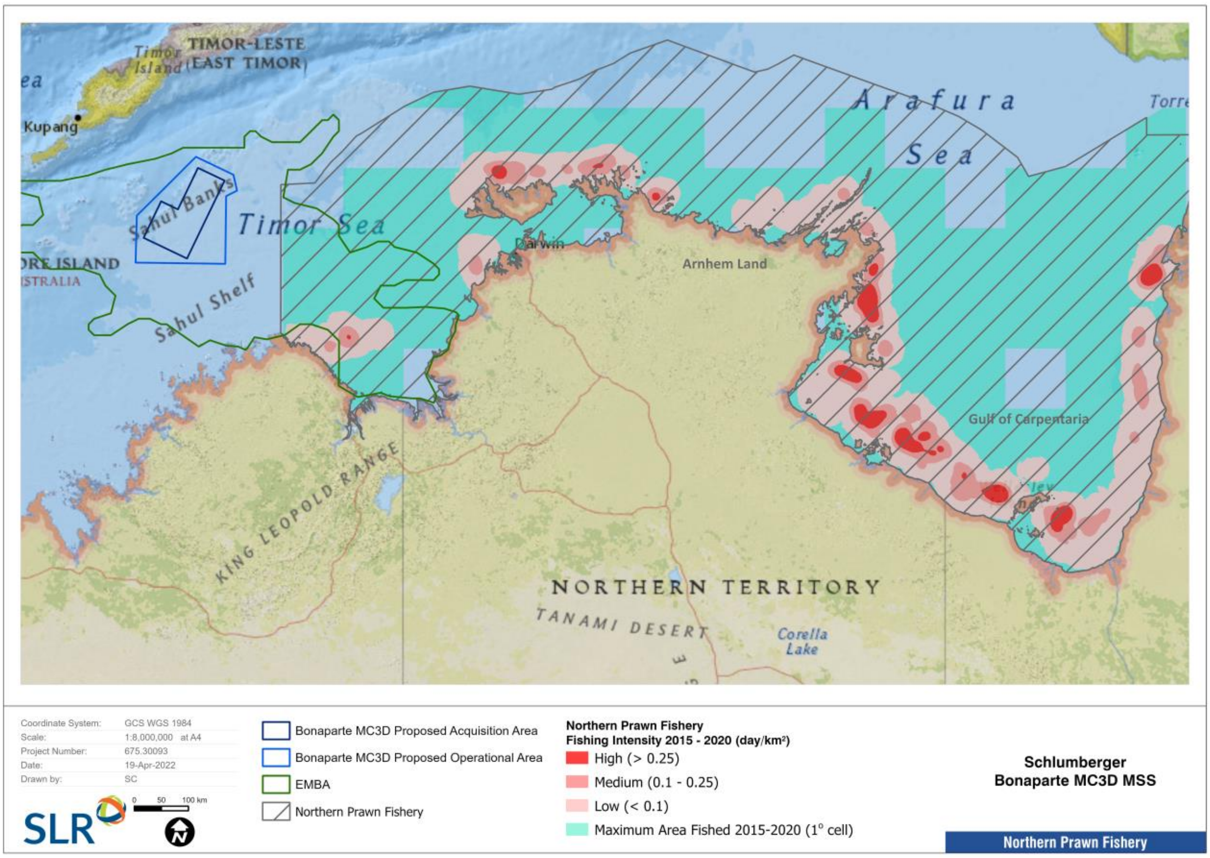

Figure 3 : Northern Prawn Fishery Effort within the EMBA (2015 -2022)

Modern seismic vessels mitigate the risk of fuel spills via physical design features such as double hull configuration and having multiple fuel tanks of reduced size instead of one large fuel tank. The vessel that will be contracted for this project will have these features and has worked in Australian waters previously.

The seismic vessel provider has safety procedures in place and documented actions to take if an incident were to occur. As a subcontractor of SLB, the vessel provider also has to comply with SLB's rigorous QHSE standards and commitments made within the Environment Plan which forms part of the regulatory approval process. At least one support vessel will work alongside the seismic vessel during the survey and will assist in communicating with other vessels that may have entered the area of operations to support safe navigation.

In the highly unlikely event of a spill SLB, the occurrence of which is unheard of in the industry, SLB will notify NOPSEMA as soon as reasonably practicable. In addition, a compensation mechanism will be in place to address loss or damage to fishing gear and catch as a direct result of the survey.

COMMUNICATION COMMITMENTS

Schlumberger is committed to maintaining regular communication with all relevant stakeholders (i.e. commercial fishers/licence holders) throughout the duration of the survey.

Due to the nature of seismic survey operations, the timing and location of the activity are prone to minor changes. To ensure clarity, Schlumberger commits to notifying commercial fishers of survey schedule, finalized survey location and vessel details as they are confirmed prior to survey commencement. This will be supported with the supply of 48-hour operational detail lookahead plans which will be supplied each day and detail the location plan for the survey vessels for the upcoming 2 days, this notification will be provided to all relevant and affected stakeholders during operations. If you wish to receive these notifications, or specific information regarding this survey, please let me know at the contact details provided below.

ENVIRONMENTAL PERFORMANCE & CONTROLS

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Control measures that will be implemented to minimise impact on commercial fishers include: provision of 48 hour look-aheads (distributed every 24 hours) and ongoing engagement, notice to mariners will be issued, markings (lights/radar reflector) on tail buoys so the extent of the gear can be determined, and support vessels will be present throughout the survey to support communications with any fishers in the area where the vessel may be heading. In addition, a compensation mechanism will be in place to address loss or damage to fishing gear as a direct result of the survey.

YOUR FEEDBACK

Schlumberger is seeking any feedback or questions you have regarding this proposed activity. If you can please send any comments or questions back through the contact information provided below, that would be appreciated.

Schlumberger intends to keep all commercial fishers fully informed during the course of project planning and execution. However, if you would like to comment on the survey or would like additional information based on this preliminary factsheet please contact us as soon as possible. If you would like to meet with us to discuss the survey further or raise any concerns you have in relation to your functions, interests or activities in the area, please get in touch with me at the contact details below.

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Email: environment@slb.com

BONAPARTE BASIN MARINE SEISMIC SURVEY

Schlumberger proposes to undertake a three-dimensional (3D) marine seismic survey in Bonaparte Basin. The operational area is located 300 km northwest of Port Warrender and 260 km northwest of Ashmore Island, with water depths in the range of 100m (**Figure 1**). Planned seismic acquisition will cover approximately 12,000 km^2 and take approximately three months to acquire.

Coordinates for the Operational Area are outlined in **Table 1** and also attached in an excel spreadsheet.

The Bonaparte seismic survey is likely to commence in 2024, however, the precise timing of survey commencement is subject to NOPSEMA's acceptance of the environment plan.

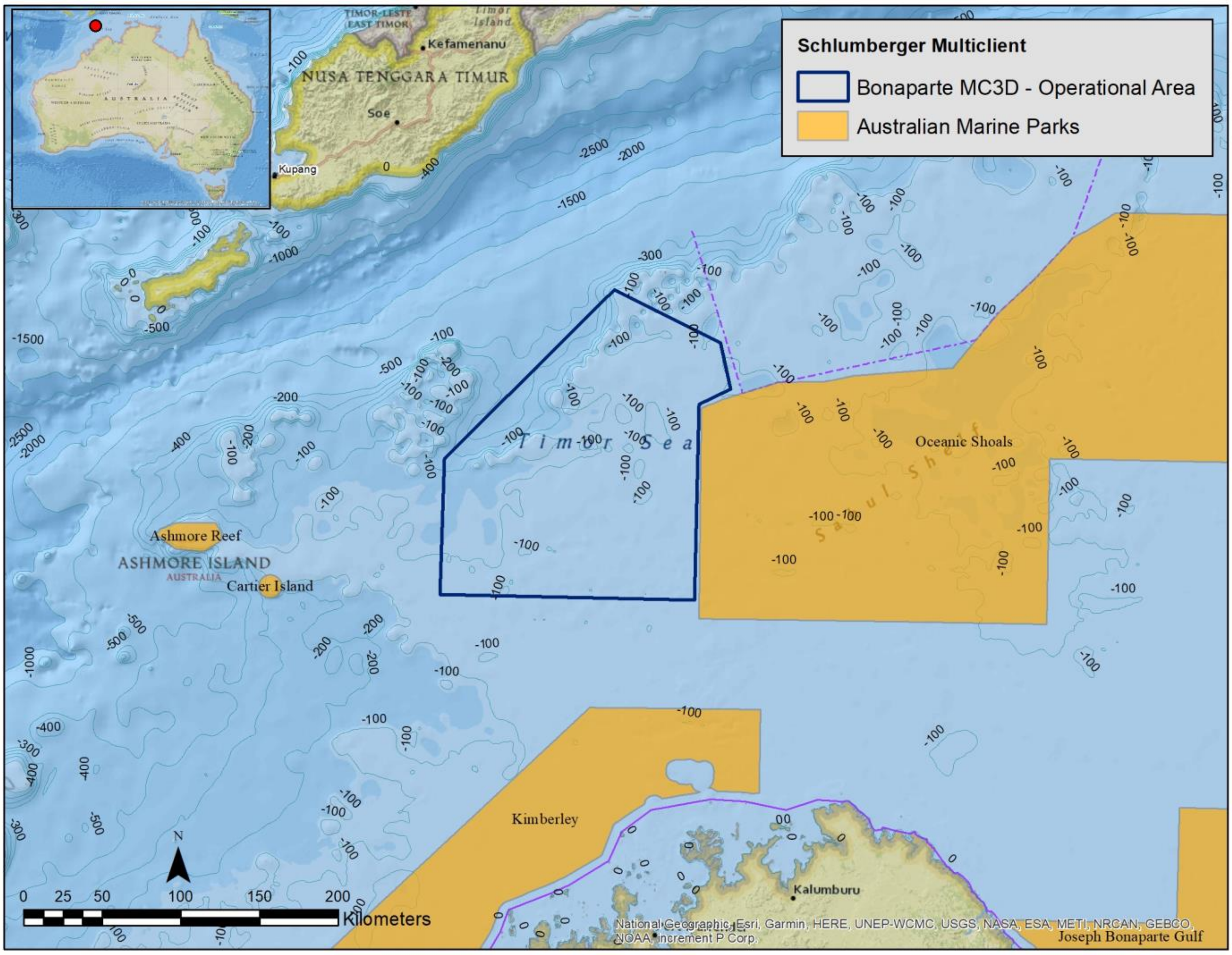

Figure 1: Location map of operational area

Table 1: Coordinates of the Operational Area (UTM Zone 51S)

S No	Longtitude	Latitude
1	124.5496968	-12.57192338
2	124.5692117	-11.79101655
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7	126.0533229	-11.46702672
8	126.0398771	-12.59225658
9	124.5496968	-12.57192338

PROPOSED ACTIVITY

Offshore seismic surveying is used to improve the understanding of subsurface geology in marine environments. During 3D marine surveys, seismic data is acquired using a purpose-built seismic survey vessel towing an acoustic source array and a multi cable hydrophone array, also known as a streamer array. Streamers are towed with a tail buoy, radar reflectors and lights to mark the end of the array. The streamers will be up to 8 km long to adequately record the necessary information.

Both the source and streamers are towed beneath the surface, (**Figure 2**). Acoustic energy from the source array is detected by the streamer array and recorded onboard the vessel. The recorded signals are then processed to provide information about geological formations below the seabed.

The seismic vessel will traverse the survey area along a series of predetermined sail lines at a speed of approximately 4-5 knots (7-9 km/h).

To minimise survey duration, geophysical data will be acquired 24 hours a day. Each 3D pass (swath) is about 140 kilometres long and will take approximately 32 hours to complete. Data for a pre-determined swath only needs to be acquired once, and the survey vessel will not need to collect data in that area again.

Two support vessels will work with the seismic vessel to assist in communicating with other vessels that have entered the area of operations and to support the overall operations, such as providing food and supplies.

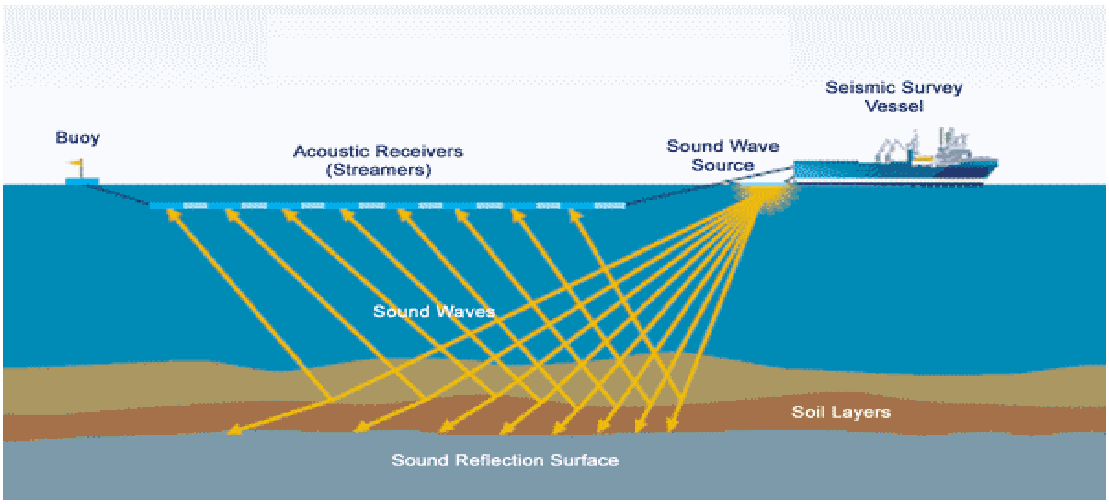

Figure 2: Conceptual diagram of marine seismic survey

ACCIDENTAL FUEL OIL SPILL DISPERSION MODELLING

As part of the environmental planning and approval process, SLB have conducted a modelling study to ascertain the level of potential impact should an accident occur with the Seismic Vessel resulting in a fuel oil (diesel) spill from it's fuel tank. The resultant dispersion of fuel from modelling was used to determine the environment that may be affected (EMBA).

The results of the modelling indicate that, should a collision occur, and the vessel's hull is ruptured, and the entire contents of the vessel's fuel tanks are breached, fuel could reach inshore areas as shown by the green EMBA polygon in **Figure 3** below. It should be noted that the inputs into the fuel spill modelling were extremely conservative and fuel spills from seismic vessels are highly unlikely due to the use of extensive controls and operational procedures. In addition, out of the many seismic surveys that have been conducted in Australia to date, a spill of this nature or rupture of a survey vessel's hull has never occurred.

We have undertaken a desktop fishery assessment within the EMBA using data extracted from ABARES and have identified that no recent Western Skipjack Fishery activities overlap with the EMBA or Operational Area. However, we are contacting you given your entitlements to fish within the Inferred Western Skipjack Fishery Area[1] to see if you have any questions or concerns over what is being proposed and whether you are satisfied with the information we have provided.

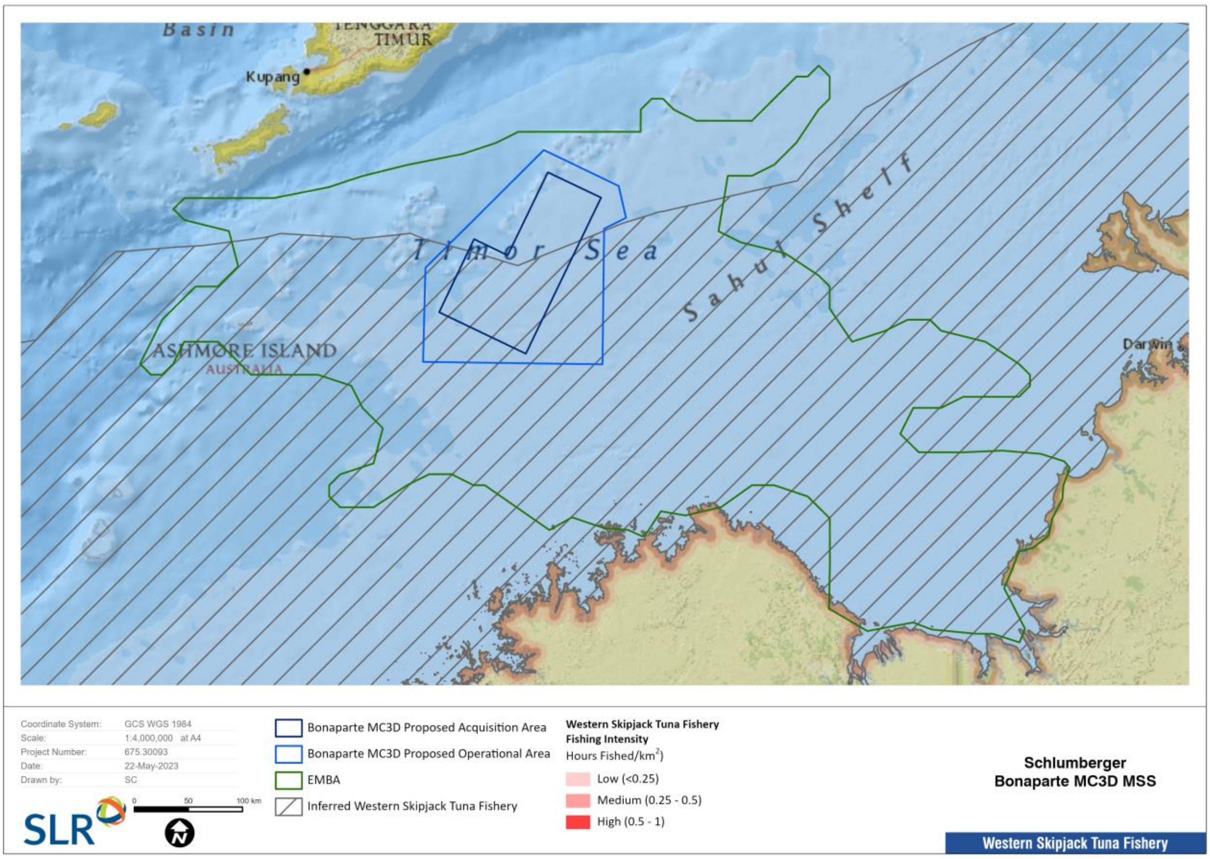

Figure 3 : Western Skipjack Tuna Fishery Activity within the EMBA (2015 -2022)

[1] Western Skipjack Fishery Area inferred as per 'fishery maps' available at https://www.afma.gov.au/fisheries/skipjack-tuna-fishery and accessed on 22 May 2023.

Modern seismic vessels mitigate the risk of fuel spills via physical design features such as double hull configuration and having multiple fuel tanks of reduced size instead of one large fuel tank. The vessel that will be contracted for this project will have these features and has worked in Australian waters previously.

The seismic vessel provider has safety procedures in place and documented actions to take if an incident were to occur. As a subcontractor of SLB, the vessel provider also has to comply with SLB's rigorous QHSE standards and commitments made within the Environment Plan which forms part of the regulatory approval process. At least one support vessel will work alongside the seismic vessel during the survey and will assist in communicating with other vessels that may have entered the area of operations to support safe navigation.

In the highly unlikely event of a spill SLB, the occurrence of which is unheard of in the industry, SLB will notify NOPSEMA as soon as reasonably practicable. In addition, a compensation mechanism will be in place to address loss or damage to fishing gear and catch as a direct result of the survey.

COMMUNICATION COMMITMENTS

Schlumberger is committed to maintaining regular communication with all relevant stakeholders (i.e. commercial fishers/licence holders) throughout the duration of the survey.

Due to the nature of seismic survey operations, the timing and location of the activity are prone to minor changes. To ensure clarity, Schlumberger commits to notifying commercial fishers of survey schedule, finalized survey location and vessel details as they are confirmed prior to survey commencement. This will be supported with the supply of 48-hour operational detail lookahead plans which will be supplied each day and detail the location plan for the survey vessels for the upcoming 2 days, this notification will be provided to all relevant and affected stakeholders during operations. If you wish to receive these notifications, or specific information regarding this survey, please let me know at the contact details provided below.

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Control measures that will be implemented to minimise impact on commercial fishers include: provision of 48 hour look-aheads (distributed every 24 hours) and ongoing engagement, notice to mariners will be issued, markings (lights/radar reflector) on tail buoys so the extent of the gear can be determined, and support vessels will be present throughout the survey to support communications with any fishers in the area where the vessel may be heading. In addition, a compensation mechanism will be in place to address loss or damage to fishing gear as a direct result of the survey.

YOUR FEEDBACK

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BONAPARTE BASIN MARINE SEISMIC SURVEY

Schlumberger proposes to undertake a three-dimensional (3D) marine seismic survey in Bonaparte Basin. The operational area is located 300 km northwest of Port Warrender and 260 km northwest of Ashmore Island, with water depths in the range of 100m (**Figure 1**). Planned seismic acquisition will cover approximately 12,000 km^2 and take approximately three months to acquire.

Coordinates for the Operational Area are outlined in **Table 1** and also attached in an excel spreadsheet.

The Bonaparte seismic survey is likely to commence in 2024; however, the precise timing of survey commencement is subject to NOPSEMA's acceptance of the environment plan.

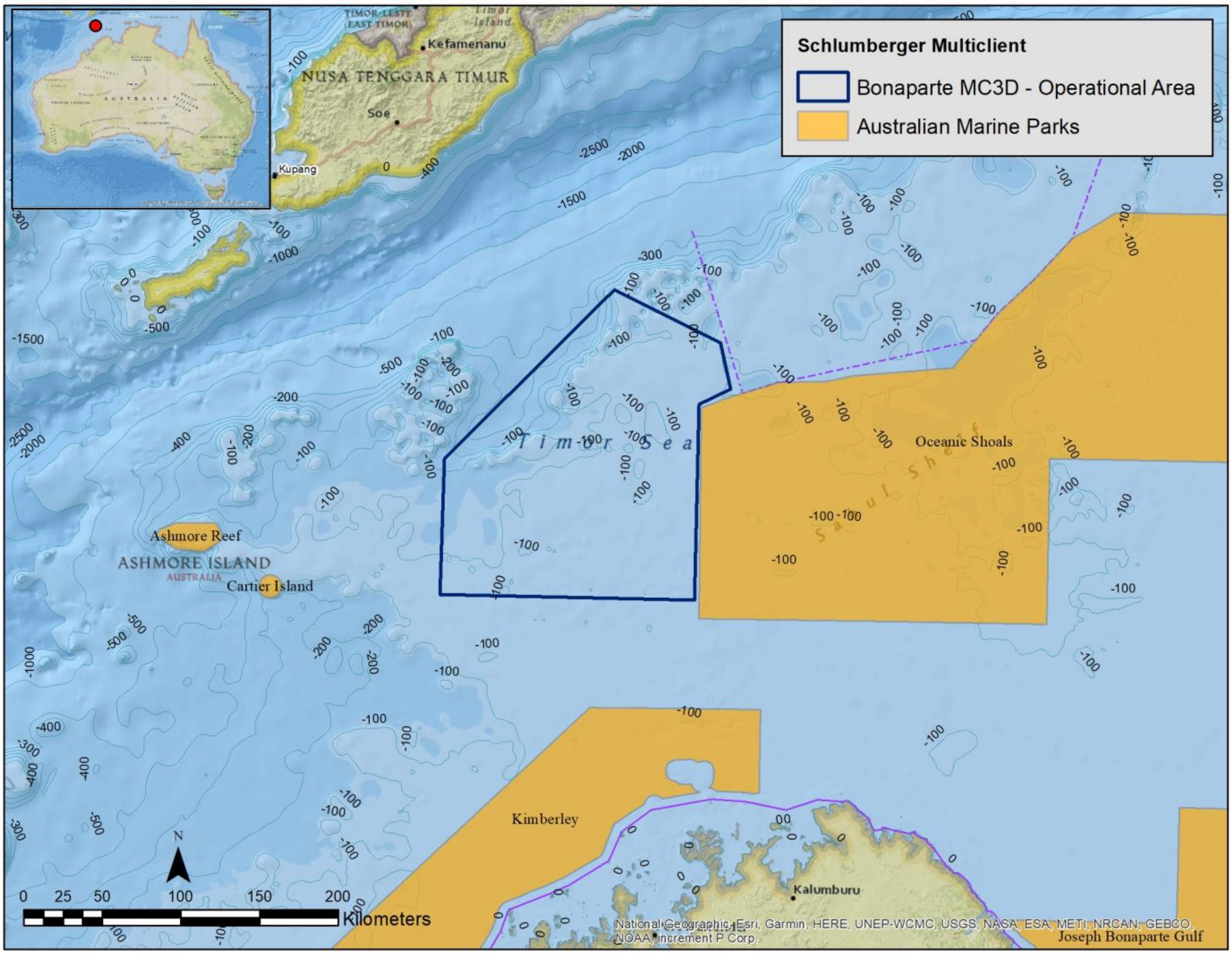

Figure 1: Location map of operational area

Table 1: Coordinates of the Operational Area (UTM Zone 51S)

S No	Longtitude	Latitude
1	124.5496968	-12.57192338
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7	126.0533229	-11.46702672
8	126.0398771	-12.59225658
9	124.5496968	-12.57192338

PROPOSED ACTIVITY

Offshore seismic surveying is used to improve the understanding of subsurface geology in marine environments. During 3D marine surveys, seismic data is acquired using a purpose-built seismic survey vessel towing an acoustic source array and a multi cable hydrophone array, also known as a streamer array. Streamers are towed with a tail buoy, radar reflectors and lights to mark the end of the array. The streamers will be up to 8 km long to adequately record the necessary information.

Both the source and streamers are towed beneath the surface, (**Figure 2**). Acoustic energy from the source array is detected by the streamer array and recorded onboard the vessel. The recorded signals are then processed to provide information about geological formations below the seabed.

The seismic vessel will traverse the survey area along a series of predetermined sail lines at a speed of approximately 4-5 knots (7-9 km/h).

To minimise survey duration, geophysical data will be acquired 24 hours a day. Each 3D pass (swath) is about 140 kilometres long and will take approximately 32 hours to complete. Data for a pre-determined swath only needs to be acquired once, and the survey vessel will not need to collect data in that area again.

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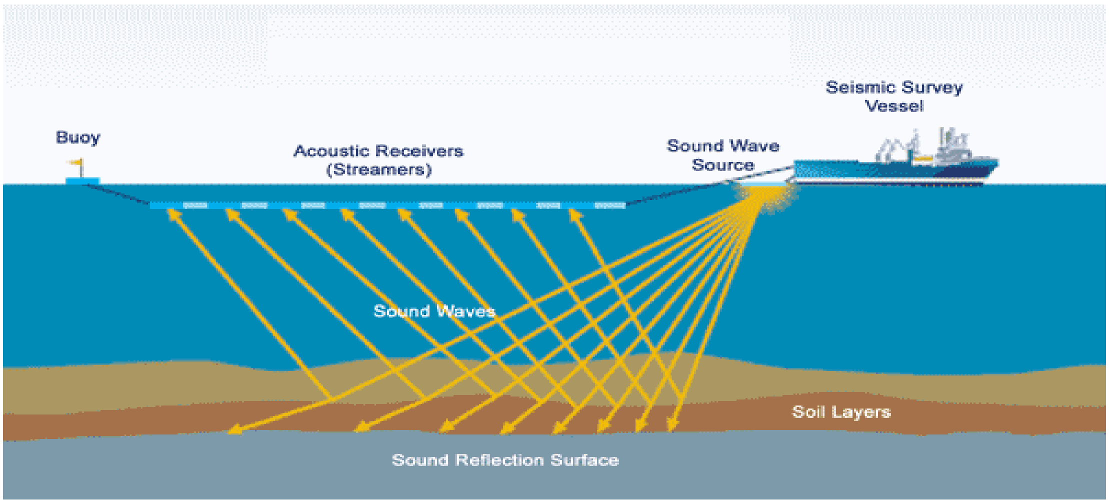

Figure 2: Conceptual diagram of marine seismic survey

ACCIDENTAL FUEL OIL SPILL DISPERSION MODELLING

As part of the environmental planning and approval process, SLB have conducted a modelling study to ascertain the level of potential impact should an accident occur with the Seismic Vessel resulting in a fuel oil (diesel) spill from it's fuel tank. The resultant dispersion of fuel from modelling was used to determine the environment that may be affected (EMBA).

The results of the modelling indicate that, should a collision occur, and the vessel's hull is ruptured, and the entire contents of the vessel's fuel tanks are breached, fuel could reach inshore areas as shown by the green EMBA polygon in **Figure 3** below. It should be noted that the inputs into the fuel spill modelling were extremely conservative and fuel spills from seismic vessels are highly unlikely due to the use of extensive controls and operational procedures. In addition, out of the many seismic surveys that have been conducted in Australia to date, a spill of this nature or rupture of a survey vessel's hull has never occurred.

We are contacting you because our assessment of values and sensitivities within the EMBA shows there is overlap with areas of fishing tour operator activity, as shown in **Figure 3.** We have undertaken a desktop fishery assessment within the EMBA using data extracted from the Northern Territory Department of Industry, Tourism and Trade and have identified that recent Northern Territory Fishing Tour Operators activities overlap with the EMBA but not the Operational Area, as shown in **Figure 3**. Hence, we would like to have further discussions with you to see if you have any questions or concerns over what is being proposed and whether you are satisfied with the information we have provided.

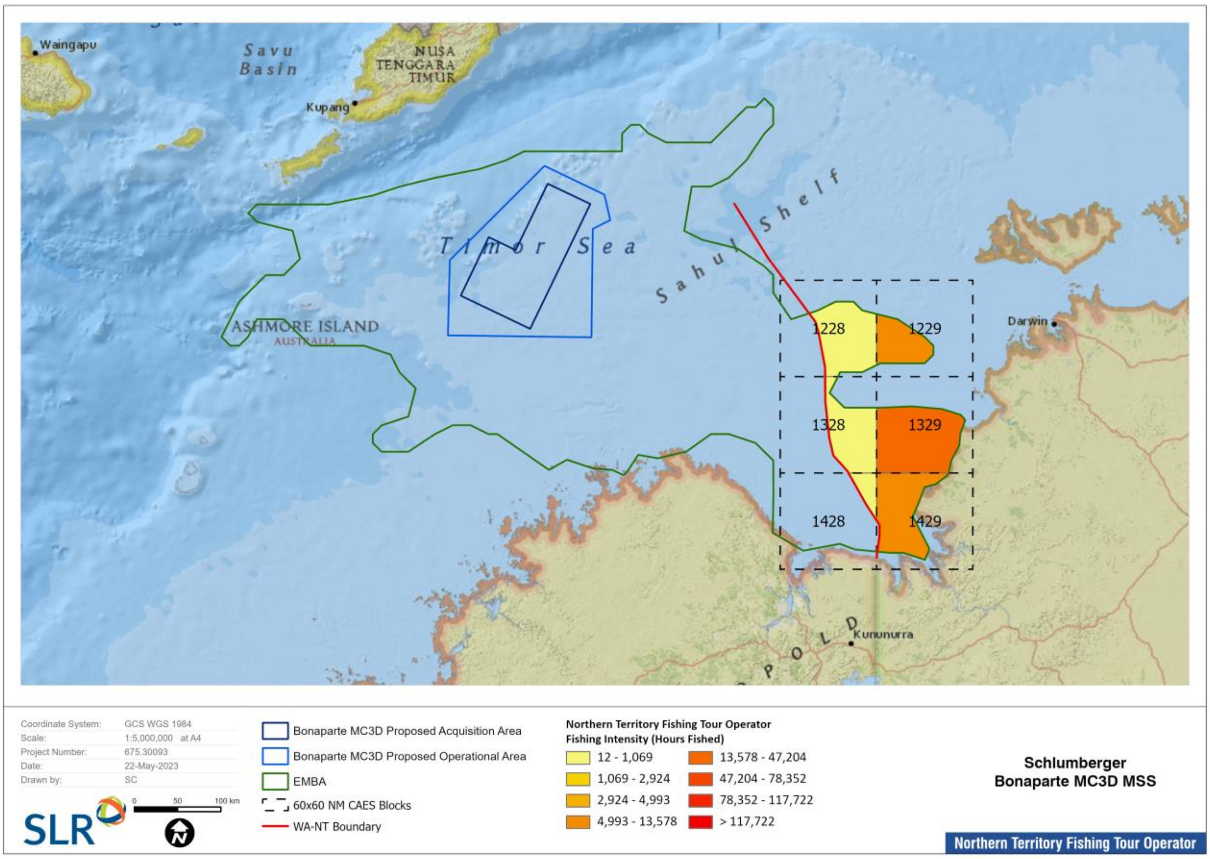

Figure 3 : Northern Territory Fishing Tour Operator within the EMBA (2015 – 2020)

Modern seismic vessels mitigate the risk of fuel spills via physical design features such as double hull configuration and having multiple fuel tanks of reduced size instead of one large fuel tank. The vessel that will be contracted for this project will have these features and has worked in Australian waters previously.

The seismic vessel provider has safety procedures in place and documented actions to take if an incident were to occur. As a subcontractor of SLB, the vessel provider also has to comply with SLB's rigorous QHSE standards and commitments made within the Environment Plan which forms part of the regulatory approval process. At least one support vessel will work alongside the seismic vessel during the survey and will assist in communicating with other vessels that may have entered the area of operations to support safe navigation.

In the highly unlikely event of a spill, SLB will notify the Northern Territory Department of Industry, Tourism and Trade as soon as reasonably practicable. In addition, a compensation mechanism will be in place to address loss or damage to fishing gear as a direct result of the survey.

COMMUNICATION COMMITMENTS

Schlumberger is committed to maintaining regular communication with all relevant stakeholders (i.e. commercial fishers/licence holders, including fishing tour operators/license holders) throughout the duration of the survey.

Due to the nature of seismic survey operations, the timing and location of the activity are prone to minor changes. To ensure clarity, Schlumberger commits to notifying commercial fishers of survey schedule, finalized survey location and vessel details as they are confirmed prior to survey commencement. This will be supported with the supply of 48-hour operational detail lookahead plans which will be supplied each day and detail the location plan for the survey vessels for the upcoming 2 days, this notification will be provided to all relevant and affected stakeholders during operations. If you wish to receive these notifications, or specific information regarding this survey, please let me know at the contact details provided below.

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Control measures that will be implemented to minimise impact on commercial fishers include: provision of 48 hour look-aheads (distributed every 24 hours) and ongoing engagement, notice to mariners will be issued, markings (lights/radar reflector) on tail buoys so the extent of the gear can be determined, and support vessels will be present throughout the survey to support communications with any fishers in the area where the vessel may be heading. In addition, a compensation mechanism will be in place to address loss or damage to fishing gear as a direct result of the survey.

YOUR FEEDBACK

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Finally, please note that you may also request any information provided during consultation not be published within the EP.

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Email: environment@slb.com

Bonaparte Basin Marine Seismic Survey

SLB proposes to undertake a three-dimensional (3D) marine seismic survey in Bonaparte Basin, in Commonwealth waters adjacent to Western Australia (WA). The operational area is 25,827 km^2 located 300 km northwest of Port Warrender (Western Australia), 260 km northwest of Ashmore Island (Western Australia). Water depths in the survey area are in the range of 100m (Figure 1). Planned seismic acquisition activity within this operational area will cover approximately 9,000 km^2 – details of extent and position of survey lines are currently being finalised.

Coordinates for the Operational Area are outlined in Table 1. In developing the Operational Area, a 15 km buffer has been applied around the proposed survey area in most cases.

The Bonaparte MC3D MSS may commence as early as December 2023 and will be completed before 30 June 2024. Up to a maximum of 10,000 km^2 may be acquired per calendar year between 2022 and 2024. It is estimated to take approximately 120 days to acquire 9,000 km^2 (including contingency time for potential vessel or equipment down time and adverse weather conditions). The precise timing of the survey is subject to NOPSEMA's acceptance of the environment plan (EP), weather conditions, vessel availability and other operational considerations, and will take into account the seasonality of environmental sensitivities, where practicable.

PROPOSED ACTIVITY

Offshore seismic surveying is used to improve the understanding of subsurface geology in marine environments.

During 3D marine surveys, seismic data is acquired using a purpose-built seismic survey vessel towing an acoustic source array and a multi cable hydrophone array, also known as a streamer array. Streamers are towed with a tail buoy, radar reflectors and lights to mark the end of the array. The streamers will be up to 8 km long to adequately record the necessary information.

Both the source and streamers are towed beneath the surface, (Figure 2). Acoustic energy from the source array is detected by the streamer array and recorded onboard the vessel. The recorded signals are then processed to provide information about geological formations below the seabed.

When recording the data, the seismic vessel traverses the survey area along a series of predetermined sail lines at a speed of approximately 4-5 knots (7-9 km/h). The level of acoustic emissions can be adjusted to provide low-power 'soft start' or 'fauna alert' procedures, at any point during the survey or maintenance operations.

To minimise survey duration, geophysical data will be acquired 24 hours a day. Each 3D pass (swath) is about 140 kilometres long and will take approximately 32 hours to complete. Data for a pre-determined swath only needs to be acquired once, and the survey vessel will not need to collect data in that area again.

A support vessel will work with the seismic vessel to assist in communicating with other vessels that have entered the area of operations and to support the overall operations, such as providing food and supplies.

There is ongoing extensive planning for the proposed survey through the EP development, with feedback being incorporated to minimize potential for disturbance to the surrounding environment. All efforts will be made to ensure the survey's primary objectives can be achieved safely and efficiently, whilst avoiding peak fishing activity in the area.

COMMUNICATION COMMITMENTS

SLB is committed to maintaining regular communication with all relevant stakeholders throughout the duration of the survey and works with communities in a transparent manner.

As part of this continuous consultation, SLB invites feedback on the proposed activities. Details of all consultation received will be provided to the National Offshore Petroleum Safety and Environment Management Authority (NOPSEMA) in accordance with EP procedures.

Due to the nature of seismic survey operations, the timing and location of the activity are prone to minor changes. To ensure clarity, SLB commits to notifying stakeholders of survey schedule, finalized survey location and vessel details as they are confirmed. This will be supported with the supply of 48-hour operational detail lookahead plans, with notification being provided to relevant stakeholders during operations. If you wish to receive these notifications, or specific information regarding this survey, please advise in response to this package as soon as possible.

Following submission of the EP to NOPSEMA, stakeholder engagement will continue throughout the EP review period and survey acquisition to ensure everyone is kept informed and to minimise potential for disruption to any ongoing activities in the area.

ENVIRONMENTAL PERFORMANCE

SLB is committed to working with all interested parties to ensure risks are identified and reduced to as low as reasonably practicable before activities begin. Latest technology in underwater sound transmission modelling will be used to understand emitted sound levels for the survey across the operational area. This will include detailed impact assessments and the adoption of appropriate mitigation measures that will be documented in the EP.

Early analysis of Flora and Fauna sensitivities in the Operational area have been undertaken and has enabled the proposed survey to incorporate mitigations as a result of the potential environmental concerns and sensitivities. Blue whales, whale sharks and turtles in particular have been identified in the early analysis as being some of the key sensitivities in the area and the EP will focus on these species to minimise disturbance as a result of the seismic activities.

There will be two dedicated Marine Mammal Observers (MMOs) onboard who will monitor precaution zones, observation zones, and low power zones during daylight hours in accordance with the Environment Protection and Biodiversity Conservation Act. There will also be Passive Acoustic Monitoring (PAM) 24 hours a day to monitor for whales in the vicinity of the survey vessel. Mitigation measures will be implemented to minimize any potential for disturbance to whales during the survey.

NOPSEMA reviews each project-specific EP in accordance with the requirements of the Offshore Petroleum Greenhouse Gas (Environment) Regulations 2009 before any approvals to the proposed seismic survey can be made.

SLB has a reputation for implementing high standards of environmental protection in environmentally sensitive areas to mitigate and minimise impacts on the surrounding marine environment and stakeholders and will implement these procedures for the duration of this proposed survey.

YOUR FEEDBACK

As indicated above, SLB is seeking feedback regarding this proposed activity before making a formal submission to NOPSEMA. The proposed survey is subject to Commonwealth Government regulatory approval and any feedback will be communicated to NOPSEMA, as required under Commonwealth legislation. We intend to lodge the EP to NOPSEMA shortly so please get in touch if you have any questions or comments.

SLB intends to keep all stakeholders fully informed during the course of project planning and execution. However, if you would like to comment on the survey or would like additional information based on this preliminary factsheet please contact us as soon as possible. If you would like to meet with us to discuss the survey further or raise any concerns you have in relation to your activities in the area, please get in touch with me at the contact details below.

Best regards,
Kevin Moran

SLB Australia Pty Ltd:
Level 5, 10 Telethon Avenue
Perth WA, 6000(08) 9420 4800
Email: environment@slb.com

Schlumberger

Figure 1: Location map of operational area

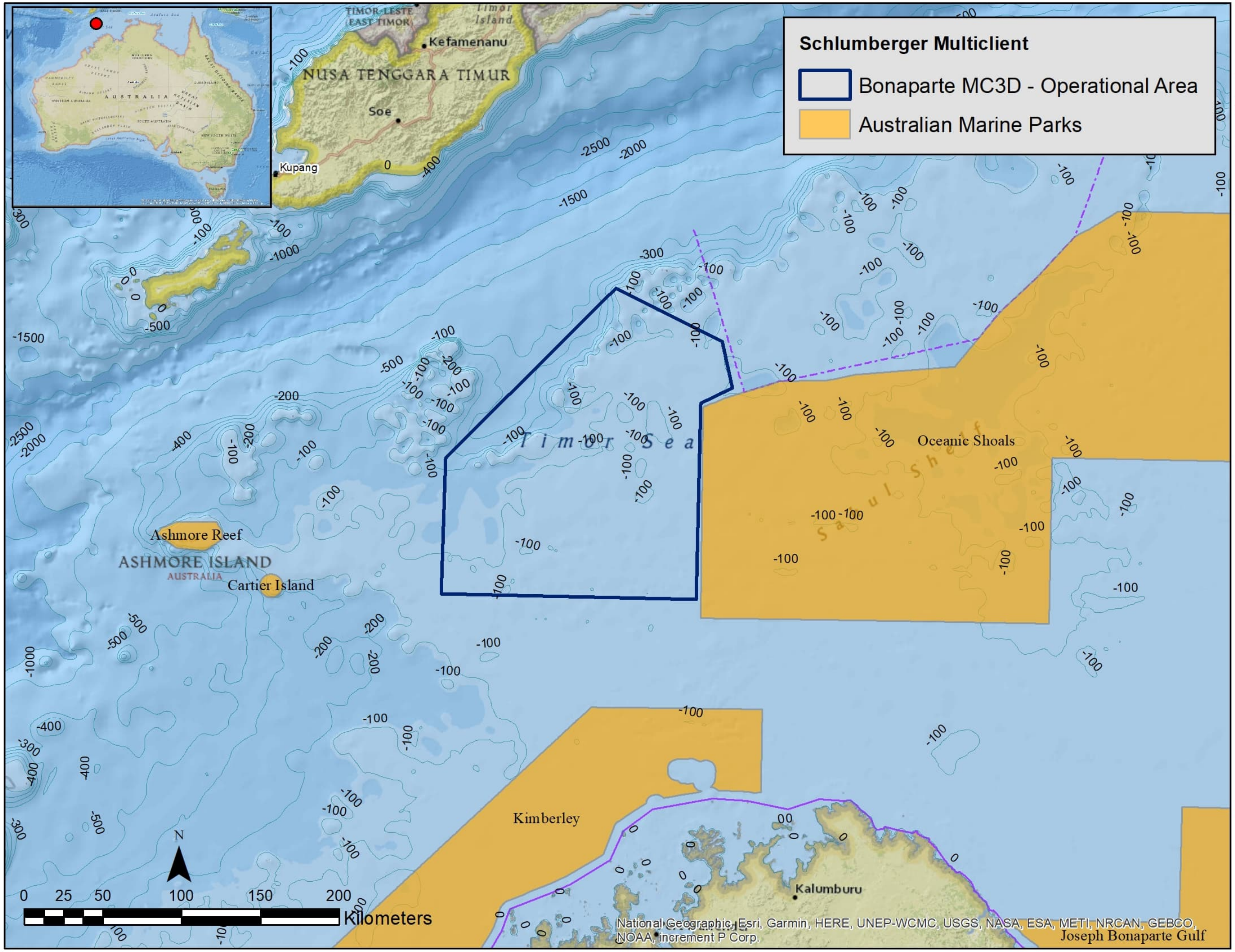
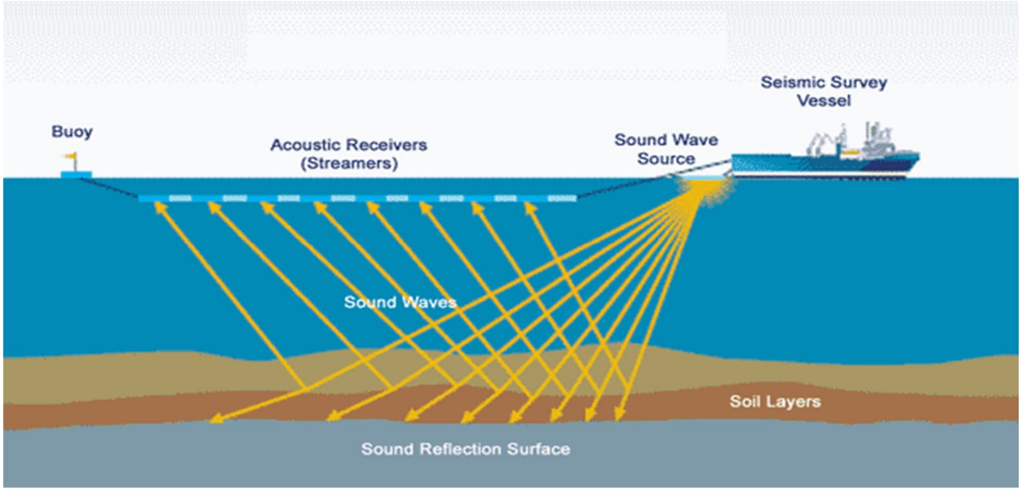


Table 1: Coordinates of the Operational Area (UTM Zone 51S)

S No	X	Y
1	668353.2981	8609707.23
2	670973.134	8696076.658
3	714112.3176	8738881.308
4	779108.1235	8803487.052
5	846839.3232	8769762.117
6	853120.6772	8740481.172
7	833166.8606	8730614.315
8	830319.4782	8606042.698
9	668353.2981	8609707.23

Figure 2: Schematic of typical Seismic geophysical survey



APPENDIX I

Relevant Persons Consultation Report

Relevant Persons Consultation Report

* To avoid unnecessary repetition in relation to the 'Reference to Location within EP' column, all unedited correspondence is provided within **Appendix E** and meeting minutes are provided in **Appendix G**, and the different versions of the Fact Sheet provided can be viewed in **Appendix G**.

** To avoid unnecessary repeition in relation to statements of fulfillment of consultation obligations with each relevant person, the following statement applies:

Consultation with this relevant person is considered to be fulfilled based on the consultation records listed.

This consultation has included numerous attempts to contact this relevant person over a consultation period extending from January 2022 to November 2023 (22 months), including what equated to a six-week period between 17 January 2022 and 28 Feberuary 2022. This period incorporates multiple occasions whereby information was provided to the relevant person, and responses requested within a two-week timeframe. Given the multiple occurrences, this resulted in an extended cumulative time period for relevant persons to respond or request further information, well beyond a stand-alone two-week period. It is worth noting that this two-week period is not a strict timeframe, if the relevant person requested additional time to consider the information for the purpose of assessing risks to their functions, activities or interests, or contacted SLB after this period ceased, consultation continued with the relevant person and any required additional time was provided.

The information provided to this relevant person has included information fact sheets with prompts for the relevant person to request further information if required, or to submit questions relating to the Seismic Survey. In addition, the entire EP was available to this relevant person during the public notification period to provide comments on. SLB has followed up with providing additional information if and when requested by relevant persons during the consultation period. This has included providing updates to the relevant person, even where no further response has been received since the last communication.

Based on this discussion, and the consultation records, it is considered that this relevant person has been provided a reasonable period of time and sufficient information to determine the potential impacts or risks to their functions, interests or activities from the Seismic Survey.

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
1	Indonesian Government	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		20/09/2022	Mail outgoing		Notification to Indonesia for the Schlumberger Bonaparte MC survey was sent	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Indonesian Government with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
2	National Offshore Petroleum Titles Administrator (**NOPTA**)	21/09/2022	Email incoming	Confirmation from the Offshore Resources Branch in Department of Industry, Science and Resources that the 3-month notification period for the Perth Treaty Area commenced yesterday		No objections or claims – no response/actions required.	* (see note above table).
		21/11/2022	Email outgoing		SLB has been trying to call NOPTA. SLB have a pathway ahead soon in order to work on a submission for access authority for areas south of the Perth treaty line so that they can commence the project without delay once SLB receive the EP	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					from NOPSEMA. SLB asked if NOPTA can have a call today.		
		22/12/2022	Email incoming	NOPTA contacted SLB that they received confirmation from DFAT, via the Offshore Resources Branch of DISR that no response was provided by the Indonesian Ministry of Foreign Affairs during the 3 months notification period for Bonaparte. NOPTA will await SLB's advice on progress towards acceptance of the EP.		No objections or claims – no response/actions required.	* (see note above table).
		07/03/2023	Email outgoing		SLR provided NOPTA with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
3	Department of Foreign Affairs and Trade (DFAT)	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		17/01/2022	Email incoming	Automated reply acknowledging email		No objections or claims – no response/actions required.	* (see note above table).
		08/02/2022	Email outgoing		Follow up Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided DFAT with the four week pre-survey notification.	N/A	* (see note above table).
		07/03/2023	Email incoming	**Response to email dated 07/03/2023** Automatic reply acknowledging receipt of email.		N/A	* (see note above table).
		31/08/2023	Email outgoing		SLB reached out to DFAT following advice from NOPSEMA. SLB informed DFAT that they are planning to conduct a MSS in Q4. SLB stated that recent developments in the EP preparation has directed them to seek to inform foreign RPs who may be affected, which would potentially include Indonesian fishers. SLB asked if DFAT could advise on how to best get early information to Indonesian authorities. SLB provided a map of the survey location and stated they have adaptive measures for real time interactions and information sheets translated into Bahasa. SLB stated that the	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					Indonesian government was contacted last year but no response was received.		
		31/08/2023	Email incoming	DFAT responded that they provide interational law advice to other parts of the Australian government and would only have a role in relation to matters like this if a part of the Australian government sought legal advice. DFAT have forwarded SLBs email to the Indonesian branch and someone will be in contact.		No objections or claims – no response/actions required.	* (see note above table).
		31/08/2023	Email outgoing		SLB thanked DFAT for the quick response and help in connecting SLB to the Indonesian branch.	N/A	* (see note above table).
		05/09/2023	Email outgoing		SLB thanked DFAT for the reply and for forwarding the email to the Indonesian Branch. SLB asked if it woud be possible for DFAT to provide a contact person to discuss this with directly as SLB has not yet received a response to the email.	N/A	* (see note above table).
		05/09/2023	Email incoming	DFAT responded that they have followed up with the Indonesia Branch and someone will be in contact.		No objections or claims – no response/actions required.	* (see note above table).
		05/09/2023	Email outgoing		SLB thanked DFAT and noted that SLB has received a reply from the Indonseia Political Section of the Indonesia Branch with whom SLB are hoping to progress discussions.	N/A	* (see note above table).
		05/09/2023	Email incoming	DFAT apologised for the delayed response. DFAT provided the email from NOPTA and stated they have had no prior involvement in this and are keen to understand DFAT's past involvement, but have nott been able yet to get further information from NOPTA. DFAT has provided the email and attachment to the Embassy in Jakarta to consider who the appropriate Indonesian authority would be.		No objections or claims – no response/actions required.	* (see note above table).
		07/09/2023	Email outgoing		SLB provided a copy of the actual project fact sheet translated into Bahasa which may help the Embassy in Jakarta in discussions with Indonesian authorities.	N/A	* (see note above table).
		15/09/2023	Email outgoing		SLB contacted DFAT asking if they had received any feedback from the Embassy in Jakarta with regard to finding the appropriate Indonesian authority to discuss the project with. SLB reached out to the Marine Affairs and Fisheries Ministry of Indonesia but have not received any reply and are unsure of what other avenues they can try.	N/A	* (see note above table).
		18/09/2023	Email incoming	DFAT apologised for the delay in responding. The Australian Embassy in Jakarta has obtained from the Indonseian Coordinating Ministry for Maritime Affairs and Investment the group email for their Directorate of Border Delimination which is the appropriate contact for SLB with regard to policy area. DFAT stated that with regard to Indonesian fishers, there is no complete registry of commercial fishers operating in Indonesia but provided a contact who may be able to help.		No objections or claims – SLB to follow up contact provided by DFAT	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
		18/09/2023	Email outgoing		SLB thanked DFAT for the contact details provided. SLB stated they will contact the Directorate of Border Delimniation and will also separately contact the Directorate of Surveillance of Marine and Fisheries Resources at the Ministry for Marine Affairs and Fisheries. SLB thanked DFAT again for their help.	N/A	* (see note above table).
		19/09/2023	Email outgoing		SLB contacted DFAT asking to check the email address provided for the Directorate of Surveillance of Marine and Fisheries Resources at the Ministry for Marine Affairs and Fisheries as it was returned as undeliverable.	N/A	* (see note above table).
		19/09/2023	Email incoming	DFAT provided corrected contact details.		N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
4	Department of Agriculture, Water and the Environment – Fisheries, Biosecurity & Marine Parks	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		01/02/2022	Email incoming	**Response to SLB email dated 17/01/2022** Requested an extension on the comment period		No objections or claims – no response/actions required.	* (see note above table).
		01/02/2022	Email outgoing		**Response email dated 01/02/2022** SLR confirmed that extension to submit comments is fine.	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
		15/02/2022	Email incoming	**Response to SLB email dated 01/02/2022** It was noted that the Operational Area (**OA**) is adjacent to the Oceanic Shoals Marine Park Multiple Use Zone (IUCN VI), which forms part of the North Network. The following objections/claims were raised in regard to the Seismic Survey: • Detailed consideration is given to the impacts upon flatback, loggerhead and olive ridley turtles that forage adjacent to the OA; • Detailed consideration is given to the impacts upon whale sharks that forage within the OA; • That Part B Additional Management Procedures are applied to areas which overlap the migration areas for pygmy blue whales; • Ensure that the Northern Land Council and Kimberley Land Council are consulted to protect cultural values; and • The EP addresses the impacts and risks on the ecological values of the Sahul Shelf, particularly on benthic communities and marine species that rely on this Key Ecological Feature. In addition to the above, it was requested that they be notified of any oil/gas pollution incidences.		Various objections/claims were raised regarding the Seismic Survey. SLB has substantiated each of these objections/claims utilising scientific literature detailing potential impacts and risks marine reptiles, marine mammals and the species that rely on the Sahul Shelf. The potential impacts and risks have subsequently been updated within the EP to manage them to ALARP and an Acceptable Level. Consultation has been undertaken with the Northern Land Council and Kimberley Land Council as detailed below (ID# 43 & 42 respectively)	* (see note above table). Impacts from acoustic disturbance on the Oceanic Shoals Marine Park has been outlined within **Section 7.2.2.5.1**. In addition, specific impacts on the matters identified have been discussed within: • **Sections 7.1.2.1**, **7.2.2.2.6** and **7.2.2.3.5** (Marine Reptiles); • **Sections 7.2.2.2.4 and 7.2.2.3.3**(Elasmobranchs); • **Sections 7.2.2.2.7, 7.2.2.3.6** and **7.2.2.4.2** (Marine Mammals); • **Section 7.2.2.5.3** (Key Ecological Features) In addition, consultation with the Kimberley Land Council and Northern Land Council is discussed within **Section 5.5**, and in relation to stakeholder ID 42 and 43 below. Provision for notification has been included within the notifications section (**Section 10.10.6.3.**) in the case of a hydrocarbon spill.
		11/03/2022	Email incoming	DAWE and JASCO Applied Sciences invited SLR to attend information briefing sessions regarding National Anthropogenic Underwater Noise Guidelines.		No objections or claims – no response/actions required.	* (see note above table).
		18/05/2022	Email outgoing		SLR provided fact sheet and invited DAWE to pass onto any others in the department who might be interested or it is of relevance to.	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
		07/03/2023	Email outgoing		SLR provided Department of Agriculture, Water and the Environment – Fisheries, Biosecurity & Marine Parks with the four week pre-survey notification.	N/A	* (see note above table).
		Also refer consultation records with Department of Agriculture, Fisheries and Forestry under ID 59. ** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
5	Department Infrastructure, Transport, Regional Development, Communications and the Arts	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided Department Infrastructure, Transport, Regional Development, Communications and the Arts with the four week pre-survey notification.	N/A	* (see note above table).
		07/03/2023	Email incoming	**Response to email dated 07/03/2023** Automated response that email will be directed to the appropriate area in the department.		N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
6	Australian Maritime Safety Authority (**AMSA**)	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		20/01/2022	Email incoming	**Response to SLB email dated 17/01/2022:** AMSA advised notifications to the Australian Hydrograph Office (**AHO**) and AMSA's Joint Rescue Coordination Centre will need to take place before the survey commences. AMSA reminded SLB of vessels obligations to comply with the International Regulations for Preventing Collisions at Sea 1972 (**COLREGs**), in particular around appropriate lights and shapes to reflect the nature of the operations. AMSA also provided links to their portal to download Automatic Identification System traffic data.		Although this feedback from AMSA was not specifically an objection or claim, SLB has taken onboard the notifications requested by AMSA and have included them within the EP. Adherence to the COLREGs has been included within the control measures and associated Environmental Performance Standards (**EPS**). AIS information on	* (see note above table). Pre-activity notifications are included within **Section 5.5.10**. Control measures (including adherence to COLREGs) are outlined within **Sections 7.1.5, 7.1.6** and associated EPS within **Section 7.1.7**.

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
						vessel traffic has been incorporated into the EP.	
		21/01/2022	Email outgoing		**Response to AMSA email dated 20/01/2022:** SLR advised that that the notifications will be incorporated into the EP and operational procedures and notifications will take place before the survey commences.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided AMSA with the four week pre-survey notification.	N/A	* (see note above table).
		13/03/2023	Email incoming	**Response to SLR pre-survey notification:** AMSA has noted survey plan and additional details provided and that publication of a Notice to Mariners has been mentioned. AMSA provided email contact for RCC Australia if SLB requires them to broadcast any other navigational warnings. AMSA would appreciate the names of vessels involved and any berthing prospects at an Australian port closer to the time. AMSA stated that if the vessels are foreign-flagged operating in Australia, they would fall under the Port State Control regime and may be subject to an inspection. AMSA requests that all parties involved are aware of relevant AMSA information including Marine Notice 15/2017 (transfer operations at sea and in coastal waters). AMSA have no further requirements aside from reminding SLB to ensure that all other relevant State (where applicable) and Commonwealth stakeholders are notified of SLBs activities.		N/A	* (see note above table).
		13/03/2023	Email outgoing		**Response to AMSA email dated 13/03/2023:** SLR thanked AMSA for the detailed response and further information which will be taken onboard as the survey gets closer to commencing.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		08/11/2023	Email incoming	AMSA responded stating that the initial advice provided on the project will continue to apply and requested SLB continue to provide updated to AMSA as the project progresses.		No objections or claims – no response/actions required.	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
7	Australian Hydrographic Office	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		18/01/2022	Email incoming	**Response to SLB email dated 17/01/2022:** AHO acknowledged receipt of the introductory email are advised that the data supplied will be registered, assessed, prioritised and validated in preparation for updating their Navigational Charting products.		No objections or claims – no response/actions required.	* (see note above table).
		18/01/2022	Email outgoing		**Response to AHO email dated 18/01/2022:** SLR thanked AHO for the response and advised that the survey would run for 4-5 months, and once completed there would be no further navigational restrictions as a result of the proposed activity, including nothing being left on the seafloor or within the water column.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided AHO with 4-week pre-survey notification for publication of Notice to Mariners	N/A	* (see note above table).
		08/03/2023	Email incoming	**Response to SLB email dated 07/03/2023:** AHO replied acknowledging the email had been received and the supplied data will be registered, assessed, prioritised and validated in preparation for updating Navigational Charting products.		No objections or claims – no response/actions required.	* (see note above table).
		08/03/2023	Email outgoing		**Response to AHO email dated 08/03/2023:** SLB thanked AHO for replying and registering notification. SLB will keep AHO informed close to the time if anything changes.	N/A	* (see note above table).
		13/04/2023	Email outgoing		SLR emailed AHO (at the direction of ACMA) with figures showing the extent of the operational area with respect to the location of submarine cables. SLR requested that, in reviewing the information, AHO consider if they have any functions, interests or activities that may be affected by the proposed activities. A factsheet was attached. ACMA suggested AHO may have information relating to domestic submarine cables which ACMA are not able to provide comment on. SLR requested AHO provide information on submarine cables or infrastructure within the operational area or EMBA if they have knowledge on additional areas.	N/A	* (see note above table).
		14/04/2023	Email incoming	**AHO response to email dated 13/04/2023:** AHO acknowledged above email and the data supplied will be registered, assessed, prioritised and validated in preparation for updating the Navigational Charts.		N/A	* (see note above table).
		18/04/2023	Email outgoing		SLR contacted AHO following up on the email dated 13/04/2023 requesting contact at AHO follow up with the relevant team to ascertain whether there is any further information they may require or which they can supply.	N/A	* (see note above table).
		19/04/2023	Email incoming	Internal email between AHO to get clarification on the question asked in email to AHO dated 13/04/2023.		N/A	* (see note above table).
		01/05/2023	Email outgoing		SLR contacted AHO requested they provide a status update on the team's review of the information pertaining to the Bonaparte Survey.	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					SLR requested AHO advise if they require any other information or if they are satisfied with the information provided.		
		02/05/2023	Email incoming	**Response to SLR email dated 01/05/2023:** AHO advised they have reached out again to the team that manages this information and has spoken with them this morning. The person spoken with will check where the reply is up to and will make sure any relevant information is sent through.		N/A	* (see note above table).
		02/05/2023	Email incoming	**Response to SLR email dated 18/04/2023:** AHO replied apologising for the delay. Cables shown on AHOs charts and in the diagram provided to AHO are the only cables AHO is aware of.		N/A	* (see note above table).
		02/05/2023	Email outgoing		**Response to AHO email dated 02/05/2023:** SLR thanked AHO for the response and confirmation of the cables through the Bonaparte Basin. Based on that information and the assessment undertaken, SLR does not foresee any impact from the survey on any cable corridor areas.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		06/11/2023	Email incoming	AHO thanked SLB for the update and look forward to further details as the activity is confirmed.		N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
8	GeoScience Australia	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		17/01/2022	Email incoming	**Response to SLB email dated 17/01/2022** Automated reply acknowledging email		No objections or claims – no response/actions required.	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided GeoScience Australia with the four week pre-survey notification.	N/A	* (see note above table).
		07/03/2023	Email incoming	**Response to SLR email dated 07/03/2023** Automated response confirming receipt of email. Email will be registered and assigned to the appropriate area for action.		N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
9	Parks Australia (**PA**) and the Director of National Parks (**DNP**)	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		01/02/2022	Email incoming	**Response to SLB email dated 17/01/2022** PA/DNP seeking an extension on the comment period		No objections or claims – no response/actions required.	* (see note above table).
		01/02/2022	Email outgoing		**Response to PA/DNP email dated 01/02/2022** SLR confirmed that an extension to submit comments is fine.	N/A	* (see note above table).
		15/02/2022	Email incoming	**Response to SLB email dated 01/02/2022** PA noted that the Operational Area (**OA**) is adjacent to the Oceanic Shoals Marine Park Multiple Use Zone (IUCN VI), which forms part of the North Network – therefore, there are no authorisation requirements from the DMP. However, given the proximity, the Seismic Survey could impact upon the values of the marine park. AP made the following objections/claims in regard to the Seismic Survey: • Detailed consideration is given to the impacts upon flatback, loggerhead and olive ridley turtles that forage adjacent to the OA; • Detailed consideration is given to the impacts upon whale sharks that forage within the OA; • That Part B Additional Management Procedures are applied to areas which overlap the migration areas for pygmy blue whales; • Ensure that the Northern Land Council and Kimberley Land Council are consulted to protect cultural values; and • The EP addresses the impacts and risks on the ecological values of the Sahul Shelf, particularly on benthic communities and marine species that rely on this Key Ecological Feature. In addition to the above, PA/DNP requested that they be notified of any oil/gas pollution incidences which may impact on the marine park.		PA raised various objections/claims regarding the Seismic Survey. SLB has substantiated each of the objections/claims utilising scientific literature detailing potential impacts and risks marine reptiles, sharks, marine mammals and the species that rely on the Sahul Shelf. The potential impacts and risks have subsequently been updated within the EP to manage them to ALARP and an Acceptable Level. Temporal and spatial mitigations will be implemented, along with observers of marine mammals and marine fauna and consider that the control measures to be implemented will mitigate any risk to the sensitive receptors.	* (see note above table). Impacts from acoustic disturbance on the Oceanic Shoals Marine Park have been outlined within **Section 7.2.2.5.1**. In addition, specific impacts on the matters identified by PA have been discussed within: • **Sections 7.1.2.2**, **7.2.2.2.6** and **7.2.2.3.5** (Marine Reptiles); • **Sections 7.2.2.2.4** and **7.2.2.3.3** (Elasmobranchs); • **Sections 7.1.2.3, 7.2.2.2.7, 7.2.2.3.6 and 7.2.2.4.2** (Marine Mammals); • **Section 7.2.2.5.3** (Key Ecological Features)

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
						PA/DNP have been included in the notification list if any oil/gas pollution incidents occur (**Section 10.9.5.3**).	In addition, consultation with the Kimberley Land Council and Northern Land Council is discussed within **Section 5.5**, and in relation to stakeholder ID 42 and 43 below. The DNP has been included within the notifications section (**Section 10.10.6.3**) in the case of a hydrocarbon spill.
		22/02/2022	Email outgoing		**Response to PA/DNP email dated 15/02/2022** SLR acknowledged the objections/claims listed and thanked PA for reply and that those issues raised would be incorporated into the EP.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided PA/DNP the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		08/11/2023	Email incoming	PA thanked SLB for the update. PA asked SLB confirm that the EP accounts for the potential impacts upon the values of the Oceanic Shoals Marine Park and to assue the timing of species migration and presence is factored into risk assessments and subsequent mitigation measures given the changes to survey timing. PA provided a summary of the objections and cliased raised on 15 February 2022.		Relevant person has raised objections/claims or requested further information. Concerns/claims have been addressed within the EP.	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
10	The Director of National Parks	See stakeholder 9 above.					
11	Australian Institute of Marine Science	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided Australian Institute of Marine Science with the four week pre-survey notification.	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
12	WA Marine Science Institution	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the WA Marine Science Institution with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
13	WA Department of Parks and Wildlife	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		17/01/2022	Email incoming	**Response to SLB email dated 17/01/2022** Automated reply acknowledging email		No objections or claims – no response/actions required.	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email incoming	**Response to SLB email dated 08/02/2022** Department of Parks and Wildlife responded and have forwarded the email to the Department of Biodiversity, Conservation and Attractions as they		No objections rf claims – no response/actions required.	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
				manage the conservation estate on behalf of the Commission.			
		08/02/2022	Email outgoing		**Response to Department of Parks and Wildlife email dated 08/02/2022** SLR asked for contact details should the Department of Biodiversity, Conservation and Attractions not respond.	N/A	* (see note above table).
		08/02/2022	Email incoming	**Response to SLB email dated 08/02/2022** Department of Parks and Wildlife advised that the Department of Biodiversity, Conservation and Attractions will not need to provide comment due to the location.		No objections or claims – no response/actions required.	* (see note above table).
		08/02/2022	Email outgoing		**Response to Department of Parks and Wildlife email dated 08/02/2022** SLR asked if Department of Parks and Wildlife wanted to stop receiving notifications of the survey.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Department of Parks and Wildlife with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
14	WA Department of Mines, Industry Regulation and Safety (**DMIRS**)	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		25/02/2022	Email incoming	**Response to SLB email dated 08/02/2022** DMIRS reviewed the information and does not require anything further at this stage. However, DMIRS wishes to be included in the pre-start notifications and cessation notifications, and that the EP includes information on reporting environmental incidents that could potentially impact any land or water in State jurisdiction.		SLB has taken onboard the notifications and reporting requirements requested by DMIRS and has included them within the EP	* (see note above table). Pre-activity notifications are included within **Section 5.5.10**, and post-activity notifications are included within **Section 5.5.11**, which have both included DMIRS Notification to DMIRS has been included within **Section 10.6.3.1**

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
							in relation to environmental incidents.
		28/02/2022	Email outgoing		**Response to DMIRS email dated 25/02/2022** SLR confirmed the two requirements regarding notification and reporting to be included within the EP.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided DMIRS with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
15	WA Department of Transport	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the WA Department of Transport with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
16	Kimberly Port Authority; Port of Wyndham	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Kimberley Port Authority/Port of Wyndham with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
17	Conservation Council of Western Australia	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Conservation Council of Western Australia with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
18	Centre for Whale Research	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).

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		07/03/2023	Email outgoing		SLR provided the Centre for Whale Research with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
19	The Wilderness Society	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Wilderness Society with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
20	Australian Fisheries Management Authority	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Australian Fisheries Management Authority with the four week pre-survey notification.	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
		08/09/2023	Email outgoing		SLB emailed AFMA following recent advice by NOPSEMA. A worst case diesel fuel spill shows that it could affect the MOU Box area and potentially Indonesian fishermen. Recent developments in EP preparation have directed SLB to seek to inform foreign RPs which would potentially include Indonesian fishermen who may be present in the MOU Box area. SLB seeks AFMAs advice on how to best get early information to Indonesian authorities to help connect to fishermen in the area.	N/A	* (see note above table).
		13/09/2023	Email incoming	AFMA responded that they have checked with the relevant people at AFMA and are advised that the MOU box may have several traditional and illegal foreign fishers operating at any given time. AFMA do not have contact details and it may be that the only way forward is to contact stakeholders through some direct work in-country. AFMA cc'd the northern compliance team which may be able to assist with suggested areas to focus on.		N/A	* (see note above table).
		13/09/2023	Email outgoing		SLB emailed AFMA thanking them for their advice. SLB stated they have a business unit in Jakarta which can hopefully be used as in country approach. SLB stated they would appreciate AFMA connecting them to their Northern Compliance team.	N/A	* (see note above table).
		21/09/2023	Email outgoing		SLB stated they have been unable to receive a response from the Indonesian authories via the contacts provided by DFAT and would like to contact stakeholders directly. SLB asked if AFMA could provide advice as to areas where SLB could narrow down their focus.	N/A	* (see note above table).
		21/09/2023	Email incoming	AFMA stated that historically Indonesian fishers known to access the MOU box are known to come from throughout East Nusa Tenggara, Sulawesi, and East Jave but that fishers from all over the region are known to stop in Papela prior to accessing the MOU Box. AFMA suggested the most effective approach would be to focus education in Papela then to include Ba'a as the biggest town and Kupang. Tenau fisheries port would also be a good place.		No objections or claims – however, AFMA provided guidance for consultation with Indonesian fishers	* (see note above table).
		21/09/2023	Email outgoing		SLB thanked AFMA for the reply and guidance.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuisition extent, nothing has changed in terms of the survey	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
21	Commonwealth Fisheries Association (**CFA**)	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email incoming	**Response to SLB email dated 08/02/2022** CFA confirming that they will leave this with relevant commercial fishers based in WA.		No objections or claims – however, consultation with relevant commercial fishers is being undertaken.	* (see note above table).
		08/02/2022	Email outgoing		**Response to CFA email dated 08/02/2022** SLR confirmed that the relevant commercial fishers are being consulted with.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the CFA with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken with the CFA can be found in Section 5.5.6.2 of the EP.					
22	Department of Primary Industries and Regional Development (**DPIRD**)	24/02/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2032	Email outgoing		SLR provided DPIRD with the four week pre-survey notification.	N/A	* (see note above table).
		08/03/2023	Email incoming	**Response to SLR email dated 07/03/2023:** DPRID acknowledged receipt of email.		No objections or claims.	* (see note above table).
		08/03/2023	Email incoming	Email between DPIRD that the notification is a FYI email.		No objections or claims.	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
		08/03/2023	Email incoming	**Response to SLR email dated 07/03/2023** DPIRD emailed to request attachments referred to in email dated 07/03/2023 to be sent again as they were not received.		No objections or claims to be assessed in EP, however, attachments resent.	* (see note above table).
		08/03/2023	Email outgoing		**Response to DPIRD email dated 08/03/2023:** SLR resent four-week notification attachments.	N/A	* (see note above table).
		08/03/2023	Email incoming	**Response to SLR email dated 08/03/2023:** DPIRD thanked SLR for resending attachments.		N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
23	Western Australia Department of Fisheries	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Western Australia Department of Fisheries with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
24	Australian Fisheries Management Authority - Northern Prawn Fishery (**NPF**)	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		18/01/2022	Email incoming	**Response to SLB email dated 17/01/2022** NPF advised that the Seismic Survey sits outside the area of the Northern Prawn and North West Slope Trawl Fisheries. Suggested that Northern Prawn Industry Association is contacted. They advised that they had also forwarded the email and fact sheet through to the Western Skipjack and Western Tuna and Billfish Fisheries.		No objections or claims – however, it is noted that consultation with relevant commercial fishers is also being undertaken by SLB.	* (see note above table).
		18/01/2022	Email outgoing		**Response to NPF email dated 18/01/2022** SLR thanked them for their email and also passing on the fact sheet. For future engagement purposes and keeping them up to date, SLR requested contact details for Western Skipjack and Western Tuna and Billfish Fisheries	N/A	* (see note above table).
		18/01/2022	Email incoming	**Response to SLB email dated 18/01/2022** NPF provided contact details for the Western Skipjack and Western Tuna and Billfish Fisheries		No objections or claims – no response/actions required.	* (see note above table).
		19/01/2022	Email outgoing		**Response to NPF email dated 18/01/2022** SLR thanked NPF for providing the contact details.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the NPF with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
25	Australian Fisheries Management Authority - North West Slope Trawl Fishery	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		18/01/2022	Email incoming	Response to SLB email dated 18/01/2022. Confirmation that the survey area sits outside the Northern Prawn and North West Slope Trawl Fisheries.	An email and fact sheet were sent to the northern prawn industry association.	No objections or claims – no response/actions required.	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
				A suggestion to contact the northern prawn industry association and contact details were provided. The email and information sheet were also forwarded on to the Western Skipjack, Western Tuna and Billfish fisheries that overlap with the area.			
		18/01/202	Email outgoing		Email and information sheet were sent to the northern prawn industry association and confirmed with AFMA. A request was made for the contact details of the pelagic fisheries that the information sheet was requested so that the stakeholder engagement register could be updated.	N/A	* (see note above table).
		18/01/2022	Email incoming	Response to SLB email dated 18/01/2022 Provision of contact details within AFMA for the Western Skipjack, Western Tuna and Billfish fisheries that overlap with the area.	An email and fact sheet were sent to the Western Skipjack, Western Tuna and Billfish fisheries divisions within AFMA to inform them of the survey and provide additional details.	No objections or claims – no response/actions required.	* (see note above table).
		19/01/2023	Email outgoing		Thank you for providing contact details.	N/A	* (see note above table).
		08/02/2023	Email outgoing		Follow up email with factsheet provided again for reference and containing further details. SLB are committed to working with all stakeholders and any further questions or comments are welcomed with a request of these in before 28 February 2023.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Australian Fisheries Management Authority - North West Slope Trawl Fishery with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken with the NWSTF licence holders can be found in Section 5.5.6.6 of the EP.					
26	Australian Fisheries Management Authority - Western Tuna and Billfish Fishery	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
		07/03/2023	Email outgoing		SLR provided the Australian Fisheries Management Authority - North West Slope Trawl Fishery with the four week pre-survey notification.	N/A	* (see note above table).
		07/03/2023	Email incoming	Automatic reply. Contact is on long term leave, returning in August 2023. Contact for the Tuna and International team provided.		New contact added to register.	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken with the WTBF licence holders can be found in Section 5.5.6.8 of the EP.					
27	Australian Fisheries Management Authority - Southern Bluefin Tuna	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Australian Fisheries Management Authority - Southern Bluefin Tuna with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person					
28	Mackerel Managed Fishery – within AFMA and to all license holders	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		22/04/2022	Letter outgoing (from SLR Perth office)		Following engagement with WAFIC, SLB requested contact details of all licence holders in the mackerel managed fishery. Only postage details were provided, and despite a number of attempts, no electronic contact details or phone numbers of the licence holders could be identified. As a result, a letter was sent to various licence holders including the Fact Sheet providing them with details of the survey and a request to get either electronic or phone contact details to undertake further discussion over the proposed survey. It is considered that sufficient information was provided to the licence holders to make an informed decision of any potential impacts of the survey on their activities. It is also considered that there has been sufficient time since that letter for the licence holders to consider the proposed Seismic Survey and get back to SLB if they have any concerns over the survey or organise further engagement. As a result, it is concluded that the mackerel managed fishery licence holders do not consider the proposed Seismic Survey will impact their fishing activities.	N/A	* (see note above table).
		5/09/2022	Letter outgoing (from SLR Perth office)		Following the 30 day public notification period of the EP, no submissions were received from any licence holders regarding any impact on fishing activities. In addition, there have still been no responses or feedback received from any licence holders from the initial mail out in April 2022. A second round of letters was sent to licence holders along with the Bonaparte information sheet. The cover letter provided an overview of the Seismic Survey and asked if the licence holders could please provide either email or phone details so further discussion could take place to discuss the Seismic Survey. It is considered that sufficient information was provided to the licence holders to make an informed decision of any potential impacts of the survey on their activities. It is also considered that there has been sufficient time since that letter for the licence holders to consider the proposed Seismic Survey and get back to SLB if they have any concerns over the survey or organise further engagement. Given there has been no response from any licence holders within the Mackerel Managed Fishery, it is considered that licence holders don't have any concerns over	No objections or claims – no response/actions required.	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					their fishing activities as a result of the proposed Seismic Survey.		
		14/09/2022	Email outgoing		Information was emailed to 17 licence holders by WAFIC. SLB provided WAFIC with a revised information sheet, which also included an excel spreadsheet with the GPS coordinates of the Operational Area boundary. WAFIC requested that any comments or feedback had to be provided within two weeks.	No objections or claims – no response/actions required.	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken with the MMF can be found in Section 5.5.6.11 of the EP.					

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
29	Northern Demersal Scalefish Managed Fishery (NDSF) – Within AFMA and to all license holders	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		22/04/2022	Letter outgoing (from SLR Perth office)		Following engagement with WAFIC, SLB requested contact details of all licence holders in the Northern Demersal Scalefish Managed Fishery. Only postage details were provided, and despite a number of attempts, no electronic contact details or phone numbers of the licence holders could be identified. As a result, a letter was sent to various licence holders including the Fact Sheet providing them with details of the survey and a request to get either electronic or phone contact details to undertake further discussion over the proposed survey. It is considered that sufficient information was provided to the licence holders to make an informed decision of any potential impacts of the survey on their activities. It is also considered that there has been sufficient time since that letter for the licence holders to consider the proposed Seismic Survey and get back to SLB if they have any concerns over the survey or organise further engagement. As a result, it is concluded that the Northern Demersal Scalefish Managed Fishery licence holders do not consider the proposed Seismic Survey will impact their fishing activities.	N/A	* (see note above table).
		5/09/2022	Letter outgoing (from SLR Perth office)		Following the 30 day public notification period of the EP, no submissions were received from any licence holders regarding any impact on fishing activities. In addition, there have still been no responses or feedback received from any licence holders from the initial mail out in April 2022. A second round of letters was sent to licence holders along with the Bonaparte information sheet. The cover letter provided an overview of the Seismic Survey and asked if the licence holders could please provide either email or phone details so further discussion could take place to discuss the Seismic Survey. It is considered that sufficient information was provided to the licence holders to make an informed decision of any potential impacts of the survey on their activities. It is also considered that there has been sufficient time since that letter for the licence holders to consider the proposed Seismic Survey and get back to SLB if they have any concerns over the survey or organise further engagement. Given there has	No objections or claims – no response/actions required.	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					been no response from any licence holders within the Northern Demersal Scalefish Managed Fishery, it is considered that licence holders don't have any concerns over their fishing activities as a result of the proposed Seismic Survey.		
		14/09/2022	Email outgoing		Information was emailed to 17 licence holders by WAFIC. SLB provided WAFIC with a revised information sheet, which also included an excel spreadsheet with the GPS coordinates of the Operational Area boundary. WAFIC requested that any comments or feedback had to be provided within two weeks.	No objections or claims – no response/actions required.	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the NDSF with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken with the NDSF can be found in Section 5.5.6.10 of the EP.					
30	Marine Aquarium Fishery license holders	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Marine Aquarium Fishery license holders with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
31	Specimen Shell Managed Fishery license holders	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Specimen Shell Managed Fishery license holders with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
32	Kimberley Prawn Fishery license holders	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Kimberley Prawn Fishery license holders with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					allow more time if requested. SLB provided the factsheet.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
33	Western Australian Fishing Industry Council (**WAFIC**)	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Further follow up to different WAFIC email address	N/A	* (see note above table).
		08/02/2022	Email incoming	**Response to SLB email dated 08/02/2022** WAFIC confirmed they had received the email and will review and provide a response before 28 February 2022.		No objections or claims – no response/actions required.	* (see note above table).
		08/02/2022	Email outgoing		**Response to WAFIC email dated 08/02/2022** SLR confirmed that key contact for SLR is available by email for any further follow up questions, or by phone after 21 February. Confirmed that it would be great to receive any feedback on the proposed survey and are available for a teams call after the 21st of February.	N/A	* (see note above table).
		11/02/2022	Email incoming	**Response to SLB email dated 08/02/2022** WAFIC requested information on the gun array volume and also requested more info around peak fishing and spawning times.		No objections or claims – the further information that was requested was provided, and a commitment was made to provide the information when it became available.	* (see note above table).
		22/02/2022	Email outgoing		**Response to WAFIC email dated 11/02/2022** SLR advised the source volume is 3,000 in^3. Also advised that SLR are currently still preparing the EP and that a request has been submitted on fisheries information in the area. Until then we cannot comment but will do so once the fishing effort data is received. Confirmed that there is no overlap with the southern bluefin fishery and also asked if there is any particular fishery they are concerned with to please let us now. Commitment to provide the information once it was received and meet either virtually or face to face to discuss.	N/A	* (see note above table).
		03/03/2022	Email incoming	**Response to SLB email dated 22/02/2022** Confirmed receipt of email and information and stated that they will wait for the additional information. Confirmed that a meeting can be arranged, if required.		No objections or claims – further fisheries information to be provided once received.	* (see note above table).
		08/03/2022	Email outgoing		**Response to WAFIC email dated 03/03/2022** SLR confirmed that there have been data requests for the fisheries information within and around the proposed survey area. It was advised that there will be no data available until end of March 2022; however, if WAFIC has any specific concerns	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					regarding the proposed survey area or any relevant fisheries to let us know.		
		17/03/2022	Email outgoing		**Response to WAFIC email dated 03/03/2022** SLR provided a summary of the Northern Demersal Scalefish managed fishery and the mackerel managed fishery based on what the fisheries assessment had provided. The information provided included a summary of what fish are being targeted. What areas they are fishing in relation to the survey area, the overlap with the survey area, volume (weight of fish caught within the area (inside vs outside operational area) and maps showing the fishing effort and fish caught within and surrounding the Operational Area. This was then used to determine any potential overlaps with commercial fishers. A request was made to WAFIC for the contact details of the relevant fishers so SLB can engage directly with the fishers and discuss details of the survey, survey timing and the ability to provide them with the 48-hour lookaheads once survey commences. Request for WAFIC to propose a time to meet and discuss the results.	N/A	* (see note above table).
		28/03/2022	Email outgoing		Follow up email to organise a time to meet and go through the results, as well as discuss any concerns that WAFIC may have following the provision of fisheries data.	N/A	* (see note above table).
		29/03/2022	Email incoming	**Response to SLB email dated 28/03/2022** Acknowledgment and thanks for passing on the fisheries information. WAFIC suggested a MS Teams meeting on 31 March to discuss the survey.	SLR and SLB were available on this data so accepted the meeting invite.	No objections or claims – meeting to be arranged.	* (see note above table).
		29/03/2022	Email outgoing		**Response to WAFIC email dated 29/03/2022** SLR organised a virtual meeting.	N/A	* (see note above table).
		31/03/2022	Meeting	Meeting between SLB, SLR and WAFIC. Key discussion points summarised below: • WAFIC mentioned they were starting to see stakeholder fatigue amongst fishers and a perception of escalated risk of cumulative impacts to fishers with multiple applications to consider. • Monthly catch data should be used to capture the seasonality component over the last five years. • Need to consider spawning season of commercially fish species with the survey timing, for example red emperor and gold band snapper spawn towards end of Q4 and start Q1. This makes it difficult to schedule considering the number of sensitivities to consider. Also must consider that some fish are site attached (e.g. red emperor) while other species are more mobile and will move away (e.g. gold band snapper). • Compensation protocol for commercial fishers, in particular the NERA Protocol and Operational Plan. • The Northern Demersal Scalefish fishers are most likely at risk of conflict with survey – there are approximately eight fishers in this fishery, although the mackerel fishery should also be consulted with. • WAFIC are working with APPEA to develop an engagement model between fishers and the oil and gas industry to ensure it is suitable for NOPSEMA requirements and effective for the fishers. • WAFIC suggested that SLB should reach out to DPIRD to get an extract from the register of all relevant licence holders in the overlapping fisheries.		No specific objections or claims to the Seismic Survey. However, the matters raised were discussed within the meeting with WAFIC and subsequent consultation (see below) addresses these matters.	* (see note above table).

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				• SLB and WAFIC to remain in contact and WAFIC to be updated throughout the next phase of the application and approval process. See meeting minutes for further details (**Appendix G**) on action items resulting from meeting.			
		31/03/2022	Email incoming	WAFIC provided additional information that may assist SLB to understand the commercial fisheries in the area. A status report of the fisheries and aquatic resources was even provided. A summary was also provided on the additional information that may assist in understanding commercial fisheries in the AOI. Contact details were provided for DPIRD where the contact details for individual commercial fishers in WA can be found.	SLB submitted a request for licence holders in the two fisheries identified as having a potential overlap with the Operational Area.	No objections or claims – the information that was provided by WAFIC was incorporated into the EP, and likewise, a request was made for the contact details of the relevant licence holders.	* (see note above table).
		31/03/2022	Email outgoing		**Response to WAFIC email dated 31/03/2022** Acknowledgement of the recent status report on fisheries. And following the meeting, SLR submitted a request for a finer scale in data, by month over the years to get an indication of seasonality of the fishery. SLR advised that WAFIC will be informed when the monthly fisheries data is obtained.	N/A	* (see note above table).
		11/04/2022	Email outgoing		SLB advised that they are reaching out to Department of Primary Industries and Regional Development and haven't had a response to form sent on 1 April.	N/A	* (see note above table).
		20/04/2022	Email outgoing		SLR advised WAFIC that a list of the licence holders has been received from DPIRD and these were also provided to WAFIC. It was confirmed that no contact details were available apart from PO Box's making direct contact with the licence holders difficult. It was questioned of WAFIC whether there was any other way to contact individual fishers so we can incorporate any concerns they may have and currently in the process of developing mitigation measures and operational procedures. It was also asked whether WAFIC had forwarded any information on the proposed survey or fact sheet on to any licence holders.	N/A	* (see note above table).
		26/04/2022	Email incoming	**Response to SLB email dated 20/04/2022** WAFIC confirmed that the issues around lack of contact details is an ongoing issue for others in the oil and gas industry. WAFIC also confirmed that they do not send out any oil and gas notifications to their members, only in certain circumstances. It was stated that WAFIC are working with APPEA and NOPSEMA to resolve this issue around contact details of licence holders, but there is no immediate solution other than posting the notifications to licence holders.		No objections or claims – no response/actions required. SLB to send out the fact sheet and a cover letter via post to PO Box addresses of licence holders.	* (see note above table).
		28/04/2022	Email outgoing		**Response to WAFIC email dated 26/04/2022**	N/A	* (see note above table).

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					SLR advised WAFIC that letters have been sent to fishers to their relevant PO Box. In addition, monthly fisheries data has been received and this information and map was provided showing the breakdown of fishing effort per month across the Operational Area and wider fishery management area for WAFICs records.		
		29/04/2022	Email incoming	**Response to SLB email dated 28/04/2022** WAFIC thanked SLB for information and to contact should SLB have any further questions.	No further questions were raised by WAFIC around the proposed Seismic Survey and any potential overlap with licence holders. There were also no further questions around compensation to fishers so it is assumed that this was not as much of a concern following the provision of the fisheries data and the identification of the small overlap with fisheries. Likewise, as SLB have reached out directly to licence holders about the survey, providing sufficient data to make an informed decision as to whether the proposed seismic survey activities will have any impact on fishing activities, and the fact that no responses were received after sufficient time was given, it is concluded that there is not going to be any significant conflict or impact on fisheries and as such no compensation to any fishers is required.	No objections or claims – no response/actions required. It is considered that sufficient information has been provided and all attempts have been made to engage directly with fishers. As such no objections were received and subsequently no additional actions or compensation to fishers is required.	* (see note above table).
		29/04/2022	Email outgoing		**Response to WAFIC email dated 29/04/2022** SLR thanked WAFIC.	N/A	* (see note above table).
		30/08/2022	Email outgoing		SLR invited WAFIC to attend an update meeting post 30 day public notification period with the intention to discuss communications with licence holders and SLB to provide an update on the survey and timings.	N/A	* (see note above table).
		31/08/2022	Email incoming	**Response to SLB email dated 31/08/2022** Carli Suggested to meet on Tuesday, 6 September 2022.		N/A	* (see note above table).
		06/09/2022	Meeting	SLB, WAFIC and SLR met to discuss the proposed Bonaparte survey and the fact that no licence holders have responded to any means of communication that have been tried to meet them. WAFIC advised that due to difficulties, title holders are having trouble getting in touch with licence holders, WAFIC has agreed to assist with licence holder consultation based on a fee for service basis. WAFIC provided some suggestions for the information sheet so it was short and succinct for the fishers so there was the right balance of having enough (i.e. sufficient) information that is relevant and has a higher chance it was read. SLB provided WAFIC with a revised information sheet and a spreadsheet of GPS coordinates for distribution to licence holders. See meeting minutes for further details (**Appendix G**).		No objections or claims – suggestions have been incorporated into the fact sheet for fishers.	* (see note above table).
		08/09/2022	Email outgoing		SLB sending info to WAFIC for distribution to fisheries as discussed in meeting on Tuesday	N/A	* (see note above table).
		14/09/2022	Email incoming	WAFIC provided confirmation of the distribution of the information sheet to commercial fishing licence holders in Northern Demersal Scalefish Fishery (Area		No objections or claims – no response/actions required.	* (see note above table).

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				2) and Mackerel Managed Fishery (Area 1). The email sent out to each licence holder was provided. The information went out to 28 different licence holders across the two fisheries, although it is noted that some companies have multiple licences.			
		20/09/2022	Email incoming	WAFIC provided an invoice for the distribution of information to the licence holders that fish in the Bonaparte Basin area. Update stated that no responses had been received yet from any stakeholders.		No objections or claims – no response/actions required.	* (see note above table).
		28/09/2022	Email outgoing		SLB tried calling WAFIC but no answer so sent an email requesting an update as to whether any licence holders had provided any feedback to the information that was distributed to them	N/A	* (see note above table).
		28/09/2022	Email incoming	**Response to SLB email dated 28/09/2022** WAFIC confirmed that no feedback was received from any fishers regarding the Seismic Survey.		No objections or claims – no actions required.	* (see note above table).
		28/09/2022	Email outgoing		**Response to WAFIC email dated 28/09/2022** SLB thanked WAFIC for their update and requested that if there is any late feedback to please pass it on. A request to WAFIC was made on their thoughts of whether any conclusions can be drawn from no feedback received that the fishers do not consider the survey will have any impacts on their activities, in that area and proposed time of year. It was also asked if there were any further suggestions to start dialogue with the fishers.	N/A	* (see note above table).
		28/09/2022	Email incoming	**Response to SLB email dated 28/09/2022** WAFIC confirmed that any future feedback provided would be passed on. And also stated that WAFIC would not like to specify or make assumptions around why no feedback was received from licence holders. It was noted that WAFIC has to be careful about over consulting with licence holders so as to avoid consultation fatigue.		No objections or claims – no response/actions required.	* (see note above table).
		13/10/2022	Email outgoing		Follow up email to WAFIC post RFFWI as part of additional consultation. WAFIC were advised that SLB were undertaking additional consultation with relevant persons in relation to potential unplanned events. This was clarified in terms of it relating to a fuel oil release and those fisheries in the wider EMBA are considered as relevant persons in terms of if a spill occurred. It was clarified that the likelihood of a spill is extremely low and no incidents to date have occurred in Australia. SLB has identified the fisheries in the wider EMBA that could be impacted should a spill occur, and a request was put to WAFIC asking if they could	N/A	* (see note above table).

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					distribute some further information to these fishers about the survey. SLB confirmed that they understand this will require a fee for service approach and SLB committed to this agreement. IN addition, SLB asked WAFIC to confirm whether they are able to distribute information to fishers on behalf of SLB. The list of fishers that SLB had identified to overlap with the EMBA was provided to WAFIC.		
		14/10/2022	Email incoming	WAFIC responded to email asking if it was possible to have the discussion today (i.e. 14th), and advised they were free until 3:30pm. WAFIC suggested there is another approach that can be taken to manage consultation for an unpanned event. WAFIC also confirmed they do not have jurisdiction for the NT and charter boat sector is recreational not commercial.	SLB agreed to meet	N/A	* (see note above table).
		14/10/2022	Email outgoing		SLB confirmed a meeting with WAFIC and thanked WAFIC for clarification around NT fisheries.	Teams meeting invite was sent to WAFIC for 3pm WAST.	* (see note above table).
		14/10/2022	Meeting	SLB and WAFIC met to go through the revised approach to consultation following the Federal Court decision and the use of the wider EMBA based on worst-case scenario to determine relevant persons. WAFIC did not agree to this approach and suggested different consultation strategies for direct operational impacts related to planned activities, i.e. those that SLB have already consulted with, and a different approach for those fisheries in the wider EMBA that would only be impacted should a spill occur. WAFIC advised that given the low likelihood of an unplanned event (e.g. a spill) occurring, it would be best to only contact the relevant affected fishers when an event occurs. WAFIC advised SLB of the key information they should have in place in the event of a spill from an unplanned event. WAFIC requested to be notified immediately and an unplanned event and they will consult the potentially affected fishers on behalf of SLB. WAFIC also suggested other emergency provisions in place within WA and provided additional RPs to be considered. WAFIC also confirmed they don't have jurisdiction in Northern Territory and therefore suggested contacting the Northern Territory Seafood Council (NTSC) for more information on commercial fishing in the NT. See meeting minutes (**Appendix G**) for further details.		SLB took onboard WAFICs suggestions for incorporating their information into the EP and consultation methodology and implementation strategy.	Refer **to Section 5.5.6.1** where WAFIC's approach has been incorporated into consultation strategy. Additionally, **Table 28** and correspondence within **Appendix I** confirm SLB has included the NTSC as a relevant person.
		14/10/2022	Email incoming	WAFIC provided a follow up email post the meeting confirming WAFICs preferred approach of having separate consultation strategies for direct operational impacts and unplanned events. Where is an unplanned event occurred, affected stakeholders (i.e. fishers) are consulted directly when that event occurs. WAFIC noted that this approach is appropriate when the likelihood of an oil spill occurring like modelled is extremely low. WAFIC confirmed the key information that SLB must have should an unplanned event occur. WAFIC requested that they are notified immediately should an unplanned event occur and made a		SLB acknowledge the information requirements that WAFIC provided and SLB have also incorporated the notification procedure of informing WAFIC of any spill within Section 10 – Implementation Strategy within the EP.	Notification to WAFIC included within Section 10 of the EP

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				commitment that WAFIC will consult all potentially affected fishers on behalf of titleholder. A link to other emergency provisions that are in place in WA was also provided. WAFIC also provided links to the charter sector and fisheries representatives in NT			
		14/10/2022	Email outgoing		An email was sent to WAFIC thanking them for the meeting and taking the time to pull together a meeting summary – as summarised above and included in WAFICs email. SLB agreed to action WAFICs suggested consultation approach and incorporate that into the EP	N/A	* (see note above table).
		02/11/2022	Email outgoing		Follow up email to WAFIC. Advised WAFIC that SLB had met with NOPSEMA and discussed WAFIC's suggested approach of consultation with fishers in the wider EMBA only in the instance that a spill occurs. SLB advised WAFIC that NOPSEMA were open to the approach but stated they wanted to ensure there were measures in place to ensure the commitments towards notifications were implemented should an unplanned event occur. A request to meet with WAFIC to go through the process and finalise the finer details and go through the key points that WAFIC raised. WAFIC were asked when they were available to meet.	N/A	* (see note above table).
		8/11/2022	Email incoming	WAFIC provided an email and introduced a new member at WAFIC who will be working on oil and gas related activities and assessments. WAFIC stated that they are happy to review SLBs draft responses to the information requests WAFIC provided once it is framed. WAFIC also pointed to the NOPSEMA guidance notes on consultation. WAFIC clarified that they can support the consultation with fishers that may be impacted if an unplanned activity occurred. However, WAFIC noted that SLB will still need to include other communication strategies given it would be SLBs incident to manage.	SLB had already incorporated the NOPSEMA guidance notes into the consultation section and approach through the development of the EP	Supportive clarifications and information to assist SLB with developing consultation methodology.	* (see note above table).
		8/11/2022	Email outgoing		Email to WAFIC and acknowledging the new staff member. Confirmed the use of the guidance notes had already been incorporated into the EP. Thanked WAFIC for clarification around consultation with fishers should an unplanned even occur. SLB noted that the EP notification requirements had been revised on who to contact should an unplanned event occur. An additional request to meet with WAFIC was made to go through and close out the key points of the consultation approach with fishers if a spill occurred.	N/A	* (see note above table).

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		9/11/2022	Email incoming	WAFIC advised that they don't have any availability to meet this week. Confirmed that if SLB send through any clarifications or closing points SLB need WAFIC to review, they will find some time to provide feedback.		No objections or claims – SLB to send through any clarifications or closing points.	* (see note above table).
		9/11/2022	Email outgoing		Email to WAFIC advising that SLB has incorporated all of WAFICs recommendations and suggestions into the consultation methodology and implementation strategy. An update was provided on SLBs intention to submit the EP on the 10th	N/A	* (see note above table).
		11/01/2023	Meeting	Meeting with SLB, SLR and WAFIC representatives to discuss NOPSEMA feedback regarding requirements/expectations set by WAFIC for an unplanned spill. Key meeting discussion points are summarised below: • The meeting commenced with general introductions and SLR confirming the purpose of the meeting was to address several NOPSEMA queries about WAFIC's expectations in an unplanned spill. • Baseline scientific data – WAFIC commented their expectation is for the proponent to demonstrate and understand where and how to access suitable information in the event of an oil spill. • Communication strategy – SLR confirmed the EP states WAFIC would be notified in the event of a spill and WAFIC confirmed that notification within 48 hours of an event occurring would be sufficient. • Temporary closure of a fishery - WAFIC commented their expectation is to see proponents demonstrate they are aware of and can implement a temporary fishery closure process, through DPIRD. • Support to the commercial fishing industry – WAFIC commented their expectation is to see proponents commit to assisting fishers communicate with processors and facilities regarding potential tainting risk following a spill event. • Compensation/financial commitment – WAFIC sought clarification from SLB on how SLB would support fishers during closure periods (i.e., was there a compensation mechanism) and provide consumers and industry confidence about returning to impacted areas. WAFIC advised consumers would want confidence there isn't a risk of tainting for any commercial fleet within the vicinity of an impacted area and suggested independent advice within monitoring would be beneficial for addressing perceptual impacts. WAFIC commented their expectation is for proponents to highlight a) the potential risk of an oil spill and b) detail what monitoring will be in place that provides fishers and consumers confidence that nearby sites are unaffected and fishing can resume safely within the impacted area. SLR commented that SLB has a Fisheries Loss Protocol for exclusion and equipment damage that could be amended to incorporate WAFIC's suggestions. WAFIC provided some suggested wording to incorporate the above commitments within the EP. • General – SLR queried whether WAFIC had received any queries regarding the EP. WAFIC advised there was a lot of uncertainty since the Santos/Tipakalippa court case and every EP is on hold and they were intending on providing consultation guidance information for proponents on their website soon. • WAFIC commented the numerous planned marine seismic surveys can make fishers nervous and they most commonly receive feedback when the vessel is already operating. WAFIC confirmed they would ensure any feedback is provided to SLB. Actions: 1. SLR to provide WAFIC with summary of approach for review to consolidate documentation of both parties' expectations and requirements. 2. SLR/SLB update EP to reflect 48 hr notification period. 3. SLR/SLB update EP to demonstrate awareness for requesting closure of a fishing area through DPIRD. 4. SLR/SLB update EP to demonstrate SLB is committed to assisting fishers in tracing potentially affected catch within the processing sector (in the event of a spill) and communicating this to processors and facilities.		WAFIC confirmed their expectations had been set based on experience within a government oil-spill response team and should be used by proponents to guide their spill response planning.	The OPEP (**Section 10.10**) provides an overview of SLB's arrangements for responding to a spill event, including the notification requirements to initiate the fishery closure process (refer to **Table 127** within **Section 10.10.6.3**). The OSMP (**Appendix L**) outlines processes for obtaining data that can assist with supporting the commercial fishing industry, such as providing traceability of affected catch to inform fishers and processors, and provide industry and consumers confidence about returning to impacted areas. SLB and WAFIC are finalising a compensation protocol (refer to within **Section 7.2.3**).

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				5. SLR/SLB update EP to demonstrate compensation and financial commitments are consistent with oil spill risk and to consider independent advice for response monitoring. 6. WAFIC to notify SLB/SLR of guidance piece featured on website; and 7. SLR to provide WAFIC with summary of changes to EP and protocol for their review and endorsement (if suitable). See meeting minutes (**Appendix G**) for further details.			
		18/01/2023	Email outgoing		SLR emailed WAFIC to request any information they can provide that confirms WAFIC are suitably placed to facilitate consultation between SLB and relevant commercial fishers.	N/A	* (see note above table).
		19/01/2023	Email incoming	**Response to SLR email dated 18/01/2023** WAFIC confirmed the following: • WAFIC is the peak body representing commercial fishing, pearling and aquaculture enterprises, processors and exporters within WA. • WAFIC was created by industry >50 years ago in partnership with government and set directions for managing WA's commercial fisheries. • These are WAFIC's comments as representatives of the broader commercial fishing, aimed at minimising impacts to their industry. With regards to this project: • WAFIC gave individual licensed commercial fishers an opportunity to provide feedback on the proposed activities – no feedback was received. WAFIC assisted with engagement process by distributing the fact sheet SLB developed to fishers.		No objections or claims – this is in response to SLB's email request above (previous item).	Additions have been included within Section 5.5.6.1 of the EP outlining these points.
		19/01/2023	Email outgoing		SLR responded to WAFIC's response emailed earlier that day acknowledging their email and advised this would be incorporated into the response to NOPSEMA.	N/A	* (see note above table).
		22/02/2023	Email outgoing		SLR emailed WAFIC to provide them with the draft Bonaparte Commercial Fishery Compensation Protocol for their review. SLB advised they had discussed the main points of the protocol with NOPSEMA whom provided feedback and SLB has now incorporated NOPESEMA's feedback also. SLB continued that they have also incorporated some content from the NERA published protocol as some of this text was suitable. SLB closed the email with a request for WAFIC to review by early next week (Monday 27/02/2023) and noted they understand if they do not have the time for this.	N/A	* (see note above table).
		22/02/2023	Email incoming	WAFIC responded to SLB's email earlier that day (previous item) to advise they will attempt to review by Friday (24/02/2023). WAFIC requested to know how much SLB included from the NERA project as that was fully endorsed by their industry. WAFIC closed the		No objections or claims – response to this email below.	* (see note above table).

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				email to advise that if SLB had changed their [compensation] method, then WAFIC's review was likely to take longer and comments won't be provided back to SLB as quickly.			
		22/02/2023	Email outgoing		SLB responded to WAFIC's earlier email (previous item) thanking them for their quick response. SLB advised the [compensation] method was the same as NERA in that SLB is defining the same loss criteria options. SLB continued on that it follows the NERA document quite closely with just a few adjustments to be focus more on SLB's Bonaparte project rather than the NERA generic offshore project.	N/A	* (see note above table).
		27/02/2023	Email incoming	WAFIC replied to SLB's email from the 22/02/2023 (previous item) advising SLB they had not yet reviewed the Fisheries Compensation Protocol as they have been very busy. WAFIC suggested SLB submit the EP without WAFIC's review and they can provide comment as required. WAFIC advised if SLB can express in the EP the protocol closely aligns with the NERA adjustment protocol (supported by WAFIC) and identify variations, then this will help.		No objections or claims – response to this email below.	* (see note above table).
		28/02/2023	Email outgoing		SLB replied to WAFIC's email sent yesterday 27/02/2023 (previous item) advising that it is not a problem that WAFIC has not been able to review the Fisheries Compensation Protocol proposed by SLB.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided WAFIC with the 4 week pre-survey notification	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		14/11/2023	Email outgoing		SLR emailed WAFIC to provide an update on the proposed survey. Following up on previous communications, WAFIC advised they did not have time to review the fisheries compensation protocol but would likely not have issues if it was prepared in accordance with the NERA protocol. SLR	N/A	* (see note above table).

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					reached out to see if WAFIC had time to review the protocol and provide comment back.		
		28/11/2023	Email incoming	WAFIC stated they started to review the document but realised there were some changes from the original NERA protocols. WAFIC requested SLB highlight in their document the changes made from the NERA adjustment protocol to make the review process quicker.		SLB to identify changes from NERA protocol and provide to WAFIC	* (see note above table).
		05/12/2023	Email outgoing		The revised version of the compensation protocol was provided to WAFIC.	N/A	* (see note above table).
		7/12/2023	Email incoming	WAFIC stated that the NERA protocols isn't referenced, and they still need to have both documents side-by-side to compare. The NERA protocol was developed over two years and includes specific wording for a reason, hence concerns with some specifics. WAFIC queried commitments made on behalf of WAFIC – will this be via a fee for service model. WAFIC has not recently engaged with the relevant commercial fishing industry stakeholders.		WAFIC queried fee-for-service model – SLB confirmed this is the case as per the next email.	* (see note above table).
		7/12/2023	Email outgoing		SLB has worked hard to ensure the document is the same as NERA, and the intention is that it is the same so that WAFIC can be comfortable with what is being proposed. SLB to see how to make it easier for WAFIC to compare. SLB agreed with the fee-for-service model as per what has taken place already where WAFIC undertook consultation with members under the model on behalf of SLB. Regarding the EP, there has been no significant changes to the last update that WAFIC have recieved or circulated to members, a lot of the changes have been taking place around consultation with first nation people. SLB offered to discuss further if WAFIC are available for a meeting.	N/A	* (see note above table).
		7/12/2023	Email incoming	WAFIC are unable to meet due to the busy time of the year. Suggest to make things very simple, the NERA adjustment protocol replaces the SLB protocol in the EP. This will give WAFIC a level of comfort that nothing is missing. Wished SLB luck with the submission.		WAFIC suggested the NERA protocol is used rather than SLBs.	Various changes throughout Section 5.5.6.9, Section 7.1.6, Section 7.1.7, Section7.2.6, Section 7.2.7 and Section 7.2.3.1 have been made to reference the NERA protocol rather than SLB protocol. Also the document within Appendix M has been replaced with the NERA protocol document to address this point as per the following email.

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		7/12/2023	Email outgoing		Thanked WAFIC for the response and understand how busy things are at this time of the year. SLB has taken onboard the recommendation and SLB will adopt the NERA adjustment protocol. This will replace the SLB adjustment protocol within the EP and included in the resubmission.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken with the WAFIC can be found in Section 5.5.6.9 of the EP.					
34	Western Australian Game Fishing Association	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Western Australian Game Fishing Association with the four week pre-survey notification.	N/A	* (see note above table).
		07/03/2023	Email incoming	Automatic reply. Out of office until end of March 2023.		N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
35	Australian Southern Bluefin Tuna Industry Association (**ASBTIA**)	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		18/01/2022	Email incoming	**Response to SLB email dated 17/01/2022** ASBTIA advised that they do not fish in that area nor is it within the spawning area for SBT stock. No need to keep them informed of this activity.		No objections or claims – no response/actions required due to no conflict of activities.	* (see note above table).
		18/01/2022	Email outgoing		**Response to ASBTIA email dated 18/01/2022** SLR acknowledging that ASBTIA no longer require notification of the proposed activity.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided ASBITA with the four week pre-survey notification.	N/A	* (see note above table).

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		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken with the ASBTIA can be found in Section 5.5.6.3 of the EP.					
36	Australia Fisheries Trade Association	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided the Australia Fisheries Trade Association with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
37	Recfishwest	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		04/02/2022	Email incoming	**Response to SLB email dated 17/01/2022** Recfishwest thanked SLR for informing them and request that they are given opportunity to comment on any future proposals.		No objections or claims – Recfishwest to be informed as the project develops.	* (see note above table).

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				Given the distance from shore, the potential impact on recreational fishers will be low.			
		05/02/2022	Email outgoing		**Response to Recfishwest email dated 05/02/2022** SLR acknowledged that we will keep Recfishwest informed as the project develops and that they will be kept up to date with any notifications in the future.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided RecFish West with the four week pre-survey notification.	N/A	* (see note above table).
		07/03/2023	Email incoming	Automatic reply. New contact details provided.		No objections or claims. Contact details to be updated.	* (see note above table).
		08/03/2023	Email outgoing		SLR provided Recfishwest with the four week pre-survey notification.	N/A	* (see note above table).
		08/03/2023	Email incoming	**Response to SLR email dated 08/03/2023**: Recfishwest responded acknowledging receipt of notification email and that Recfishwest appreciates the continual communications regarding this activity.		No objections or claims.	* (see note above table).
		08/03/2023	Email outgoing		**Response to Recfishwest email dated 08/03/2023:** SLR acknowledged Recfishwest email.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		09/11/2023	Email incoming	RecfishWest noted the updated timing of the survey and confirmed that Recfishwest has not questions or comments on the proposed activites.		No objections or claims	* (see note above table).
		09/11/2023	Email outgoing		SLB thanked Recfishwest for the reply and confirmation that they have no further questions.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
38	Coral Expeditions	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided Coral Expeditions with the four week pre-survey notification.	N/A	* (see note above table).

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		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
39	Marine Tourism WA	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided Marine Tourism WA with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
40	Kimberley Marine Tourism Association (**KMTA**)	24/02/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		29/03/2022	Email outgoing		Follow up email to confirm if KMTA had any concerns.	N/A	* (see note above table).
		06/4/2022	Email incoming	**Response to SLB email dated 29-03-2022** KMTA responded advising they have passed details onto their members to respond directly.		No objections or claims – no response/actions required.	* (see note above table).

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		06/4/2022	Email outgoing		**Response to KMTA email dated 06/04/2022** SLR acknowledging response	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided KMTAwith the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
41	BKB Holidays Travel Agency	24/02/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		29/03/2022	Email outgoing		Follow up email to confirm if BKB Holidays had any concerns.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided BKB Holidays Travel Agency with the four week pre-survey notification.	N/A	* (see note above table).
		07/03/2023	Email incoming	Automatic reply acknowledging receipt of email.		N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
42	Kimberley Land Council	24/02/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
		31/08/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached and requested a time to meet to discuss the proposed survey further.	N/A	* (see note above table).
		14/09/2022	Phone call outgoing		Phone call with Kimberley Land Council. Introduction of the survey and also confirmation that the previous information sheets and emails distributed had been received, which they had. A discussion was held over the survey details, survey area and distance offshore and control measures that would be implemented. Kimberley Land Council confirmed they do not have any concerns over the proposed survey due to the long distance offshore. If any further questions or concerns arise from Kimberley Land Council, they would email SLB direct.	No objections or claims – no response/actions required.	* (see note above table).
		10/10/2022	Phone call outgoing		Call was made to KLC to have a follow up discussion about the proposed survey. Unfortunately, no one was available for a discussion and a message was left with receptionist for a call back. No further call was received, despite another follow up phone call at the end of the week.	N/A	* (see note above table).
		17/10/2022	Phone call outgoing		Call was made to KLC to discuss the survey; however the chief executive was heading overseas on leave. The receptionist provided contact details of another person within the organisation who would be the best person to speak with regarding the survey.	N/A	* (see note above table).
		17/10/2022	Email outgoing		SLB utilised the new contact details provided and provided an update of the proposed seismic survey and EP development. The utilisation of the worst-case scenario from unplanned activities (i.e. fuel oil spill) was mentioned and the role it plays in determining relevant persons and how it could impact them. Information was provided on the survey location, and clarification that the chance of this occurring is remote, in fact has never happened in Australia waters before. SLB stated that they want to make sure Traditional Owners are aware of the survey and have the opportunity to comment, ask questions about the survey, spill scenario of EP. A request for a phone call was made to discuss the proposed survey and EP further and to identify other parties who may be concerned.	N/A	* (see note above table).
		17/10/2022	Email incoming	KLC responded to the email above advising that it would be best to get in touch with each of the Traditional Owner groups represented around the coastline through their PBCs. The offer was made for KLC to share contact details if SLB would like.		No objections or claims – response to this email below.	* (see note above table).

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		17/10/2022	Email outgoing		SLB responded, thanking KLC for the quick response and asked if KLC could provide contact details for the relevant Traditional Owner groups. A map was provided which showed the EMBA which overlapped with three Traditional Owner groups. The survey fact sheet was also provided again as part of this email response. The three Traditional Owner groups were: • Wunambal Gaambera Aboriginal Corporation (WGAC); • Balanggarra Aboriginal Corporation (Combined) (BAC); and • Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation (MG Corporation).	N/A	* (see note above table).
		17/10/2022	Email incoming	KLC provided contact details for the three Traditional Owner groups and advised that for each group it is best to go through the formal channels (i.e. contacting each group) and ask who is the best person to speak to. It was also offered that if SLB have trouble getting hold of the right person, KLC will pass on the contact details of individual people.		No objections or claims – consultation with these three traditional owner groups undertaken as per ID# 51-53.	See consultation undertaken with the three groups mentioned under ID# 51-53.
		24/10/2022	Email outgoing		SLB contacted KLC to provide an update and a request for help in contacting the relevant Traditional Owner groups as there had been some difficulties making contact with anyone. An update was provided in the email to KLC on each of the three groups and the efforts that had been made. There had been some difficulty with contacting them so a request was made to KLC if they had any specific people and contact details to provide that would be appreciated to help facilitate contacting the correct people.	N/A	* (see note above table).
		24/10/2022	Email incoming	KLC provided specific contact details for Balanggarra. The also advised that KLC would speak to the Balanggarra CEO directly as well and ask that they contact SLB to discuss the survey. KLC advised that they don’t have any advice for contacting Miriuwung Gajerrong as they are independent of KLC.		No objections or claims – no actions required.	* (see note above table).
		01/11/2022	Email outgoing		SLB reached out to KLC with some further additional information, which SLB thought might help the Balanggarra CEO with his further discussions with Council Members and asked for KLC’s advice on the information provided and whether that was suitable or if there as any further information required.	N/A	* (see note above table).

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					SLB developed three key questions to prompt some further discussion and to find out what concerns they may have in regard to the survey. SLB asked that KLC provide any feedback if they did not think it was appropriate. The key questions asked included: • Do you have any functions, interests or activities that may be affected by the proposed activities to be carried out under the environment plan? • Do you have any sea country rights that may be affected by the proposed activities to be carried out under the environment plan? • Do you want to meet with SLB to discuss the proposed activities to be carried out under the environment plan? SLB further offered an invitation to meet and discuss the proposed survey further.		
		01/11/2022	Email incoming	KLC advised that they have not heard anything back from Balanggarra either. KLC provided the email details of the CEO to contact directly.		No objections or claims – no actions required.	* (see note above table).
		08/12/2022	Email outgoing		SLB contacted KLC to gain feedback. SLB stated they had been provided contact details for three Traditional Owner groups: • Wunambal Gaambera Aboriginal Corporation (WGAC); • Balanggarra (Combined) Aboriginal Corporation (BAC); and • Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation (MG Corporation). SLB advised they had been in contact with all three groups who were interested in meeting to discuss. However, SLB has been having difficulty getting a response to arrange a meeting for the discussions. SLB included a more comprehensive information sheet to help explain the marine seismic process and project, in the email. This provides the basis for further discussions to listen to any concerns and determine if the native title holders: • Have any functions, interests or activities that may be affected by the proposed activities to be carried out under the EP; • Have any sea country rights that may be affected by the proposed activities to be carried out under the EP; and • Want to meet with SLB to discuss the proposed activities to be carried out under the EP.	N/A	* (see note above table).

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					SLB believe meeting and discussing directly allows them to better understand any concerns and even if no concerns, would still like to meet to be able to update NOPSEMA as part of the EP. Concluded email to state SLB are always open to meeting and discussing further.		
		10/02/2023	Email outgoing		SLB emailed invite for KLC to attend a workshop where SLB will present and discuss their proposed marine seismic survey offshore Bonaparte. SLB advised that SLB had been in discussions with WGAC whom had help propose and schedule the workshop. SLB and their environmental specialists (SLR) would like to present their project discuss the identified risks and adaptive management of those risks. SLB would also like to discuss and understand KLC's sensitivities to the proposed activity in the area and find out if SLB has captured all concerns. The invitation was also extended to representatives from WGAC, MC Corporation, and BAC. SLB advised they will describe the Environmental Plan that they have been developing following regulatory requirements and confirm the project timeframe.	N/A	* (see note above table).
		10/02/2023	Email outgoing		SLB emailed KLC to advise that due to low availability SLB would like to reschedule the proposed workshop (discussed in previous email, above item) to 16/02/2023 between 9:30 am and 11:30 am Perth time.. SLB concluded the email by commenting it would be great if KLC could attend.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided KLC with the four week pre-survey notification.	N/A	* (see note above table).
		22/09/2023	Email outgoing		SLB contacted KLC to update them with the current status of the EP. SLB stated they are finalising the EP in the next couple weeks and wanted to asked if KLC or any members have expressed concerns or had further questions. SLB anticipate acquisition in Q4 subject to approval.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions	N/A	* (see note above table).

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					or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken with the KLC can be found in Section 5.5.8.1 of the EP.					
43	Northern Land Council	24/02/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		31/08/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached and requested a time to meet to discuss the proposed survey further.	N/A	* (see note above table).
		14/09/2022	Phone call outgoing		Phone call with Northern Land Council to introduce SLB and the proposed Seismic Survey. An overview was provided to the Northern Land Council, who confirmed they had received the earlier correspondence. The overview of the Seismic Survey included the survey location, distance offshore, timing and duration as well as control measures. Details of the proposed survey were taken down by Northern Land Council and that information would be discussed among the team at NLC. NLC had all contact details of SLB and would make contact should there be any further questions about what is being proposed and the regulatory application.	N/A	* (see note above table).
		10/10/2022	Phone call outgoing		SLR tried calling NLC multiple times to follow up on previous discussions, however there was no answer. SLB also tried to reach NLC the following two days but there was no answer.	N/A	* (see note above table).
		18/10/2022	Phone call outgoing		SLB phoned NLC and spoke to reception. Received a phone number and email address for the PA of the CEO who has been spoken with previously about the survey.	N/A	* (see note above table).
		19/10/2022	Phone call outgoing		SLB called NLC but could not get hold of anyone. A voice message was left and was also followed up by an email.	N/A	* (see note above table).
		19/10/2022	Email outgoing		SLB emailed NLC to follow up on previous discussions and provide some further information and updates on the EP process. In particular the inclusion of the worst-case EMBA to the consultation methodology and approach and provide further details and context around that. A request was made to have a phone call over the next few days to further discuss the project and for some support with contacting other relevant groups who may be concerned. It was noted that a voice message was left on the landline number as well	N/A	* (see note above table).

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		20/10/2022	Email incoming	NLC responded to SLB and asked SLB to contact the NLC Sea Country Team. The Sea Country Team were cc'd into the email to provide their contact details. It was also advised that the Sea Country Team are currently travelling at the moment so may not respond until tomorrow.		No objections or claims - additional contact details acknowledged.	* (see note above table).
		20/10/2022	Email outgoing		SLB thanked NLC for the email and connecting SLB with the NLC Sea Country team. SLB Noted that they will reach out to them directly	N/A	* (see note above table).
		27/10/2022	Phone call outgoing		Phone call with NLC to introduce SLB and the proposed Seismic Survey including an overview of the proposed activity. NLC acknowledged the information emailed earlier and apologised for not responding however advised they had forwarded to NLC legal representatives and was waiting for their response before responding to SLB. SLB discussed intentions of consulting relevant persons from NLC acknowledging they may be able to provide information on sensitivities not previously identified or have concerns about the project. SLB also discussed the modelling results for a potential unplanned oil spill and the relative low likelihood that such an event could occur. SLB requested a forum to discuss the project with the wider native title holder population within NLC's management area and how best to achieve this. SLB discussed the control measures in place to mitigate impacts on marine life should an oil spill occur, again highlighting the relative likelihood that such an event could occur. NLC responded noting that they welcomed the contact and would reach out again once the legal team had generated a response by 31 October 2022. NLC requested SLB follow up NLC and keep reminding them to pursue internal response.	No objections or claims – SLB to maintain contact with NLC for an internal response.	* (see note above table).
		01/11/2022	Email outgoing		SLB email to the three members that make up the NLC Sea Country team. The email contained the information sheet which was focused on being relevant for native title groups to help with future discussions with members or any concerned parties about the proposed survey. The information that SLB are trying to find out from native title holder groups was summarised in the email, along with the information sheet, that being: • Do you have any functions, interests or activities that may be affected by the proposed activities to be carried out under the environment plan?	N/A	* (see note above table).

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					• Do you have any sea country rights that may be affected by the proposed activities to be carried out under the environment plan? • Do you want to meet with SLB to discuss the proposed activities to be carried out under the environment plan? SLB stated they would like to meet and discuss the survey further.		
		02/11/2022	Email incoming	NLC Sea Country team responded to the SL B email, thanking SLB for the information provided. The NLC legal team was copied into the email trail and suggested for any further information to contact the legal team directly.		No objections or claims – referred any further questions to the legal team.	* (see note above table).
		02/11/2022	Email outgoing		SLB contacted NLC's Sea Country legal team and provided a summary of the proposed Seismic Survey. SLB provided the Native Title holder specific information sheet and a summary of the EMBA being based on a fuel oil spill under a worst-case scenario. SLB provided the questions below, stating that this was to find out the key answers from Native Title holders: The information that SLB are trying to find out from native title holder groups was summarised in the email, along with the information sheet, that being: • Do you have any functions, interests or activities that may be affected by the proposed activities to be carried out under the environment plan? • Do you have any sea country rights that may be affected by the proposed activities to be carried out under the environment plan? • Do you want to meet with SLB to discuss the proposed activities to be carried out under the environment plan? And SLB asked the legal team if they thought any other information was required to provide the native title holders, either in the email or in the information sheet. SLB also asked if the legal team were able to meet to discuss the proposed survey further.	N/A	* (see note above table).
		21/11/2022	Email outgoing		SLB contacted NLC's Sea Country legal team to request an opportunity to present and overview of the proposed project, discuss the project with NLC members and to listen to any potential concerns they may have. SLB advised this forms part of the Environmental Plan and requested a response even if the feedback received was that there were no concerns. The email included the previous email sent to the NLC legal team on 02/11/2022 that	N/A	* (see note above table).

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					included information they would like to obtain from native title holders and information about the survey including a factsheet. The NLC Sea Country team was copied into the email trail also.		
		07/12/2022	Email outgoing		SLB sent an email to NLC's Sea Country legal team attempting to engage with NLC. SLB also advised the EP had been resubmitted to NOPSEMA for reassessment and confirmed they are still wanting to engage with NLC to discuss the project and any potential concerns they may have. The previous two emails sent to the NLC's Sea Country legal team dated 21/11/2022 and 02/11/2022 were also included within this email. The NLC Sea Country team was copied into the email trail also.	N/A	* (see note above table).
		16/12/2022	Email outgoing		SLB contacted NLC's Sea Country legal team to request an opportunity to call following a meeting NOPSEMA held to present updated guidelines for requirements when consulting relevant persons. SLB advised the call would be to seek advice on how SLB could meet with NLC to present an overview of the proposed project, discuss the project with NLC members and listen to any potential concerns they may have. SLB also advised they are required to consult all persons who may have interests or concerns regarding activities with respect to the local environment. The previous three emails sent to the NLC's Sea Country legal team dated 07/12/2022, 21/11/2022 and 02/11/2022 were also included within this email. The NLC Sea Country team was copied into the email trail also.	N/A	* (see note above table).
		05/01/2023	Email outgoing		SLB sent an email to the three members comprising the NLC Sea Country team seeking guidance on methods to progress engagement, as no response had been received from the Sea Country legal team since November 22. SLB advised the consultation section of the EP was being updated and wanting to confirm best approach to effectively consult.	N/A	* (see note above table).
		06/01/2023	Email incoming	NLC Sea Country team responded to the SLB email, advising they will pass information on to the legal team and get a response when they return to work end of January. The NLC legal team was copied into the email trail also.		No objections or claims – no response/actions required.	* (see note above table).
		06/01/2023	Email outgoing		SLB email acknowledging the NLC response dated 06/01/2023.	N/A	* (see note above table).

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		11/01/2023	Email outgoing		SLB contacted an alternative NLC representative advising they had been liaising with members of NLC regarding consultation and feedback on proposed project. SLB advised they had been passed on to a member of the legal team, however had not received any replies and were not expecting a reply from the NLC Sea Country Team until the end of January 2023. SLB were hoping they could assist. SLB's email included an information sheet about the project to encourage future discussions that would provide more detailed information, particularly relating to any potential environmental sensitivities not previously identified. SLB confirmed they would still like to receive feedback regarding the survey. SLB requested NLC review the information sheet to advise whether the information was appropriate or whether further information or whether other details would be required that are not covered in the factsheet. SLB also advised their intention to find out from native title holders and sea country whether they: • Have any functions, interests or activities that may be affected by the proposed activities to be carried out under the environment plan? • Have any sea country rights that may be affected by the proposed activities to be carried out under the environment plan? • Want to meet with SLB to discuss the proposed activities to be carried out under the environment plan? The previously consulted NLC Sea Country team and legal team members were copied into the email trail also.	N/A	* (see note above table).
		13/01/2023	Meeting	Meeting between SLB, SLR and NLC. Key discussion points are summarised below: • SLB provided an introduction to the project and SLR as the project's environmental consultant. • SLB described the nature of the project (marine seismic survey) and that SLB intend to carry out the survey in Q1 pending regulatory approval, which involves consultation with relevant persons. • SLB has been contacting Native Title Holders and Sea Country Managers as part of the consultation process hoping to identify suitable contacts to determine who may have functions, interest or activities which may be affected by the proposed activities. • SLB provided an overview of the EP aspects, including: o planned and unplanned activities, o how the activity impacts are assessed and mitigated using measures such as marine mammal observers, exclusion zones etc, and o how the EMBA is derived using highly conservative oil spill modelling. • SLR commented the meeting is an opportunity to provide more information about the activity and EP. • SLR described how an assessment of relevant persons was undertaken in accordance with the new NOPSEMA relevant person consultation guideline to determine who may be potentially affected (based on the EMBA). SLR explained the oil spill modelling in great detail and stressed the low likelihood of a		No objections or claims raised – SLB to provide NLC with shape files of the EMBA, OA and AA and organise a follow-up meeting to discuss.	* (see note above table).

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				spill occurring (e.g. that a spill has never occurred during a seismic survey within Australia and that there are many mitigation measures in place to ensure a spill, due to a collision of vessels, does not occur). • NLC queried what the survey outcome will be and SLB advised that SLB collect and process the data which is then sold to prospective oil and gas companies who determine whether there is a commodity (oil or sequestration) in the acquisition area. SLB also commented this survey is more efficient and cost effective as is only one survey covering a large area that is potentially available to multiple clients, removing the need for multiple surveys in the one area. • NLC queried whether this is a speculative survey and not over tenements – SLB advised the survey is over some held acreage, however, primarily comprises open area that is not licensed/leased. • The group discussed SLB's consultation with the Kimberley Land Council (KLC) which is the same approach as with NLC. SLB has been adapting consultation methodology based on the Santos appeal outcome and NOPSEMA consultation guidelines, which includes looking more at native title owners and Traditional Owners. SLB is attempting to introduce the project, the risk and mitigation measures and gain an appreciation for any of their activities, functions or interests that may be affected by the survey. • SLB commented that one of the KLC corporations has been assisting SLB identify other relevant persons and disseminate information to them. • SLR advised SLB has made substantial effort with consultation and it has been occurring over the last 12 months with multiple and tailored variations of information adapted to different relevant persons. • NLC commented they are trying to come to terms with what the Santos ruling means also. Another proponent focused on town hall community type meetings, where factsheets are provided following public notification. • NLC commented that based on visual observation, the west coast of the Bonaparte Gulf intercepts the EMBA, which is in the NLC area of interest. • SLB queried NLC how SLB could get guidance on where town hall meetings could be held. NLC noted they could provide high level guidance (focus areas) if a shape file was provided, although NLC couldn't confirm when this would be provided to SLB as many staff are on leave. SLB advised they would provide NLC with shape files of the EMBA, OA and AA. • SLB queried whether NLC could recommend any additional consultation methods that SLB could use, advising that SLB had recently advertised the activity within local newspapers. NLC advised there needs to be something that helps determine if their functions, activities or interests are affected and assist the community interpret whether they are likely to be affected, such as with pictures/figures rather than words. • SLB queried the best way to distribute this information and NLC suggested a) identifying the relevant communities and b) considering places where notices could be placed that people would see. • SLR queried what the local community attendance is likely to be at community meetings. NLC commented this is hard to predict yet noted attendance may be higher if the company has had a presence in the community longer because they've fostered community relationships. • NLC did not have concerns, rather are trying to help SLB consult as effectively as possible. NLC commented that NLC hasn't formed a position on how to respond to these activities as they haven't been involved in such processes before. NLC clarified that proponents need to consult if they believe the native title holders along the coastline are relevant persons. • SLB needs to seek their own legal advice on how far offshore NLC functions, activities, and interests may be. • SLR suggested the way forward is to have a follow up meeting once NLC has reviewed the shapefiles to determine if NLC has any concerns regarding the activity. See meeting minutes (**Appendix G**) for further details.			
		13/01/2023	Email outgoing		SLB emailed NLC members who attended the meeting earlier that day acknowledging the opportunity to discuss the project, highlight regulatory requirements and the consultation process. SLB also acknowledged NLC is also new to	N/A	* (see note above table).

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					the latest NOPSEMA relevant persons consultation guidelines and welcome any assistance to reach native title holders in the NT who may have interest in the project. SLB queried NLC's offer to plot GIS shape files for project and EMBA to help identify specific areas where population would have interests and open to further consultation. SLB attached the following three files: • Acquisition polygon; • Operational area; and • EMBA derived from oil spill modelling. SLB also mentioned the more condensed information flyer discussed at the previous meeting, confirming SLB has made this a priority and will provide to them for quick review to ensure suitable. Once finalised, SLB will plan to have distributed to communities. Following that, SLB would be open to further meetings and consultation as required. SLB affirmed they intend to continue consultation while the project is ongoing throughout the activity, and not just prior to EP being approved.		
		19/01/2023	Email outgoing		SLB emailed two representatives from NLC (Petroleum and Energy team and Legal team) to provide more condensed information flyer for community notice boards etc. SLB requested NLC review and provide feedback to advise if sufficient content. SLB also enquired about the GIS shape files and whether they could provide any guidance on where the target audience for the flyer might be located. SLB also advised they would be meeting NOPSEMA today and would be updating them of their ongoing consultation with NLC.	N/A	* (see note above table).
		19/01/2023	Email incoming	A representative from the NLC Petroleum and Energy team responded to SLB's email sent earlier that day, acknowledging the chance to provide feedback on flyer. NLC said they will advise if any comments on content but not in a position to comment on sufficiency. NLC also advised their GIS team does not have the capacity to produce the maps discussed in the last meeting or email (both dated 13/01/2023).		No objections or claims raised – response provided in email below.	* (see note above table).
		19/01/2023	Email outgoing		SLB acknowledged NLC's email dated 19/01/2023 regarding flyer and GIS mapping. SLB advised they can assist with mapping although weren't sure what is best to be represented on the map and what zoom level would be appropriate. SLB attached a map for NLC to review including the: • survey area;	N/A	* (see note above table).

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					• EP area around the survey area; • EMBA; and • NLC boundaries and Native Title Determinations. SLB requested if they could review the map and advise if they could use this map or how it might be amended to help identify consultation areas to focus on.		
		25/01/2023	Phone call outgoing		SLB called the representative from the NLC Petroleum and Energy team to get an update on previous email dated 19/01/2023. SLB asked NLC's opinion on the noticeboard flyer and map to help identify areas and communities where the flyer might be distributed. NLC advised changes to flyer could include: • More simplified English; • Remove reference to NLC for queries or meeting requests – only to SLB. SLB advised the flyer would be edited and offered to resend to NLC for further comment. NLC suggested SLB contact local government council offices for assistance on the ground. NLC apologised for not having resources to assist with map and SLB reassured them SLB has the resources and not a problem. SLB advised not much luck identifying communities to speak to and NLC t suggested a Google search and possible web resource strike.nt.gov.au would assist. SLB updated NLC on engagement with KLC to develop agreement and offered to update NLC once agreement finalised. NLC advised they would appreciate that and advised SLB the agreement should be sent to their legal team. SLB agreed to do this. SLB asked if the Tiwi Islanders were part of NLC and NLC confirmed yes however they have their own council. SLB advised given the far distance between EMBA and Tiwi Islands they had not yet engaged but will update them as soon as possible to listen to any concerns they may have. Meeting concluded with NLC confirming they would email a summary of their feedback on flyer to SLB and meeting notes. SLB thanked NLC for their time and agreed to keep NLC informed of discussions and agreements with KLC.	No objections or claims raised.	* (see note above table).
		25/01/2023	Email incoming	A representative from the NLC Petroleum and Energy section returned SLB call earlier that day to provide the following feedback and information: • Draft flyer – consider plain English where possible and remove reference to contacting Land Council if any concerns of with request to meet to		No objections or claims – no response/actions required.	* (see note above table).

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				maintain clear distinction between SLB and Land Council communications. • Agreement – send a copy to KLC. • Provided the NTG Mapping site (http://strike.nt.gov.au/wss.html) as possible reference.			
		25/01/2023	Email outgoing		SLB acknowledged NLC's previous email from earlier in the day and feedback. SLB asked if ok to provide flyer for further feedback once reviewed and thanked NLC for providing the NTG mapping site link. SLB also advised they would keep in contact with the NLC legal team regarding discussions with KLC and how that progresses.	N/A	* (see note above table).
		02/02/2023	Phone call outgoing		Following discussions with NOPSEMA, SLB called NLC to progress consultation with NLC Traditional Owners regarding the proposed project. SLB contacted an NLC representative in Wadeye to discuss the possibility of holding a community meeting (also termed a 'town hall meeting') as suggested by previous NLC representatives. SLB explained the revised consultation process following the Tipakalippa court case and recently released consultation guidelines from NOPSEMA. NLC agreed to hold a community meeting in Wadeye within the next two weeks to discuss the project and listen to Traditional Owner concerns and questions. NLC will liaise with Traditional Owner groups to ensure their attendance and will arrange meeting room and presentation equipment. NLC asked SLB to select a date. See meeting minutes (**Appendix G**) for further details.	No objections or claims – meeting to be organised.	* (see note above table).
		06/02/2023	Phone call outgoing		SLB called NLC to discuss the planned Traditional Owner engagement in Wadeye but there was no answer. SLB left a voice mail message to return call.	N/A	* (see note above table).
		06/02/2023	Phone call incoming	NLC returned SLB's phone call from earlier in the day to discuss the planned Traditional Owner engagement in Wadeye. NLC advised SLB there may be difficulty visiting remote groups due to access but still advised the preference for face-to-face visit. NLC commented on the local population's general lack of understanding regarding oil and gas activities and to expect questions around general oil and gas aspects. SLB confirmed arrangements would be made as soon as possible and NLC confirmed they would secure a venue and Traditional Owner groups to be present. SLB advised NLC of their intention to also liaise with NLC's legal team during their visit.		No objections or claims – meeting to be organised.	* (see note above table).
		06/02/2023	Email outgoing		SLB emailed NLC to confirm plans to visit and hold a community meeting with the Traditional Owners	N/A	* (see note above table).

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					as discussed previously. SLB suggested a tentative date of 16/02/2023. SLB also advised NLC that SLR would be present as their independent environmental consultants. SLB confirmed they would prepare suitable material to present and discuss their project and asked if NLC could arrange a venue for 16/02/2023 and as many Traditional Owners as possible or who would have an interest in learning more about marine seismic surveys and SLB's project. SLB advised they would be in contact regarding travel and an agenda.		
		06/02/2023	Email incoming	NLC replied to SLB's previous email earlier that day to confirm they have informed the Traditional Owners and recommended NLC apply for a permit (online) to visit the area. This included a contact within NLC to assist with obtaining a permit.		No objections or claims – no response/actions required.	* (see note above table).
		06/02/2023	Email outgoing		SLB emailed the NLC legal team to provide an update on consultation with NLC, particularly the Traditional Owners of the Daly River group in Wadeye. SLB advised of their intentions to hold a community meeting and asked if they would be available to meet while traveling through Darwin around the same time (15 or 17/02/2023).	N/A	* (see note above table).
		06/02/2023	Email incoming	The NLC legal team replied to SLB's previous email sent earlier that day to advise they will not be available on the date that SLB proposed to meet but are checking with other NLC legal representatives that may be able to attend in their place.		No objections or claims – no response/actions required.	* (see note above table).
		06/02/2023	Email outgoing		SLB replied to the NLC legal team's previous email sent earlier that day to advise they may have to delay to following week due to flight availability.	N/A	* (see note above table).
		08/02/2023	Email outgoing		SLB emailed NLC to advise they had been trying to call also to inform them SLB is not able to travel to Wadeye due to the wet season. However SLB were wanting to visit once the dry season arrives. As a result SLB would like to hold the community meeting online, acknowledging there may be connectivity issues but would like to test as they need to introduce the survey and listen to the Traditional Owner concerns as soon as possible. SLB asked whether 16/02/2023 could still work for an online session and to advise them so they can test this week. SLB concluded the email by apologising for the visit cancellation.	N/A	* (see note above table).
		10/02/2023	Email outgoing		SLB emailed the NLC legal team to provide an update that due to inability to travel they will be holding an online workshop for Wadeye on Friday 17/02/2023 from 9 am onwards. SLB asked if the legal team would be available to attend and said they would send the invite through.	N/A	* (see note above table).

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		10/02/2023	Email incoming	The NLC legal team responded to SLB's previous email sent earlier in the day advising their NLC legal representative would be retiring as of today and to continue corresponding with the other NLC legal team representatives.		No objections or claims – no response/actions required.	* (see note above table).
		10/02/2023	Email outgoing		SLB acknowledged the previous email sent earlier in the day from the NLC legal team's advising a representative was retiring, thanking them and wishing them well.	N/A	* (see note above table).
		10/02/2023	Email outgoing		SLB emailed NLC (Wadeye) advising they had booked a meeting room in Wadeye for 17/02/2023 and would be sending an online meeting request to join in and forward to any others that would be interested in attending. SLB also advised they would send out the agenda on Monday (13/02/2023) and thanked the NLC representative for their help. The email included the booking confirmation from West Daly Regional Council for the online meeting venue.	N/A	* (see note above table).
		13/02/2023	Email outgoing		SLB forwarded a meeting invite to NLC including their legal team for a meeting to discuss the proposed survey. The invite was for a meeting on 17/02/2023 at 10:30 am and provided venue details. SLB advised they would like to present their project with SLR to discuss identified risks and management of those risks. They would also like to discuss and understand sensitivities in the area which may not have been previously identified and determine if all concerns had been captured.	N/A	* (see note above table).
		15/02/2023	Email outgoing		SLB present the meeting invitation email to NLC to confirm the workshop date and start time with NLC attendees, as a reminder.	N/A	* (see note above table).
		15/02/2023	Email incoming	NLC replied to SLB's previous email confirming the meeting start time would be fine and they would notify the Traditional Owners that day.		No objections or claims – no response/actions required.	* (see note above table).
		15/02/2023	Email outgoing		SLB replied to NLC's previous email to thank them for their response.	N/A	* (see note above table).
		17/02/2023	Meeting	Meeting between SLB and NLC (Wadeye District representative and IT personnel). Key discussion points summarised below: • The original workshop scheduled for the morning (17/02/2023) had to be postponed due to poor connectivity and visual/sound problems. • NLC requested this meeting with SLB in the afternoon to test connectivity for the rescheduled workshop with Traditional Owners arranged for 20/02/2023. • SLB discussed the objectives (to present the survey and listen to and address any of their concerns or queries) of the up-and-coming workshop with NLC. • NLC were under the misconception the workshop was regarding a recent fish kill on local beaches. • NLC did not understand why dead fish were appearing and wondered if it was related to the oil and gas industry, in particular the offshore production facilities.		Matters raised by NLC in the meeting were not within the scope of the EP – no further actions required regarding the recent fish kill on local beaches.	* (see note above table).

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				• SLB advised they are not involved with these offshore oil and gas projects so could not comment on the fish. SLB reaffirmed the seismic survey method and purpose of the consultation with Traditional Owners was due to them being identified as relevant persons in relation to the survey's EMBA. • NLC confirmed they understood and said they would need more time to explain the purpose of the meeting to the Traditional Owners and requested the meeting be postponed until 24/02/2023. This would allow several coastal family representatives to attend the meeting and provide more value and meaning. • SLB agreed a postponed meeting with an extended group of Traditional Owners would be really beneficial. See meeting minutes (**Appendix G**) for further details.			
		17/02/2023	Email outgoing		SLB emailed and NLC representative from the Wadeye district following their MS Teams meeting earlier that day. SLB thanked NLC for their time and provided the factsheet and EMBA map as promised during the meeting. SLB also provided a link to the NOPSEMA website with information about what they do and their role in the Environmental approval process. SLB acknowledged NLC's concerns discussed during the meeting with the offshore oil and gas production and clarified SLB are not currently involved in any offshore operations so can't comment on that. SLB further clarified they are a data provider specialising in seismic data acquired offshore and hopefully licenced to potential customers who would then analyse and decide further exploration activities. SLB confirmed the benefit of a multiclient survey is that once the survey is complete and the data is collected, it can be provided to a range or end users meaning it's unlikely a seismic survey is required within the area again. SLB also confirmed they are consulting with NLC after identifying them as an interested party (relevant person) who need to be made aware of the survey, aspects that may affect the environment and controls put in place to manage and reduce potential risks. SLB also noted how NLC mentioned there were more families that should be notified and suggested a postponed meeting with them next Thurs 24/02/2023. SLB confirmed they are happy to do this and the factsheet would be beneficial when talking to other families. SLB said following their meeting on Monday morning with SLR, NLC may be more comfortable with the survey and be able to explain to other families the low impact nature of the work, removing the need for a meeting on Thursday. However happy to meet if a meeting on Thursday was still required.	N/A	* (see note above table).

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		24/02/2023	Meeting	Meeting between SLB and NLC representatives and the area Traditional Owners. No representatives from NLC or Traditional Owner groups attended. Meeting was abandoned at 0930 hrs on 24/02/2023.		N/A	* (see note above table).
		24/02/2023	Phone call incoming	An employee from the Wadeye District Conference Room called SLB to ask if they knew about a meeting arranged with NLC. SLB confirmed with the employee there was a meeting arranged with Traditional Owner families and the meeting had started. The employee confirmed the meeting room was empty and there was no one present from NLC. SLB advised the employee they had called NLC earlier but the call was not answered. SLB left a voice mail message and text message with NLC stating they hoped the meeting was still on but did not receive an answer. The employee mentioned there had been an important funeral in the shire the previous day (23/02/2023) that may have affected the plans for today's meeting. SLB passed on his condolences and told the employee they would try contact NLC later to rearrange the meeting for early next week. SLB closed the call by thanking the employee for their call and providing a possible reason why no one turned up to the meeting. SLB advised they will try reschedule the meeting for either Monday 27th or Tuesday 28th February 2023. The employee noted SLB's intentions and said they would discuss with NLC when they next see them.		No objections or claims – no response/actions required.	* (see note above table).
		24/02/2023	Email outgoing		SLB emailed NLC advised they were waiting online for the meeting scheduled with NLC representatives and Traditional Owners today but no one joined. The venue holder advised SLB to contact NLC and hopefully rearrange for Monday 27/02/2023 and they offered to waive the hire fee. SLB closed the email by saying they will see if they can rearrange for early next week once they speak to NLC.	N/A	* (see note above table).
		24/02/2023	Email incoming	A NLC Sea Country Representative responded to the email SLB send earlier in the day (previous item) regarding cancelled meeting. NLC apologised and advised that they were busy today and hopefully they can re-connect the following week once the meeting was rearranged.		No objections or claims – no response/actions required.	* (see note above table).
		27/02/2023	Phone call outgoing		SLB made several attempts to call NLC but there was no answer. SLB left multiple voice messages requesting a call back to discuss a new date and time for a meeting with NLC and Traditional Owners.	N/A	* (see note above table).
		27/02/2023	Email incoming	NLC emailed SLB to advise they haven't got clear direction from NLC to conduct the meeting and asked SLB to confirm with the Petroleum and Energy section within NLC for an official request.		No objections or claims – response to request in email below.	* (see note above table).

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		27/02/2023	Email outgoing		SLB replied to NLC's last email (previous item) advising NLC they were concerned as they hadn't heard from them since the lead up to the workshop planned for 24/02/2023. SLB confirmed they would discuss with the NLC Petroleum and Energy section. SLB included a recipient from the NLC Petroleum and Energy section in this email and asked if they would have some time to discuss a way forward to continue consultation with NLC. SLB confirmed they are still not sure if there are any concerns regarding SLB's plans for a MSS offshore Bonaparte (referred to attached information sheet and one page flyer). SLB mentioned they have already had a meeting with the NLC Petroleum and Energy section (13/01/2023) whom advised SLB should contact the local Traditional Owners along the coast and hence the effort to liaise with previous NLC representative. SLB advised they are available at any time NLC are and provided their contact details.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided NLC with the four week pre-survey notification.	N/A	* (see note above table).
		07/03/2023	Email incoming	Automatic reply with updated contact details for NLC.		No objections of claims – contact details to be updated.	* (see note above table).
		13/03/2023	Email outgoing		SLB reached out to NLC in that hope that SLB can connect into someone in the NLC to discuss the project in terms of finding out if there are any remaining concerns from the Land Council, Sea Country or any TOs as survey commencement approaches. SLB met with NLC some months back and have since tried to get meetings with TOs in the Wadeye region to present and discuss the project.	N/A	* (see note above table).
		16/03/2023	Email outgoing		SLB reached out to NLC (new contact) to progress discussions on the MSS. SLB provided background to who SLB has contacted from NLC in the past. SLB asked if there are any concerns with the review of the provided material and if not, requested NLC let SLB know so they can log with the regulator as concluded.	N/A	* (see note above table).
		23/03/2023	Email outgoing		SLB stated that SLB has been trying to reach NLC this week via the NLC Darwin reception and left messages. SLB wants to get some time to pick up on consultation efforts that began last year with other NLC representatives with regard to plans for the Bonaparte Basin MSS. The factsheet that has previously been provided to NLC was attached. SLB want to make sure there are no remaining concerns or sensitivities in NLC Traditional Owners	N/A	* (see note above table).

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					and so would appreciate if NLC had time for a discussion.		
		24/05/2023	Email outgoing		SLB sent an update to NLC and asked if NLC would like SLB to arrange an update meeting.	N/A	* (see note above table).
		22/09/2023	Email outgoing		SLB sent an email stating they have been trying to contact NLC regarding the planning progress of the Bonaparte survey. SLB stated that the previous contact they have been using had a bounced back email so asked who within the council SLB could direct emails to.	N/A	* (see note above table).
		02/11/2023	Email outgoing		SLB informed NLC they would be happy to provide any further information if requested and asked for any feedback to be provided back within the next two weeks.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken with the NLC can be found in Section 5.5.8.2 of the EP.					
44	Department of Biodiversity, Conservation and Attractions (**DBCA**)	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		20/01/2022	Email incoming	**Response to SLB email dated 17/01/2022** DBCA advised that given the location of proposed activities they are unlikely to cause and impacts to Western Australian Marine Parks and provided contact details for future correspondence.		No objections or claims – contact details to be updated.	* (see note above table).
		21/01/2022	Email outgoing		**Response to DBCA email dated 20/01/2022** SLR acknowledged the new contact details and that our engagement register will be updated and keep DBCA included in all future correspondence.	N/A	* (see note above table).
		21/02/2022	Email incoming	DBCA acknowledged email sent from SLB earlier that date (previous item).		N/A	* (see note above table).
		07/03/2023	Email outgoing		Provided the DBCA with the four week pre-survey notification to relevant persons.	N/A	* (see note above table).
		07/03/2023		Automated response acknowledging receipt of email.		No objections or claims	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
		07/03/2023	Email incoming	**Response to SLR email dated 07/03/2023:** DBCA acknowledged notification and has forwarded to relevant staff and region for visibility.		No objections or claims.	* (see note above table).
		08/03/2023	Email outgoing		SLB thanked DBCA.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
45	Carnarvon Energy - AC/P63	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		Provided Carnarvon Energy with the four week pre-survey notification to relevant persons.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
46	Inpex Browse - AC/P66	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/03/2023	Email outgoing		Provided Inpex Browse with the four week pre-survey notification to relevant persons.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		06/11/2023	Email incoming	Inpex asked SLB to add other contacts (provided) to the notification list for future communication.		No objections or claims – consultation register has been updated.	* (see note above table).
		07/11/2023	Email outgoing		Confirmed consultation register has been updated.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
47	Finder Energy – AC/P61	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		17/01/2022	Email incoming	**Response to SLB email dated 17/01/2022** Finder requested shapefile of the OA.		No objections or claims – however, requested shapefile provided.	* (see note above table).
		18/01/2022	Email outgoing		**Response to Finder email dated 17/01/2022** Shapefiles provided by SLR	N/A	* (see note above table).
		07/03/2023	Email outgoing		Provided Finder Energy with the four week pre-survey notification to relevant persons.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					any additional information that may be required or allow more time if requested. SLB provided the factsheet.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
48	Santos - AC/P69, AC/P67	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		18/01/2022	Email incoming	**Response to SLB email dated 17/01/2022** Santos requested future correspondence is made to another contact and those contact details were provided.		No objections or claims – contact details to be updated.	* (see note above table).
		18/01/2022	Email outgoing		**Response to Santos email dated 18/01/2022** SLR noted the request and updated stakeholder register	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email incoming	**Response to SLB email dated 08/02/2022** Santos has been in touch with SLB and requests 48hr operational look ahead plan.		No objections or claims – Santos included in 48hr look-ahead.	* (see note above table).
		08/02/2022	Email outgoing		**Response to Santos email dated 18/01/2022** SLR confirmed Santos will be included in 48hr look-ahead plan.	N/A	* (see note above table).
		07/03/2023	Email outgoing		Provided Santos Energy with the four week pre-survey notification to relevant persons.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
49	PTTEP Australasia - AC/RL12, AC/RL7	17/01/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		08/02/2022	Email outgoing		Follow up to introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		Consultation is considered to be fulfilled as sufficient information has been provided and a reasonable period of time has elapsed for the relevant person to determine the potential impacts or risks to them from the Seismic Survey. In addition, no objections or claims were received.					

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
		07/03/2023	Email outgoing		Provided PTTEP Australasia with the four week pre-survey notification to relevant persons.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
50	Melbana Energy AC/P70	11/08/2022	Phone call outgoing		SLB called Melbana Energy to discuss the permit (AC/P70) they were granted on 14 February 2022. Melbana were not included on the initial rounds so contact was made via phone first and then the distribution of the information sheet was to follow.	N/A	* (see note above table).
		11/08/2022	Email outgoing		Introductory email from SLR with Fact Sheet attached. SLB provided the information sheet to Melbana Energy and provided a brief overview in cover email. Requested further discussion if Melbana had any further questions or concerns over the proposed MSS.	No objections or claims made since information was provided.	* (see note above table).
		07/03/2023	Email outgoing		Provided Melbana Energy with the four week pre-survey notification to relevant persons.	N/A	* (see note above table).
		15/05/2023	Email outgoing		SLB provided an update regarding the seismic survey and attached an updated factsheet. Melbana can contact SLR with any questions or concerns they have.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					allow more time if requested. SLB provided the factsheet.		
		08/11/2023	Email outgoing		SLB provided update email to new contacts due to previously spoken to contact having moved on. SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
51	Balanggarra Aboriginal Corporation (BAC)	18/10/2022	Email outgoing		Email follow up to the Balanggarra Aboriginal Corporation (BAC). SLB advised in the email that they had already submitted a request for contact via the "contact" tab on the BAC website. SLB explained the consultation approach and including the worst case from unplanned scenarios (i.e. an oil spill from the vessels fuel tank) and using this to identify relevant persons and provide further information as well as the opportunity to comment or ask questions as to whether a spill could occur offshore and its potential to reach the shoreline. SLB requested availability for a call to discuss further and find other groups that may also be concerned.	N/A	* (see note above table).
		18/10/2022	Website contact		SLB went onto the BAC website but there was no phone number provided on the website for contact. SLB provided details on the 'Contact Us' tab and submitted it. This was then followed up with an email (as detailed above) with a request to meet with BAC.	N/A	* (see note above table).
		20/10/2022	Email outgoing		SLB got introduced to the key people at BAC by the KLC. An email was submitted which provided an introduction of SLB and the proposed seismic survey. SLB explained the consultation approach and including the worst case from unplanned scenarios (i.e. an oil spill from the vessels fuel tank) and using this to identify relevant persons and provide further information as well as the opportunity to comment or ask questions as to	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					whether a spill could occur offshore and its potential to reach the shoreline. SLB asked the key people at BAC if they could arrange a time for a call in the next couple of days to discuss the project further.		
		01/11/2022	Email outgoing		SLB was provided with the contact details of another key person at BAC so provided another introductory email. Attached to the email was a revised and targeted fact sheet that was developed for native title holders. The email summarised the proposed survey and also the suggestion that the information provided could be provided to other BAC members. A number of key questions were also asked in the email to prompt some further discussion with SLB and to find out what concerns they may have in regard to the survey. The key questions asked included: • Do you have any functions, interests or activities that may be affected by the proposed activities to be carried out under the environment plan? • Do you have any sea country rights that may be affected by the proposed activities to be carried out under the environment plan? • Do you want to meet with SLB to discuss the proposed activities to be carried out under the environment plan? SLB further said that they would like to meet with BAC and discuss the proposed survey and details within the factsheet and to advise a convenient time for that discussion.	N/A	* (see note above table).
		02/11/2022	Email incoming	**Response to SLB email dated 01/11/2022** The email from BAC thanked SLB for the earlier email and stated that they are busy preparing for an important members meeting on 16 November. BAC requested that SLB get back in touch following this date so they can develop a discussion.		No objections or claims – BAC requested a later meeting, which SLB have committed to as part of the ongoing consultation that will take place for the duration of the Environment Plan.	* (see note above table).
		02/11/2022	Email outgoing		Response to BAC email dated 02/11/2022 SLB thanked BAC for the reply and confirmed to touch base again following the members meeting on 16 November. SLB asked if timing allowed whether the information provided on the proposed survey could be discussed further with council members at the meeting on 16 November. SLB informed BAC that the EP is being prepared with the intention of acquiring the survey over 2022/2023 and would like to continue to consult with BAC. It was advised that even if the EP is	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					submitted prior to the members meeting, SLB would still like to receive some feedback on the survey and this would be incorporated as part of the ongoing consultation efforts that will continue.		
		21/11/2022	Phone call outgoing		As a follow-up to BACs email asking to wait until mid-November, SLB called BAC and left a message offering to discuss the Bonaparte Seismic Survey.	N/A	* (see note above table).
		25/11/2022	Phone call outgoing		SLB called BAC and left a message offering to discuss the Bonaparte Seismic Survey and to set up a meeting..	N/A	* (see note above table).
		05/12/2022	Phone call outgoing		SLB called BAC but there was no answer. SLB left a voice mail message offering to discuss the project further and to set up a meeting. SLB requested a call back.	N/A	* (see note above table).
		09/12/2022	Phone call outgoing		SLB called BAC but no answer so left a voice mail message offering to discuss the project further and set up a meeting. SLB requested a call back and advised they'd be following the call up with an email. SLB included SLR within this correspondence.	N/A	* (see note above table).
		09/12/2022	Email outgoing		SLB emailed BAC following unanswered phone calls and voice mail messages, requesting a time to have another call regarding the project. SLB expressed their desire to try and set up meetings with native title holders in their land council to describe and discuss the survey and listen to any concerns they may have. The previous email sent to BAC dated 02/11/2022 was also included within this email.	N/A	* (see note above table).
		03/02/2023	Email outgoing		SLB emailed BAC to provide an update on consultation with WGAC and advise of the workshop being planned for week commencing 16/02/2023 to discuss the proposed project. SLB invited BAC to join the workshop and noted that they would send updated information once timing confirmed. This email contained the previous three emails that SLB has sent to BAC dated 02/11/2022 and 09/12/2023.	N/A	* (see note above table).
		10/02/2023	Email outgoing		SLB emailed invite for BAC to attend a workshop where SLB will present and discuss their proposed marine seismic survey offshore Bonaparte. SLB advised SLB had been in discussions with WGAC whom had help propose and schedule the workshop. SLB and their environmental specialists (SLR) would like to present their project discuss the identified risks and adaptive management of those risks. SLB would also like to discuss and understand BAC's sensitivities to the proposed activity in the area and find out if SLB has captured all concerns.	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					The invitation was also extended to representatives from WGAC, MC Corporation, and KLC. SLB advised they will describe the Environmental Plan that they have been developing following regulatory requirements and confirm the project timeframe.		
		10/02/2023	Email outgoing		SLB emailed BAC to advise that due to low availability SLB would like to reschedule the proposed workshop (discussed in previous email, above item) to 16/02/2023. SLB concluded the email by commenting it would be great if BAC could attend.	N/A	* (see note above table).
		14/02/2023	Email outgoing		SLB emailed a different representative within BAC (passed on to SLB by WGAC). SLB advised they had been trying to discuss SLB's marine seismic survey offshore Bonaparte with another BAC alternative however had not received any response to SLB's outgoing consultation efforts since 22/11/2022. SLB advised they had attached a fact sheet and one page flyer describing SLB's survey and commented that BAC may have seen the invitation that SLB send them for their online session on 16/02/2023 where they would provide a presentation detailing the proposed survey, listening to feedback and taking any questions around any concerns. SLB commented it would be great if BAC and anyone else from the Balanggarra Group could join the workshop where SLB will be describing their survey, the environment, the potential risks to the environment and how SLB has developed adaptive measurements and operational procedures to mitigate these potential risks. SLB would then listen to feedback and take questions around any concerns.	N/A	* (see note above table).
		07/03/2023	Email outgoing		Provided the BAC with the four week pre-survey notification to relevant persons.	N/A	* (see note above table).
		24/10/2023	Email outgoing		SLB upated BAC. The EP is under assessment with NOPSEMA and SLB hope to be in a position to acquire late in December this year or starting in January 2024. The plan has not changed apart from a reduction in acquisition area so it is now smaller than shown in the factsheet attached. SLB stated they continue to be in contact with WGAC to work towards closing out concerns.	N/A	* (see note above table).
		26/10/2023	Email incoming	SLB's email has been forwarded to BAC's CEO for her attention.		N/A	* (see note above table).
		27/10/2023	Email outgoing		SLB thanked BAC for the update on the BAC CEO. SLB explained that they have previously been discussing the survey with another BAC contact and would be keen to update the new CEO on the	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					project to ask if she could see any aspects that might be of concern to the Balanggarra people. SLB asked contact to ask CEO if they have time in their schedule for a meeting where the project could be presented to them.		
		02/11/2023	Email outgoing		SLB asked BAC if they could ask the new CEO if they have any concerns about the proposed survey and that SLB would be happy to provide further information if requested. SLB asked feedback to be provided back within the next two weeks.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB asked BAC if they could provide a telephone contact for the new CEO so SLB could call them directly.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken can be found in Section 5.5.8.1 of the EP.					
52	Uunguu Part A – Wunambal Gaambera Aboriginal Corporation (WGAC)	19/10/2022	Phone call outgoing		SLB called WGAC but there was no answer. SLB left a voice message requesting a call back.	N/A	* (see note above table).
		20/10/2022	Phone call outgoing		SLB called WGAC again and got hold of a person there. SLB introduced the project to the person. WGAC advised it would be better for SLB to speak to the director and provided the phone number to SLB. SLB subsequently called this number but could only leave a voice message.	N/A	* (see note above table).
		21/10/2022	Email outgoing		SLB received email details for the director at WGAC and provided an introductory email. This email introduced the proposed Bonaparte Seismic Survey and provided further details on the consultation approach. That being the use of the worst-case scenario for an oil spill to occur which has been used to define the relevant persons that are included within the consultation process.	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					Details were provided on the survey location and the very low likelihood of a spill occurring given all the controls in place and the fact that it has not happened before in Australian waters. The fact sheet was provided which was targeted at providing sufficient information to Native Title groups. A map was also included in the correspondence which shows the EMBA and the potential any fuel oil could come close to the coastline, and reinforced that SLB want to make sure all relevant persons are aware of this, and have the opportunity to comment or ask questions if concerned. An invitation was made for a call to discuss the project or any concerns in the next couple of days.		
		24/10/2022	Text message incoming	WGAC contacted SLB to confirm they were available for a call on 27/10/2022 and provided contact details.		No objections or claims – scheduling meeting with SLB.	* (see note above table).
		27/10/2022	Meeting	SLB introduced themselves to WGAC and provided a project overview discussing high level aspects of marine seismic acquisition with regards to operations and risk of vessel oil spill, including proposed control measures for accidental fuel spill. SLB reaffirmed such a spill had never occurred within Australian waters and was therefore unlikely. SLB explained the intentions of consulting relevant persons from WGAC who would have sensitivities or concerns with the project. SLB requested a forum to discuss with the wider native title holder population and how best to achieve this. WGAC advised there was a Director's meeting mid-November where they would raise the project with the intention to table at the next AGM scheduled early December. WGAC requested additional information be provided ahead of the November meeting. SLB offered to construct more tailored information on operations, controls, risks and mitigation measures. WGAC confirmed that is exactly what would be needed and general native title holders would be very interested in hearing from SLB and a visit to the region to run a short presentation would be good. Actions: • SLB to provide WGAC with overview document. • WGAC to use at upcoming Corporation meetings. Both parties agreed to keep in touch and progress discussions. See meeting minutes (**Appendix G**) for further details.		No objections or claims - WGAC provided direction on future consultation and both parties have actions to progress.	* (see note above table).
		01/11/2022	Email outgoing		SLB provided a follow up email to provide further information on the proposed survey with so provided another introductory email. It is noted that there is an upcoming council meeting that the material provided would be good to distribute to members. Attached to the email was a revised and targeted fact sheet that was developed for native title holders. Some key questions were also asked in the email to prompt some further discussion with SLB and to find out what concerns they may have in regard to the survey. The intention of these questions was to pass on to Native titleholders. The key questions asked included:	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					• Do you have any functions, interests or activities that may be affected by the proposed activities to be carried out under the environment plan? • Do you have any sea country rights that may be affected by the proposed activities to be carried out under the environment plan? • Do you want to meet with SLB to discuss the proposed activities to be carried out under the environment plan? SLB stated that they would like to meet and discuss the proposed survey and details within the factsheet and to advise a convenient time for that discussion. In addition, SLB also asked if the information could also be forwarded on to the Balanggarra Aboriginal Corporation to help facilitate the provision of information. As SLB have been unsuccessful at reaching them at that time.		
		04/11/2022	Email outgoing		Follow up email from SLB as to whether there were any initial thoughts or questions regarding the email sent on 01/11/2022.	N/A	* (see note above table).
		21/11/2022	Phone call and text message outgoing		SLB called WGAC but there was no answer. SLB followed with a text message to offer a call at his convenience.	N/A	* (see note above table).
		25/11/2022	Phone call outgoing		SLB called WGAC but there was no answer. SLB left a voice mail message requesting a call back to arrange a meeting.	N/A	* (see note above table).
		05/12/2022	Phone call outgoing		SLB called WGAC but went straight to voice mail. SLB left a voice mail message requesting a call back to arrange a meeting.	N/A	* (see note above table).
		09/12/2022	Phone call outgoing		SLB called WGAC but there was no answer. SLB left a voice mail message requesting a call back to arrange a meeting and advised would follow up with an email.	N/A	* (see note above table).
		09/12/2022	Email outgoing		SLB sent an email to WGAC following a phone call and multiple voice mail messages to request a suitable time to call and discuss the project. SLB expressed their desire to set up meetings with native title holders in their Land Council to describe and discuss the survey and listen to any concerns. The previous two emails sent to the WGAC dated 01/11/2022 and 04/11/2022 were also included within this email.	N/A	* (see note above table).
		12/12/2022	Email incoming	WGAC emailed SLB to arrange a phone call on 15/12/2022 at 0900hrs.	SLB responded (see next item).	No objections or claims – phone call arranged in next email.	* (see note above table).

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		12/12/2022	Email outgoing		SLB responded to previous correspondence request confirming a date and time for phone call meeting on15/12/2022 at 0900 hrs.	N/A	* (see note above table).
		16/12/2022	Email outgoing		SLB emailed WGAC acknowledging WGAC's inability to meet the day before due to competing meeting commitments. SLB suggested a phone meeting the next Monday (19/12/2022) following a meeting NOPSEMA held to present updated consultation guidelines.	N/A	* (see note above table).
		16/12/2022	Email incoming	WGAC emailed SLB to confirm a meeting on 19/12/2022 at 0900 hrs and advise they will provide feedback over the weekend and issues with the briefing paper. WGAC also advised they will be in Perth Wednesday 21/12/2022 and Thursday 22/12/2022 to meet in person.	SLB responded (see next item).	No objections or claims – response below.	* (see note above table).
		16/12/2022	Email outgoing		SLB acknowledged WGAC's response (previous item) and offer to meet in person the following Wednesday or Thursday. SLB also thanked WGAC's for their offer to provide feedback on the fact sheet from WGAC and advised this will help address any concerns.	N/A	* (see note above table).
		19/12/2022	Email incoming	WGAC emailed feedback on fact sheet to SLB with the following queries and comments: • What time of the year/season will activity occur? • Has the oil spill modelling been completed? • What type of fuel and provide more detail on expected impact of type of vessel. • What is SLB's notification and impact response, impact and remedial plans within the EMBA on WG Waters and Coastal reef and inter-tidal areas. • WGAC has declared the marine waters and mainland of Uunguu Determination area as Indigenous Protected Area Classification VI International Union Conservation Nature Protected Area managed by WAGAC implementing our Wundaagu Saltwater Management Plan. • What is the anticipated participation of Wunambal Gaambera in any response plans? • Agreement process between SLB and WGAC to secure contingent response, remediation and compensation arrangements. The email was closed advising Thursday morning would be a more suitable time to meet in person.	SLB responded (see next item).	No objections or claims – however, SLB provides a response to WGAC's queries below in preparation for the future meeting.	* (see note above table).
		20/12/2022	Email outgoing		SLB replied to WGAC's queries in previous email dated 19/12/2022 with the following information which included extracts from the EP: • Activity to occur Dec – Mar. If commenced February 2023 would extend into April 2023.	N/A	* (see note above table).

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					• Oil modelling has been completed – EP Section 8.3 and Appendix B. • Light MGO used as fuel. SLB subcontracts vessels – will provide vessel specs when contracted. Segmented fuel tanks, smaller volume, double hull etc reduces spill risk to negligible. Never known to occur in Australian waters. • Sections 5.6, 10.6 and 10.9 of EP address impact response, remedial plans. • Would like to discuss the 'WWUunguu Determination area as Indigenous Protected Area Classification VI International Union Conservation Nature Protected Area' and Wundaagu Saltwater Management Plan as unsure of meaning and actions required. • As per EP, full notifications to WG reps should a spill occur. No direct action required by WG, participation would be receipt of updates and containment reporting only. • To discuss thoughts on remediation and compensation models further. Emergency response plan attached. Email closed with request for a meeting time and place for Thursday 22/12.		
		22/12/2022	Meeting	Meeting with SLB and WGAC summarised in the below email (next item) from SLB to WGAC dated 23/12/2022 below. See meeting minutes (**Appendix G**) for further details.		N/A	* (see note above table).
		23/12/2022	Email outgoing		SLB emailed WGAC to thank them for their attendance at the meeting held the day before and sharing the cultural historical background. The email summarised key meeting discussion items: • SLB's intention to engage with native title holders fully and transparently to fully understand the interaction with the environment and ensure native title holders have the opportunity to discuss and address any concerns they have. • The NOPSEMA consultation guidelines issued 15 Dec and SLB's willingness to visit the Land Council and hold a town meeting/s to explain project, potential environmental impacts and listen to any concerns. • Both parties agreed to developing an 'agreement of terms' with Kimberley Land Council on processes to be followed if a spill occurs and how will be put into effect. • The agreement would be suitable and agreeable by design to all groups within the KLC and the WGAC would be willing to take lead developing the agreement and help SLB link to other groups.	N/A.	* (see note above table).

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					• SLB would support a fee for service arrangement to enable KLC to develop the terms of agreement, subject to agreement by both parties. • Action items: 1. SLB to send WGAC financial assurance confirmation to include in EP; and 2. WGAC to supply SLB summary of key terms needed in agreement for first draft as soon as possible. • Both parties agreed the agreement would target completion by the end of January 2023. Email closed with invitation to advise if anything missed from meeting and advised email is copied to SLR.		
		05/01/2023	Email outgoing		SLB emailed WGAC regarding intention to work on the agreement of terms document from meeting 22/12/2022. SLB requested the summary of key terms to enable agreement to be drafted.	N/A	* (see note above table).
		10/01/2023	Phone call outgoing		SLB called WGAC but there was no answer. SLB left a voice mail message requesting that the summary of key terms be provided to SLB to enable an agreement to be drafted.	N/A	* (see note above table).
		11/01/2023	Email outgoing		SLB emailed WGAC to advise they would appreciate if they could provide the summary of key points to SLB to enable agreement to be drafted. SLB advised they would also continue to try them via phone. The previous email sent to KLC dated 05/01/2023 was also included within this email.	N/A	* (see note above table).
		16/01/2023	Email outgoing		SLB called WGAC and there was no answer. SLB left a voice mail message to call SLB back at earliest convenience.	N/A	* (see note above table).
		16/01/2023	Phone call incoming	SLB thanked WGAC for returning SLB's voice mail message left earlier the same day. SLB and WGAC further discussed the development of an 'agreement of terms' used to formalise communications and actions required between SLB and the Land Council regarding what processes are to be followed should seismic vessel spill occur. WGAC confirmed he would send the list of key terms needed to build the agreement to SLB within the following three days.		No objections or claims – both parties progressing action to develop terms of agreement.	* (see note above table).
		26/01/2023	Email incoming	WGAC provided SLB with a draft term sheet to assist SLB with drafting up an agreement for the survey discussed at the meeting on 22/12/2023.		No objections or claims – both parties progressing action to develop terms of agreement.	* (see note above table).
		27/01/2023	Email outgoing		SLB responded to WGAC's email dated 26/01/2023 providing proposed terms to be used within agreement. SLB advised they would contact WGAC early next week with feedback following their	N/A	* (see note above table).

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					review. SLB also acknowledged that WGAC will be available for a catch up in Perth from next Monday.		
		31/01/2023	Meeting	Meeting between SLB and WGAC to discuss the key terms that need to be considered as part of the onward consultation process and form a written agreement between WGAC and SLB. Action items: 1. SLB to provide feedback to WGAC on the key terms document with a marked-up version; 2. SLB to construct scope document of the technical peer review process for the existing oil spill modelling to be shared with WGAC. Include timeline and list of suitable specialist companies who have ability to carry out peer review study; and 3. SLB to then engage services with a view to complete the review within 2 weeks. See meeting minutes (**Appendix G**) for further details.		No objections or claims – various meeting actions required in follow-up consultation.	* (see note above table).
		02/02/2023	Phone call outgoing		SLB called WGAC to discuss a workshop with Traditional Owners within their management area to go over the project including proposed activities, risks and risk management and spill modelling review. There was no answer. SLB left a voice mail message to check availability for a workshop over next fortnight.	N/A	* (see note above table).
		02/02/2023	Email outgoing		SLB emailed WGAC following voicemail left the previous day (above), including: Update following correspondence with NOPSEMA and a suitable contact (and this contact has reached out to WGAC) and WGAC concerns about potential adverse effects to long term lease. SLB advised NOPSEMA suggested holding a workshop to discuss oil spill modelling, the operational risk management and then hear WGAC's concerns. SLB asked if a workshop would be ok and also noted this would be an opportunity to further discuss the key terms drafted in January. SLB concluded the email asking WGAC to advise when WGAC are free to discuss.	N/A	* (see note above table).
		03/02/2023	Phone call incoming	WGAC returned SLB's call from previous day. Discussion is summarised in the below email (next item) from SLB to WGAC dated 03/02/2023 below. See meeting minutes (**Appendix G**) for further details.		N/A	* (see note above table).
		03/02/2023	Email outgoing		SLB emailed WGAC a summary of phone call shared earlier in the day, including: • WGAC is open to the idea of a workshop; • WGAC will discuss workshop with council next week; • WGAC will also liaise with other KLC groups (BAC and MG Corporation) to ask if they would like to join the workshop – SLB will also invite them; • WGAC stated the need to have spill modelling assessed and SLB said they can revisit following workshop if WGAC still not satisfied with modelling; and	No objections or claims – various meeting actions required for further consultation.	* (see note above table).

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					• WGAC will be available in Perth 13/02/2023 for workshop and could assist with setting up video-conferencing for attendees not able to travel. SLB said they would contact WGAC next week to confirm workshop. See meeting minutes (**Appendix G**) for further details.		
		06/02/2023	Email outgoing		SLB emailed WGAC to advise 13/02/2023 will not work and asked if they could advise SLB if the 14/02/2023 (the following day) would work.	N/A	* (see note above table).
		08/02/2023	Email outgoing		SLB emailed WGAC to provide an update on the following: • The key terms document WGAC provided to SLB is being reviewed and will get a response to WGAC ASAP so they can review and discuss at the up-and-coming workshop. • SLB asked if 14/02/2023 suits to hold the workshop in Broome and suggested alternative dates if not suitable. This email included the previous email sent from SLB to WGAC on 06/02/2023.	N/A	* (see note above table).
		09/02/2023	Email outgoing		SLB emailed WGAC the proposed agenda for the up and coming workshop, which will take approximately two hours. SLB asked WGAC to confirm whether 14/02/2023 works for WGAC and the KLC team. SLB also advised they were hoping to get feedback on the proposed key terms the following day (10/02/2023).	N/A	* (see note above table).
		10/02/2023	Email outgoing		SLB emailed WGAC to provide them with a letter of assurance which included the key terms discussed within previous meetings and correspondence. SLB advised they were proceeding with booking the Workshop for the following Tuesday morning (14/02/2023), sending out an invite later that day. SLB asked WGAC to forward invite to those within WGAC and KLC that would be interested to learn about their processes and survey. See letter of assurance (**Appendix G**) for further details.	N/A	* (see note above table).
		14/02/2023	Email incoming	WGAC emailed SLB to advise their original representative was unable to attend presentation that morning but another person would attend. WGAC advised they would respond to the Term sheet in the coming days and provided an alternative contact for BAC.		No objections or claims – no response/actions required.	* (see note above table).
		14/02/2023	Email outgoing		SLB acknowledged WGAC's email from earlier that day advising they could not attend the workshop. SLB asked if they could dial in as they were hoping to discuss the draft letter of agreement.	N/A	* (see note above table).

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		15/02/2023	Email outgoing		SLB emailed WGAC to confirm their availability for workshop scheduled 16/02/2023 (following day) and asked if they would be coming into office.	N/A	* (see note above table).
		16/02/2023	Meeting	Meeting with SLB, SLR and WGAC to further discuss survey and letter of assurance SLB provided WGAC for consideration. Key meeting discussion points are summarised in email below (next item). Refer to meeting minutes for further details (**Appendix G**).		N/A	* (see note above table).
		16/02/2023	Email outgoing		SLB emailed WGAC to provide a summary of the meeting notes and actions from meeting held earlier that day. SLB thanks WGAC for their time and opportunity for SLB to better explain the survey. SLB mentioned they are preparing the next submission of their EP to NOPSEMA following revisions to the consultation methodology with relevant persons. SLB noted the following key items discussed at the meeting: • SLB provide more clarity on actions and responsibility following a spill. • Insurances and indemnity. • SLB to provide a summary of spill risk identification, modelling, effect and potential residual risks to coastline. • SLB to arrange peer review of above report. • WGAC to provide agreement document to use a mutual agreement for both parties. SLB concluded the email advising they have secured a meeting with NOPSEMA next week. See meeting minutes (**Appendix G**) for further details.	No objections or claims – various meeting actions required for further consultation.	* (see note above table).
		21/02/2023	Email outgoing		SLB present the above email (previous item) to WGAC to see if there was anything further WGAC needed while preparing the short agreement document for SLB. SLB asked the above because SLB were meeting with NOPSEMA later that day and wanted to provide them with an update and any concerns WGAC may have. SLB closed the email asking if they had an estimate of when the document will be ready.	N/A	* (see note above table).
		24/02/2023	Email outgoing		SLB emailed WGAC to provide all the information requested at the previous meeting between SLB and WGAC (held 16/02/2023), including: • a summary of the oil spill risk assessment modelling study WGAC requested this information in order to have it peer reviewed to understand the risk to near shore areas of concerns. SLB advised they are in the process of identifying a 3rd party consultant suitable for the review and will update WGAC in due course.	N/A	* (see note above table).

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					• More detail and clarity on the practicalities of oil spill response, authority control (Commonwealth and State waters), financial insurance and indemnity and financial obligations.
					• SLB commits to supply the following information to WGAC prior to survey commencement:
					  ○ Insurance details carried by seismic vessel operator;
					  ○ SLB insurances for financial resources and capability to cover responsibilities in the event of a fuel oil spill response activity; and
					  ○ indemnity to WGAC and KLC for all such finalise responsibilities.
					• SLB has already provided the required financial assurances to NOPSEMA (also attached in the email).
					SLB stated they are awaiting the WGAC agreement document (letter of assurance) also agreed at the meeting held the previous week, which confirms SLB's intention to work to the signed agreement with WGAC and is part of the ongoing consultation process with WGAC.
					SLB also hopes the agreement could cover and apply other KLC groups BAC and MG Corporation.
					SLB concluded the email stating SLB has provided the requested information and kindly request the execution of the agreement ASAP, advising SLB intend to resubmit their EP the following week and are committed to continue the engagement through the project commencement, execution and beyond.
					SLB asked if WGAC could let SLB know that all the requested information has been provided and received in order to finalise the agreement, or whether anything is missing.
					SLB advised they would be in contact soon with suitable peer review candidates for WGAC to choose from.		

		01/03/2023	Phone call incoming	WGAC returned SLB's phone call voice mail message left earlier that day. WGAC updated SLB on their research in to the information that SLB provided on 24/02/2023 (previous item). WGAC commented they understand that NOPSEMA do not have authority within the 3NM zone from the coastline. WGAC were seeking clarification from DMIR on oil spill response responsibilities within this zone at a meeting scheduled for 02/03/2023.		No objections or claims – no response/actions required.	* (see note above table).

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				SLB asked about the agreement that WGAC were drafting and WGAC replied this was delayed based on the volume of information they are having to read through, having limited resources and not fully understanding all of the content. WGAC advised the agreement would not be ready until after a meeting with DMIR. WGAC discussed how overwhelming the new consultation process is with no previous experience and how the they are hoping the draft agreement can be used for other EPs in the future. SLB advised that all future EPs for offshore activity will require a separate risk analysis and modelling so would be difficult to capture in one document. SLB asked if WGAC intended for the agreement to cover the other Traditional Owner groups within KLC (BAC and MC Corporation) and WGAC confirmed yes the agreement would include the other groups. SLB confirmed they would cover the costs that WGAC forecasts as needed to finalise the agreement. SLB updated WGAC they intend to submit the EP this week. SLB stated they are committed to reaching an agreement with WGAC and the KLC as soon as possible and this would be ongoing. SLB and WGAC concluded the conversation by agreeing to catch up soon after WGAC meet with DMIR to progress the agreement to signature as quickly as possible.			
		07/03/2023	Email outgoing		Provided the DBCA with the four week pre-survey notification to relevant persons.	N/A	* (see note above table).
		09/03/2023	Email outgoing		SLB emailed WGAC to update on the topic of the peer review for the oil spill modelling. SLB have contacted industry professionals and have two companies with local offices in Perth who can provide consultants capable of carrying out this work. SLB questioned if WGAC want SLB to proceed and ask for consultant's names and engage them in the scope of work or if WGAC would like to engage directly and then decide which consultant WGAC are happy with for SLB to subcontract for the work. SLB stated that the EP has been resubmitted to NOPSEMA for assessment which is now ongoing.	N/A	* (see note above table).
		15/03/2023	Email outgoing		SLB emailed WGAC to add further to the email sent 09/03/2023. SLB has reviewed suitable peer reviewers for the oil spill modelling and are trying to finalise that now. SLB asked if WGAC are happy to go ahead with SLBs selection and have the review process commenced. SLB will aim to commence the review next week if they do not hear back from WGAC.	N/A	* (see note above table).

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		17/03/2023	Email incoming	**Response to SLB email dated 15/03/2023:** WGAC emailed to apologise for the delayed response due to travel and meetings. WGAC have WGAC Director's meeting next Tuesday (21 March) and Wednesday (22 March) at Kalumburu and asked if SLB is able to attend on either day to present the proposal. WGAC is expecting legal to provide draft agreement on Monday 20 March. In response to the peer review, WGAC has requested SLB provide the Peer Review Consultants, profile and availability from each company and the proposed brief for the peer review so WGAC can review and confirm.			* (see note above table).
		20/03/2023	Phone call incoming	SLR received a call following an email received from WGAC regarding meetings with WGAC directors online in Kalumburu. WGAC updated SLB on the status of WGAC internal discussions regarding the survey and commented he is now in Kalumburu for WGAC directors meeting. SLB were invited to present the SLB project to the directors. SLB updated WGAC that SLB are down a person due to personal reasons and it would be difficult to travel to Kalumburu and it is very short notice to travel due to logistics. SLB offered to present via Teams and have SLR consultants online also. WGAC accepted this would be a good idea. WGAC informed SLB that the draft agreement between WGAC and SLB should be ready from lawyers later in the day and would be sent through. WGAC discussed the request to have the oil spill modelling peer reviewed and would like a scope of work from SLB and named candidates of consultants to carry out the work.		SLB to provide WGAC with candidates to carry out review of oil spill modelling	* (see note above table).
		20/03/2023	Email incoming	WGAC emailed that they will have wifi connection at the meeting venue on Tuesday and Wednesday and can do a Teams connection if SLB can meet online. A half hour session between 11am and 2pm could be allotted to SLB.		No objections/claims. SLB to reply confirming time slot for presentation.	* (see note above table).
		20/03/2023	Email outgoing		**SLB response to WGAC email dated 20/03/2023:** SLB replied suggesting a slot at 11am western Australia time due to SLR office in New Zealand. SLB will send a Teams invite and requested 45 minute time slot. SLB will run through a shorter version of the slides previously presented and then will discuss ongoing concerns and path forward.	N/A	* (see note above table).
		22/03/2023	Teams Meeting	SLB held an online Teams Meeting with the WGAC GM, WGAC Director, and a group of directors from Wunambalgaambera group. SLB opened the meeting with an explanation as to why they wanted to hold the meeting with the WGAC Directors following the invitation. Introductions were made around the meeting room with SLB noting approximately 9 attendees from WGAC – SLB asked for names and designations post meeting. SLB provided a presentation and described MSS and the Bonaparte MSS in detail. SLR took over the presentation to describe the environment, values and sensitivities SLR had identified and discussed in detail the adaptive management measures to be implemented within the EP as well as the UAM. SLR discussed unplanned activities and the oil spill modelling as this is a key concern to WGAC. WGAC confirmed planned activities are of lower concern due to the distance from shore of the project and of more concern is the remaining uncertainty around a vessel collision with an oil spill reaching the inshore area. WGAC described meetings with DoT and AMSA regarding gaining clarity on responsibilities and actions in place to remedy an oil spill in Australian waters. WGAC has concerns that AMSA reach does not extend to		SLB to provide oil spill modelling peer review scope and consultant CVs to WGAC.	* (see note above table).

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				the far north Kimberley. SLB asked what mitigation AMSA offered to spill incidents of which WGAC was unsure. WGAC described how community ancestors used to walk the seabed between Australia and Timor Leste and had developed an underwater culture and stories of the seabed – this is driving their concerns of a collision and spill. WGAC acknowledged SLB controls to be used to safeguard a spill from the seismic vessel were apparent, however concerns remained for a 3rd party vessel involved in any collision with SLBs operations – what fuel type and size of tank would that vessel have? SLB discussed the previous request from WGAC to have the spill modelling peer reviewed and WGAC confirmed they would like to be sent a scope of work for the peer review and CVs of potential consultants. SLB raised the subject of the proposed agreement being drafted by WGAC lawyers which WGAC had requested be in place in December 2022. It was confirmed that the draft was still under construction and would include working regarding SLB and vessel insurance and financial insurances and will detail WGAC requirements regarding other items to be agreed which would include the peer review of the modelling. WGAC confirmed this would be sent to SLB by the end of next week (30 March) and SLB confirmed they would send the oil spill modelling review scope and CVs to WGAC. SLB thanked WGAC for their time and expressed their hope that SLB and SLR had been clear in their descriptions of the project and risks and the steps going forward.			
		22/03/2023	Email outgoing		SLB thanked WGAC for their time this morning and organising the attendees. SLB will get moving on the oil spill peer review and wanted to share their preferred company and person. SLB provided WGAC with information about the company to be used (RPS) and attached the CV of the consultant to be used. SLB outlined the scope of work – review of modelling done by Calypso followed by a summary along the line of what WGAC has requested where the results would be explained, and the risks quantified. The RPS consultant can present the results once ready. SLB is still pushing for the other company (EPI) for a candidate and will get a name to WGAC asap.	N/A	* (see note above table).
		24/03/2023	Email outgoing		SLB emailed to inform WGAC that EPI group have no availability to conduct the peer review and have suggested alternatives. SLB are not familiar with the suggested companies and would recommend going with RPS. If WGAC does not have any major objections, SLB will begin to put the scope detail together with RPS and get the peer review underway.	N/A	* (see note above table).
		24/03/2023	Text message outgoing		Text message to WGAC to ask if everything was ok and if the emails were getting through. No response was received.	N/A	* (see note above table).
		31/03/2023	Email outgoing		SLB emailed to send a note on the status of consultation. SLB asked WGAC to provide feedback on the draft agreement letter status (when it would be ready from WGAC for review), and the oil spill peer review process (confirm that WGAC is happy to proceed with RPS). SLB would like to advance the ongoing consultation with WGAC so that these items can be included in the EP to NOPSEMA.	N/A	* (see note above table).

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		06/04/2023	Email incoming	**Response to SLB email dated 31/03/2023:** WGAC replied thanking SLB for their email and requesting the brief/scope for the peer reviewer for WGAC review and to enable approval to proceed with the review. WGAC concurs with recommendations on RPS to conduct the peer review once WGAC has signed off on the peer review scope. WGAC-SLB agreement is anticipated to be ready to be sent to SLB next week.		N/A	* (see note above table).
		06/04/2023	Email outgoing		**Response to WGAC email dated 06/04/2023:** SLB emailed thanking WGAC for the update and has asked RPS to put more detail on his scope (attached). Missing in this scope is the offer to present and discuss findings with WGAC via a Teams meeting once he has completed. SLB is looking forward to receiving the draft agreement document next week.	N/A	* (see note above table).
		13/04/2023	Email outgoing		SLB contacted WGAC to see if WGAC had any feedback or updated on the oil spill peer review scope document or draft agreement document to be sent to SLB.	N/A	* (see note above table).
		19/04/2023	Email outgoing		SLB emailed WGAC to say that they had tried calling on mobile earlier to touch base on the oil spill review and draft agreement document, and to update WGAC with the most recent update from NOPSEMA regarding the EP and consultation with WGAC. SLB told NOPSEMA they are committed to continuing engagement with WGAC until they conclude the agreement letter and complete the oil spill review to address all concerns. To end this, SLB committed to maintaining regular contact (every 2 weeks) and document progress until the agreement is concluded. SLB asked WGAC is they have any feedback on the oil spill scope as they can progress with this but will wait to hear from WGAC. SLB asked if the draft agreement is ready to share with SLB.	N/A	* (see note above table).
		05/05/2023	Email outgoing		SLB emailed WGAC to see how they are doing and to ask if there were any further updates on the agreement draft and if WGAC are happy with the oil spill assessment scope for SLB to go ahead.	N/A	* (see note above table).
		23/05/2023	Email outgoing		SLB emailed WGAC to see if there was an update on the two items SLB are still engaging on.	N/A	* (see note above table).
		20/06/2023	Email outgoing		SLB emailed WGAC to confirm the emails from SLB are being received and if WGAC would like to continue with the engagement.	N/A	* (see note above table).
		20/06/2023	Email incoming	WGAC advised that had just arrived back in Perth and has a draft consultation agreement that will be sent to SLB tomorrow (21/3/2023) and may possibly catch up in person on Friday (23/3)2023) if available.		N/A	* (see note above table).

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		20/06/2023	Email outgoing		SLB responded that available to meet in the SLB office on Friday.	N/A	* (see note above table).
		23/08/2023	Email outgoing		SLB apologised and said they were meant to follow up again earlier to touch base and see if WGAC are in Perth for a discussion on the draft agreement and so this can be moved forward. SLB asked if WGAC could send through the draft if it is ready.	N/A	* (see note above table).
		13/09/2023	Phone call outgoing		SLB phoned WGAC to follow up on previous emails sent with no reply and to update WGAC on the oil spill peer review. The review was underway and should be completed early next week with a presentation being compiled. SLB and WGAC discussed times for a meeting to run through the modelling review if complete or an outline of it, with the full discussion and presentation scheduled for a meeting with the Corporation full board following their return to the country. WGAC informed SLB that the draft agreement could also be reviewed and discussed. SLB requested this be shared next week in order to give SLB time to review.	N/A	* (see note above table).
		13/09/2023	Email incoming	WGAC are keen to meet to run through the spill modelling peer review and explanation presentation either in completeness or in a skeleton so that feedback can be provided before presenting fully to the WGAC board. The draft agreement can also be discussed. WGAC will call SLB to arrange a meeting.		No objections or claims.	* (see note above table).
		20/09/2023	Phone call outgoing		SLB phoned WGAC to follow up on last week's phone call. SLB left a message asking WGAC's availability on 21 September for a catch up to discuss the draft agreement and status of the spill modelling peer review.	N/A	* (see note above table).
		11/10/2023	Email outgoing		SLB emailed WGAC an update that the oil spill peer review report is completed but that a presentation needs to be prepared in less scientific language for WGAC. SLB will get back to WGAC once this has been completed.	N/A	* (see note above table).
		30/10/2023	Phone call outgoing		SLB phoned WGAC to update on the project and the peer review oil spill modelling report. SLB left a message asking if WGAC was free in the new few days to discuss the plan to meet.	N/A	* (see note above table).
		31/10/2023	Email outgoing		SLB emailed WGAC to let them know they left a voice message. SLB asked if WGAC have had time to discuss and schedule the meeting to present the outcome of the spill modelling peer review and discuss the progress of the WGAC agreement. SLB stated they hope to be in a position to begin acquisition late December 2023 or early January 2024.	N/A	* (see note above table).
		03/11/2023	Email outgoing		SLB asked WGAC if they had availability to meet on 8 November to go through the presentation that captures the concerns that WGAC raised some	N/A	* (see note above table).

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					time ago and in the original Term Sheet. SLB stated they are committed to continue to work towards getting the agreement document in place and concluded.		
		06/11/2023	Phone call outgoing		SLB rang WGAC to follow up on the email sent on 3/11/2023 asking for availability for a meeting. SLB asked WGAC to provide an alternative date if they have availability.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB asked WGAC contacts if either could help with getting in contact with both the Balanggarra and MG Corporation GMs. SLB asked if phone numbers could be provided.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		09/11/2023	Meeting	SLB and WGAC met to review previously raised concerns of WGAC which were sent to SLB via a term sheet in early 2023. SLB provided an overview of the results of the oil spill modelling review and answered WGAC's questions.		Meeting discussed concerns previously raised by WGAC around oil spills.	* (see note above table).
		10/11/2023	Email outgoing		SLB thanked WGAC for meeting on 9/11/2023 where they went through the material prepared on the spill modelling review. SLB provided WGAC with the meeting minutes for WGAC to provide feedback. SLB informed WGAC that the final version will be submitted to NOPSEMA but will only be in the sensitive information pack. SLB asked If they could reserve a slot in the WGAC AGM for 7 December. SLB informed WGAC they plan to resubmit the EP to NOPSEMA in the coming 10 days or so and would appreciate any feedback before then.	N/A	* (see note above table).
		14/11/2023	Email outgoing		SLB provided WGAC an update following more data extraction from the spill modelling as requested. SLB provided the updated information to the powerpoint as a revision for the Corporation. SLB asked WGAC to provide any further information requests or thoughts on the updates. SLB asked if the draft agreement is ready to be shared.	N/A	* (see note above table).

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		16/11/2023	Phone call outgoing		SLB phoned WGAC to provide an update on a meeting held with NOPSEMA. SLB explained that NOPSEMA advised SLB check with [NAME REDACTED] on his role representing WGAC native title hodler population in disseminating information received from SLB.	N/A	* (see note above table).
		17/11/2023	Phone call outgoing		SLB phoned WGAC to provide an update following advice from NOPSMEA. SLB asked if WGAC would be free for a call or could call SLB ack as a matter of urgency. SLB explained the advice from NOPSEMA and what SLB require of WGAC. SLB further explained this information was important to clarify before SLB can resubmit.	N/A	* (see note above table).
		17/11/2023	Email outgoing		SLB emailed WGAC to follow up on voice message left earlier in the day and to update them following advice from NOPSEMA. SLB asked WGAC to confirm: • The information provided has been passed on to WGAC native title holders who [NAME REDACTED] represents as GM. • If any feedback was received back • If [NAME REDACTED] will continue to update WGAC native title holders after the EP has been resubmitted?	N/A	* (see note above table).
		21/11/2023	Phone call outgoing		SLB called WGAC to try again to update on a meeting with NOPSEMA. SLB left a voice message asking if WGAC contact was free for a call. SLB outlined that they are intending to resubmit the EP later this week but hoped to hear back before that. SLB explained they while still waiting to receive the agreement document, SLB intend to pursue the agreement document with WGAC post resubmission of the EP assuming WGAC still desire to have the agreement in place. SLB asked if WGAC require any further information to that provided recently and over the past months as SLB now consider they have provided all requested information. SLB asked WGAC contact to confirm the information has been dissemintated to the corporation members.	N/A	* (see note above table).
		21/11/2023	Phone call outgoing		Another SLB contact attempted to contact WGAC on the mobile and WGAC office phone to inform WGAC that a colleague was out of office so was following up on their behalf. SLB requested WGAC return a call.	N/A	* (see note above table).
		23/11/2023	Phone all outgoing		SLB phoned WGAC on their mobile to again try and update WGAC on the meeting SLB held with NOPSEMA (16/11/2023) and to share further information regarding WGAC's request for further information. SLB left a message outlining the advice received from HQ and has prepared a letter	N/A	* (see note above table).

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					regarding insurance cover which SLB would bring to bear if a fuel spill or other accident resulting from the survey occurred. SLB advised they would provide WGAC with a detailed email following this message. SLB updated WGAC that they are intending to resubmit the EP by the end of the week but hoped to hear from WGAC before then. SLB mentioned that SLB still intend to pursue the agreement document with WGAC post resubmission assuming WGAC still desire to have this in place.		
		23/11/2023	Email outgoing		SLB followed up earlier phone call with an email. The final action item from the slide presented in th emeeting on 9 November was to provide detail on SLB insurance coverage. SLB provided a letter of assurance for WGAC regarding SLB's commitment to cover all costs. SLB asked WGAC to convey this message to the Traditional Owners within the corporation. SLB stated that they await the draft agreement from WGAC's side and news on the opportunity to present at the next AGM. SLB explained that for the EP the pre activity consultation process is now concluded but that future discussions and communications will continue under ongoing consultation as per the regulator guidelines. SLB stated that they are always willing to provide WGAC any further information if requested.	N/A	* (see note above table).
		27/11/2023	Phone all incoming	[SLB phoned WGAC three times during the day and left messages for a call back] WGAC returned SLBs earlier phone calls. WGAC informed SLb that the draft agreement of terms between SLB and WGAC was ready to send and he would email them directly. WGAC stated the insurance letter sent by SLB was not adequate for WGAC and that more detail would be provided by email. SLB unpdated WGAC on the meeting earlier that day with NOPSMEA and their concern asking SLB to check that [WGAC contact] is contacting the native title holders in WGAC and passing on information related to the survey as and when provided by SLB? WGAC confirmed that the procedure was that all information was first shared with the WGAC directors and then after that shared with TO members. WGAC also commented that SLb had directly spoken with WGAC in a March online meeting. SLB asked if [WGAC contact] had communicated with the corporation and native title owners the presentation material and it was confirmed that he had not due to travel. The WGAC AGM has been pushed back to December 13 and a Directors meeting will be held on 7 December – WGAC asked if SLB could		SLB to review draft agreement once recieved by WGAC. SLB to provide WGAC with further information regarding insurance concerns once provided by WGAC.	* (see note above table).

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				present the spill review again at both these meetings which SLB agreed to. SLB informed WGAC that SLB are now in a position to resubmit the EP and that progressing to a signed agreement with WGAC would now fall into "ongoing consultation". WGAC commented that as long as this resulted in a meaningful document rather than just paper, then WGAC would be pleased.			
		28/11/2023	Phone call outgoing		SLB phoneded WGAC to thank them for the call yesterday and for sending through the agreement and to discuss further concerns regarding the insurance documentation sent through. WGAC did not answer the call so SLB left a message to outline that the draft agreement is now under review from SLBs legal and contracts department. SLB asked if WGAC would still be in Perth on Thursday to meet? SLB asked WGAC to confirm that the information previously sent regarding the proposed survey had been passed on to the WGAC directors and from there was communicated with the native title holders. SLB understands the spill modelling information had not yet been shared and the plan is for SLB to present this as the next WGAC directors meeting and then the next AGM.	N/A	* (see note above table).
		30/11/2023	Meeting	SLB met with WGAC with the purpose of the meeting to provide additional information to clarify further oil spill response roles and responsibilities in relation to commonwealth and state waters, and some additional information on the Financial Assurance side. SLB noted that they have received and are working through proposed the WGAC-SLB Agreement. WGAC mentioned that the date for the Directors meeting has been confirmed but the date for the AGM has moved again. SLB presented the slides on oil spill roles and responsibilities and discussed with WGAC as to who in the organisation would be responsible. SLB presented the Financial Assurance requirements from NOPMSEA. WGAC stated they still hold some reservation in that the assurance provided to NOPSEMA may not apply for State waters and may not be recognised by WA DoT – WGAC requested confirmation that this is the case and that WA DoT recognises the assurance and liability in the same way as NOPSEMA does. SLB confirmed they would try find additional supporting information for WGAC to further alleviate their concern. SLB asked WGAC if they could provide any formal communication to confirm that [WGAC contact] represents the WGAC Director's and Traditional Owners of WGAC. WGAC stated this calls their role into question and is offensive and did not agree to provide in-writing confirmation as a matter of principle but was open to a telephone call with NOPSEMA. [WGAC contact] confirmed they had provided the information up until the Additional Spill modelling information had been passes on to the WGAC Directors. WGAC mentioned that the best way forward was to provide a formal confirmation on engagements is through the Agreement, which WGAC are ready to sign. The WGAC Directors have been through the Agreement and it is final (ready to sign) as far as they are concerned. SLB confirmed they will respond on the Agreement as soon as possible and are working hard to ensure the best outcome for WGAC. [WGAC Contact] confirmed that the Directors are representing the TO group and that [WGAC Contact] has been discussing SLB engagement with the Directors (i.e sharing information).		SLB to provide further financial assurance information (with regard to State waters) SLB to review and respond to Agreement.	* (see note above table).
		1/12/2023	Email outgoing		SLB emailed WGAC to thank them for the meeting the previous day and provide the material that was discussed. SLB outlined a discussion that occurred with NOPSEMA around confirmation that there is no further need to discuss the roles and	N/A	* (see note above table).

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					dissemination of material to WGAC population that has been provided in recent months. SLB asked WGAC for details on the route and charter company used to reach the meeting with the Directors on 7 December.		
		7/12/2023	Meeting	Full meeting minutes are provided within Appendix G, the following is a summary of the discussions held: SLB met with the Directors of WGAC on Country. SLB thanked the Directors for meeting with SLB and explained that nothing with the project has changed since the meeting in March 2023. SLB acknowledged the Traditional Owners of the land and sea country, recognised their continuing connection with the land, waters, and cultura, and paid respects to their Elders past, present and emerging. SLB explained the purpose of the presence at the meeting was to discuss the fuel spill modelling that was initially undertaken, and the review into that modelling which was conducted as requested by WGAC. SLB provided an overiview of the Seismic Survey, including the many mitigation measures being employed for the duration of the survey to ensure the impacts and risks associated with the survey are ALARP and an Acceptable Level. The reviewer of the fuel spill modelling introduced themselves and provided a background to their experience. A description of the modelling process was provided, including how the fuel behaves when a spill occurs, including evaporation, entrapment, degradation, weathering etc. The reasoning for the spill modelling was discussed, being that the worst-possible case has to be accounted for. The reviewer went on to discuss the fact that when uncertainaty is faced, the modellings use extremely conservative calculations which often results in an overstatement of results. A discussion was held on the thresholds that are utilised and what they mean in the real world. These thresholds are set as a tough test to work out the area that might be affected. The model conducted for SLB shows that 60 days after releasea a combination of currents/winds and that is it possible that some material may be transported to the WGAC area. However, the model is a worst case and modelled the oil particles to stay together. It was explained that in reality, diesel spills last 3 – 4 weeks in the marine environment. Half of the spill is evaporated and the rest spreads out and is consumed by bacteria. The conclusion of the model was that the risk is overstated although it is possible to get some low concentration oil spill in the WGAC area. However, the model was run at a different time of year than when the survey will be carried out (a worst case of October), therefore it was asked that the modellers show a worst case of the actual survey operations (summer months). This resulted in conditions that were unlikely to bring oil into the WGAC area and showed a worst case of the spill moving west away from the shoreline. WGAC queried what species would be affected by the higher concentrations shown on the figure. The reviewer noted that we need to look at what concentrations cause issues in marine fauna. This is done by toxicity testing. The lowest concentrations found to cause effects show that the animal needs to be exposed for 2 – 4 days, with the lowest and most sensitive thresholds 10 ppb. What is shown on the figure is instantaneous concentrations, not calculated over 2 – 4 days. It shows concentrations are lower than what has been demonstrated to impact marine species. Therefore, if that concentration was to remain at that spot for 3 days, it would still be lower than the thresholds required to impact marine species. A discussion was had on the response actions that would be taken to clean up the spill before it reached the coastline after a question from WGAC. The model assumed no actions were taken, however, if a spill did occur, there are many actions that would be taken such as tracking of the spill to understand where it is, limit the amount released, etc. The modelling is a very conservative approach and only looks at what the ocean/wind is doing. WGAC queried if the agencies responsible for cleaning up will pull back their response actions when the pollution is still in the water if the concentrations are below thresholds. It was explained that a group of modellers are on standby 24/7 to run oil spill models to guide AMSA's response. The responses are interactive in that there are people on the water looking for the oil and this happens for weeks – months following the initial spill until the responders know the oil has moved from sensitive places. There are teams of specialists (i.e. birds, mangroves, etc) that are launched to see if there has been an influence of the oil spill. The Government regulators are tough on the oil and gas industry – more so than others such as shipping and fishing who do not have the same strict regulators regarding planning and pre-thought		All queries raised by WGAC during the meeting were addressed. The WGAC Director's confirmed they were happy with the information presented and no further concerns were raised.	* (see note above table).

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				WGAC explained that there are many vessels such as cruise ships that use the area and that WGAC want to understand what may happen if a vessel grounds on a reef. WGAC want the agreement to be in place as they want to make use of the data and bring it to value for the coast as at the end of the day, the oil spill will stop at the coast. The reviewer is comforted that the modelling is conservative and shows that it is at least two months before a spill would move into the WGAC area, over which time the diesel would have become food for the bacteria. He explained that for all oils the most harmful parts are the aromatic hydrocarbons which are highly soluble and volatile and therefore evaporate and dissolve rapidly. The concentration reduces rapidly as shown in the modelling. Concentrations of aromatics would not come into the WGAC area. As the weathered diesel would have lost the aromatics, it would be benign/non-harmful. It was stated that this operation represents a low risk, but it is good that SLB have taken it seriously to understand all areas and create plans for responding to it. WGAC Director asked what the chance of two boats hitting is? SLB provided an overview of the spill response such as notifications, training of vessel crew, immediate action in the event of an oil spill. WGAC Director asked how close is the project to land - 240 km to shore, 120 km to the Ashmore Islands. WGAC Director asked if two boats collide, will there be any impact on fish - it depends on what specifically happened, so if fish were in the immediate vicinity they may be impacted but there would be an immediate clean up response to limit the impact. SLB asked if the WGAC Directors were happy with the information that had been presented today and if what was discussed in March had been put to the WGAC community? SLB stated that there is a very low risk of an oil spill occurring and that there are many control measures in place to stop one. WGAC directors confirmed they were happy with the information presented. SLB asked if there were any concerns on the oil spill information? No further concerns were raised by WGAC Directors. SLB stated that the Agreement is currently being reviewed and will be provided back to WGAC. SLB stated that they are happy to present at the AGM. WGAC stated that the Agreement is so that WGAC and SLB understand each other and that it was given to SLB to create ongoing relationships and to make use of the models etc. The Agreement is about keeping in touch, raising WGAC capacity through small but important projects. SLB confirmed they are looking to getting that signed off SLB thanked everyone for their time and ended discussions.			
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken can be found in Section 5.5.8.1 of the EP. SLB is confident and in no doubt that all relevant information to date has reached the WGAC Directors, which is subsequently disseminated to the Traditional Owners. Sufficient time has elapsed (effectively since March 2023) for determination on the potential impacts and/or risks to their functions, interests and activities and for feedback to be provided on this information. As such, SLB considers their obligations under regulation 11A have been discharged.					
53	Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation (MG Corporation)	18/10/2022	Phone call outgoing		SLB called MG Corporation and spoke to them about the proposed survey. It was advised that SLB should send through the fact sheet plus the unplanned modelling data. MG Corporation advised that they would help to arrange a call with chairpersons for local native titleholders to discuss the survey etc.	N/A	* (see note above table).
		18/10/2022	Email outgoing		SLR sent an email following up on the phone call mentioned above. The intention of this initial email was to provide the specific factsheet developed for native titleholders as well as a map whish shows the EMBA in relation to the native title area. A request was made for a meeting with council members to discuss the project and the scenario of the unplanned spill even which was used to determine the EMBA.	N/A	* (see note above table).

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		18/10/2022	Email incoming	MG Corporation emailed SLB thanking for the phone call and also receipt of email. It was stated that this email would be forwarded on to the Chair and General Manager of MG Corp.		No objections or claims – no response/actions required.	* (see note above table).
		18/10/2022	Email outgoing		SLB thanked MG Corporation for the email and also followed up with the Chair and GM. SLB requested and opportunity to meet with them and discuss the project. SLB asked if there was a preferred time to meet and also requested phone numbers for follow up calls.	N/A	* (see note above table).
		18/10/2022	Email incoming	The GM of MG Corporation responded to SLB and provided contact details. The GM advised that he has sent on the information to their Native Title lawyers in Perth for their review and action as required. The GM advised that once they hear back from Legal, they will be better placed to discuss the project.		No objections or claims – no response/actions required.	* (see note above table).
		18/10/2022	Email outgoing		SLB thanked the GM of MG Corporation and stated it would be good to have a call to explain the survey further as well as the unlikely nature of a fuel oil spill from occurring due to a number of reasons.	N/A	* (see note above table).
		01/11/2022	Email outgoing		SLB contacted MG corporation again (GM and Chair) to follow up asking if they had received any feedback from the Native Title lawyers. SLB provided the factsheet specifically developed for Native Titleholders and its intention to help steer future discussions with the wider group. SLB also asked if they had any comments on the information provided or if there is any further information or details required. SLB stated they would like to meet and discuss further when they are able to.	N/A	* (see note above table).
		01/11/2022	Email incoming	MG Corporation responded to the SLB email and advised that there has been no response from the legal team to date. The legal team was then copied into the email and it was advised that the legal team will be providing the response in due course.	SLB has not received a response from the MG Corporation's legal team to date at time of submission.	No objections or claims – no response/actions required.	* (see note above table).
		01/11/2022	Email outgoing		SLB thanked MG Corporation for the update and stated they would wait for more feedback from the legal team. It was also offered in the email for MG Corporation to use the summary information when discussions with members or other interested parties. SLB stated that they hope there is an opportunity to meet soon to further explain the survey and listen to any concerns MG Corporation may have in regard to the survey.	N/A	* (see note above table).
		21/11/2022	Email outgoing		SLB emailed the MG Corporation's legal team to offer an opportunity to present and discuss information about the project with members of	N/A	* (see note above table).

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					the MG native title and to listen to any potential concerns they may have. SLB noted a meeting and discussing directly will help with better understanding any concerns they may have. SLB also advised this engagement forms part of the EP submitted to update NOPSEMA. SLB offered contact details and availability at any time. SLB included the fact sheet within this email and the previously consulted MG Corporation member was copied into the email trail also.		
		07/12/2022	Email outgoing		SLB emailed the MG Corporation's legal team again in the hope of connecting with them. SLB advised the legal team that SLB had resubmitted the EP to NOPSEMA in November and SLB would still really like to discuss the project and receive feedback regarding any potential concerns. The previous email sent to the MG Corporation's legal team dated 21/11/2022 was also included within this email and the previously consulted MG Corporation member was copied into the email trail also.	N/A	* (see note above table).
		16/12/2022	Email outgoing		SLB emailed the MG Corporation's legal team to advise them about the NOPSEMA meeting to present updated guidelines for stakeholder consultation. SLB asked the legal team for advice on how SLB could meet with the MG Corporation to present the proposed project and listen to any concerns raised. SLB reminded them as a title holder, SLB are required to consult all persons who may have interests and concerns regarding activities with respect to the local environment. SLB provided contact details and the previous two emails sent to them dated 07/12/2022 and 21/11/2022 were also included within this email.	N/A	* (see note above table).
		16/12/2022	Email outgoing		SLB emailed the recently appointed MG Corporation General Manager as the previous General Manager had left. SLB explained their past effort to discuss the project with MG Corporation, providing past correspondence with the previous General Manager (dated 01/11/2022). SLB confirmed they would like to progress with MG Corporation consultation and provided the information sheet provide to MG Corporation in earlier correspondence. SLB asked if MG Corporation would be available to discuss further where SLB could highlight the project and ask how to arrange a meeting with MG Corporation interested parties to listen to any concerns they may have.	N/A	* (see note above table).
		03/02/2023	Email outgoing		SLB emailed MG Corporation to provide an update on recent consultation with WGAC and advise of a workshop being planned for the week commencing	N/A	* (see note above table).

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					16/02/2023. At the workshop SLB will provide a presentation detailing the proposed survey, listening to feedback and taking any questions around any concerns they may have. SLB invited MG Corporation to join the workshop and would send more updated information once timing had been confirmed. This email contained the previous three emails that SLB has sent to MG Corporation dated 16/12/2023, 07/12/2022 and 21/11/2022.		
		10/02/2023	Email outgoing		SLB emailed invite for MG Corporation to attend a workshop where SLB will present and discuss their proposed marine seismic survey offshore Bonaparte. SLB advised SLB had been in discussions with WGAC whom had help propose and schedule the workshop. SLB and their environmental specialists (SLR) would like to present their project discuss the identified risks and adaptive management of those risks. SLB would also like to discuss and understand MC Corporation's sensitivities to the proposed activity in the area and find out if SLB has captured all concerns. The invitation was also extended to representatives from WGAC, BAC, and KLC. SLB advised they will describe the Environmental Plan that they have been developing following regulatory requirements and confirm the project timeframe.	N/A	* (see note above table).
		10/02/2023	Email outgoing		SLB emailed MG Corporation to advise that due to low availability SLB would like to reschedule the proposed workshop (discussed in previous email, above item) to 16/02/2023. SLB concluded the email by commenting it would be great if MG Corporation could attend.	N/A	* (see note above table).
		07/03/2023	Email outgoing		Provided the MG Corporation with the four week pre-survey notification to relevant persons.	N/A	* (see note above table).
		17/10/2023	Email outgoing		SLB thanked MG Corp for suggesting direct contact via them with council chairpersons to set up a meeting. SLB stated that MG Corp may be affectect if an incident opccurred causing discharge of vessel fuel. Factsheets were also attached.	N/A	* (see note above table).
		18/10/2023	Email incoming	MG Corp thanked SLb for the email. They will forward it to the Chair and General Manager.		N/A	* (see note above table).
		18/10/2023	Email outgoing		SLB thanked MG Corp. SLB reached out to Chair and GM and stated that SLB would like to have a quick call to discuss the survey.	N/A	* (see note above table).
		18/10/2023	Email incoming	GM of MG Corp shared contact details and informed SLB the email has been forwarded to MG Corp's lawers in Perth for review.		N/A	* (see note above table).

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		24/10/2023	Email outgoing		Provided the MG Corporation an update on the survey. The EP is currently under assessment with NOPSMEA. SLB plan to acquire late December 2023 or start January 2024. There has been a reduction in AA. SLB remain in contact with WGAC to work towards closing out concerns.	N/A	* (see note above table).
		01/11/2023	Email outgoing		SLB touched based with MG Corp to follow up and see if they had received information from Native Title lawyers? SLB utlined that their intention is to find out the following from Native Title Holders: do they have any functions, interests, or activities that may be affected? Do they have any sea country rights that may be affected? Do they want to meet with SLB to discuss the survey.	N/A	* (see note above table).
		01/11/2023	Email incoming	No response to date has been received from lawyers. MG Corp included the NT lawyer in response.		N/A	* (see note above table).
		01/11/2023	Email outgoing		SLB thanked MG Corp and will await more feedback. SLB asked MG Corp to use the summary when discussing with council members or other intested parties.	N/A	* (see note above table).
		02/11/2023	Email outgoing		SLB touched base with MG Corporation using an alternate email)to inform that as the project nears, SLB would be happy to provide any further information if requested. SLB asked for feedback to be provided back within the next two weeks.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken can be found in Section 5.5.8.1 of the EP.					
54	Northern Territory Seafood Council (NTSC)	27/10/2022	Email outgoing		SLB emailed the NTSC following recommendation from WAFIC. This was in relation to the EMBA and most NT fisheries are outside the EMBA as well, but SLB wanted to provide them with sufficient information to make an informed decision as to whether they would be impacted. A summary of the proposed survey, survey area along with the information sheet was provided. In	N/A	* (see note above table).

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					addition, a set of GPS coordinates in a Microsoft Excel spreadsheet was provided which marks the boundary of the Operational Area and was suggested that can be passed on to members for them to assess if there are any conflicts. Summary of control measures and regulatory process, as well as the approach agreed with WAFIC about informing fishers should a spill occur. A request for further discussion was made to listen if NTSC has any concerns and whether NTSC are able to take a similar approach as WAFIC if a spill occurred. SLB asked what the best time is for a further discussion on this and to arrange a meeting.		
		18/01/2023	Email outgoing		SLB emailed NTSC following up from SLB's previous email sent (dated 27/10/2022) and to see whether they would be available for a meeting to discuss further details of the project and any potential conflict with commercial fishers. SLB asked for this email to be distributed to whoever is most appropriate.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLB provided NTSC with the 4 week pre-survey notification.	N/A	* (see note above table).
		18/04/2023	Email outgoing		SLR emailed looking to follow up regarding information provided to NTSC on 27 October 2022 and follow-up correspondence issued on 18 January 2023. Original emails with the relevant attachments were provided. SLR understands from discussions that NTSC intend to clarify whether this information has already been circulated as part of internal weekly newsletter to NT license holders. SLR requested NTSC review the attached and let SLR know the status of this information.	N/A	* (see note above table).
		01/05/2023	Email outgoing		SLR emailed NTSC to understand whether any feedback could be provided regarding the request for clarification (email dated 18/04/2023). NTSC can contact SLR if there is any additional information or assistance required to progress the query.	**N/A**	* (see note above table).

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		15/05/2023	Email incoming	**Response to SLR email dated 01/05/2023:** NTSC apologised for the delay. The area is in WA and not in NT waters and they have not communicated this to the broader membership. Those fishers that have dual licences in NT and Wa NTSC assume would be aware of the process from WAFIC.		**N/A**	* (see note above table).
		31/05/2023	Email outgoing		SLR contacted a new email address for NTSC to progress discussions around the survey. A factsheet and supporting information was provided for review. SLB are eager to confirm their interpretation of NTSCs role as it relates to consultation with proponents of offshore petroleum exploration activities and licence holders and would like to discuss this further with NTSC to see if they have any questions over what is being proposed, if they are satisfied with the information provided and confirm the delegation for consultation with NT commercial fisheries license holders.	**N/A**	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken can be found in Section 5.5.6.12 of the EP.					
55	Shire of Wyndham-East Kimberley	27/10/2022	Email outgoing		SLB emailed the Shire of Wyndham-East Kimberly to inform them of the proposed seismic survey in the Bonaparte Basin. An information sheet was attached to the email providing further details on the survey. A summary of the consultation approach which incorporates the EMBA based on spill modelling was provided. In addition it was advised that the risk of such a spill scenario occurring was very low. An offer to meet to go through the survey, control measures, spill modelling etc. was provided. In addition it a request was made as to whether there are any other local representatives that SLB should contact about the survey.	N/A	* (see note above table).

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		07/03/2023	Email outgoing		Provided the Shire of Wyndham-East Kimberley with the four week pre-survey notification to relevant persons.	N/A	* (see note above table).
		15/05/2023	Email outgoing		SLR provided a follow up email to that dated 27/10/2022. An updated factsheet was provided. SLB have undertaken oil spill modelling to estimate the EMBA. Shire of Wyndham-East Kimberley are being contacted as the worst-case scenario modelling indicates some fuel oil could reach the shoreline. SLB would like to understand if Shire of Wyndham-East Kimberley require any other information of if that provided is sufficient.	N/A	* (see note above table).
		15/05/2023	Email incoming	**Internal email between Shire of Wyndham-East Kimberely personnel in response to SLR email dated 15/05/2023:** Questioned if other contact had comment on the matter. Whilst portions of the report are in the Shire, they do not look after coastal waters, the areas are remote and inaccessible and would only be able to be inspected by aerial surveys.		N/A	* (see note above table).
		23/05/2023	Email incoming	Shire of Wyndham-East Kimberley confirmed there are no comments or concerns relating to the survey but requested oil spill modelling report.		SLR to provide Oil Spill Modelling Report.	* (see note above table).
		23/05/2023	Email outgoing		**Response to email dated 23/05/2023:** SLR provided modelling report to Shire of Wyndham-East Kimberley	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
56	Victoria Daly Regional Council	27/10/2022	Email outgoing		SLB emailed Victoria Daly Regional Council to inform them of the proposed seismic survey in the Bonaparte Basin. An information sheet was attached to the email providing further details on the survey. A summary of the consultation approach which incorporates the EMBA based on spill modelling	N/A	* (see note above table).

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					was provided. In addition, it was advised that the risk of such a spill scenario occurring was very low. An offer to meet to go through the survey, control measures, spill modelling etc. was provided. In addition, it a request was made as to whether there are any other local representatives that SLB should contact about the survey.		
		07/03/2023	Email outgoing		Provided the Victoria Daly Regional Council with the four week pre-survey notification to relevant persons.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
57	West Daly Regional Council	27/10/2022	Email outgoing		SLB emailed West Daly Regional Council to inform them of the proposed seismic survey in the Bonaparte Basin. An information sheet was attached to the email providing further details on the survey. A summary of the consultation approach which incorporates the EMBA based on spill modelling was provided. In addition, it was advised that the risk of such a spill scenario occurring was very low. An offer to meet to go through the survey, control measures, spill modelling etc. was provided. In addition, it a request was made as to whether there are any other local representatives that SLB should contact about the survey.	N/A	* (see note above table).
		07/03/2023	Email outgoing		Provided the West Daly Regional Council with the four week pre-survey notification to relevant persons.	N/A	* (see note above table).
		15/05/2023	Email outgoing		SLR provided a follow up to the email dated 27/10/2022. An updated factsheet was provided. SLB have undertaken oil spill modelling to estimate the EMBA. West Daly Regional Council are being contacted because the worst-case spill scenario modelling indicates some fuel oil could reach the shore. SLB would like to understand if West Daly	N/A	* (see note above table).

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					Regional Council require any further information or if the information provided is sufficient.		
		16/05/2023	Email incoming	**West Daly response to SLR email dated 15/05/2023:** West Daly thanked SLR for the email and has forwarded it to the relevant officer for review. They will get in contact should they require more information.		N/A	* (see note above table).
		16/05/2023	Email outgoing		**Response to West Daly emailed dated 16/05/2023:** SLR thanked West Daly for confirming receipt of the email and asked for confirmation if there is not additional information required or no concerns over the proposed.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
58	Tiwi Land Council (TLC)	25/01/2023	Phone call outgoing		SLB called the phone number provided on the TLC website to reach out and raise awareness of the project and determine who they could speak to within TLC about this. SLB was transferred to an appropriate TLC representative. SLB described the survey background information including location and the ongoing consultation process which had been updated following the consultation guidelines recently issued by NOPSEMA. SLB expressed their desire to reach out to TLC to discuss the survey further and listen to any feedback they may have. TLC asked to be sent more information on the survey to direct the information to the appropriate TLC person. SLB confirmed they would send a survey factsheet and one-page flyer for noticeboard distribution [to allow the community to view]. TLC mentioned that since the project was offshore Bonaparte then consultation should be with NLC. SLB advised they were already consulting with NLC however wanted to ensure Tiwi Islanders were also aware of the survey and provided an opportunity	No objections or claims raised in phone call – however, TLC requested further information which was provided in following email.	* (see note above table).

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					to comment. TLC confirmed they would direct the factsheet to the Tiwi Islander representatives. The meeting concluded with TLC providing an email address for SLB to share the information (factsheet and one-page flyer) and confirmed they would reply to the information once it had been provided.		
		25/01/2023	Email outgoing		SLB emailed the TLC representative email address provided during the phone call with TLC earlier that day. SLB advised they were sending information about the survey as SLB is carrying out consultation at the moment in accordance with the recent consultation guidelines released by NOPSEMA. SLB attached the factsheet about the survey and a one-page flyer for local distribution if necessary. SLB asked TLC to read the information and advise SLB if they thought the survey would be of interest to Tiwi Islanders to learn more regarding the modelled risks and adaptive management processes to manage those risks. SLB pointed out the survey area is quite a distance from the Tiwi Islanders as TLC mentioned in their earlier phone call conversation and how TLC advised the offshore activities would fall to NLC to discuss and not the TLC. SLB asked TLC to provide confirmation of this opinion as they had been discussing this already with NLC. SLB advised TLC of their intention to find out from Native Title Holders the following (as mentioned in the factsheet): • Do you have any functions, interests or activities that may be affected by the proposed activities to be carried out under the environment plan? • Do you have any "sea country" rights that may be affected by the proposed activities to be carried out under the environment plan? • Do you want to meet with SLB to discuss the proposed activities to be carried out under the environmental plan? SLB concluded the email advising they would be keen to meet and discuss further in order to respond to any concerns the local Tiwi Island population may have.	N/A	* (see note above table).
		06/02/2023	Email outgoing		SLB had received a phone call from a TLC representative following up SLB's email correspondence on 25/01/2023. This was a different person from TLC than who SLB had corresponded with earlier at TLC. This email correspondence was SLB's acknowledgment of that phone call. SLB thanked TLC for following up on previous engagement with	N/A	* (see note above table).

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					TLC. SLB attached a copy of the original email sent to TLC on 25/01/2023 within this email and asked if they could follow up with that previous representative on advice on SLB's consultation requirements regarding SLB's proposed seismic survey offshore of Bonaparte Basin. SLB acknowledged the TLC representative is busy but asked if they could ask the previous TLC representative to reply to SLB regarding the need to further consult with TLC, given SLB's current consultation ongoing with NLC.		
		09/02/2023	Phone call outgoing		SLB called the TLC representative they had previously corresponded with on 06/02/2023. SLB was calling to follow up on the previous correspondence. TLC apologised for the delay in response requesting feedback related to the survey and advised SLB the representative that SLB had been contacting has been away ill and the environment team was very busy with other requests. SLB mentioned previous discussions with TLC where TLC indicated that due to the survey location, environmental concerns would fall to NLC and as long as SLB were consulting them then that is all that is needed. TLC responded that it would be better if SLB liaise with the TLC lead environmental specialist (returning to the office this week) and send them with the relevant information. Then TLC could confirm if further consultation is needed. SLB thanked TLC for their help and TLC confirmed they provide feedback by early next week (13/02/2023). SLB promised to follow up with TLC early next week to confirm.	No objections or claims raised – further actions following this phone call as per the items below.	* (see note above table).
		15/02/2023	Phone call outgoing		SLB called TLC to follow up on previous attempts to connect with TLC and was provided an alternative representative within TLC. SLB called this representative (3rd contact) and left a voice mail message to call SLB back. The TLC representative called SLB back and they discussed the survey. The TLC representative confirmed they had been sent the fact sheet and commented the survey was remote from Tiwi Islands. SLB and TLC further discussed the EMBA, conservative nature of oil spill modelling and the therefore low likelihood of any effect on the Tiwi Islands. TLC confirmed a 6 km mark from the shore is where the sea connection ends for Tiwi Islands and the survey EMBA does not reach [overlap] that mark. SLB advised TLC of previous advice from another TLC representative that any ongoing consultation with Native Title Owners is to engage with NLC as	No objections or claims – no response/actions required.	* (see note above table).

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					more relevant and this TLC representative agreed also. SLB reaffirmed that SLB wanted to engage with TLC to be certain there were no concerns regarding the survey given the recent court case. SLB updated TLC with the NLC consultation status including a townhall online meeting scheduled for 17/02/2023 with Traditional Owners from Wadeye and representatives from NLC Darwin. TLC commented this would be a good approach and to explain the low impact nature of seismic surveying. SLB asked TLC to respond via email to confirm discussion. TLC said they would discuss internally with other TLC representatives and respond via email later today.		
		15/02/2023	Email incoming	TLC emailed SLB to advise they were unable to speak to the other TLC representatives regarding their previous discussion (previous item). TLC advised any future questions should be directed to the TLC representative that SLB initially corresponded with (on 25/01/2023). TLC advised that any involvement and consultations with the Tiwi Islands must go through all the formal documents, processes and permits within the TLC.		No objections or claims – no response/actions required.	* (see note above table).
		15/02/2023	Email outgoing		SLB responded to TLC's previous email (previous item) to acknowledge their email and comment that SLB had been engaging with various TLC representatives over the last 4-5 weeks but was referred to this current representative for onwards discussion. SLB advised they would revert back to the TLC representative SLB had initially contacted (on 25/01/2023) going forward and asked when they are back in the office as would like to follow up urgently. SLB also advised they were including their environmental consultants (SLR) into the email as a record for the EP and minute the phone conversation from earlier that day. SLB concluded the email by saying it was good to speak with them earlier and would take on board their advice about further engagement with NLC.	N/A	* (see note above table).
		20/02/2023	Email outgoing		SLB emailed the TLC representative that SLB initially corresponded with (on 25/01/2023) again to see if they had time today or following day (21/02/2023) to discuss the planned seismic survey. SLB mentioned that since they last spoke and the earlier email (sent 25/01/2023), SLB had spoken to two other TLC representatives and their last correspondence directed SLB back to this TLC representative. SLB concluded the email hoping to speak with TLC, advising TLC that SLB is preparing to finalise their EP submission for NOPSEMA this week.	N/A	* (see note above table).

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					SLB included a copy of the email sent 25/01/2023 within this response, which included the factsheet containing information about the survey.		
		21/02/2023	Phone call outgoing		SLB called TLC to discuss proposed survey in detail and spoke to the TLC representative initially corresponded with 25/01/2023. SLB outlined the previous correspondence with another TLC representative (phone call dated 15/02/2023). TLC re-confirmed their understanding the survey was remote from Tiwi Islands and the EMBA did not reach the Tiwi Islands. SLB acknowledged this discussion and further added the conservative nature of the oil spill modelling that had been undertaken [to assist calculate the EMBA]. SLB asked TLC if there were any other concerns the Tiwi Islanders may have in relation to the project. TLC suggested the best way forward was to hold a presentation meeting online where SLB could present the project, the risks to the environment and the management of those risks. SLB agreed this would be good and asked if the TLC representative could help organise personnel to join an online meeting. TLC suggested holding a meeting on 22/02/2023 (next day) given the time SLB had been seeking to consult over the past several weeks. SLB appreciated this and confirmed they would sent a meeting invite out for 22/02/2023. SLB concluded the phone call by thanking TLC for their time and advice related to setting up an online meeting with SLB and their team.	No objections or claims – meeting to be arranged to discuss the project as per the suggestion by TLC.	* (see note above table).
		21/02/2023	Email outgoing		SLB emailed TLC following a phone call from TLC earlier that day. SLB acknowledged their phone call and request for SLB to present the proposed survey project to them. SLB advised they have set a tentative slot for Wednesday 22/02/2023 at 11:30 am Perth time. SLB apologised for not being available earlier on 22/02/2023 and suggested Thursday 23/02/2023 if TLC prefer. SLB also included the original email SLB sent on 25/01/2023 and information sheets to provide background information again on the proposed survey and noted a correction with an email address SLB had been using. SLB closed the email stating they look forward to the meeting and presenting the project.	N/A	* (see note above table).
		21/02/2023	Email outgoing		SLB emailed TLC a meeting invite to attend a meeting the following day 22/02/2023 at 11:30 (Perth time) to present and discuss the proposed marine seismic survey offshore Bonaparte. SLB advised that with SLR (their environmental consultants), they would like to present their	N/A	* (see note above table).

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					project, discuss the identified potential risks and adaptive management of those risks. SLB would also like to discuss and understand TLC's sensitivities to activity in the area and find out if SLB has captured all of their concerns they may have. SLB advised they would describe their Environmental Plan they had been developing following regulatory requirements from NOPSEMA and confirm their project timeframe. SLB closed the invite stating they hoped TLC can join SLB for the information sharing session.		
		22/02/2023	Meeting	Meeting with SLB, SLR and TLC representatives to provide a presentation detailing the proposed survey, listen to feedback and take questions around any concerns they may have. Key meeting discussion points are summarised below: • The meeting commenced with introductions between the groups and SLB explained the purpose of the meeting regarding consultation objectives and outlined the agenda. TLC acknowledged SLB and SLR for the meeting and confirmed their interest in the presentation. • SLB presented information about SLB and the survey using visual aids and SLR presented information on the environment, the EP, the risk assessment and the adaptive management processes in the EP to reduce the impact of all the potential risks. • TLC commented on the oil spill modelling and how the EMBA was located well west of the Tiwi Islands. TLC mentioned their concerns were centred on SLB's mitigation of spill risk from vessel collision. SLR explained how highly conservative the oil spill modelling was and the additional measures to be employed, e.g. two support vessels to protect against collisions, lookahead plans to be distributed to all mariners daily and how the seismic vessels are double hulled and have several compartments for fuel with a few hundred cubic metres of capacity rather than one large tank with thousands of cubic metres capacity. SLR also mentioned the stringent refuelling procedures the seismic operators must follow, including holding regular emergency fuel spill response drills. • TLC mentioned their second main concern is the protection of marine turtles as the turtle population migrates along the coastline. SLR discussed the adaptive management procedure in place for marine turtles, which include measures such as soft start procedures, shutdowns if sightings. SLB/SLR agreed to develop a presentation on relevant information from the EP that focuses on marine turtles as soon as possible. • TLC enquired to what extent fish species would be damaged if directly under the seismic vessel during operation. SLB explained the soft start procedure as a gradual and slow increase to move fauna from the area and operations. SLR advised they will provide TLC a video link that discusses a study that measured the effects on reef species during seismic operations. SLR advised one of the measures to help protect site attached benthic invertebrate and fish species is to restrict use of the active source in water depths at 60 m or less. The exclusion zone plus a buffer around this zone is uploaded into the vessel's navigation system to prevent source operation near the pre-identified areas. • TLC advised SLB and SLR that it would be very useful to provide this presentation to the newly elected TLC members from late March, to upskill them in this sector given the increase in activity they are noticing. SLB responded they would definitely like to do this and would be part of the ongoing consultation with the TLC. SLB concluded the meeting by thanking TLC and reconfirmed their main concerns which SLB planned to action with additional information on marine turtle protection. Actions: 1. SLB/SLR to provide a presentation on mitigation measures within the EP for marine turtles; 2. SLB/SLR to provide a link to video of study measuring the effects on reef species; and 3. Provide a presentation on seismic surveys to newly elected TLC members from late March.		No objections or claims raised – however, various action items came from the meeting to provide further information on the potential risks and impacts on areas of concern to TLC; these action items were addressed in the following email. The EP contains multiple control measures to reduce the impacts and risks to these areas of concern to ALARP and an Acceptable Level. A package of information was provided to TLC as per the next item.	No additions were considered required based on this meeting.

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				Refer to meeting minutes (**Appendix G**) for further details.			
		23/02/2023	Email outgoing		SLB thanked TLC for meeting with them the day before (previous item), the feedback and questions they raised. SLB confirmed that from the discussion that Tiwi Islanders would be most concerned about the following points and addressed each of these in their response: • *Fuel oil modeled extent EMBA and the mitigation of risks via operational procedures and* management – SLB/SLR discussed the high level of conservatism in the modelling approach with additional measures employed in the field, including equipment and procedures and training. • *Marine turtle protection for both habitat and migratory movements* – SLB advised the EP provides an environmental assessment, behavioural impacts and control measures to mitigate risks to marine turtles. SLB also advised they continue to research and would like to update TLC as part of ongoing consultation. • *Damage to fish species* – SLB/SLR explained the soft start procedure to 'warn off' fauna in the area, water depth restrictions for using the source and a buffer to protect site attached benthic invertebrates and fish species. SLB/SLR also referred to a study performed by Woodside investigating the effects of seismic operations on a reef system (link to video provided). SLB also mentioned TLC's previous comments regarding a new council group being elected mid-March and SLB/SLR repeating the information session to the new members to upskill their knowledge in MSS. SLB confirmed they would like to do this and will be in contact mid-March as part of the ongoing consultation process. SLB concluded the email inviting TLC to advise them if any of the information provided is unclear or missing and advised TLC they look forward to their continued discussions as ongoing consultation evolves.	N/A	* (see note above table).
		27/02/2023	Email outgoing		SLB emailed TLC to enquire whether TLC has looked at the information sent through in earlier email sent 23/02/2023 (previous item), particularly on marine turtle adaptive management processes including the newly added measure of an 8 km buffer. SLB asked if TLC had any other concerns with what SLB were proposing.	N/A	* (see note above table).
		27/02/2023	Email incoming	TLC advised the email sent from SLB earlier in the day (previous item), has been forwarded to the		N/A	* (see note above table).

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				environment officer, who was also included in this email distribution.			
		28/02/2023	Email outgoing		SLB acknowledged the email that TLC had sent yesterday (previous item) and addressed the TLC environmental officer directly, offering for them to call SLB if they would like to discuss any elements of the survey plans. SLB offered to include SLR (environmental consultants) if they need. SLB said alternatively if they don't have any further concerns to advise SLB in a reply email and SLB will keep in touch as ongoing consultation and to update the new council once elected. SLB attached the survey information factsheet to this email.	N/A	* (see note above table).
		01/03/2023	Email incoming	The TLC environment officer replied to SLB's email dated 28/02/2023 (previous item) apologising for not being able to take SLB's earlier phone call and thanking SLB for providing information about the survey. The TLC environment officer advised they had spoken with the TLC CEO and discussed SLB's path forward with Tiwi in relation to their project and whether further consultation may be required. TLC advised they will be having a full land council meeting in March (date TBA) where the survey will be tabled. The TLC advised they will be in a better position to reply to SLB following that meeting and discussion with members.		N/A	* (see note above table).
		01/03/2023	Email outgoing		SLB replied to the email from the TLC environment officer received earlier that day (previous item) thanking them for responding and advising the current status of their discussions. SLB mentioned they had spoken with the previous TLC representative about SLB attending that meeting to present the project to the newly elected council. SLB said they would be more than happy to present and discuss their project if they would like them to take an hour slot. SLB advised TLC they are currently finalising their EP for resubmission this week and will now continue to engage with TLC as part of their commitment to ongoing consultation. SLB concluded the email by stating that if TLC would like SLB to plan an update to the TLC to please let them know the date and time once scheduled, otherwise SLB will touch base again later in March.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided TLC with the 4 week pre-survey notification.	N/A	* (see note above table).
		20/04/2023	Email outgoing		SLB emailed TLC to check whether the newly elected council had reviewed the project material at the full Council meeting in March and whether	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					there were any concerns in relation to adaptive management procedures for marine turtle habitat and movements, or any other concerns. SLB offered to schedule another meeting if the new Council members wanted.		
		24/05/2023	Email outgoing		SLB emailed TLC to state that they are available at TLC convenience if the new council members would like to have a repeat presentation	N/A	* (see note above table).
		22/09/2023	Email outgoing		SLB contacted TLC to update them with the current status of the EP. SLB stated they are finalising the EP in the next couple weeks and wanted to asked if TLC or any members have expressed concerns or had further questions. SLB anticipate acquisition in Q4 subject to approval. SLB also re-stated the offer of another online presentation.	N/A	* (see note above table).
		02/11/2023	Email outgoing		SLB touched based with TLC to say that they are happy to provide any further information if requested and asked TLC to provide any feedback within the next two weeks.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken can be found in Section 5.5.8.3 of the EP.					
59	Department of Agriculture, Fisheries and Forestry (DAFF) – formerly the Department of Agriculture, Water and the Environment (ID 4 above)	26/01/2023	Online enquiry form		SLR submitted an online query to request contact details of best person to speak to regarding the survey. SLR also attempted to call various phone numbers from the DAFF website but could not get hold of anyone.	N/A	* (see note above table).
		27/01/2023	Email incoming	SLR received automated acknowledgement email confirming the online query above had been received.		N/A	* (see note above table).
		30/01/2023	Email incoming	The National Maritime Centre (Biosecurity Operations Division) (NMC) responded to the online query above providing link to more information on Australia’s biosecurity obligations for international vessels. Additionally the email advised the vessel would be		Although not specifically an objection or claim, the details on biosecurity obligations were assessed in relation to the information within the EP,	All of NMC’s information is already addressed within the EP.

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
				subject to Australia biosecurity control and must comply with biosecurity requirements when returning to Australia territory if it travels outside 12 NM and exposed to another vessel/aircraft. The requirements may vary due to vessel type. The department regulates all vessels arriving in Australian territory. There was also an invitation to contact NM if SLB has more queries.		which has already addressed this matter and SLB are cognisant of the biosecurity requirements they need to meet.	
		30/01/2023	Email outgoing		SLR replied to the above email from NMC earlier that day providing information sheet about the proposed project awaiting approval. SLR advised NMC the survey area is beyond 12 NM but will not come in to contact with any other vessel and will comply with all relevant biosecurity requirements. SLR asked NMC if they had any other biosecurity concerns or queries about the proposed survey.	N/A	* (see note above table).
		30/01/2023	Email incoming	NMC replied to SLR advising the above response from SLR had been forwarded to the policy advice team.		N/A	* (see note above table).
		30/01/2023	Email outgoing		SLR replied to NMC's previous email acknowledging them passing SLR's email on to their policy advice team.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided NMC with the 4-week pre-survey notification.	N/A	* (see note above table).
		07/03/2023	Email incoming	Automated response from NMC confirming receipt of email.		N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
60	Petrofac	13/07/2022	Public Notice	Petrofac responded to public notice as the survey area could overlap with the decommissioning of the Northern Endeavour FPSO where diving operations may be required. The FPSO is due to be decommissioned before Sept 2022 and there may be a requirement to use divers during the ongoing decommissioning/disconnection activities. Petrofac asked to be included as part of relevant person's list.		SLB has substantiated this request from Petrofac and has included them within the list of relevant persons, see below in relation to the notification etc. proposed to ensure the impacts and risks to commercial divers are	See next item below advising relevant reference within the EP.

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
						ALARP and an Acceptable Level.	
		13/07/2022	Response to Public Notice		SLB has assessed the potential impacts from the survey on commercial dive operations typically based on distance between diving operations and the seismic vessel, including the distance of closest installations to the AA (providing potential for a diver to be present in water). Using underwater sound modelling, risk assessments results concluded a low potential risk as the sound levels emitted will be below the threshold sound levels for safe diving operations.	SLB will operate in accordance with Rev 2.1 of 'Safe Diving Distance from Seismic Survey Operations' (DMAC, 2020) to ensure the impacts and risks to commercial divers are ALARP and an Acceptable Level. Additionally, Petrofac is included as part of the notification process and will be notified 4 weeks prior to the survey commencing. SLB will also provide Petrofac with 48 hour lookahead plans to advise where survey will be happening.	No changes have been made to the EP to address the comments received from Petrofac. However, assessment of potential impacts, control measures and relevant EPS of survey on commercial dive operations in discussed in **Sections 7.2.4, 7.2.6, 7.2.7 and 7.2.8** of EP Petrofac consultation is summarised within **Section 5.5.9.1** also.
		07/03/2023	Email outgoing		SLR provided Petrofac with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
61	Australian Communications and Media Authority (ACMA)	16/02/2023	Email outgoing		SLR emailed ACMA to inform them of the proposed seismic survey in the Bonaparte Basin. An information sheet and map (showing the location of the northwest cable system within the survey area) were attached to the email providing further details on the survey. Key information relevant to submarine cables was provided in the email including there will be no physical contact with the seabed and only sound waves from compressed air will be directed towards cable with no impact to the cable systems.	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					SLR invited ACMA to contact them with any queries or concerns and whether they would like to receive lookahead plans.		
		21/02/2023	Email incoming	ACMA responded to SLR's email sent 16/02/2023 to confirm this email had been received and SLR's request for consultation on the SLB seismic survey is being considered.		N/A	* (see note above table).
		21/02/2023	Email outgoing		SLR acknowledged ACMA's response to previous email received 21/02/2023 advising ACMA to contact them if they are able to provide any further information. SLR advised they might call tomorrow to discuss further as they are trying to finalise the risk assessment and would be good to understand if ACMA has any concerns.	N/A	* (see note above table).
		22/02/2023	Email incoming	ACMA responded to SLR's email sent 16/02/2023 (previous item). Key points from the email included: ACMA regulates the submarine cable regime and may declare protection zones for cables of national significance. ACMA can impose restrictions or prohibitions on certain activities that pose a risk to the cables in the protection zones. Based on the information provided by SLR, the survey does not appear to be in the vicinity of a protection zone. ACMA encourages SLR/SLB to contact owners of any submarine cables in the vicinity of the survey area to discuss their plans, for example the North West Cable system that appears to run through the proposed survey area. ACMA provided contact details for the cable system owner. ACMA also suggested contained the AHO for assistance with identifying domestic submarine cables in the vicinity of the survey area, that ACMA may not be able to comment on and suggested upcoming projects that may be relevant. ACMA concluded the email by advising SLB/SLR can recontact them in the future about the email or Australia's submarine cable protection regime.		No objections or claims – however, the feedback provided has been taken into account, with additional consultation undertaken with the cable owners (see ID# 62-64).	Additional relevant persons have been identified in Table 28 within Section 5.4.5.2.2 of the EP. A summary of this consultation is included in the text below, and full unedited correspondence included within Appendix F.
		22/02/2023	Email outgoing		SLR responded to ACMA's email sent 22/02/2023 (previous item) acknowledging their email. SLR advised they have contacted AHO and appreciated the information and contacts relating to upcoming projects.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided ACMA with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken can be found in Section 5.5.7.1 of the EP.					
62	Vocus Group	23/02/2023	Online enquiry form		SLR submitted an online query to request contact details of best person to speak to regarding the survey.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided Vocus Group with the four week pre-survey notification.	N/A	* (see note above table).
		05/04/2023	Email outgoing		SLR contacted Vocus informing that SLR is working with SLB who are proposing a seismic survey in the Bonaparte Basin. SLR has previously contacted Vocus via an online enquiry in February but did not yet receive a response and has subsequently been directed by the switchboard operator within the Melbourne office to this address. A factsheet has been attached showing the AA in relation to the existing submarine cables. SLB will be making look ahead plans and asked if Vocus would like to receive these. SLR would be interested to hear from Vocus as to if there is any other information required or if Vocus is satisfied with the information provided.	N/A	* (see note above table).
		06/04/2023	Email incoming	Internal Vocus email forwarding SLR email to appropriate contact.		N/A – contact details updated in stakeholder register.	* (see note above table).
		18/04/2023	Email incoming	**Response to SLR email dated 05/04/2023:** Vocus is having difficulty with the co-ordinates provided and requested them in lat/long.		No objections or claims – SLR to provide lat/long co-ordinates.	* (see note above table).
		18/04/2023	Email outgoing		**Response to Vocus email dated 1/04/2023:** Co-ordinates in WGS 84 and shapefiles of OA provided.	N/A	* (see note above table).
		19/04/2023	Email outgoing		SLR emailed Vocus to thank them for the phone call to discuss the coordinates. SLR asked if the coordinates supplied (18/04/2023) are sufficient to determine where it is planned in relation to Vocus activities? SLB can provide 48-hour look aheads every 24 hours. SLB are aiming to finalise the EP this week so if Vocus are able to come back with any concerns (or not) that would be appreciated.	N/A	* (see note above table).
		20/04/2023	Email incoming	**Response to SLR email dated 19/04/2023**		N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
				Thanks SLR for email and would overlay the shapefiles to see what they have near by			
		01/05/2023	Email outgoing		**Response to Vocus email dated 20/04/2023:** SLR followed up to see if Vocus had overlaid the coordinates and to see if Vocus had any concerns about the OA.	N/A	* (see note above table).
		03/05/2023	Email incoming	Vocus have overlaid the coordinates and there is some survey area over a Vocus repeater. According to the ICPC best practices, Vocus need to understand the pressure waves as anything greater than 2 bar at the sea level could be detrimental to active devices on the sea bed and SLB may need to adjust grid patterns or signal strength nearer the equipment. Vocus requested SLB provide the estimated pressure wave at the sea bed for the survey. Vocus would like to have the look ahead plans.		SLB to respond to Vocus query on sound pressure levels at the seabed.	* (see note above table).
		10/05/2023	Email outgoing		**Response to Vocus email dated 03/05/2023:** SLR have plotted the North West Cable System asset as it related to the proposed survey and is appears that assets intercept the OA but not the AA. A description of the difference between these two areas was provided. Boundary coordinates for the AA are attached and shapefiles of OA and AA attached. SLR requested the coordinates for the repeaters in the water so the EP can be updated to show specific areas in the OA where the sensitive equipment is placed. SLR questioned if Vocus have worked with any other seismic providers where a suitable distance threshold from the receivers was prescribed. Vocus will be added to the look ahead notification list. SLR questioned if Vocus could advise suitable notification requirements when acquiring near the south-east portion of the AA so they may be considered for incorporation into operations.	N/A	* (see note above table).
		19/05/2023	Email outgoing		SLR emailed Vocus to follow up on email dated 10/05/2023. SLR asked if Vocus have any further concerns or are comfortable, based on the spatial separation provided that there will be no impact from the survey on Vocus assets.	N/A	* (see note above table).
		19/05/2023	Email incoming	**Response to SLR email dated 19/05/2023:** Vocus have looked at the information and are fine with the fact that there is no active equipment in the AA.		N/A	* (see note above table).
		07/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken can be found in Section 5.5.7.4 of the EP.					
63	BW Digital	23/02/2023	Online enquiry form		SLR submitted an online query to request contact details of best person to speak to regarding the survey.	N/A	* (see note above table).
		23/02/2023	Email incoming	BWD responded to the online query form submitted by SLR earlier that day (previous item) acknowledging their query regarding planned offshore seismic surveys. BWD advised they had no additional questions at that stage but asked to be added to the look ahead notifications and provide any maps of the survey area, along with general information on timing of the wider survey program. BWD advised they can add the information to their proposed vessel movements and notify SLB of any areas that might require notification.		No objections or claims – SLB to provide information sheet and maps to BWD and add them to the lookahead notification distribution list.	* (see note above table).
		24/02/2023	Email outgoing		SLR responded to BWD's email received the day before (previous item) acknowledging their quick response. SLR advised they will add BWD to their daily 48 hour look ahead plan distribution list. SLR also attached the information sheet to provide details about the survey and a map showing the operational and acquisition areas where the survey will take place in relation to the known submarine cables that SLR is currently aware of. SLR advised that timing depended on regulatory approval but intention is to start March/April 2023 if all goes to plan. SLR advised BWD to let them know if they need further information.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided BWD with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken can be found in Section 5.5.7.3 of the EP.					
64	Inligo Networks	23/02/2023	Online enquiry form		SLR submitted an online query to request contact details of best person to speak to regarding the survey.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided Inligo Networks with the four week pre-survey notification.	N/A	* (see note above table).
		05/04/2023	Email outgoing		SLR emailed to say that Inligo has previously been contacted through submitting an online enquiry via the Inligo website in February but no response has been received. Inligo suggested a direct email. SLR attached a factsheet and figure showing the AA in relation to existing submarine cables and details on the planned activity. SLB will be making look ahead plans and if Inligo would like to receive these to please let SLR/SLB know. Please contact if there is any other information required of if Inligo are satisfied with the information provided.	N/A	* (see note above table).
		11/04/2023	Email incoming	**Response to SLR email dated 05/04/2023:** Email reply thanking SLR for the advice and supporting information. The material has been reviewed and it is not anticipated that the works described will have any impact on the cable planned by Inligo Networks. A cable is planned in the vicinity of the EMBA, however, the planned route does not cross into the EMBA (image attached). Cable installation will also not be before 2025 although marine survey works are expected in 2024 along the line of, or close to, the expected cable path. Please advise if delays or changes to the works timetable require any part to push into 2025.		N/A – Inligo to be kept informed of survey progress.	* (see note above table).
		11/04/2023	Email outgoing		**Response to Inligo email dated 11/04/2023:** SLR responded thanking Inligo for the response and Inligo will be kept updated on the programme going forward. SLR stated that as there will be no physical presence within the EMBA, there should be no conflict between the two activities.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken can be found in Section 5.5.7.2 of the EP.					
65	Department of Infrastructure, Planning and Logistics (**DIPL**)	23/02/2023	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		23/02/2023	Email incoming	Automated response email from Australian Maritime Safety Authority acknowledging email and directing all applications and queries to contact AMSA Connect via website or telephone (details provided).		SLB notes AMSA are already within the relevant person consultation system (ID 6 above). SLB has already corresponded with AMSA at the contact details provided. Therefore, this consultation (ID 65) may be redundant.	* (see note above table).
		07/03/2023	Email outgoing		SLR provided DIPL with the four week pre-survey notification.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
66	Department of Defence	08/03/2023	Email outgoing		SLR provided four-week pre-survey notification including notification information sheet and separate co-ordinates and commencement date.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
67	Northern Prawn Industry Association	08/02/2023	Email outgoing		SLR provided an introductory email to SLBs Bonaparte seismic survey and included a factsheet with more details on the survey. If there are any comments/issues/concerns, please provide these by 28 February 2023.	N/A	* (see note above table).
		07/03/2023	Email outgoing		SLR provided Northern Prawn Industry Association with the four week pre-survey notification.	N/A	* (see note above table).
		06/04/2023	Email outgoing		SLR emailed following the email dated 8 February 2023. An updated factsheet and coordinates of OA are attached. SLB has conducted a modelling study to ascertain the level of potential impacts from an oil spill with the resultant dispersion used to determine the EMBA. SLR are contacting this relevant person as the fisheries assessment within the EMBA shows overlap with areas of commercial fishing activity. There is no overlap with the Northern Prawn Fishery and where planned seismic acquisition will occur. Any concerns/questions can be sent through directly to SLB via the contact details provided in the factsheet.	N/A	* (see note above table).
		06/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
68		06/04/2023	Email outgoing		SLR emailed to introduce SLB and the Bonaparte survey. A factsheet and more details were		* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
	Northern Territory Department of Industry Tourism and Trade - Fisheries				provided. When reviewing this information, please consider whether you have any functions, interests or activities that may be affected by the proposed activities. SLB has conducted a modelling study to ascertain the level of potential impact from a fuel spill, with the resulting dispersion used to determine the EMBA. A fisheries assessment was undertaken using data requested from the NT DITT and overlap was identified with areas of commercial fishing activity. Attempts to consult with fishers outside the main survey areas, but within the EMBA have been made through engagement with the Northern Territory Seafood Council. Based on the process for emergency consultation with commercial fisheries license holders in WA, it has been suggested that Northern Territory Seafood Council could undertake the notification process advising all licence holders. SLB understand that consultation with NT commercial fisheries licence holders is deferred to Norhern Territory Seafood Council as the peak industry body; however, it would be good to discuss this further. Please get in touch if there is anything further you would like to discuss.		
		06/04/2023	Email incoming	Automatic response. Email has been received and will be attended as soon as possible.		N/A	* (see note above table).
		11/04/2023	Email incoming	Internal email passing SLR email onto the correct contact.		No objections or claims – contact details updated in stakeholder register.	* (see note above table).
		13/04/2023	Email incoming	**Response to SLR email dated 06/04/2023:** NT Fisheries thanked SLR for the information and opportunity to comment on the proposed survey. The OA is wholly within WA waters and consequently there are no NT commercial fisheries operating within the area. Nonetheless, stock structure of commercially and recreationally important fish species is not well understood and any potential impact on aquatic life within the OA could potentially negatively impacts on fish stocks across the NT or stocks that straddle the WA/NT border. NT Fisheries is particularly concerned about potential impacts from 3D seismic. Research as resulted in a greater understanding of the range of potential impacts to fish from seismic, including impacts to audio organs, larval survival and other varying spatial and temporal impacts. Several areas of concern remain. NT Fisheries acknowledges that seismic is a key component of oil and gas exploration and ask that any seismic work undertaken does not occur within the warmer months of the year which generally co-incide with many tropical fish species spawning seasons. Spawning seasons usually occur from September to		Concerns are relating to the effects of seismic on sustainability of fish stock and effects on spawning fish. These have been considered within the EP and mitigation measures will be adopted as appropriate.	See impact assessment for seismic effects on fish, larvae, and commercial fisheries, Sections

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				end of March. Given the range of tropical species that spawn during this period the actual spawning window is quite protracted (6 months). The best option from NT Fisheries point of view is to conduct the survey soon are the wet season ends and spawning ceases, from March/April onwards. Conducting the survey later in the year (September onwards) may potentially lead to negative impacts on fish stocks just prior to a spawning event and therefore should be avoided where possible. The Northern Territory Seafood Council would be the appropriate body to contact with regard to fuel spills.			
		14/04/2023	Email outgoing		**Response to email dated 13/04/2023:** SLR thanked NT Fisheries for the detailed response. SLR attached the UAM report and selected excerpts related to the assessment of impacts on fish, fish larvae, and eggs for their review. SLR has noted the statement around spawning occurring in the warmer months. In developing the EP, consideration has been given to all sensitivities, seasonality and receptors that could be influenced and the temporal windows in which these sensitivities may be most vulnerable. Temporal exclusions have been applied for receptors determined to be most sensitive to the effects of acoustic disturbance (e.g. cetaceans). With regard to mitigations for fish, there will be no active acoustic source within water depths less than 60 m plus a 421 m horizontal buffer associated with shallow water shoal features. Should any unanticipated impacts to fish arise as a result of the seismic survey, a commercial fisheries protocol will be in place to compensate fishers for loss of catch where a claim is determined to have merit. A copy of this will be available in the final EP and upon request. SLR asked NT Fisheries to review the information provided and let SLR know if this has assisted in determining if there may be any impacts to their functions, interests and activities. Additionally, let SLR know if they have further queries regarding the activity.	N/A	* (see note above table).
		20/05/2023	Email outgoing		SLR emailed NT Fisheries to follow up on the email dated 14/04/2023. Based on the information within this email, did NT Fisheries have any further questions or concerns regarding the survey and was the information provided sufficient?	N/A	* (see note above table).
		22/05/2023	Email incoming	**Response to SLR email dated 20/05/2023:** NT Fisheries informing SLR that key research personnel have been away from the office but now have the information provided and will consider it,		N/A	* (see note above table).

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				and the formulation of any potential reply within the next couple of weeks.			
		07/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
69	Tuna Australia Ltd	09/04/2023	Email outgoing		SLR emailed to introduce SLB and the Bonaparte survey. As part of developing the EP, consultation with relevant persons has been undertaken. Consultation with a peak industry body has identified Tuna Australia has a potentially relevant person. Factsheet was attached. An assessment of commercial fishing activity within the planned area and surrounds has been made which shows no overlap between the proposed activity and contemporary fishing effort within the skipjack tuna fisheries, southern bluefin tuna fishery and western tuna and billfish fishery. It also appears the western skipjack tuna fishery management area does not overlap the proposed OA or surrounds. In reviewing the information, please consider whether Tuna Australia have any functions, interests or activities that may be affected by the proposed activities. SLB are committed to working with all stakeholders and encourage Tuna Australia to get in touch with any concerns or to discuss the survey further.	N/A	* (see note above table).
		12/04/2023	Email incoming	**Response to SLR emailed dated 09/04/2023:** Tuna Australia thanked SLR for the contact and background information provided. Tuna Australia stated that many Eps focus on previous temporal and spatial fishing effort, however there is also a need to expand the scope to include proposed fishing activity, navigation and conservation of marine resources. Based on their understanding of the western and eastern tune and billfish fisheries, the survey is unlikely to have an impact, however, Tuna Australia can carry out full consultation with WTBF concession		Consultation to continue throughout the life of the EP.	* (see note above table).

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				holders on SLBs behalf. A services agreement to carry this out was attached.			
		12/04/2023	Email outgoing		**Response to Tuna Australia email dated 12/04/2023:** SLR thanked Tuna Australia for the response and provision of the position statement. SLR notes that the email dated 12/4/2023 referred to a services agreement regarding consultation which was not included and requested this be sent.	N/A	* (see note above table).
		12/04/2023	Email incoming	**Response to SLR email dated 12/04/2023:** Service agreement provided.		N/A	* (see note above table).
		01/05/2023	Phone call	SLR introduction. It was noted the purpose of the call was to follow up recent email correspondence regarding request to meet. Tuna Australia's written position statement and position that they must be engaged via Service Agreement in order to provide further comment was acknowledged. The purpose of the call was to understand Tuna Australia's perception on the benefit of executing the Service Agreement for this project, given their feedback that there were unlikely to be any impacts associated with the Bonaparte Survey (see email dated 12/04/2023). Tuna Australia noted they were not just interested in the direct impacts of the survey on fishing activity but also how it may affect the conservation of aquatic resources through indirect of cumulative impacts. Fisheries and stocks are facing multiple pressures from various anthropogenic threats and accordingly Tuna Australia want to assess each proposal. Tuna Australia perceived all offshore activities should be assessed by them and need to be communicated to members. Tuna Australia are receiving an extremely high volume of requests to consult or notifications and were not able to sufficiently resource responding to them within a normal working week. The Service Agreement was intended to equip Tuna Australia with the capacity to respond. SLR queried what Tuna Australia's proposed timeline for completing the deliverables outlined in the Service Agreement would be. Tuna Australia noted three to four weeks from engagement. Tuna Australia queried what the next steps would be. SLR noted they would advise the project team of the discussion and confirm how they would like to proceed. SLR to touch base with Tuna Australia following these discussions.		No objections or claims raised – SLB to consider Service Agreement and provide response to Tuna Australia.	* (see note above table).
		04/05/2023	Phone call outgoing	SLB called Tuna Australia to follow up on communications with SLR regarding consultation services. The reason for the call is SLBs intention to engage Tuna Australia for consultation services via a service agreement. Tuna Australia acknowledged their conversations with SLR and welcomed the opportunity to work on the project. Tuna Australia confirmed they would send SLB a service agreement for review with scope of service and rates defined.		N/A	* (see note above table).
		05/05/2023	Email outgoing		SLB emailed thanking for the phone call to fully understand Tuna Australia's position regarding the agreement. SLB are reviewing today and questioned if SLB could make an adjustment to the timing of services to say "start date upon execution of the service agreement and deliverables following 3 weeks turn around time". Would this be agreeable to Tuna Australia? Once the agreement is signed, SLB will immediately pay the invoice upon receipt of it.	N/A	* (see note above table).
		05/05/2023	Email incoming	**Response to SLB email dated 05/05/2023:** Tuna Australia replied that the agreement already specifies terms of 60 days. SLB could change the clause to "deliverables as per agreement terms or otherwise as agreed between parties". As discussed,		No objections or claims raised – SLB to consider suggested terms.	* (see note above table).

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				Tuna Australia can meet the 1 June deadline but wouldn't normally lock into a three week turnaround.			
		05/05/2023	Email outgoing		**Response to Tuna Australia email dated 05/05/2023:** SLB would rather the term be 4 weeks rather than 60 days due to the tight timeline. SLB appreciates the confirmation on deliverables by 1 June and it is very much appreciated. Term would reduce to 4 weeks and would put deliverables wording as per last email correspondence. Should SLB amend and finalise, or will Tuna Australia amend?	N/A	* (see note above table).
		08/05/2023	Phone call outgoing	SLB phoned Tuna Australia to confirm that the draft agreement had been received and was under review. The scope of work and timeframe was discussed with SLB emphasising a start as soon as possible would be appreciated. Tuna Australia confirmed the resources are available to meet the timeline for the defined scope and they would commence as soon as the agreement was signed.		N/A	* (see note above table).
		08/05/2023	Email outgoing		SLB emailed Tuna Australia to say that early indications from the contracts department is that there would need to be quite a few changes to the service agreement before SLB can sign. SLB understands Tuna Australia's intention is to sign a long term service agreement, however in the interests of the very short time frame, SLB wanted to check: - Is there any way to revisit the option to have the scope of work for consultancy on Bonaparte 3D as an agreed section within an invoice you could directly send for SLB to immediately pay? -Failing the above, can Tuna Australia let SLB know if they are open to receiving clarifications and requests for changes to the service agreement, and if yes, is there any indication how long this process would take? -Aside from the above, if it is the case that SLBs Environmental Consultant (SLR) can expedite the agreement with Tuna Australia than SLB, do you have any problem in signing the agreement with SLR	N/A	* (see note above table).
		09/05/2023	Email incoming	**Response to SLB email dated 08/05/2023:** Tuna Australia replied to say that they have put in a lot of effort to make sure the proposed agreement fits the needs of both parties and the changes proposed by SLB seem to be superfluous detail and doesn't materially change the nature of the agreement: an agreement which has been executed unchanged by other energy companies. This is creating more time hurdles for the work to get done. Since 27 April, Tuna Australia has dealt with multiple calls and emails to SLB/SLR which is a lot of extra work and noise for a simple agreement. Tuna Australia provided SLB with the service agreement for signing and would like to know how SLB would like to proceed.		SLB to consider how to proceed with service agreement.	* (see note above table).

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		09/05/2023	Phone call outgoing	SLB phoned Tuna Australia to update them on the SLB review of the draft agreement. The agreement is nearly final; however, two points need to be discussed in order to make the agreement compliant with SLB. Tuna Australia noted they would not have authority to confirm the two items and would need to discuss with management.		N/A	* (see note above table).
		11/05/2023	Phone call outgoing	SLB phone Tuna Australia to follow up on the requested edits to the draft agreement. Tuna Australia responded that they would not be prepared to alter the terms as they would prefer a long-term agreement (24 months) with SLB and the payment terms are non-negotiable. SLB responded that this feedback would be taken to SLB legal and contracts, but that SLB standards were being proposed and difficult to have approved changes without internal higher management approval. Tuna Australia restated their position and expressed the desire to conclude the agreement as soon as possible in order to commence and achieve the desired timeline.		N/A	* (see note above table).
		11/05/2023	Email outgoing		SLB emailed Tuna Australia to say that in the phone call earlier in the day SLB was explaining that SLB contracts and legal in Perth has escalated the agreement up to management for comment and feedback since this is the procedure that must be followed. They have come back with the few minimum updates to the agreement which if acceptable to Tuna Australia would capture the typical O&G industry standard wordings to make this agreement more applicable to O&G companies. Tuna Australia could more easily use this version as a standard which would be easily acceptable to other O&G industry companies. SLB has added notes regarding the requested changes and inserted SLBs standard payment terms, however, it is SLBs intention to pay Tuna Australia directly upon being invoiced.	N/A	* (see note above table).
		11/05/2023	Email outgoing		SLB emailed following phone call earlier in day. In NOPSEMA's guidance, consultation should also provide for 'self-identification'. In the event that an individual is incidentally made aware of the activity as a result of Tuna Australia's consultation services, SLB want to ensure that SLB would be made aware of this occurrence and that the individuals' feedback would be captured, addressed and report to the same effect as would occur for consultation with Tuna Australia's members. SLB notes that the service agreement provides a nominal fee of $500 per hour for works such as this. SLB requested Tuna Australia confirm SLBs interpretation is correct and that the service agreement does not account for consultation with individuals who self-identify and that SLB would be informed of this occurrence.	N/A	* (see note above table).
		12/05/2023	Email incoming	**Response to SLB email dated 11/05/2023:** Tuna Australia replied that their consultation covers all concession holders in WTBF, ETBF and longline component of the SBT fishery. This includes Tuna Australia members and non-members and covers latent rights holders as well as active fishers. Tuna Australia have found during this process that they sometimes get told about existing rights or		N/A	* (see note above table).

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				fishing operations in another fishery. As a rule, these are flagged with the energy client in the interest of the member but commentary or analysis outside of tuna fisheries is not provided.			
		12/05/2023	Email outgoing		**Response to Tuan Australia email dated 12/05/2023**: SLB thanked Tuna Australia for the clear response. And confirmed SLBs understanding of the email. SLB requested Tuna Australia provide SLBs details to self-identifying relevant persons.	N/A	* (see note above table).
		12/05/2023	Email incoming	**Response to SLB email dated 12/05/2023:** Tuna Australia confirmed SLB details to be provided.		N/A	* (see note above table).
		15/05/2023	Email outgoing		SLB emailed Tuna Australia to see if Tuna Australia have had time to review the marked up edits.	N/A	* (see note above table).
		15/05/2023	Email incoming	**Response to SLB email dated 15/05/2023:** Tuna Australia are currently reviewing and will be in touch.		N/A	* (see note above table).
		15/05/2023	Email outgoing		**Response to Tuan Australia email dated 15/05/2023**: SLB thanked Tuna Australia	N/A	* (see note above table).
		17/05/2023	Phone call outgoing		SLB phoned Tuna Australia to update on the progress of the service agreement. A lot of effort has been made internally to ask to for approval for the agreement because it was falling outside the SLB standard third-party agreement terms. SLB explained that approval had been achieved and the agreement was being processed today for signature. Once signed, SLB would email a copy for countersignature. Tuna Australia thanked SLB and said that once signed, the scope of work would commence.	N/A	* (see note above table).
		30/05/2023	Phone call outgoing	SLB phoned Tuna Australia to receive an update on the consultation progress being conducted by Tuna Australia and to see if they were ready to invoice SLB. Tuna Australia are progressing with consultation and quite a few responses have been received. Tuna Australia explained that they would be representing Eastern and Western Skipjack fishers. Tuna Australia had been contacted by some fishers who they were not aware of and going forward they would be represented by Tuna Australia. An invoice would be issued in early June.		N/A	* (see note above table).
		08/06/2023	Email outgoing		SLB emailed to enquire how Tuna Australia are progressing with the consultation and when they estimate to wrap up and provide the report. SLB are planning to resubmit the EP mid next week.	N/A	* (see note above table).
		08/06/2023	Email incoming	**Response to SLB email dated 08/06/2023:** Report is being written up at the moment and will be with Tuna Australia boss for review tomorrow afternoon.		N/A	* (see note above table).
		08/06/2023	Email outgoing		**Response to Tuna Australia email dated 08/06/2023:** Thanks.	N/A	* (see note above table).

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		12/06/2023	Email outgoing		SLB emailed Tuna Australia to check on the report status and when it will be sent through for review.	N/A	* (see note above table).
		14/06/2023	Email incoming with Tuna Australia report attached	**Response to SLB email dated 12/06/2023:** Tuna Australia apologised for the delay and provided the report on consultation with tuna fishers. The concerns raised within the Tuna Australia report are summarised below.		SLB reviewed the report and individual response are below.	* (see note above table).
				Seismic testing has proven detrimental to fishing productivity in sectors targeting demersal fish as well as invertebrates.		As part of developing the EP, the assessment of impacts of acoustic noise on fish and benthic invertebrate species involved an extensive review of all available literature and studies. Underwater acoustic modelling was specifically undertaken for the Seismic Survey and known noise exposure criteria for fish and invertebrate species were utilised to understand the potential risk based on lethal and sub-lethal impact thresholds. The modelling results were used along with the literature to undertake the risk assessment process and development of control measures to reduce any potential impacts to ALARP and an Acceptable Level. Studies have suggested that there is evidence of fish returning to survey areas following the cessation of seismic/acoustic activities. Therefore, based on the literature and studies, it is considered that any effects from a seismic survey on fish and fish populations will be temporary, and fish will return to normal behaviour and distributions within days of any acoustic exposure.	Evaluation of acoustic impacts on commercial fisheries – **Section 7.2.3.1** Evaluation of acoustic impacts on demersal fish – **Section 7.2.2.2.3** Evaluation of acoustic impacts on Benthic invertebrates – **Section 7.2.2.2.2**

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				Lack of understanding of seismic impacts on tuna and billfish species, by-product species (wahoo and mahi mahi), larvae and baitfish		It is considered that impacts from seismic activities are well understood based on a comprehensive literature review and underwater acoustic modelling. Literature utilised within the EP states that fish will move away from a noise source if they are uncomfortable with the noise, thereby minimising their exposure and the potential for any deleterious effects. Due to this ability and behavioural traits of fish to avoid exposure to loud noise sources, it is considered that exposure to noise levels that would result in mortality or potential mortal injuries to pelagic species is unlikely. Based on literature, fish species are classified into four different categories. Tuna and pelagic fish species are classified as either Group I or Group II species. Group I species are those fish without a swim bladder (i.e. skipjack tuna and albacore tuna), while Group II species are those fish with a swim bladder whose hearing does not directly involve the swim bladder which includes some tuna species (i.e. yellowfin tuna, bluefin tuna, wahoo). With the acoustic source moving across the OA, pelagic fish would have a period of time as the source approaches that they can avoid the area and avoid exposure to levels that may cause mortality or mortal injury.	Acoustic noise assessment on fish is assessed within Section 7.2.2.2.3 Acoustic noise assessment on fish eggs and larvae morality is assessed within Section 7.2.2.2.3.2

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
						Based on the available evidence (i.e. literature and underwater acoustic modelling results), the assessment within the EP concluded that the residual risk of fish mortality due to exposure to seismic emissions was low. Shallow reef areas will be avoided during the Seismic Survey, where any water depths less than 60 m will have a 421 m horizontal buffer zone placed around them to avoid any impacts on site attached fish. This will also reduce the potential for baitfish associated with these shallow areas to be impacted by the acoustic noise. Spawning activities of pelagic fish are not expected as there are no known spawning aggregation areas within the OA. Studies suggest that a regular 3D seismic survey has the potential to result in a mortality rate of 0.45% of the total larval population for five different fish species. Natural rates of mortality experienced by fish eggs and larvae can be very high, in some cases greater than 50% per day and often more than 20% per day (see **Section 7.2.2.2.3.2**). Based on the literature, it is considered that any potential mortality from a seismic survey on the larval stages of fish is considered negligible compared to the natural mortality rates.	

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						After spawning, the fate of eggs and larvae in the marine environment is uncertain and there are often high mortality rates during these early life phases of most fish species. Marine currents carry and disperse pelagic eggs and larvae through different habitats and consequently affect their fate. Condition, growth and survival in marine fish larvae are influenced by food, temperature, hydrographic patterns and the marine environment parameters (i.e. chlorophyll-a) in general. When Atlantic bluefin tuna spawn, which typically occurs at night, each female can release over 10 million eggs. This high release rate of eggs is to help ensure survival of the species, where it is considered that each individual egg has a 1 in 40 million chance of surviving and maturing into a full-grown adult tuna (ACES, 2023). After spawning, the eggs float just below the surface where most are eaten by other fish. Three days after the eggs are fertilised, they hatch and begin to grow very quickly.	
				Two fishers noted that they had previously witnessed successive years of large-scale spawning of events of yellowfin Tuna in areas immediately south of the OA. The times noted were between December and February. There are two distinct yellowfin tuna stocks mean the NW WA is important in the context of productivity of the greater Indian Ocean.		Impacts of seismic on fish eggs and larvae is discussed within **Section 7.2.2.2.3.2** and summarised above. Yellowfin tuna spawn at the surface at night mostly within 10^{o} of the equator when temperatures exceed 24-26^{o}C with the main spawning season between November to	Acoustic noise assessment on fish is assessed within **Section 7.2.2.2.3** Acoustic noise assessment on fish eggs and larvae morality is assessed within **Section 7.2.2.2.3.2**

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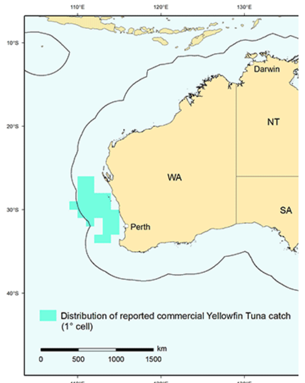
						April. Yellowfin tuna are serial spawners, spawning every few days throughout the peak season (MPI, 2023). During a single spawning season, an individual yellowfin tuna can produce up to 1,500,000 eggs which is a mechanism to mitigate low natural survival rates (Wild Fisheries Research Programme, 2009). There are two fisheries for yellowfin tuna in Australia, along both the east and west coasts; however, the commercial catches of yellowfin tuna on the western coast of Australia are a long way south of the Operational Area - see below (source: [Yellowfin tuna | Australian Fisheries Management Authority (afma.gov.au)]).  Based on the literature available the OA does not appear to be the natural spawning area for yellowfin tuna, nor do any commercial landings of Yellowfin tuna come from within the OA or even the EMBA. Anecdotal sightings of spawning yellowfin tuna are acknowledged.	
				Unknown impacts of marine seismic surveys on SBT larval spawn, where the EMBA is adjacent to the single known spawning area for SBT, which takes place		Impacts of seismic surveys on fish eggs and larvae is considered within **Section**	Southern Bluefin Tuna background

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				September to April. Reference was made to a 2019 Japanese research cruise that found 0-year SBT in the northwest WA.		**7.2.2.2.3.2** and summarised above. The Japanese cruise that was referenced that found 0-year SBT in the northwest WA was off Exmouth, approximately 1,700 km south of the OA. Literature within the EP states that fish will move away from a noise source if they are uncomfortable with the noise, thereby minimising their exposure and the potential for any deleterious effects. Due to this ability and behavioural traits of fish to avoid exposure to loud noise sources, it is considered that exposure to noise levels that would result in mortality or potential mortal injuries to pelagic species is unlikely. Through consultation with ASBTIA, it was stated that "we do not fish in that area, nor is this area within what we believe to be the spawning area for our SBT stocks". "You do not need to keep us informed of this activity". Based on this feedback from the consultation process, it is considered that the risk to SBT stocks is low and not at any potential risk from the proposed Seismic Survey. Based on the literature and consultation with ASBTIA there is not expected to be any impacts on the larval spawn of SBT. The Japanese cruise referenced is a significant distance away from the OA.	information in **Section 4.5.3.1.2.1** Acoustic noise assessment on fish is assessed within **Section 7.2.2.2.3** Acoustic noise assessment on fish eggs and larvae morality is assessed within **Section 7.2.2.2.3.2** **Appendix F**
				Any impacts on the larval stages of SBT or 0-year fish has the potential to wipe out a year class of fish with		Based on consultation with ASBTIA and the location of where the	Southern Bluefin Tuna background

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
				downstream impacts on global tuna markets and industry collapse.		2019 Japanese cruise took place, it is not considered there is any conflict with the proposed seismic activities within the OA and SBT larvae or 0-year class fish. Impacts of seismic activity on larvae and fish is summarised above as well as within the EP. The proposed Seismic Survey in the Bonaparte Basin is a relatively small survey of a finite time and is not expected to have an impact on larval stages of SBT that could impact global markets. Pelagic tuna are serial spawners releasing millions of eggs each year to ensure the survival of their species due to the very high natural mortality rates. Based on the literature and consultation with ASBTIA there is not expected to be any impact on the larval stages of SBT that would result in downstream impacts on global tuna markets and industry collapse.	information in **Section 4.5.3.1.2.1** Acoustic noise assessment on fish eggs and larvae morality is assessed within **Section 7.2.2.2.3.2** Acoustic noise assessment on fish is assessed within **Section 7.2.2.2.3**
				Precautionary principle should apply to the use of seismic energy until impacts are understood vertically within marine ecosystems and in particular, species associated with tuna longline operations (i.e. pelagic fish, prey species, larvae and phytoplankton).		The impacts of seismic surveys are well studied and well understood. Seismic surveys are not new technology and have been undertaken for many years using the technology that is currently proposed to be used for the acquisition of the Seismic Survey. The existing environment within the OA and EMBA are also well understood and an extensive summary of all the regional, physical, biological, cultural and socio-economic environments,	**Section 3** – Project Description **Section 4** – Existing Environment **Section 7** – Environmental Impacts and Risks from Planned Activities **Section 8** – Environmental Impacts and Risks from Unplanned Activities

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
						as well as sensitive environments and marine protected areas that are present within the EMBA has been included within the EP. A very detailed literature review has been undertaken within the EP, supported by underwater acoustic modelling to understand sound propagation and different thresholds at certain distances from the acoustic source in relation to the bathymetry across the OA. Impacts of seismic are well understand and there is a lot of associated literature available as included within the EP. Based on the above, a precautionary approach is not considered necessary.	**Section 9** – Cumulative Effects
				Concerns that wildlife mitigation performance criteria and process documented in the EP are undermined by concerns that marine mammal observation is difficult to do successfully given the constraints identified in The Saturday Paper article (June 10-16, 2023, No. 453).		Email response was provided to Tuna Australia directly on this. See communication on 20 June 2023. To summarise the response, it is provided below: Industry procedures for MMO observations on seismic vessels direct the observer to scan to the horizon in a forward arc from the deck and from the bridge (approximately 25m above water line which would allow 18km visual distance with the naked eye on a clear day – see link below). This is because the seismic vessel is moving slowly in a forward direction, and it is imperative to scan for fauna ahead of the source. Standard equipment to aid	Appendix I,

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
						the MFO in their observations include high powered binoculars – Bigeyes – Fujinon. Night time and low visibility operations are monitored by the Passive Acoustic Monitoring System (PAM) which is an acoustic system receiving signals from a towed hydrophone tuned to pick up vocalizations of the whale species expected to be in the area. https://samathieson.com/sa-mathieson/training/data/how-far-can-you-see-at-sea-calculate/?height=25	
				Current compensation protocol framework demonstrated in the EP is inadequate. The compensation framework does not address the impacts of a large-scale disruption to globally important fisheries, nor does it include a compensation mechanism for lost perspectivity.		SLB has developed a compensation protocol that is aligned with the NERA protocol. If commercial fishers experience an economic loss because of the Seismic Survey, financial compensation will be considered. Fishers may seek compensation for loss or damage of fishing equipment, temporary loss of fish landed due to damaged or lost fishing equipment, displacement from fishing grounds which result in additional costs incurred, loss of catch due to displacement from fishing grounds or impacts of acoustic emissions or displacement from fishing grounds because of avoiding contaminated waters following a fuel oil spill. The NERA protocol was developed with input from a range of different organisations, from both government and the commercial fishing sector	Commercial fisheries protocol is summarised in **Section 7.2.3.1** of the EP and in full within **Appendix M** of the EP.

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
						(see **Section 7.2.3.1** of the EP). Based on the acoustic disturbance to the marine environment assessment (**Section 7.2**) undertaken within the EP for the proposed activities, the assessment does not conclude that the impacts would lead to a large-scale disruption to globally important fisheries. Consultation to continue throughout the life of the EP.	
				Some fishers raised concerns over deconfliction of fishing operations with seismic activities, but Tuna Australia notes SLBs comprehensive plan to mitigate any conflict.		SLB has committed to providing Tuna Australia with the 48-hour lookahead plans for distribution to members. These lookahead plans will be distributed every 24 hours, indicating the vessels movements over the next 48 hours. SLB will also notify Tuna Australia prior to starting the survey as part of the notification requirements within the Implementation section, where relevant persons will be notified. A support vessel and a chase vessel will also be involved in the survey which can help interact with fishers in the area as well. Consultation to continue throughout the life of the EP.	**Section 5.5.6** **Section 5.5.14**
				A consortium of WTBF concession owners is currently planning to fish in key NW grounds from late 2023 onwards, including in areas contained within the EMBA.		A request has been made to further identify the location of the likely fishing area. Not all of the EMBA will be impacted by the planned activities contained within the EP. The EMBA was developed from the worst-case scenario of an unplanned activity, that being a vessel	**Section 7** – Environmental Impacts and Risks from Planned Activities

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
						collision and a release of fuel oil into the marine environment. An extremely conservative modelling approach was taken and resulted in a large EMBA, most of which won't impact any fishing activities. Consultation to continue throughout the life of the EP.	
				Concerns raised over cumulative impacts on substantial amount of activity by the energy sector in the Bonaparte Basin. It is acknowledged there is significant resources to support some of these activities, but it is inevitable that there will be an incident one day which will place the valuable fisheries in jeopardy.		Cumulative impacts have been assessed within the EP (Section 9) from the activities SLB are proposing to conduct. SLB cannot speak for other activities that are proposed as that is outside the mandate of what SLB can respond to. As noted, there are extensive control measures and operational procedures that will be implemented throughout the survey to mitigate the risk of a collision which is the greatest potential for a widespread impact. The EP includes an assessment of all potential unplanned activities and associated impacts and risks as well as the control measures implemented to reduce those risks to ALARP and an Acceptable Level. Consultation to continue throughout the life of the EP.	**Section 8** – Environmental Impacts and Risks from Unplanned Activities **Section 9** – Cumulative Impacts.
				In the absence of a before, after, control, impact (**BACI**) analysis, SLB needs to demonstrate clearly how the environment (pelagic and benthic) will be independently assessed following seismic survey activity. There is a suggestion that an industry wide BACI assessment would be a useful fisheries energy sector collaboration but consider this would be better to be led by NOPSEMA or APPEA as a practical way to		In **Section 7.2.2.3.2** of the EP a BACI study was undertaken by Meekan et al. (2021) for the effects of seismic surveys on demersal fish fauna on the northwest shelf of Western Australia. Following exposure to the acoustic source no impacts to fish behaviour or	**Section 7.2.2.3.2** **Table 70 –** Assessment of Control Measures for Managing the Acoustic Disturbance in the Marine Environment

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
				support sectoral overlap, marine spatial squeeze and underpin a compensation framework.		movement patterns were recorded for a range of demersal fish species. Acoustically tagged red emperor showed no evidence of any long-term displacement following exposure to the acoustic source, with individuals generally remaining within 0.15 km^2 of the location they were first detected. A BACI study was considered prior to the seismic survey commencing as part of the control measures considered. Developing and completing a BACI study for the active fisheries within and surrounding the OA is a significant undertaking and would need to occur over a long period of time to ensure that the methodology and results were robust, representative and consider the inherently high level of natural variability present. There have been many studies undertaken on the effects of fish and their response to seismic emissions, with many reporting that fish typically move away from a loud acoustic source if they are uncomfortable with the noise, thereby minimising their exposure and the potential for any deleterious effects. Most studies that are undertaken on fish are essentially represented as worst case scenarios, as the fish are not able to move away from the	

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
						acoustic source like they can in the wild. The costs of undertaking an extensive BACI study for the proposed seismic survey area would be grossly disproportionate to the environmental benefit gained from implementing such a control measure and as a result was not included in the suite of control measures to be implemented.	
				Would like any advice on whether there are any known impacts from marine seismic arrays and other equipment on the navigational equipment of other vessels. It was noted that there is evidence of wind turbines causing false radar scatter with impacts on navigation safety. A request was made to SLB whether there is any advice that can be provided as to whether seismic equipment may be an impediment to safe fishing operations.		A response to Tuna Australia was provided on 20 June 2023 regarding this. To summarise, this response: The seismic arrays and other equipment used in offshore seismic surveying do not have any impact on navigational systems of any other vessels including the seismic vessel itself. All radio transmitting equipment onboard the survey vessels are certified safe to ensure that they do not interfere with any other vessels navigation signals and/or equipment. The vessels radio equipment is operated according to international safety standards (DNV), and the vessels have valid Ships Radio Safety certificates. The in-sea marine source arrays employed in seismic vessel operations does not have any effect on radio signals. In practice, the seismic and support vessels are reliant on their shipboard radar to track all vessels and obstructions inside radar range during the project.	Appendix I (row below)

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
						The impact on radar systems by wind farm equipment appears to be related to the movement of the wind turbine blades and the reflected energy produced and detected by the radars receivers. A report on the electromagnetic effect of wind turbines was published by the US Naval Postgraduate School and is freely available at https://apps.dtic.mil/sti/pdfs/ADA580765.pdf.	
		20/06/2023	Email outgoing		Acknowledgment email to Tuna Australia thanking them for the report from relevant persons. There were two questions that Tuna Australia raised that needed a response, which were: 1) "We also express concern that some of the wildlife mitigation performance criteria and processes documented in the EP are undermined by concerns that marine mammal observation is difficult to do successfully given the constraints identified in the above article. However, this is for marine mammal experts to provide commentary". a) Newspaper article referenced the text states, "There was often nowhere on the ship from which she could monitor all sides. The blasting continued nonstop, every 10 seconds. It ran through the night without a marine fauna observer rostered on" 2) Advice on any known impacts the marine seismic arrays and other equipment has on the navigational equipment on other vessels The responses to these questions are provided in the row above and also contained in full within Appendix F.		**Appendix I** **Appendix F**
		07/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitisision extent, nothing has changed in terms of the survey	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person. In addition, a further detailed discussion regarding the consultation undertaken can be found in Section 5.5.6.7 of the EP.					
70	Northern Territory Guided Fishery Industry Association (**NT GFIA**)	22/05/2023	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		06/06/2023	Email outgoing		Follow up email sent with fact sheet and coordinates attached. Response requested back on or before 13 June 2023.	N/A	* (see note above table).
		02/06/2023	Phone call outgoing	Message left on mobile requesting feedback or a call back. No meeting minutes associated with this call as per the discussion within Section 5.5.6 of the EP.			
		07/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
71	Western Skipjack Tuna Fishery Concession Holders	22/05/2023	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		07/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					allow more time if requested. SLB provided the factsheet.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
72	Northwest Slope Trawl Fishery Concession Holders	22/05/2023	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		06/06/2023	Email outgoing		Follow up email sent with fact sheet and coordinates attached. Response requested back on or before 13 June 2023.	N/A	* (see note above table).
		07/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
73	Northern Prawn Fishery Concession Holders	22/05/2023	Email outgoing		Introductory email from SLR with Fact Sheet attached.	N/A	* (see note above table).
		06/06/2023	Email outgoing		Follow up email sent with fact sheet and coordinates attached. Response requested back on or before 13 June 2023.	N/A	* (see note above table).
		07/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
74	Bengal Energy – AC/RL10	03/03/2023	Email outgoing		Initial email from SLB with factsheet to introduce the survey and open discussions for Access	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					Authority following their take over as operator from PTTEP for AC/RL10		
		06/03/2023	Email incoming	Bengal Energy contact responded to SLB email nominating himself as the person to contact for all future correspondence. It was also asked that the Exploration Manager is to be copied into the emails as well.		N/A	* (see note above table).
		24/03/2023	Email outgoing		Draft Access Authority letter from SLB to Bengal Energy contact and Exploration Manager	N/A	* (see note above table).
		24/03/2023	Email incoming	Bengal Energy contact asked if SLB could provide the previous Access Authority letter that was in place with PTTEP.		N/A	* (see note above table).
		28/03/23	Email outgoing		Email from SLB to Bengal Energy contact and Exploration Manager with the PTTEP draft Access Authority letter plus response to Bengal Energy feedback to the draft sent 24/03/23	N/A	* (see note above table).
		29/03/23	Email incoming	Email from Bengal Energy contact with the signed Access Authority letter attached		N/A	* (see note above table).
		30/03/23	Email outgoing		Email from SLB to Bengal Energy contact with fully executed Access Authority letter, also signed by SLB.	N/A	* (see note above table).
		07/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		08/11/2023	Email incoming	Bengal Energy contact asked for a map of where the acquisition area is in relation to the currently held tenements.		Relevant person has requested additional information which is provided in following email.	* (see note above table).
		08/11/2023	Email outgoing		SLB thanked Bengal Energy contact for the response and provided the location of AC/RL-10 in relation to the survey area.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
75	Ministry of Agriculture and Fisheries of Timor Leste	05/08/2023	Email outgoing		SLB emailed following recent advice from Australia regulators for when offshore operations across the EEZ may affect Timor Leste fisheires. SLB stated	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					they would like to inform foreign revelvant persons who may be affected by SLB's activities. As this would potentially include Timor Lest fishermen, SLB asked for assistance in helping provide fishermen with survey information. SLB asked if the department could share any information regarding fishing activities in the area and if they would be able to provide help sending out information packs.		
		05/09/2023	Email outgoing		SLB emailed stating they have been trying to reach either the Maritime Unit or the Ministry of Agriculture and Fisheries of Timor Leste regarding recenet advice from Australian regulators where offshore operations across the EEZ may affect Timor Leste Fishers. May affect Timor Leste Fishers. SLB asked for assistance in helping provide survey infomratin to fishers to make sure they are aware of the survey. SLB asked if the department could share any information regarding fishing activities in the area.	N/A	* (see note above table).
		07/09/2023	Email outgoing		SLB provided the project fact sheet translated into Tetum to help in understanding the operations and how they may affect activities of local mariners.	N/A	* (see note above table).
		22/09/2023	Meeting	SLB met with the Minister of Agriculture and Fisheries in Dilli to provide an overview of the proposed seismic survey. SLB presented material summarising the project and explained the reasons for SLB wanting to contact them to seek advice in reaching and informing potential local fishermen who may be present in the Bonaparte area at the time of the survey.		No issues or concerns raised.	* (see note above table).
		07/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
76	Directorate of Surveillance of Maritime and Fisheries Resources at the Ministry for Marine Affairs and Fisheries	19/09/2023	Email outgoing		SLB stated this contact has been provided from DFAT as a person to contact regarding the Bonaparte EP. SLB stated they would like to raise awareness and inform foreign relevant persons which may be affected by SLBs activities which could potentially include Indonesian fishermen. SLB provided a map of the OA and fastsheet designed for Indonesian fishermen. SLB requested	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					the Directorate provide (via email) if they have any concerns or questions.		
		21/09/2023	Email outgoing		SLB resent the above email in case it had been missed.	N/A	* (see note above table).
		27/09/2023	Email outgoing		SLB provided a follow up email to see if there were any concerns regarding the Bonaparte survey.	N/A	* (see note above table).
		24/10/2023	Email outgoing		SLB provided an update on the progress of the survey. The Ep is under assessment with NOPSEMA. SLB plan to commence the survey in December 2023 or January 2024.	N/A	* (see note above table).
		07/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.	N/A	* (see note above table).
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
77	Indonesian Ministry for Maritime Affairs and Investment (Directorate of Border Delimitation)	19/09/2023	Email outgoing		SLB stated this contact has been provided from DFAT as a person to contact regarding the Bonaparte EP. SLB stated they would like to raise awareness and inform foreign relevant persons which may be affected by SLBs activities which could potentially include Indonesian fishermen. SLB provided a map of the OA and fastsheet designed for Indonesian fishermen. SLB requested the Directorate provide (via email) if they have any concerns or questions.	N/A	* (see note above table).
		21/09/2023	Email outgoing		SLB resent the above email in case it had been missed.	N/A	* (see note above table).
		28/09/2023	Email outgoing		SLB provided a follow up email to see if there were any concerns regarding the Bonaparte survey.	N/A	* (see note above table).
		24/10/2023	Email outgoing		SLB updated on the progress of the survey. The EP is under assessment with NOPSEMA. SLB plan to acquire in December 2023 or January 2024.	N/A	* (see note above table).
		07/11/2023	Email outgoing		SLB provided an update on the proposed survey. Notification was provided in March 2023 that the survey would commence within 4 weeks, however the EP is still under assessment and SLB are working through the changes with NOPSEMA. SLB is reaching out again to see if there are any	N/A	* (see note above table).

ID	Relevant Person	Date	Communication/ Consultation Type	Summary of Relevant Person Communication / Feedback / Concerns	Summary of SLB Communication / Response	Assessment of Relevant Person Objection or Claim	Reference to Location within EP
					questions or further information required. With the exception in the planned data aqcuitision extent, nothing has changed in terms of the survey scope or proposed activities. Pending approval, the survey will comment at the end of this year or early January 2024. SLB requested any questions or requests for further information be provided back by 20 November. SLB are happy to provide any additional information that may be required or allow more time if requested. SLB provided the factsheet.		
		** - see note above table regarding SLBs fulfillment of its consultation obligations with this relevant person.					
The following concession holders were consulted as part of the overarching Concession Holders relevant person identified above under 71 to 73. Due to confidentiality reasons, these relevant persons were not listedin the body of the EP; however, the following consultation occurred.							

APPENDIX J

PAM Specifications

PAM Specifications

Cetacean Detection Capability

The vocalisations made by the full range of marine mammal species can be detected by our PAM systems. Typical system configuration has the capability of detecting sounds within a frequency range of 200 Hz to 200 kHz. This frequency band covers most marine mammal vocalisations. The system sensitivity may be extended to 10 Hz to 200 kHz for surveys in which it is necessary to monitor for baleen whales that vocalise at very low frequencies. However, in some circumstances, vessel noise at low frequencies can mask marine mammal vocalisations and limit the performance of PAM. The frequency response of some hydrophone channels is set to counter this (e.g. lower frequency response of 2 kHz for channels designed to detect the majority of species vocalisations). Seiche can readily tailor the frequency sensitivity of the hardware to suit the project application and the range of marine mammal species likely to be encountered. Additionally, PAMGuard software can be configured to focus on the detection of the vocalisations of particular species of interest or concern.

PAMGuard Software

PAMGuard software is integrated into all our PAM systems. PAMGuard is industry-standard software for the acoustic detection, localization and classification of vocalizing marine mammals. It is a sophisticated and extendible software package that assists trained operators in robust decision-making during real-time mitigation operations. As an open source development, PAMGuard is publicly owned and freely available. PAMGuard development is led by a team of specialists at the University of St Andrews, U.K. This has to date been funded by industry via the IOGP Sound and Marine Life Joint Industry Program. Funding is now transitioning to a self-funding mechanism operated through voluntary user contributions.

Table 1. Hydrophone elements frequency range

Hydrophone Elements	
H1	10 Hz to 200 kHz (-3 dB points)
H2	10 Hz to 200 kHz (-3 dB points)
H3	2 Hz to 200 kHz (-3 dB points)
H4	2 Hz to 200 kHz (-3 dB points)

Table 2. Hydrophone sensitivity

Hydrophone sensitivity	
Broadband channel sensitivity	-166 dB re 1V/µPa (nominal)
Standard channel sensitivity	-157 dB re 1V/µPa (nominal)

APPENDIX K

Summary of Proposed Marine Mammal Control Measures

SUMMARY OF PROPOSED MARINE MAMMAL CONTROL MEASURES

Based on the distribution and likelihood of marine mammals in the OA (as described in **Section 4.5.6** of the EP) and as per the definitions outlined in the EPBC Act Policy Statement 2.1:

- There is a moderate to high likelihood of encountering whales in the OA; and
- The OA overlaps with biologically important habitat (i.e. the blue whale migratory BIA).

On this basis, the application of both standard management procedures and additional management procedures is necessary to ensure that potential impacts from the proposed Seismic Survey to marine mammals are managed to an acceptable level.

Modelling of underwater noise from the 3,000 in^3 acoustic source has been conducted (both conventional Underwater Acoustic Modelling and Animat modelling, see **Section 7.2.1.1** of the EP), and while the modelling results indicate that the standard management procedures outlined in EPBC Act Policy Statement 2.1 will be sufficient to protect high-frequency and very high-frequency cetaceans and sirenians from predicted noise levels, additional control measures are required to protect baleen whales. The control measures below are therefore proposed to ensure full compliance with the EPBC Act Policy Statement 2.1 and the Blue Whale Conservation Management Plan. Where species identification is uncertain, a precautionary approach will be adopted.

In accordance with the EPBC Act Policy Statement 2.1, no control measures are required for dolphins and porpoises, and the modelling results (see **Section 7.2.1.1** of the EP) support this approach.

TERMINOLOGY

In accordance with the EPBC Act Policy Statement 2.1, the term ‘whale’ refers to baleen whales and other large, toothed whales such as, sperm whales, killer whales, false killer whales, pilot whales and beaked whales.

For clarity, all whale species other than blue whales/pygmy blue whales are herein referred to as ‘other whales’, meaning:

- All baleen whales excepting blue whales or pygmy blue whales; e.g. humpback, fin, sei, Bryde’s, Omura’s and dwarf minke whales etc; and
- All large, toothed whales; e.g. sperm whales, killer whales, false killer whales, pilot whales and beaked whales.

The measures that are specific to ‘other whales’ have been developed on the basis that free-ranging pelagic animals are not expected to remain in the vicinity of the Seismic Vessel for extended periods and the movement of the Seismic Vessel means that any potential exposure will be transitory.

MANAGEMENT PROCEDURES – ALL WHALES

Unless otherwise stated, the following management procedures (**MP**s) apply to ‘other whales’ and blue whales/pygmy blue whales and will be followed throughout the entire OA[1] for the duration of the survey.

[1] Including the blue whale migratory BIA and proposed 17 km buffer.

Where management procedures for all whales are superseded by species specific management procedures, as is the case for blue whales/pygmy blue whales, this has been identified using superscript and associated explanatory footnotes. In these cases, the applicable blue whale/pygmy blue whale management procedures are described in the subsequent section of this appendix.

- MP 1: During daylight hours at least one marine mammal observer (**MMO**) or marine fauna observer (**MFO**) will be on duty at all times from the Seismic Vessel and one MMO will be on duty at all times from the Chase Vessel to undertake continuous visual observations for marine mammals[2].
- MP 2: Throughout the OA, MMOs/MFOs will implement a 5+ km Observation Zone[AC3] from the acoustic source. In practise this means that MMOs/MFOs will be required to scan as far as possible towards the horizon given the prevailing sightings conditions. The minimum Observation Zone permissible will be 5 km[4].
- MP 3: During daylight hours, Pre Start-up Visual Observations for the presence of whales will be undertaken for at least 30 minutes before the commencement of the Soft Start Procedure;
- MP 4: If no whales have been sighted within the relevant Shut-down Zones, Soft Start Procedures will commence over a 30-minute period.
- MP 5: A 2 km Extended Shut-down Zone[AC] for all whales will be implemented throughout the entire OA at all times. On this basis a Low Power Zone is deemed unnecessary[5].
- MP 6: A Start-up Delay will occur if a whale enters or is detected in the relevant Shut-down Zone during the soft start. Whale presence within the Shut-down Zone will trigger an immediate and complete shut-down, and Soft Start Procedures may only resume after the whale has been observed to move outside the relevant Shut-down Zone, or when 30 minutes have lapsed since the last whale sighting;
- MP 7: If a whale is detected within any nominated Observation Zone during the Seismic Survey, an additional MMO/MFO will be stationed on the bridge of the vessel from which the detection was made to assist with observations. The only permissible exception to this is when the off-duty MMO/MFO is on a meal or toilet break or is standing-down having reached maximum shift duration for that particular working day. In these instances a trained crew member will assist with marine mammal observations;
- MP 8: Stop Work Procedures will be implemented for the entire duration in which operations are underway as follows: the acoustic source will shut-down whenever a whale is detected in the relevant Shut-down Zone. Soft Start Procedures may only resume after the whale has been observed to move outside the relevant Shut-down Zone, or when 30 minutes have lapsed since the last whale sighting;

[2] Note that this measure goes above and beyond the requirements of the standard management procedures outlined in the EBPC Act Policy Statement 2.1 and, hence, is an additional management procedure.
[3] While standard management procedures outlined in the EPBC Act Policy Statement 2.1 will be adopted for the Seismic Survey, SLB has adapted some of these measures to provide increased protection to marine mammals. These are marked with an 'AC' superscript.
[4] Note that this measure goes above and beyond the requirements of the standard management procedures outlined in the EBPC Act Policy Statement 2.1 and, hence, is an additional management procedure.
[5] Note that this measure goes above and beyond the requirements of the standard management procedures outlined in the EBPC Act Policy Statement 2.1 and is superseded only by Additional Management Procedure applicable to blue whales/pygmy blue whales.

- MP 9: Low Visibility or Night-time Operations may occur provided that there have not been three or more whale instigated power-down or shut-down situations during the preceding 24-hour period[6]; and
- MP 10: When species identification is uncertain, a precautionary approach will be taken, and the additional management procedures for blue whales/pygmy blue whales will be followed until identification is otherwise confirmed.

The Extended Precaution Zones for 'other whales' are depicted in **Figure 1**.

ADAPTIVE MANAGEMENT PROCEDURES – OTHER WHALES

Unless otherwise stated[7], the following adaptive management procedures (**ADMP**s) will be followed throughout the entire OA[8] for the duration of the survey.

- ADMP 1: If three or more 'other whale' instigated shut-downs occur within a 24-hour period, the Seismic Vessel will relocate at least 10 km away before commencing Pre Start-up Visual Observations and Soft Start Procedures[9]; and
- ADMP 2: If an 'other whale' mother and calf pair is observed during the Seismic Survey, the acoustic source will be immediately shut-down and the Seismic Vessel will relocate to another area at least 10 km away before commencing Pre Start-up Visual Observations and Soft Start Procedures[10].

ADDITIONAL MANAGEMENT PROCEDURES – GENERAL

The following additional management procedures (**AMP**s) apply to all operations:

- AMP 1: Soft start procedures throughout the OA will be limited to conditions that allow visual inspection of the 5+ km Observation Zone[AC];
- AMP 2: Marine mammal observations made during the Seismic Survey will be undertaken by dedicated, trained and experienced MMOs/MFOs. MMOs/MFOs must have logged a minimum of 20 weeks' relevant sea-time engaged in marine seismic survey operations in Australian waters as an MMO or MFO and have proven 'at sea' experience in whale identification and behaviour, and distance estimation. The MMOs/MFOs used must be confident in the identification of those species that the EP predicts will be present in the OA and will hold a JNCC Marine Mammal Observation certification (or equivalent);
- AMP 3: A minimum of two MMOs/MFOs will be onboard the Seismic Vessel for the duration of the Seismic Survey and two additional MMOs/MFOs will be stationed on the Chase Vessel;

[6] Note that this measure is superseded only by Additional Management Procedure applicable to blue whales/pygmy blue whales.
[7] Note that management procedures for all whales are superseded by Additional Management Procedure applicable to blue whales/pygmy blue whales, as outlined.
[8] Including the blue whale migratory BIA and proposed 17 km buffer.
[9] Note that this adaptive management procedure is superseded only by Additional Management Procedure applicable to blue whales/pygmy blue whales.
[10] Note that this adaptive management procedure is superseded only by Additional Management Procedure applicable to blue whales/pygmy blue whales

- AMP 4: A passive acoustic monitoring (**PAM**) system will run 24 hours per day on the Seismic Vessel during the Seismic Survey, with dedicated, trained and experienced PAM Operators conducting acoustic monitoring for the presence of cetaceans[11] while the acoustic source is active and during the 30 minutes before the commencement of any Soft Start Procedure;
- AMP 5: Two dedicated, trained and experienced PAM Operators will be on the Seismic Vessel for the duration of the survey, with at least one PAM Operator maintaining 'acoustic watch' at all times while the acoustic source is active and during the 30 minutes before the commencement of any Soft Start Procedure;
- AMP 6: PAM Operators must have logged a minimum of 20 weeks' relevant sea-time engaged in seismic survey operations in Australian waters as a PAM Operator. PAM Operators will need to be able to demonstrate competency in the acoustic identification of the species that are likely to be present during the Seismic Survey, and in interpreting acoustic software and estimating distance to any detected whale calls;
- AMP 7: A full replacement PAM system will be kept onboard the Seismic Vessel and will be used as a back-up if the PAM system malfunctions and is unable to be repaired; and
- AMP 8: The PAM system will be programmed to receive/recognise vocalisations of whales within the frequencies 10 Hz to 200 Hz. The frequency range will theoretically be tuned to detect both low frequency vocalisations of baleen whales and the high frequency echolocations of sperm whales; and
- AMP 9: PAMGuard software will be incorporated into the PAM system to assist with locating and classifying the vocalisations of marine mammals, and the PAM Operators will be suitably trained in using the PAMGuard software.
    -

ADDITIONAL AND ADAPTIVE MANAGEMENT PROCEDURES – BLUE WHALES/PYGMY BLUE WHALES

The Animat modelling predicts the onset distances for 24 hour cumulative PTS and TTS for pygmy blue whales to be 1.4 km and 17 km respectively. The onset distance for behavioural effects for all cetaceans (including blue whales/pygmy blue whales) ranges from 9 to 14 km depending on the modelled location.

It is noteworthy that the modelling undertaken was highly conservative, where 1) the worst-case scenarios for noise propagation were modelled to produce maximum estimates of onset distances for physiological effects, and 2) the modelled source locations and seasons were those expected to exhibit noise propagation over the greatest distances. In addition, the EP takes a precautionary approach in relation to predictions about blue whale presence in and around the OA, in particular the following points (which are described more thoroughly in **Section 4.5.6.2**) were fundamental to developing appropriate additional controls for blue whale:

- The EP assumes that the blue whale migration period extends from mid-April to mid-January. This period encompasses the entire shoulder season of both the north and south migration seasons, e.g. tagging data suggests the peak of the southward migration has passed by the end of November, yet the EP assumes stragglers could be present until mid-January.

[11] Note, PAM is not considered to be a particularly reliable method for detecting low-frequency cetaceans. On this basis, management measures for baleen whales have been developed to remove the reliance on PAM while still maintaining a high level of protection.

- Data suggest that the migratory corridor in the vicinity of the OA is highly dispersed; hence blue whale density at this latitude is low. Thums *et al.* (2021) found good alignment between locational data from tagged whales and the boundaries of the migratory BIA; hence, outside the BIA, densities are predicted to be even lower.
- The EP notes that blue whales do engage in bouts of feeding while migrating, but evidence suggests that in the vicinity of the OA, travel associated with migration is the most prevalent behaviour. It is noteworthy that the most important migratory path at this latitude appears to be along the west coast of Timor (Thums *et al*., 2021) through the Savu Sea.

The 17 km onset distance for cumulative TTS has been used to define a buffer zone around the BIA. No acquisition will occur within the BIA or buffer during the blue whale/pygmy blue whale migration season. This spatio-temporal measure has been designed to eliminate any physical or behavioural effects on migrating blue whales/pygmy blue whales; hence, to comply with the requirement of the Blue Whale Conservation Management Plan that blue whales can continue to use biologically important areas without injury. On this basis, the protection afforded to blue whales/pygmy blue whales in the BIA is very strong.

In addition an Extended Shut-down Zone will be implemented, and several adaptive management measures are proposed in the event that higher than anticipated numbers of blue whales/pygmy blue whales are observed.

In light of the conservative approach taken by both the modelling and the EP, the proposed controls (as outlined below) clearly demonstrate consistency with the objective of the Blue Whale Conservation Management Plan (that "*anthropogenic threats are demonstrably minimised*") and the purpose of the Australian Whale Sanctuary (that cetaceans are not killed, injured, or interfered). On this basis, acoustic injury to blue whales/pygmy blue whales can be avoided throughout the OA; hence, anthropogenic threats (as they relate to physiological impacts from underwater noise) are minimised through robust and adaptive management measures. The following additional management procedures for blue whales/pygmy blue whales (**BMP**) will be implemented during the Seismic Survey:

- <u>BMP 1:</u> A 17 km buffer will be established around the blue whale migratory BIA where it overlaps with the OA;
- <u>BMP 2:</u> The Seismic Vessel will not activate the acoustic source(s) within the blue whale migratory BIA or buffer from mid-April (14^{th}) to mid-January (14^{th}) which represents the period during which migrating blue whales/pygmy blue whales have historically been known to be present in and around the OA;
- <u>BMP 3:</u> Throughout the OA when the source is active during daylight hours, a minimum of two experienced MMOs/MFOs will be on-duty to increase the detection rate of blue whales/pygmy blue whales. To achieve this, at least one MMO/MFO will be on-duty on the Seismic Vessel and at least one MMO/MFO will be on-duty on the Chase Vessel;
- <u>BMP 4:</u> An Extended 5+ km Shut-down Zone for blue whales/pygmy blue whales will be implemented throughout the entire OA, where shut-downs will be triggered by a blue whale/pygmy blue whale sighting at any distance, and to a minimum of 5 km from the acoustic source. On this basis a Low Power Zone is deemed unnecessary;
- <u>BMP 5</u>: A Start-up Delay will occur if a blue whale/pygmy blue whale enters or is detected in the 5+ km Extended Shut-down Zone during the soft start. Blue whale/pygmy blue whale presence at any distance will trigger an immediate and complete shut-down, and soft start procedures may only resume when 30 minutes have lapsed since the last blue whale/pygmy blue whale sighting

- BMP 6: If higher than anticipated numbers of blue whales/pygmy blue whales are observed (three or more blue whale/pygmy blue whale instigated shut-downs are made during the preceding 48 hour period) at any time or location during the survey, the following adaptive management controls will apply:
    a. the acoustic source will be shut-down and the Seismic Vessel will relocate to another area at least 17 km away from the last blue whale/pygmy blue whale sighting, and outside of the blue whale migratory BIA or buffer, before commencing Pre Start-up Visual Observations and Soft Start Procedures;
    b. An Extended 10+ km Observation Zone will be adopted such that MMOs/MFOs observe for blue whales/pygmy blue whales as far as practicable, and to a minimum of 10 km from the source.
    c. The Extended 10+ km Observation Zone will be monitored using the Chase Vessel as an additional observation platform with two MMOs/MFOs onboard. During the adoption of these adaptive management measures, the Chase Vessel will travel approximately 5 km ahead of the Seismic Vessel and will conduct visual surveillance for marine mammals during daylight hours;
    d. While the Extended 10+ km Observation Zone is being implemented, all measures applicable to Observation Zones and relevant to blue whales/pygmy blue whales will adopt this measure;
    e. Night-time and low visibility operations shall cease; and
    f. Normal operations may only resume after 48 hours of no blue whale/pygmy blue whale instigated shut-downs.
- BMP 7: If a blue whale/pygmy blue whale mother and calf pair is observed during the Seismic Survey, the acoustic source will be immediately shut-down and the Seismic Vessel will relocate to another area at least 17 km away (and outside of the blue whale migratory BIA or buffer) before commencing Pre Start-up Visual Observations and Soft Start Procedures.

The Precaution Zones for blue whales/pygmy blue whales are depicted in **Figure 2**.

Figure 1 Extended Precaution Zones: Other Whales

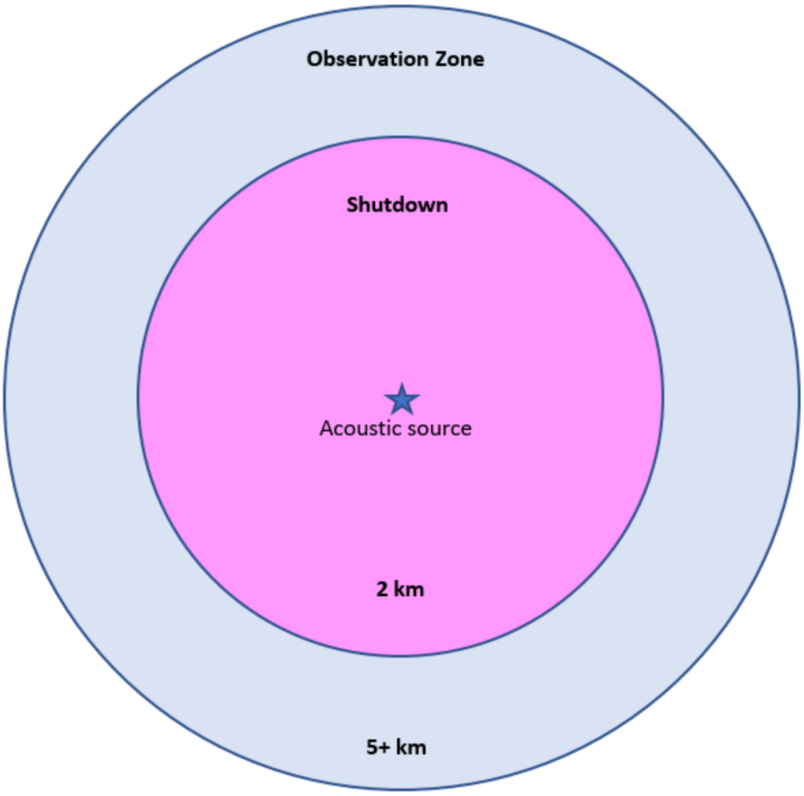
Observation Zone
Shutdown
Acoustic source
2 km
5+ km

Figure 2 Extended Precaution Zones: Blue Whales/Pygmy Blue Whales

APPENDIX L

Operational and Scientific Monitoring Plan

BONAPARTE BASIN MC3D MARINE SEISMIC SURVEY

Operational and Scientific Monitoring Plan (OSMP) - Logistics and Monitoring Plan

Prepared for:

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Schlumberger Australia Pty Ltd. (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
675.30093.00000-R02-v1.0	25 May 2022	SLR Consulting	Dan Govier	Dan Govier

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1 Introduction

1.1 Background and purpose

Schlumberger Australia Pty Limited (**SLB**) is proposing to acquire the Bonaparte Basin Multiclient 3D Marine Seismic Survey. Hereafter, these activities are referred to as the Seismic Survey. An Environment Plan (**EP**) has been prepared concurrently with this Operational and Scientific Monitoring Plan (**OSMP**).

The objective of the Seismic Survey is to provide an improved subsurface image of the eastern flank of the Vulcan Sub-basin and Londonderry High. The new data will provide an improved understanding of the subsurface, which to-date has been limited due to legacy surveys being unable to resolve shallow carbonate intervals and complex faulting. The Operational Area is located off the coasts of North-Western Australia, mostly within the Exclusive Economic Zone and outside Coastal Waters covering 25,827 km^2.

Section 10.9 of the EP contains an Oil Pollution Emergency Plan (**OPEP**) which includes a functional Operational and Scientific Monitoring Program (**OSMP**) in Section 10.9.6 of the EP. The OSMP section broadly outlines the details of Type I Operational Monitoring and Type II Scientific Monitoring studies which would be undertaken in the event of a Level 2 hydrocarbon spill. These plans are an integrated package of environmental management documents designed to manage environmental issues and protect the environment during the Seismic Survey.

This document provides further detail on how the OSMP will be implemented in the event of a Level 2 spill. Specifically, this OSMP Logistics and Monitoring Plan demonstrates how the Type I Operational and Type II Scientific monitoring tasks assigned to SLR would be implemented on behalf of SLB in the event that monitoring is initiated.

This document is consistent with the guidance from NOPSEMA in "Operational and Scientific Monitoring Programs – Information Paper – N-04700-IP1349".

1.2 Worst-case Spill Scenario

The worst-case spill scenario from the Seismic Survey is the catastrophic rupture of a seismic vessel fuel tank via vessel collision. Accidental release of hydrocarbon during bunkering is also recognised as a risk, but lower and with preventative operational procedures in place to reduce this risk. Thus, the worst-case is based on a vessel collision. As a result of vessel collision/sinking, the integrity of the hull of the vessel(s) may be compromised, leading to the release of marine gas oil (**MGO**) or other hydrocarbon products into the marine environment. The very worst-case scenario for a hydrocarbon spill would likely arise where the entire contents of the seismic vessel's fuel tanks were released into the surrounding ocean. Pending confirmation of vessel type to be used for the Seismic Survey, a hypothetical worst-case spill was simulated to determine the extent of the Environment that May be Affected (**EMBA**) for any spill event.

Calypso Science (2022) utilised the OpenOil simulation framework to model the weathering dispersal and trajectory of a spill. The OpenOil module is part of the OpenDrift[1] project – an open-source code base. The OpenOil module was modified to include dissolution processes, and is consistent with that adopted in other oil spill simulation software modules (e.g. OSCAR, SIMAP).

[1] Introduction to OpenDrift — OpenDrift documentation; GitHub - OpenDrift/opendrift: Open source framework for ocean trajectory modelling

Conservatively, MGO was used as the fuel type, which has a greater environmental persistence than marine diesel oil (**MDO**). The release of up to 1,000 m^3 MGO over a six-hour period was simulated and included three potential release locations within the proposed Operational Area. The model framework applied annual average conditions (as well as seasonal conditions) to simulate the spatial extent of a potential spill, accounting for the spreading, dispersion, entrainment and beaching of the spill.

The Operational Area is predominantly in an offshore marine environment which is within the Indonesian Throughflow, where the current primarily flows from NE to SW, north of the West Australian coastline.

The results for oil spill assessment are represented in **Figure 1**. Two thresholds are depicted for the EMBA, the low threshold (green line) and the moderate threshold (orange line). The lines represent the outline of the total scenarios assessed for the three potential release areas[2] that show the extent of the entrained surface oil (from the surface to 10 m deep) at a concentration at 10 ppb (low, threshold, green line), and the extent of entrained oil at a concentration up at 100 ppb (moderate threshold, orange line).

This representation of the EMBA for both the low and moderate thresholds are conservative and are regarded as worst-case scenarios. Given these are the cumulative results across all modelled scenarios for the entrained surface oil (0-10 m), in the event of an actual oil spill, it is expected that the extent of any potential impact will incur a much smaller ‘footprint’ than represented here.

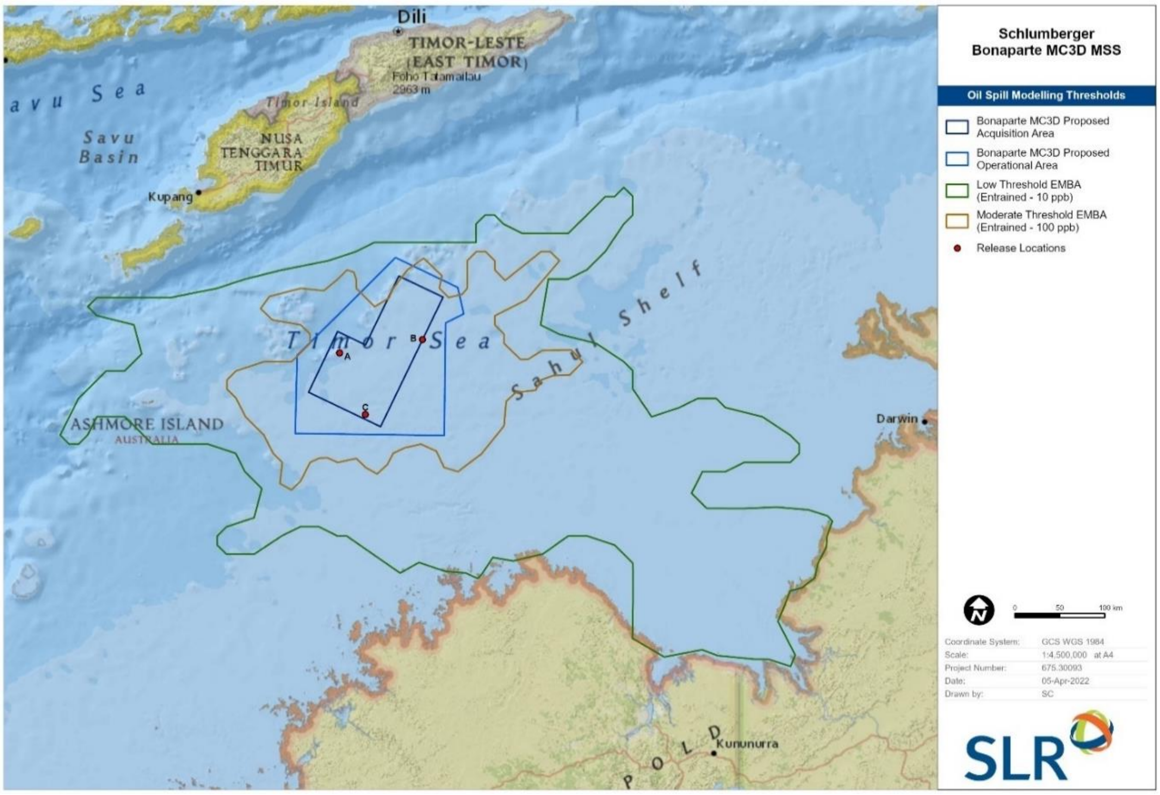


Figure 1 **Total extent of modelled Low Thresholds and Moderate Threshold EMBA for entrained surface oil under all modelled scenarios for accidental release of oil from three potential release sites (A, B. C)**

[2] EMBA extent is the total output of 300 scenarios, 100 each for summer, transition period and winter period

In addition to the extent of the EMBA thresholds, the potential beaching of oil is depicted in **Figure 2**. As with the EMBA thresholds, this represents a cumulative worst case scenario of the total of beached droplets, across all scenarios, for the three potential release locations (A,B,C). In the event of an actual oil spill, it is expected that the extent of any potential beach impact will incur a much smaller 'footprint' than represented in **Figure 2**.

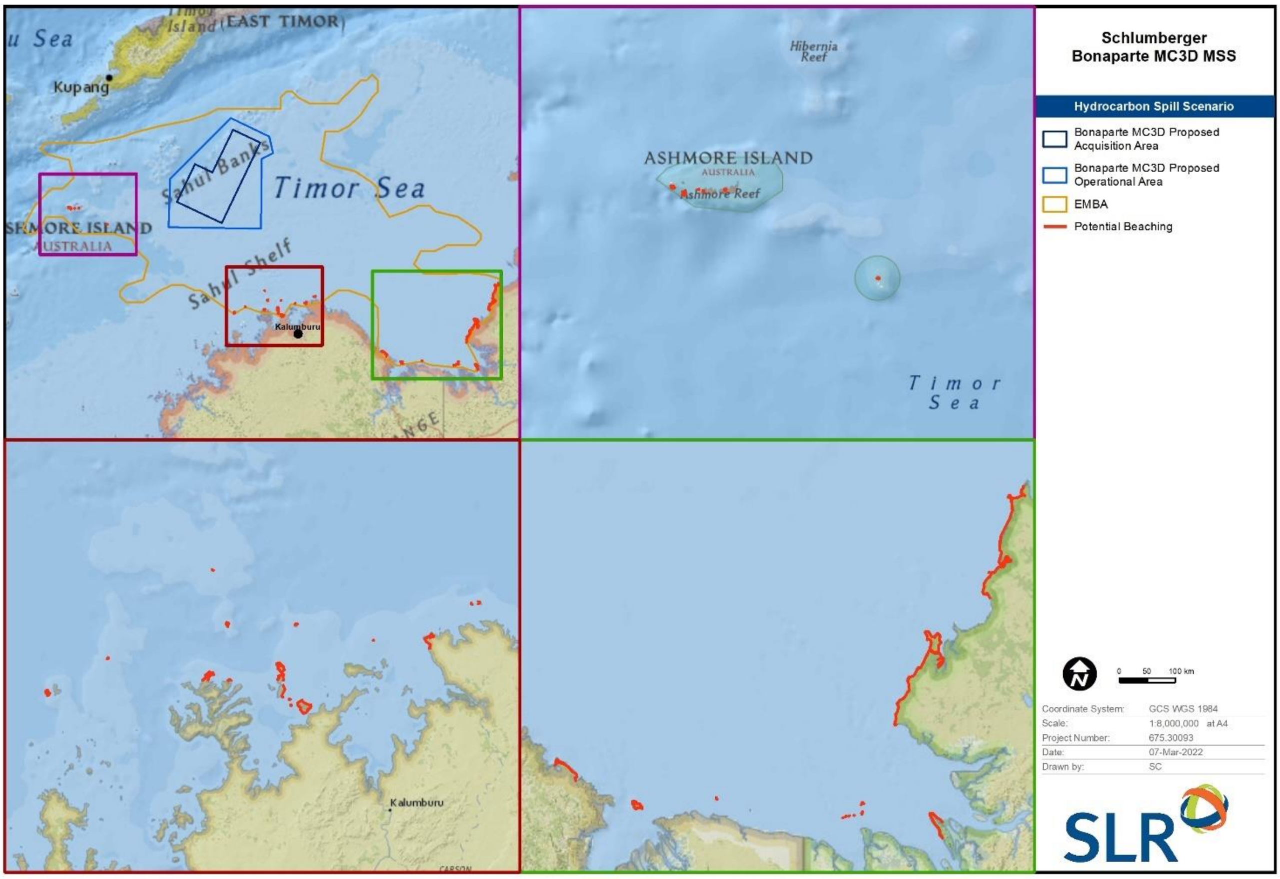


Figure 2 Total extent of potential beached oil under all modelled scenarios for accidental release of oil from three potential release sites (A, B. C).

Hydrodynamic modelling of the MGO (see Calypso, 2022) concluded the fate of spilled MGO in the Bonaparte Basin is highly dependent on the wind and wave climate. During the transitional months (March, September, October and November) winds and waves are relatively calm and the fuel persists on sea surface for a long period of time than other seasons.

Results of the modelling demonstrated there is less dispersion within the water column and more surface trajectory toward Joseph Bonaparte Gulf. During the winter months (April, May, June, July and August) the plume tends to spread toward the South-West (i.e., Ashmore reef and Cartier Island), whereas during the summer months (December, January, February) the plume trajectory is predominantly directed toward the North-East (Calypso, 2022)

Worst-case scenario modelling demonstrates in the event of a worst-case spill scenario (simulated for October transition conditions), the bulk of hydrocarbons would disperse and evaporate rapidly in the higher-energy offshore marine environment. This is demonstrated in the timeseries output representing the fate and mass budget averaged across scenarios (see Calypso, 2022). A worst-case beaching outcome is likely to result in an average of 1.7% of the spilled volume expected to be beached for a release from location B, and on average less than 1% if released from location A or C. A worst-case scenario, simulated for a seasonal transition period would, however, potentially result in up to 13% of the spilled volume beaching on the North Kimberly Coast.

1.3 OSMP Studies

Section 10.9 of the EP contains various monitoring programs, both Type I Operational and Type II Scientific, which may be implemented in the case of a Level 2 spill (consistent with the worst-case scenario) and these are further detailed below.

1.3.1 Type I – Operational Monitoring

As an integral part of the response to a spill ‘Type 1’, ‘response phase’ or ‘operational monitoring’, is used to collect information about the oil spill and associated response operations for the purposes of aiding decision-making during the response.

Type I ‘Operational Monitoring’ will be implemented where it is safe to do so and when there is a net benefit in doing so (as agreed with the Control Agency). This monitoring will be implemented to:

- Determine the extent and character of a spill;
- Visual tracking of the movement/ trajectory of surface slicks;
- Identify areas/ resources potentially affected by surface slicks; and
- Determine sea conditions/ other constraints.

Table 1 provides a description of operational monitoring plans (**OMP**) likely required in the event of a Level 2 spill (consistent with the worst-case scenario), the key receptors and the aims of the plan. These include:

- OMP1 (Oil Spill Modelling) - real-time spill trajectory modelling to provide assurances that response options can be tailored to the specific spill situation. The modelling will be based on continuous weather monitoring which will be utilised in conjunction with hindcast data to predict any potential beaching locations of the hydrocarbon, if any exist. This real-time spill trajectory modelling will be utilised to focus any potential scientific monitoring if it were to be required (and directed by the Control Agency) in order to monitor the impacts from a spill occurrence;
- OMP2 (Surveillance and Tracking) - field-based monitoring, including vessel and/or aerial surveillance, will be undertaken immediately following a spill event. This monitoring will enable the Vessel Master to provide up-to-date information to the relevant Control Agency via the POLREP form to appropriate plan any response options; and
- OMP3 (Monitoring of Hydrocarbons: Weathering and Behaviour in Marine Waters). This field-based monitoring will be led by an SLR MMO onboard the support vessel. A draft plan is included in **Appendix B**.

Operational monitoring and observation in the event of a spill will inform an adaptive spill response and scientific monitoring of relevant key sensitive receptors.

1.3.2 Type II – Scientific Monitoring

'Type II', 'recovery phase' or 'scientific monitoring', comprises a series of Scientific Monitoring Plans (**SMPs**) designed to be implemented at the termination of the response phase to quantify impacts from the spill.

Table 1 provides a description of the Type II Scientific Monitoring Plans, including the key receptors and the aims of the plans.

Table 1 Monitoring Plans for the Seismic Survey – key receptors, aims and responsibilities

Plan Reference	Title	Key Receptor(s)	Aim	Implementation
OMP1	Oil Spill Modelling	Multiple receptors at local- to regional-level scales	Provide information that can be used to define the spatial extent of the spill, for comparison with the pre-defined EMBA	**SLB**
OMP2	Surveillance and Tracking	Multiple receptors at local- to regional-level scales	Provide situational awareness to the Incident Management Team (**IMT**), to allow effective ongoing planning and management of spill response activities and identify any significant changes in risk Provide information to allow the assessment of the efficacy and potential impacts (positive and negative) of spill response strategies and tactics	**SLB**
OMP3	Monitoring of hydrocarbons in seawater - Weathering and Behaviour in Marine Waters	Offshore pelagic habitats (i.e., water column) exposed or at risk of exposure from spill hydrocarbons	Provide information that can be used to define the spatial extent of the spill, for comparison with the pre-defined EMBA, and inform SMP requirements	SLR
SMP1	Marine water quality	Background water quality	To monitor the hydrocarbons in marine waters to inform assessment of impacts and recovery of sensitive receptors, and to verify hindcast/real-time modelling to inform ongoing SMP requirements	SLR
SMP2	Intertidal and shoreline sediment quality	Background sediment quality, particularly focused on sensitive locations	Characterise the state, persistence and fate of spilled hydrocarbons within sediments	SLR
SMP3	Intertidal and shoreline habitats and benthos	Invertebrates, filter feeders, benthic primary producers, demersal fish, shorelines and intertidal habitats	Determine the impacts of spilled hydrocarbons on intertidal benthos and habitats	SLR
SMP4	Seabirds and shorebirds population and recovery	Foraging seabirds and coastal shorebird populations	Assess impacts on seabird and shorebird populations.	SLR
SMP5	Marine fauna (excluding avifauna)	Marine mammals, marine reptiles, bony fish, elasmobranchs	Assess impacts on non-avian marine fauna potentially impacted by a hydrocarbon spill.	SLR
SMP6	Socio economic impact monitoring (fisheries, aquaculture and tourism)	Target species or areas of importance for fishing/tourism	Assess impacts on fisheries (including aquaculture) and tourism activities	SLR

2 Preparedness

This section includes information relating to contractual arrangements, communication protocols, roles and responsibilities and resources to activate the OSMP, initial mobilisation and ongoing maintenance of the response.

2.1 Contractual Arrangements

2.1.1 SLR and SLB

In accordance with Section 10.9.6.2.1 of the EP, **SLB** have a service agreement with SLR. This agreement, a signed Cost-Time-Resource (**CTR**) will enable SLR to initiate the planning and commence preparation in anticipation that a field response may be required. Authorisation to commit funds, will be confirmed within 12 hours of the spill under the approved CTR.

Contractual arrangements with third parties will be in place with key third-party suppliers, service providers and organisations (e.g. CSIRO, AIMS) as part of a demonstration of preparedness prior to mobilisation.

Information on contractual status of resources will be included in the Resource Register (**Section 2.4.1**). Contractual arrangements for any additional suppliers/personnel identified during the OSMP response planning (e.g. for newly-available technologies or processes that would have a positive impact on HSE and/or data collection/quality) that were not identified during the preparedness phase will be facilitated by SLB to support a rapid response.

2.1.2 Logistics

Logistical requirements (including but not limited to arrangement of transport, accommodation, victualling, shipping, vessels, etc.) will be contracted directly by SLB via existing contracts, direct sourcing or Master Service Agreements.

2.2 Roles and Responsibilities

Section 10.2 of the EP provides a description of the roles and responsibilities of all personnel involved in the Seismic Survey. Those relevant to the OSMP implementation are described below.

2.2.1 OSMP Management

The roles responsible for the overall management of the OSMPs, and integration, data transfer and communications between SLB and the Service Provider (SLR) are defined in **Table 2**.

Table 2 OSMP Management Roles and Responsibilities

Tile	Role	Responsibilities
SLB Project Manager (SLB PM)	- The SLB PM is the direct line of communication and Management between and the OSMP Service Provider (SLR). - The role facilitates information transfer between SLB internal management and stakeholders and Service Provider, manages the day-today needs of the project (including addressing operational needs/requests), and makes sure that the OSMP meets the needs of SLB (including regulatory requirements) and external independent review/stakeholder groups	- Has overall responsibility for the implementation of the OSMP. - Ensures all required reporting (including to regulators and AMSA) has occurred in accordance with the relevant requirements. - Notifies SLR in the event of a Level 2 spill within 2 hours and provide the relevant information discussed in Section 10.9.5.3 in the EP. - Coordinates communication/liaison between SLR, AMSA, SLB and any other relevant parties. - Provides and/or facilitates support to the OSMP service provider (e.g. in the application of permits).
SLR Project Manager (SLR PM)	- Direct engagement with the SLB PM. - Responsible for the implementation and day-to-day management of the OSMPs, and information transfer between SLB and the OSMP response teams. - Management of communications between the OSMP Service Provider (SLR) and SLB	- First point of contact in the event that an OSMP response is required. - Response initiation. - Management of SLR personnel and subcontractors. - Day-to-day responsibility for facilitating/coordinating OSMP monitoring activities. - Direct engagement with the SLB PM. - Maintenance of SLR' preparedness - Overall responsibility for HSE of SLR personnel and subcontractors.
SLB Onboard Representative	- Direct engagement with the SLR Monitoring Coordinator.	- Day-to-day responsibility for the provision of the spill characteristics and operational monitoring required to implement the OSMP. - Day-to-day responsibility for facilitating/coordinating OSMP monitoring activities on behalf of SLB.
SLR Monitoring Coordinator	- Direct engagement with the SLR Monitoring Coordinator. - Oversight of the Field Operations Coordinator (see **Table 3**).	- Responsible for the development of detailed OSMP plans and their implementation. - Responsibility for overseeing an OSMP is initiated and performed.

2.2.2 Operational Management Personnel

The roles responsible for the day-to-day management of survey operations and operational activities (including data management, QA/QC and reporting) are outlined in **Table 3**.

Table 3 Operational personnel roles and responsibilities

Tile	Role	Responsibilities
SLR Field Operations Coordinator	- Supporting the mobilisation and the day-to-day field management of OSMPs. They are required to engage with the internal management team and SLB logistics (in line with the communications protocol) to resource, equip and maintain all survey operations	- Day-to-day management of field teams - Engagement with subcontractors and analytical laboratories - Sourcing personnel, equipment and consumables for OSMPs, including managing shifts and periodic shift rotations - Coordinating logistics with SLB (equipment, sample containers, travel and accommodation, supporting infrastructure, etc.) - Managing relevant survey permit applications and notifications - Coordinating sample pick-up and shipping to labs in line with sample holding times - Arranging sample labels (e.g. barcodes) with laboratory - First point of contact for field teams - Management of personnel qualification, medical and accreditation database - Communicating survey platform requirements (e.g. winches, a-frames, deck cranes, deck space, etc.) - Identification of additional survey requirements
HSE Coordinator	- Health, safety and environment (**HSE**) aspects of the OSMP scope	- Management of HSE plan, HAZIDs, and JHA preparation - Point of contact for Health, Safety and Environment issues - Provision of guidance in all HSE matters - Management of HSE reviews, incident investigation and reporting - Management of post-survey debriefs and lessons learned as part of an ongoing improvement process - Review of load testing information for equipment and additional components
Data Manager/ Quality Lead	- Managing the collection, transmittal, QA/QC and delivery of all OSMP and laboratory data. Responsible for ensuring all QA/QC procedures are in place and that processes have been adhered to	- Management of the preparation and implementation of Standard Operating Procedures (**SOPs**) in line with appropriate guidance and standards - Management of QA/QC reviews - Development and implementation of the data and metadata management plan - Provision of data management and QA/QC guidance throughout the OSMP response - Responsible for managing data quality (QA/QC), issues and lessons learned

Tile	Role	Responsibilities
Field Technical Leads	- Technical quality of survey operations, data and sample collection in the field - Responsible for all non-vessel-based survey management (e.g. HSE, field communications, field operational management decisions)	- Supporting mobilisation and demobilisation of equipment - Participating in HSE processes (e.g. HSE briefings, toolbox talks) - Coordinating day-to-day survey planning with the Vessel Party Chief and/or other Field technical leads (where appropriate) - Pre-survey vessel contamination risk assessment (to plan deck operations to minimise vessel-related sample contamination risks) - Field management of technical survey protocols, equipment, personnel and subcontractors - Deployment and retrieval of survey equipment - In situ collection of samples in line with approved SAP/PEP procedures - QA/QC of samples and sampling procedures - In situ identification of biota (where required) - Collection of relevant environmental meta data (e.g. time, sampling coordinates, depth, conditions etc.) - Management of sampling data records (e.g. field sheets, data records) and imagery - Sample processing and proper handling and storage - Sample transfer and Chain of Custody (**CoC**) forms - All field personnel have stop work authority – safety is everyone's responsibility
Field Survey Personnel (Field Teams)	- Collection of data and samples under the direction of the field technical lead	- Supporting mobilisation and demobilisation of equipment - Participating in HSE processes (e.g. HSE briefings, toolbox talks) - Deployment and retrieval of survey equipment - Labelling of sample containers - In situ collection of samples in line with approved SAP/PEP procedures - Sample processing and proper storage - Data entry - Sample transfer and CoC forms - All field personnel have stop work authority – safety is everyone's responsibility

2.3 Communication

All OSMP response communications will be managed by the SLB Project Manager (**PM**) in accordance with the OPEP (Section 10.9 of the EP).

2.4 Resources

Information regarding sub-contractors, equipment, personnel, analytical laboratories and survey platform requirements are compiled and maintained in an Excel spreadsheet format (subsequently referred to as the 'Resource Register'). Resource suppliers will be identified based on a series of criteria that include, but are not limited to:

- Appropriate accreditation (e.g. laboratories with National Association of Testing Authorities (NATA) accreditation of relevant analytical methods);
- Able to provide the relevant services to the required level of accuracy/reliability/environmental parameter/limit of detection;
- Able to calibrate equipment (where required);
- Able to provide robust, commonly used, scientifically accepted survey equipment;
- Multiple units of appropriate survey equipment available (preferably within Australia) with spares;
- Previous experience with the supplier/subcontractor;
- Reliability and reputation of supplier/subcontractor;
- Qualifications, accreditation and experience of subcontractor personnel;
- Able to source and mobilise equipment rapidly;
- Availability to respond to queries/issues with survey equipment should they arise;
- Location (e.g. based in Australia or international); and
- Minimum mobilisation times.

This approach allows continual evolution and development of the understanding of the OSMP support resources available. The intent is to incorporate redundancy through the identification of a greater range of resources than should be required to support an OSMP response to the scenario defined in the activity-specific EP.

Appendix B includes details regarding personnel and equipment requirements to implement the OSMP.

2.4.1 Resource Register

The Resource Register will be used to manage and demonstrate preparedness. It will be maintained as a 'live' document and will be the responsibility of the SLR PM (though this task may be delegated to the Field Operations Coordinator following activation of the OSMP response). The Resource Register can be continually updated and enhanced to include additional personnel, equipment and suppliers to allow incorporation of new technologies or techniques where appropriate to study objectives (additional information to support implementation will be provided in appendices to relevant OSMPs). This approach also allows consideration of the natural movement of personnel within the employment market.

The Resource Register also allows for testing of the availability of resources, providing records (e.g. date/time-stamped pdf files) that can be used to assess adequacy in preparedness over time. Where gaps or inadequacies are identified, the QA/QC process requires that additional resources relevant to non-compliances be identified and resourced.

2.4.2 Core OSMP Personnel and Equipment Requirements

The core personnel requirements for OMP3 and SMP1, SMP2 and SMP3 are included in Appendix and summarised in **Table 8**. The core requirements (= 'survey units') specified are the minimum required to implement a specific OMP or SMP response for a single shift on a single survey platform (e.g. vessel) or shoreline. These survey units have been defined to allow a flexible response to an evolving situation. To increase response, the number of survey units can be increased. This approach allows flexibility to implement multiple monitoring plans from the same survey vessel through undertaking different scopes on different shifts (24/7 operations).

2.4.3 Personnel Safety and Security Training Requirements

Field personnel will require the following valid and in-date safety and security training, accreditation and assessments as a minimum:

- Medical (e.g. United Kingdom Oil and Gas (UKOG) offshore medical, or equivalent);
- Maritime Security Identification Card (**MSIC**); and
- Basic Offshore Safety Induction and Emergency Training (**BOSIET**) or Tropical Basic Offshore Safety Induction and Emergency Training (**TBOSIET**). The BOSIET and TBOSIET include Helicopter Underwater Escape Training (**HUET**).

In addition, there will be a requirement for at least one person with current Senior First Aid certification (or equivalent) per field team as a minimum.

Before commencing field work for any project, all field personnel (including subcontractors) must undertake the SLR Project Induction, the SLR HSE Induction, as well as any additional client required inductions. The purpose of these is to brief all personnel on project scopes and the risks identified during a Hazard Identification (**HAZID**) workshop.

Any required port- or site-specific inductions will be arranged during mobilisation. Vessel inductions will include a survival suit/cold water survival component, to familiarise those with TBOSIETs with the use of survival suits and identify key cold-water survival recommendations. Vessel safety drills will incorporate survival suits to develop practical experience in their fitting and use.

2.5 Health, Safety and Environment

HSE performance will be managed through SLB's Management System. This system requires all contracted companies to have an HSE management system in place. The SLR Safety Management System is an integrated component of its total Integrated Management System and is AS/NZS 4801:2001 & BS OHSAS 18001 certified. It defines the SLR processes used to achieve consultation, management ownership, periodic management system reviews and ongoing continual improvement, and forms the framework around which health and safety is managed within the organisation.

2.5.1 SLR HSE Personnel

SLR has identified senior HSE personnel who are available to provide rapid response capability during an oil spill emergency:

Ben Simpson, Health & Safety Manager – APAC.

Mobile: +61 407 602 377, Email: mailto:srothman@slrconsulting.com bsimpson@slrconsulting.com

2.5.2 HSE Plan

An HSE Plan for OSMP activities will be developed prior to mobilisation. Operational monitoring will be undertaken during the response phase to support situational awareness and allow evaluation of spill response activities. There are inherent risks associated with working in a hydrocarbon spill area that need full consideration. Such risks include the potential exposure of operational personnel to hazardous hydrocarbon compounds (e.g. volatile organic compounds (**VOCs**) such as benzene, toluene, ethylbenzenes and xylenes (**BTEX**)), and management actions such as safe work limits will be defined based on recommendations in the SLB HSE plan.

2.5.3 JHAs and MSDSs

SLR will prepare a number of draft Job Hazard Analyses (**JHAs**) for the implementation of operational and scientific monitoring plans, prior to mobilisation of the MODU. These will be reviewed following SLR activation and updated as required for the specific response requirements and situation at the time. Additional JHAs will be developed and implemented as required. Some sampling may require the use of chemicals for cleaning and/or storage of samples, in which case Material Safety Data Sheets (**MSDSs**) for relevant chemicals (and copies of the draft JHAs) will be appended to the HSE Plan.

2.5.4 Personal Protective Equipment

All field staff will have appropriate Personal Protective Equipment (PPE) in suitable condition. As a minimum, these will include:

- Long-sleeved high visibility work shirts;
- Spare safety overalls;
- AS compliant hard hat with wide brim;
- Sun visors/shade hat;
- AS compliant boots with protective steel toecaps and/or gumboots with protective steel toecaps;
- AS compliant gloves (rigger gloves and access to rubber/nitrile gloves for sample processing);
- Glove clips;
- AS compliant eye protection – both clear safety glasses (AS/NZS1337) and polarised sunglasses;
- Wet weather gear (appropriate for the Timor Sea if offshore);
- Cold weather gear (appropriate for the Timor Sea, and able to be worn beneath wet weather gear where necessary);
- Beanie hats and warm gloves (suitable for wearing under hard hats and waterproof protective gloves);

- Sunscreen;
- Insect repellent (jungle formula);
- Earplugs; and
- Personal first aid kit.

Additional items of PPE will be issued where appropriate to the environment to be sampled (e.g. personal flotation devices (**PFDs**) on vessels to meet Australian Standards Offshore (ISO 12402-1), ear defenders and personal radios for intertidal or vessel-based surveys).

2.6 Permit Requirements

OSMP field survey operations may be undertaken in both Commonwealth and state waters (the latter extend from the mean low water mark to the three-nautical mile limit) and a hydrocarbon release could conceivably reach the mainland and Ashmore Island waters (which are determined based on modelling outcomes and to be verified through surveillance during the event of a spill). The permits generally required by the Commonwealth, Western Australia, and Northern Territory governments are listed in **Table 4**.

In general, permit applications require details on the samples to be collected (including timing, species, numbers, methods to be used, etc.) and specific details of the survey platforms (e.g. vessel names and registration details) and personnel. Permits can take 4–6 weeks (or longer) to be approved, though in the event of an oil spill, the Responsible Agencies can expedite the process and/or possibly offer exemptions (depending on the legal ramifications to the relevant agency).

Notification SHALL be given to relevant government agencies in the region to be sampled, prior to mobilisation. Post-survey reports must also be filed in accordance with the requirements of the specific permit(s) in place.

Confirmation of any reporting requirements shall be sought should an exemption be granted.

Table 4 Commonwealth and State/Territory permit requirements for the collection of survey samples

<table>
<tr><th>Permit</th><th>Relevance</th><th>Legislation</th><th>Responsible Agency</th></tr>
<tr><td colspan="4">Commonwealth</td></tr>
<tr><td>General Permit Application for:
- threatened species and ecological communities
- migratory species
- whales and dolphins
- listed marine species.</td><td>- Required for scientific sampling of matters listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999)</td><td rowspan="2">- EPBC Act 1999</td><td rowspan="2">- Department of the Environment and Energy (DEE)</td></tr>
<tr><td>Access to Biological Resources in a Commonwealth Area for Non-Commercial Purposes</td><td>An applicant must obtain written permission from each Access Provider. The Access Provider must state permission for the applicant to:
- enter the Commonwealth area
- take samples from the biological resources of the area
- remove samples from the area.</td></tr>
</table>

Permit	Relevance	Legislation	Responsible Agency
Western Australia			
Authority to Take Fish for Scientific Purposes: Permit to take fish for the purpose of scientific research. Taking fish includes catching, capturing, trapping, enclosing, gathering, removing, poisoning, stunning, killing or destroying fish by any means	Required to ensure that research does not impact on populations, environmental integrity of habitats or conservation values of protected areas. Exemption/Separate approvals required for: - taking fish from a state reserve or marine park - taking fish for genetic or chemical extraction or analysis, as well as handling, delivering, receiving, storing, packaging, purchasing or selling of fish for that purpose.	- Fish Resources Management Act 1994 Western Australia - Fish Resources Management Regulations 1995 Western Australia	Department of Primary Industries and Regional Development Fisheries
Scientific Purposes Licence (Marine) required for the take flora or fauna (including fish and pearl oysters) from a marine nature reserve, marine park or marine management area for scientific purposes. Taking includes injuring, destroying, hunting or otherwise interfering with flora and fauna	Required for research in any aquatic parks under Western Australian legislation (in State waters or in relation to any waters on the landward side of waters adjacent to the State that are within the Australian fishing zone	- Conservation and Land Management Act 1984 - Conservation and Land Management Regulations 2002	Department of Biodiversity, Conservation and Attractions (WA)
Requirement to be licensed for the purpose of using animals for scientific purposes, and adhere to Scientific Use Code. The scientific use of animals other than those defined by the Animal Welfare Act 2002 (such as fish, cephalopods and insects) are not subject to the Act.	Taking tissue samples for hydrocarbon analysis from live vertebrates (excludes fish, noted here that the Fish Resources Management Act 1994 does not include regulation for welfare of fish)	- Animal Welfare Act 2002 - Animal Welfare (Scientific Purposes) Regulations 2003	Department of Primary Industries and Regional Development
Heritage Permits Activities within a Protected area or Aboriginal site	Most people passing through or visiting communities on Aboriginal Lands Trust reserves proclaimed under Part III of the Aboriginal Affairs Planning Authority Act 1972 must obtain an Aboriginal Affairs Planning Authority (AAPA) Lands Permit (ALPS) to comply with the Act. Consent is required under Regulation 10(b) of the Aboriginal Heritage Act (1972) to: *dig any hole or otherwise disturb the surface of the ground, or remove or disturb any stone, soil, sand, rock or gravel, or any other natural object;*	- Heritage Act 2018 - Aboriginal Heritage Act 1972 (Effective during Transitional period to Aboriginal Cultural Heritage Act 2021) - Aboriginal Cultural Heritage Act 2021	Department of Planning, Lands and Heritage

Permit	Relevance	Legislation	Responsible Agency
Northern Territory			
A Scientific Permit Application is required to: - take or interfere with wildlife, with the purpose to - watch, collect, survey, measure, assess or monitor wildlife in the wild for scientific research	Required for the take, interference with, or for undertaking scientific research in the NT. Permits required for flora and fauna under the Biological Resources Act 2006 NT Note – an application for a benefit sharing agreement must accompany the Science Permit application.	- Biological Resources Act 2006 Northern Territory - Biological Resources Regulations 2007 Northern Territory	Department of Industry, Tourism and Trade Northern Territory Fisheries (for land access) Parks and Wildlife Commission of the NT (for marine access)
Animal Welfare Authority (NT) licence is required for the use of animals in any kind of research	Required for the use of animals in any form of research. Likely to be required for the taking tissue samples for hydrocarbon analysis from live vertebrates	Animal Protection Act 2018 Animal Welfare Regulations 2020	Department of Industry, Tourism and Trade
Entry to Aboriginal Land requiring a written permit	Access to Aboriginal Land for work purposes, including research activities on Aboriginal Land, requires a permit to be administer by the Northern Land Council	NLC seeks approval from the relevant Traditional Aboriginal owners as required.	Northern Land Council

2.7 Quality Control

Standard Operating Procedures (**SOPs**) for QA/QC, such as ISO 9000, will be applied by SLR and SLB to all relevant components including:

- Training;
- Protocols for the management of positional data;
- Pre-mobilisation, in situ and demobilisation equipment checks;
- Protocols for the download of data and preliminary field QA/QC of data quality;
- Protocols for the calibration/adjustment (e.g. conversion) of raw data in line with accepted scientific methods; and
- Data management protocols and security and data audits.

3 Initiation and termination of the OSMP

Initiation and termination criteria for the OSMP as per the approved EP are defined below.

3.1 Initiation Criteria

Initiation criteria for the Type 1 Operational and Type II Scientific monitoring tasks are shown in Table 5. In the case of a Level 2 spill, AMSA would likely request trajectory modelling indicates that sensitive receptors may be impacted in consultation with AMSA, a Net Environmental Benefits Assessment will be performed to help identify the most appropriate studies to initiate.

Once the extent of the spill and required response effort is understood, SLR and the SLB Project Manager will agree any additional costs, time and resources required to implement the appropriate elements of the OSMP. As soon as possible after notification (but within 12 hours), a teleconference will be held between the SLR and SLB project managers, the responsible program and response managers, the vessel operator and vessel master (or representative if unavailable) to determine requirements for scientific monitoring. The Monitoring Coordinator(s) will then begin coordinating the development of the detailed monitoring plans.

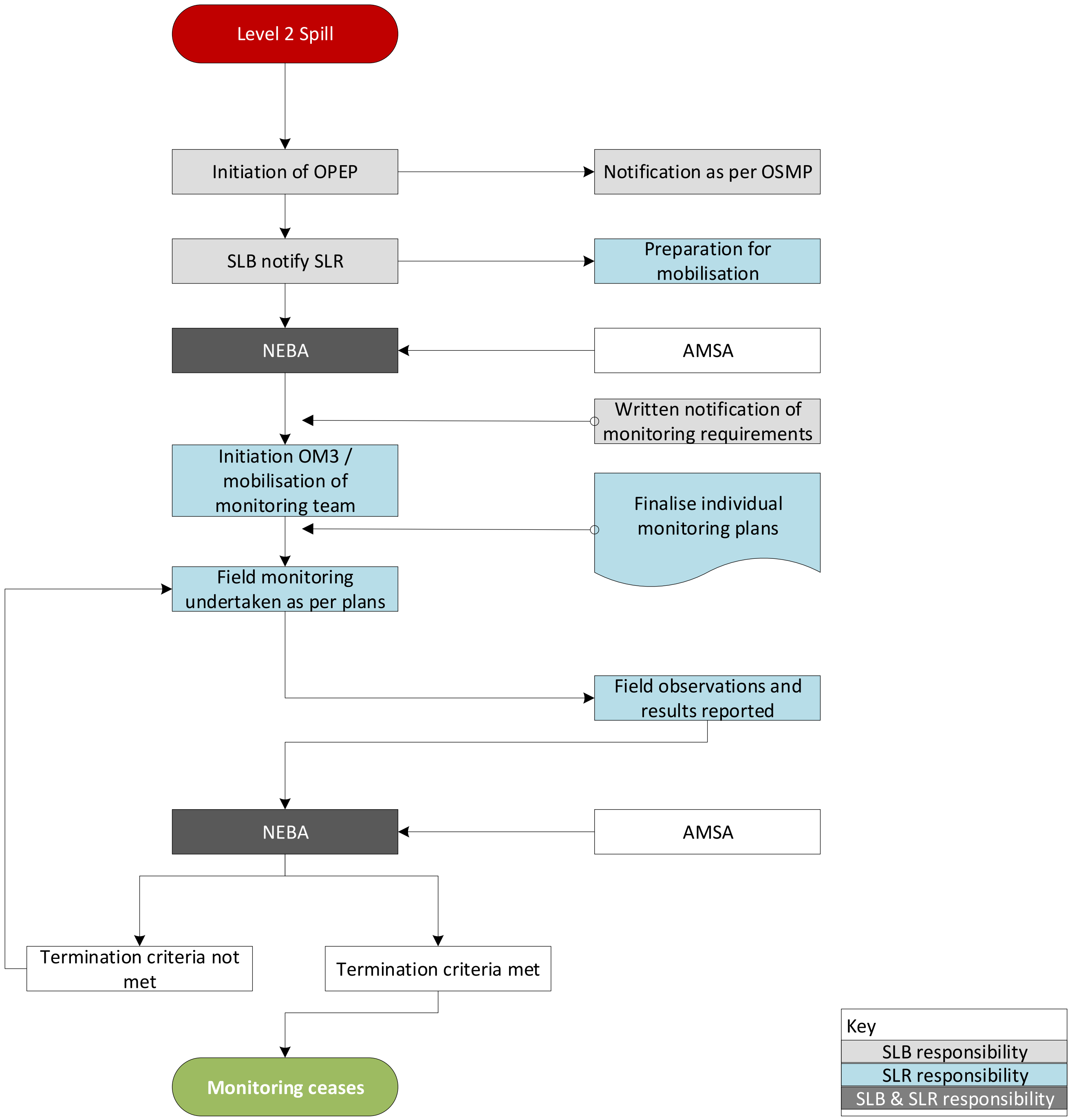
An overview of the response process, through the mobilisation of personnel and equipment is provided in **Figure 2**. Termination criteria and provided in **Section 4** (**Table 6**).

Table 5 Initiation Criteria - Operational and Scientific Monitoring Plan

Plan	Criteria
OM1 - Oil Spill Modelling	Notification of a Level 2 or greater hydrocarbon spill
OM2 – Surveillance and Tracking	Notification of a Level 2 or greater hydrocarbon spill
OM3 - Monitoring of hydrocarbons in seawater	Notification of a Level 2 or greater hydrocarbon spill
SMP1 - Marine water quality	Notification of a Level 2 or greater hydrocarbon spill
SMP2 - Intertidal and shoreline sediment quality	Notification of a Level 2 or greater hydrocarbon spill and Where modelling and/or Operational Monitoring indicates likely exposure to intertidal and/or shoreline sediments or Reports are received of shoreline and/or shoreline contact from hydrocarbon spill
SMP3 - Intertidal and shoreline habitats and benthos	Notification of a Level 2 or greater hydrocarbon spill and Where modelling and/or Operational Monitoring indicates likely exposure to intertidal and/or shoreline habitats or benthos, or Reports are received of shoreline and/or shoreline contact from hydrocarbon spill
SMP4 - Seabirds and shorebirds population and recovery	Notification of a Level 2 or greater hydrocarbon spill and Where modelling and/or Operational Monitoring indicates likely exposure to seabird and/or shorebird populations and/or Reports are received of contact with avifauna from hydrocarbon spill And/or Reports of oiled or dead avifauna are received
SMP5 - Marine fauna (excluding avifauna)	Notification of a Level 2 or greater hydrocarbon spill and Where modelling and/or Operational Monitoring indicates likely exposure to non-avian marine fauna and/or Reports are received of contact with non-avian marine fauna from hydrocarbon spill and/or Reports of oiled or dead non-avian marine fauna are received
SMP6 - Socio economic impact monitoring (fisheries, aquaculture and tourism)	Notification of a Level 2 or greater hydrocarbon spill and Where modelling and/or Operational Monitoring indicates likely exposure to aquaculture operations and/or Reports are received of commercial fisheries closures due to hydrocarbon contamination and/or Reports are received of tourism operation closures due to hydrocarbon contamination.

The initiation criteria (**Table 5**) for each monitoring plan is broadly applied to enact the response described within the EP. However, it is important to note that the final decision to commence each monitoring plan will be based on the net environmental benefit in which the environmental sensitivities should be avoided if the monitoring proposed may reasonably result in further impacts and offer no net benefit.

Figure 3 OSMP Implementation Process



3.2 Termination Criteria

Each monitoring plan that is initiated will continue until certain termination criteria have been met (Table 3), in consultation with the relevant Control Agency (**AMSA**).

Table 6 Termination criteria

Plan	Criteria
OM1 - Surveillance and Tracking	It can be demonstrated that no further environmental improvement outcomes can be achieved through continued implementation of OM1 and/or Notification of termination of spill response phase.
OM2 - Surveillance and Tracking	It can be demonstrated that no further environmental improvement outcomes can be achieved through continued implementation of OM2 and/or Notification of termination of spill response phase.
OM3 - Monitoring of hydrocarbons in seawater	It can be demonstrated that no further environmental improvement outcomes can be achieved through continued implementation of OM3 and/or Notification of termination of spill response phase.
SMP1 - Marine water quality	Hydrocarbon spill has ceased, there are no visible sheens present and no further sheens are predicted by the modelling. Monitoring data of in-water concentrations of hydrocarbons have been compiled and analysed. Reporting on sampling has been completed detailing extent and severity of spilled hydrocarbons which can enable further analysis of impacts on other receptors in any further scientific monitoring plans.
SMP2 - Intertidal and shoreline sediment quality	Hydrocarbon spill has ceased, there are no visible sheens present and no further sheens are predicted by the modelling. Any monitoring done shows concentrations of hydrocarbons present within sediments fall below relevant guidelines (e.g. ANZECC). Reporting on the sampling has been completed detailing the extent and severity of spilled hydrocarbons which can enable further analysis of impacts on benthic communities.
SMP3 - Intertidal and shoreline habitats and benthos	Hydrocarbon spill has ceased, there are no visible sheens present and no further sheens are predicted by the modelling. Impacts from hydrocarbon spill on benthos quantified and recovery evaluated. Reporting on the monitoring has been completed detailing the extent and severity of spilled hydrocarbon impacts on benthos.
SMP4 - Seabirds and shorebirds population and recovery	Hydrocarbon spill has ceased, are no visible sheens present and no further sheens are predicted by the modelling. Objectives and values associated with any relevant species recovery plans and/or conservation advices have been met. Impacts from hydrocarbon spill on avifauna quantified and recovery evaluated. Reporting on the monitoring has been completed detailing the extent and severity of spilled hydrocarbon impacts on avifauna.
SMP5 - Marine fauna (excluding avifauna)	Hydrocarbon spill has ceased, there are no visible sheens present and no further sheens are predicted by the modelling. Objectives and values associated with any relevant species recovery plans and/or conservation advices have been met. Impacts from hydrocarbon spill on marine fauna (excluding avifauna) quantified and recovery evaluated. Reporting on the monitoring has been completed detailing the extent and severity of spilled hydrocarbon impacts on marine fauna (excluding avifauna)
SMP6 - Socio economic impact monitoring (fisheries, aquaculture and tourism)	Hydrocarbon spill has ceased, there are no visible sheens present and no further sheens are predicted by the modelling. Impacts to important commercial fisheries quantified and recovery evaluated. Impacts to seafood quality and secondary impacts on human health evaluated. Impacts on tourism ventures quantified and evaluated. Reporting on the monitoring has been completed detailing the extent and severity of spilled hydrocarbon impacts on commercial fisheries, aquaculture and tourism operations.

4 Development of Detailed Monitoring Plans

Following the initial notification of a spill, a NEBA will be undertaken in consultation with the Control Agency to identify applicable operational and scientific monitoring requirements. Where a net environmental benefit is identified and the Control Agency recommends field monitoring, SLR will develop detailed OSMP plans in accordance with the EP.

Draft detailed monitoring plans will be provided to SLB as soon as practicable, but within 24 hours after receiving the initial notification that monitoring is required.

Detailed monitoring plans will be developed in consultation with the Control Agency and **SLB**. Each plan will include as a minimum:

- Objectives and rationale of the monitoring plan: Each plan developed will outline the key objectives, rationale and focus of the plan.
- Baseline information: It is important for each monitoring plan to specify the details of the baseline to be applied, or a method for selection of suitable reference/control sites. If possible, previous monitoring from published studies and findings is to be utilised.
- Spatial awareness: It is important for any scientific monitoring plan to provide information and outcomes obtained from the operational monitoring (such as real-time spill trajectory modelling) to support the proposed design.
- Methodology: The proposed survey methodology should consider the statistical methods and sampling effort required to achieve the objectives of the scientific monitoring plan. If sampling is proposed as part of the monitoring plan, industry recognised methods for collection and analysis of the samples must be used. This includes utilising accredited laboratories and following best practice guidelines and applicable legislation where applicable. The methodology should include, as a minimum:
  - Details of any permits or approvals required to undertake the work, including whether there are any exemptions;
  - Collection and analysis requirements (i.e. permits);
  - Personnel proposed to undertake the monitoring, including appropriate qualifications and skills;
  - Equipment required to complete the proposed monitoring;
  - HSSE requirements to complete the survey; and
  - QA/QC requirements if appropriate.
- Initiation criteria: The criteria used to initiate the proposed scientific monitoring plan.
- Termination criteria: Each monitoring plan will include a termination date at which time the monitoring can stop which is consistent with the objectives of the monitoring plan. These criteria must be adaptive and be able to change based on the actual circumstances of the impacts and/or risks of assessment.

- Management of change: The monitoring plans must be adaptive to ensure the impacts and risks are managed appropriately. As such, if a monitoring plan is required to change to adapt to these circumstances, then a process for change needs to be detailed so that any revision is provided to SLB and the relevant Control Agency for acceptance as soon as practicable. Any revisions undertaken must be tracked to clearly communicate the current status of the monitoring requirements.
- Reporting: Each monitoring plan is required to detail the reporting of results during and post monitoring. This reporting will include ongoing situation reports during the implementation of monitoring; the timing of these situation reports will be based on the nature and scale of the impacts/risks. Post monitoring, a draft report and third-party peer reviewed report will be provided to SLB, the Control Agency and NOPSEMA which will include any recommendations resulting from the monitoring plan.

5 Activation and Initial Mobilisation

5.1 Immediate Response

1. Following notification of a Level 2 spill by the SLB Project Manager, the SLR Program Manager will confirm availability of scientific personnel and instruct each team member to stand-by.
2. Incident control will be established at the Qube Supply Base, Portland Victoria.
3. Equipment (see **Appendix B**) will be prepared for shipping and laboratories and freight contractors placed 'on-call'. Flights and accommodation will be booked. Vessel operators will be contacted and advised to prepare for mobilisation. The analytical laboratory will prepare and dispatch all sample containers. Security arrangements for sample handling and transport will be confirmed with both laboratory personnel and the courier company.
4. Inductions under the SLR HSE Management System will be conducted prior to any site / field work. Any additional HSE inductions required by SLB will also be completed at this time.

5.2 Mobilisation

5.2.1 Freight

SLB will be responsible for logistical management of freight during the response phase.

Shipping of equipment will be managed by SLR during the scientific monitoring phase, or where otherwise requested by SLB (e.g. to support freight management during periods of exceptionally high demand for logistical support). SLR has an existing national contract with TOLL Group. All freight will be handled by TOLL Express or TOLL Priority and delivered to the point of embarkation. SLR believes that the freight can be ready to ship within 24 hours of being notified. It is estimated that shipping to the offshore departure point would require an additional 24 to 36 hours.

Refrigerated transport will be required for all samples between Portland and the analytical laboratory. Sample transfer is described separately in **Section 5.4**.

5.2.2 Personnel

Personnel mobilised for scientific studies may require accommodation. This will be managed by SLB. Where SLB direct SLR to arrange accommodation (e.g. to support scientific monitoring), the SLR administration team will source and book accommodation as per instructions from SLR Program Manager.

It is anticipated that all personnel will arrive at Portland Victoria, within 24 hours.

5.3 Daily Field Reporting

All field teams will prepare daily reports for transmittal to the SLR Field Operations Coordinator. The Daily Progress Reports (DPRs) will contain the following information:

- Project and scope (OSMP) reference;
- Date;
- Name or person completing report;

- Permit number (if relevant);
- Vessel name/registration number;
- Name and contact details of vessel master (where relevant);
- Location (e.g. nearest geographic location, or closest survey site reference if at sea);
- Work day/shift start time(s) and end time(s);
- Daily HSE statistics and lessons learned;
- Daily weather observations (e.g. wind and sea state);
- Daily events reported with event times;
- Plans for subsequent day(s);
- List of vessel's complement; including names and details (company, role, date mobilised, date demobilised, total days on board) of all vessel crew and survey personnel; and
- Records of loss of equipment and/or down-time related to survey equipment and vessel deployment gear shall be kept allowing office-based support staff to identify if particular equipment is likely to need replacement during the next rotation.

5.4 Sample Transfer and management

Samples collected for laboratory analysis as part of OSMP field operations will be stored and transferred as per the specific instructions provided by the analytical laboratory for each analytical method. Samples will be collated based on holding times, storage requirements and sample type, to maximise sample management and facilitate transfer of samples within holding times.

All samples submitted for analysis will be accompanied by a CoC form, which details the laboratory the samples will be sent to, the analytical methods and the limits of detection required. The CoC form will accompany samples during transport and delivery. The form will be signed with the time and date recorded by each individual responsible for the samples including SLR staff and laboratory personnel. Upon each exchange, the CoC form is countersigned and duplicated by the relinquisher. The recipient retains the original. When samples are received by the laboratory, a duplicate of the original will be issued to SLR confirming arrival. The CoC allows SLR to track the samples and ensure that samples arrive at the intended destinations on schedule.

Where holding times are shorter than the survey rotation period (e.g. seven days for water samples, with up to three weeks between survey personnel rotations), then alternative arrangements will be made to collect samples for transfer to the laboratory). Samples will either be freighted from site/ports to laboratories or accompany survey personnel on return flights for hand-delivery to laboratories. Refrigerated transport will be required for the majority of samples. In the event the refrigerated truck is not available on the day, previous survey experience in Australia has demonstrated that ice-packed eskies will suffice to store and transport samples to the laboratory.

5.5 Data Transfer and Management

During implementation, the Data Manager/Quality Lead will be responsible for finalising the following SOPs:

- Pre-mobilisation, in situ and demobilisation equipment checks;
- Protocols for the download of data and preliminary field QA/QC checks of data quality;
- Protocols for the calibration/adjustment (e.g. conversion) of raw data in line with accepted scientific methods; and
- Data management protocols and security and data audits.

These SOPs will require internal approval (facilitated by the OSMP Program Manager).

Following field-based QA/QC check protocols, data collected in the field will be collated on a survey laptop and backed up on two secure (password-protected) external hard drives. Data will be partitioned on the drive-in folders, as defined in the OSMP metadata requirements. Files will also be re-named in the field in line with metadata requirements, where time allows. Where this is not feasible, a comment to this effect will be included in daily progress reports and this task will then be allocated to office-based support personnel upon receipt of the raw field data.

Where critical to support situational awareness (following pre-approval by the SLB OSMP PM), some data may be transferred via email or cloud storage drive. Most data will be transferred from the field via password-protected external hard drives, which will then be returned with survey personnel during their shift rotation (after a period of up to a maximum of three weeks in the field).

Laboratory data will be received by SLR approximately two weeks following receipt of the samples by the analytical laboratory. SLR will undertake a QA/QC review of laboratory reports and collate relevant data into files for subsequent analysis. Field and laboratory data will be imported into an appropriate database. Relevant data and metadata will be transferred to SLR and/or SLB GIS teams to support situational awareness and for reporting purposes. Data (comprising QA/QC'd field data, laboratory reports, collated data or a high-level summary) will be transferred to SLB in line with the relevant SOP. This may be achieved via the transmission of data files (in an electronic data deliverable format) or through provision of access to an online data portal.

6 Reporting and Closeout

Upon termination and demobilisation of the final active OSMP, the operational and scientific monitoring program finalisation and close-out phase will commence. This phase incorporates:

- Data collation and delivery;
- Analysis and interpretation;
- Final reporting; and
- Archiving.

6.1 Data Collation and Delivery

QA/QC'd data will be compiled in OSMP databases throughout the OSMP response. Data collation includes digital (scanned) copies of all field survey reports, field survey logbooks, CoCs and other records completed by hand.

The Data Manager/Quality Lead will ensure the compiled datasets have been checked against data records to confirm that all data (and metadata) for each scope are accounted for and will confirm details of the QA/QC assessments undertaken on the data. Any remaining data gaps will be identified and addressed, with records generated detailing the outcomes.

Once all digital data (or sets of data) have been compiled and final checks have been completed, databases will either be transferred to SLB via appropriate password-protected storage media, or (where applicable and in line with Corporate data management requirements) transferred via online resources (e.g. secure websites/data portals, cloud services and/or Corporate internet-based file transfer systems).

6.2 Analysis and Interpretation

Final datasets for individual scopes (SMPs) will be analysed to provide interpretation of:

- Impacts of the spill on the values or sensitivities for each plan;
- Potential impacts of spill response activities;
- Recovery over time; and
- Consideration of the potential effects of other natural and anthropogenic impacts.

Statistical analyses of quantitative data will be undertaken using appropriate, commonly-used and scientifically-robust univariate and multivariate statistical analysis techniques. Depending on the size of datasets for each scope, data analyses may be undertaken solely by SLR or in conjunction with a third-party service provider.

6.3 Final Reporting

Reporting will comprise:

- OSMP program status reports;
- Field daily progress reports;
- Health, safety and environment (HSE) reports;
- Technical reports;
- A summary report, collating the outcomes of each OSMP report; and
- A ‘lessons learned’ report, detailing OSMP challenges, solutions and future recommendations.

6.4 Archiving and Close-out

All digital and paper records, data and reports will be archived in accordance with SLR internal archiving procedures and standards. Completion of the archiving process will be the final requirement of the operational and scientific monitoring program close-out phase. SLB will then be informed that the OSMP response has been completed.

7 References

Calypso Science, 2022. '*Oil spill trajectory modelling arising from a vessel collision in the Bonaparte Basin*'. Report prepared for Schlumberger Australia Pty Ltd.

Oil spill monitoring handbook / editors: Sharon Hook, Graeme Batley, Michael Holloway, Paul Irving and Andrew Ross. CSIRO 2016

APPENDIX A

SLB HSE Policy

Quality, Health, Safety, and Environmental (QHSE) Policy

Schlumberger

The long-term business success of Schlumberger depends on our ability to continually improve the quality of our services and products while protecting people and the environment. Emphasis must be placed on ensuring human health, operational safety, environmental protection, quality enhancement and community goodwill. This commitment is in the best interests of our customers, our employees and contractors, our stockholders and the communities in which we live and work.

Schlumberger requires the active commitment to and accountability for, QHSE from all employees and contractors. Line management has a leadership role in the communication and implementation of, and ensuring compliance with, QHSE policies and standards. We are committed to:

- Protect, and strive for improvement of, the health, safety and security of our people at all times;
- Eliminate Quality non-conformances and HSE accidents;
- Meet specified customer requirements and ensure continuous customer satisfaction;
- Set Quality & HSE performance objectives, measure results, assess and continually improve processes, services and product quality, through the use of an effective management system;
- Plan for, respond to and recover from any emergency, crisis and business disruption;
- Minimize our impact on the environment through pollution prevention, reduction of natural resource consumption and emissions, and the reduction and recycling of waste;
- Apply our technical skills to all HSE aspects in the design and engineering of our services and products;
- Communicate openly with stakeholders and ensure an understanding of our QHSE policies, standards, programs and performance. Reward outstanding QHSE performance;
- Improve our performance on issues relevant to our stakeholders that are of global concern and on which we can have an impact, and share with them our knowledge of successful QHSE programs and initiatives.

This Policy shall be regularly reviewed to ensure ongoing suitability. The commitments listed are in addition to our basic obligation to comply with Schlumberger standards, as well as all applicable laws and regulations where we operate. This is critical to our business success because it allows us to systematically minimize all losses and adds value for all our stakeholders.

Olivier Le Peuch
Chief Executive Officer, Schlumberger Limited

For further information regarding this policy:
CONTACT: Mohamed Kermoud, Vice President HSE
LOCATION: Schlumberger Limited, Houston
EMAIL: Mohamed Kermoud

SLB-QHSE-L001
Released on 5 June 1997
Last update on 9 August 2019

APPENDIX B

Personnel and Equipment Requirements

OMP3: Monitoring of hydrocarbons: weathering and behaviour in marine waters

Table 7 Field survey unit personnel requirements for OMP3

Tile	Role Requirements	Qualifications / experience required
Water Quality Field Lead	Contribution to HSE briefings, pre-start checks, and toolbox talks Management of the technical components of field operations Pre-start assessment of potential sources of contamination Daily sampling plans (with Party Chief and vessel master, where appropriate) QA/QC of sampling methods QA/QC of field sampling logs Management of sample integrity and storage Health and safety during field operations Supervision of field scientists/technicians In-field management and QA/QC of data Preparation and QA/QC of Chain of Custody (CoC) documents Preparation of samples for transport	Qualifications: Bachelor's degree in relevant subject (as a minimum), plus: - TBOSIET - medical (UKOG or acceptable alternative) - MSIC Optional: Senior First Aid Experience: At least five years' offshore and coastal WQ and water column profiling experience in both field scientist and field lead role, preferably with the use of fluorimeters in the field. Previous experience of intertidal field surveys.
Water Quality Field Scientist/ Technician	Mobilisation and de-mob of field equipment Active engagement at HSE briefings, pre-start checks, and toolbox talks Undertaking technical scopes of OMP3 operations Take personal responsibility for management of contamination risks, safety, sampling, sample integrity and field logs Supporting the Water Quality Field Lead Setting up and deployment of sampling equipment Collecting and labelling samples Sample storage Downloading field data Securing field sampling equipment during vessel transits	Qualifications: Bachelor's degree in relevant subject (as a minimum), plus: - TBOSIET - medical (UKOG or acceptable alternative) - MSIC Optional: Senior First Aid Experience: Offshore and coastal WQ and water column profiling experience.

Table 8 Core equipment requirements for OMP3 with recommendations for different sampling environments

Sampling Environment	Equipment Requirements
General (all survey areas)	- Spares kits for survey equipment and technologies - Tool kits, including spanners, shifting spanners (large and small), socket sets, wire cutters/snips, pliers (needle-nosed and standard), Allen key sets (imperial and metric), screwdrivers (Phillips, flat head and screwdriver watch repair kits), Stanley knives and spare blades, tape measures (up to 30 m+), silicone grease, superglue, neoprene glue, duct tape, electrical tape, packaging tape, hose clamps (Jubilee clips) and cable ties (various sizes) - Sample containers, appropriate to samples - Thin foam/bubble wrap sample jar pockets - Aluminium foil - Laptop computer and backup (with appropriate software) - UPS unit plus spare - Hand-held GPS plus spare unit - Nitrile gloves - Decontamination cleaning product (e.g. Decon 90, or dichloromethane for cleaning of the slick sampler fishing pole) - Eskies with ice blocks (frozen) - Consumables (e.g. batteries)
Offshore (e.g. Commonwealth waters)	Mandatory - Survey navigation software plus GPS unit/vessel GPS access and/or handheld GPS plus spare - 3 × bomb samplers and/or Niskin Bottles (plus 2 spares and 2 extra spare messenger weights) - \WQ profiler with self-recording polycyclic aromatic hydrocarbon fluorimeter, pH meter, and conductivity/ temperature/depth (CTD) sensors - GO nets (pre-cleaned or new pre-packaged nets) - AGI slick samplers with fishing pole, line and disposable floats (which will be discarded after every sampling attempt) - Wide-mouth amber glass jars with Teflon-lined lid (min. 350 ml) for sampling - surface hydrocarbons and for GO nets - 2 × extendable sampling pole/boat hooks Optional (additions to the water quality (WQ) profiler): - turbidity logger - particle analyser - coloured dissolved organic matter (CDOM) fluorimeter - chlorophyll fluorimeter - dissolved oxygen (DO) sensor - Wave glider(s)** with: hydrocarbon fluorimeter - CTD sensor - DO sensor weather station current profiler

Sampling Environment	Equipment Requirements
Coastal (e.g. State waters to ≤100 m water depth)	- Survey navigation software plus GPS unit/vessel GPS access and/or handheld - GPS plus spare - 3 × bomb samplers, Niskin Bottles and/or van Dorn water samplers (plus 2 spares and 2 extra spare messenger weights) - WQ profiler with self-recording polycyclic aromatic hydrocarbon fluorimeter, pH meter, and conductivity/ temperature/depth (CTD) sensors - GO nets (pre-cleaned or new pre-packaged nets) - AGI slick samplers with fishing pole, line and disposable floats (which will be discarded after every sampling attempt) - Wide-mouth amber glass jars with Teflon-lined lid (min. 350ml) for sampling surface hydrocarbons and for GO nets - 2× extendable sampling pole/boat hooks Optional: - Additions to the WQ profiler: - turbidity logger - particle analyser - coloured dissolved organic matter (CDOM) fluorimeter - chlorophyll fluorimeter - dissolved oxygen (DO) sensor
Intertidal zone (e.g. shorelines)	- Wide-mouth amber glass jars with Teflon-lined lid (min. 350 ml - 2 × extendable sampling pole/boat hooks - Booms and absorbent pads

Table 9 Core OMP3 logistical requirements

Component	Requirement
OSMP equipment logistics	OSMP mobilisation will require consideration of the process of supply of equipment and mobilisation of survey equipment consignments to each survey unit. Each survey unit will have specific equipment needs, which will be sourced from a range of suppliers/service providers. Batches of bulk-ordered items will need to be broken down and split into survey team consignments (based on pre-prepared equipment lists). This will require organisation of personnel and suitable location(s). Single-order items may be shipped directly to survey deployment locations (e.g. ports) where possible.
Core field survey team	Intertidal surveys: - 2 technical personnel (Field Lead and Field Technician) - Vessel-based surveys: - 2 technical personnel (Field Lead and Field Technician) - 1 operational personnel (Party Chief)

Component	Requirement
Survey platform requirements	Vehicles for intertidal surveys: - 4WD off-road vehicles (preferably mine-rated) - Off-road trailers for shelter and sample transport - Quad bikes may be appropriate in some areas Vessel specifications: - Sufficient deck space for sampling - Covered area of deck for shelter from the elements - Sample storage space (refrigerated) - Access at stern or via gunwale for deployment of sampling equipment - Hi-Ab, crane and/or A-frame (suitably rated) - Winches with sufficient winch wire (rated to a minimum of 2T) - Winch with sufficient Dyneema - Deckhands with appropriate certifications - Deck hoses (freshwater and seawater) - Dynamic positioning systems (DPS) preferable (critical in offshore deep-water environments) - Indoor table access with direct access to work deck - Access to bridge (for Party Chief) - GPS access/outputs - Sufficient bunking space for vessel crew and field survey teams - Sufficient crew to allow 24-hour operations where appropriate - Potential for dual deployments (in offshore environments) - Potential requirement for tender vessel (small, shallow-draft vessel) for shallow water sampling
Sample transfer requirements	Vessel-based surveys are likely to require regular pick-up of samples to enable shipment and analysis within holding times.
Data management	2 × 2 TB external hard drives with password protection to allow transfer of data with returning field personnel

SMP1: Assessment of Water Quality

Table 10 Field survey unit personnel requirements for SMP1

Tile	Role Requirements	Qualifications / experience required
Water Quality Field Lead	Contribution to HSE briefings, pre-start checks, and toolbox talks Management of the technical components of field operations Pre-start assessment of potential sources of contamination Daily sampling plans (with Party Chief and vessel master, where appropriate) QA/QC of sampling methods QA/QC of field sampling logs Management of sample integrity and storage Health and safety during field operations Supervision of field scientists/technicians In-field management and QA/QC of data Preparation and QA/QC of Chain of Custody (CoC) documents Preparation of samples for transport	Qualifications: Bachelor's degree in relevant subject (as a minimum), plus: - TBOSIET - medical (UKOG or acceptable alternative) - MSIC Optional: Senior First Aid Experience: At least five years' offshore and coastal WQ and water column profiling experience in both field scientist and field lead role, preferably with the use of fluorimeters in the field. Previous experience of intertidal field surveys.

Tile	Role Requirements	Qualifications / experience required
Water Quality Field Scientist/ Technician	Mobilisation and de-mob of field equipment Active engagement at HSE briefings, pre-start checks, and toolbox talks Undertaking technical scopes of OMP3 operations Take personal responsibility for management of contamination risks, safety, sampling, sample integrity and field logs Supporting the Water Quality Field Lead Setting up and deployment of sampling equipment Collecting and labelling samples Sample storage Downloading field data Securing field sampling equipment during vessel transits	Qualifications: Bachelor's degree in relevant subject (as a minimum), plus: - TBOSIET - medical (UKOG or acceptable alternative) - MSIC Optional: Senior First Aid Experience: Offshore and coastal WQ and water column profiling experience.

Table 11 Core Equipment Requirements for SMP1

Sampling Environment	Equipment Requirements
General (all survey areas)	- Spares kits for survey equipment and technologies - Tool kits, including spanners, shifting spanners (large and small), socket sets, wire cutters/snips, pliers (needle-nosed and standard), Allen key sets (imperial and metric), screwdrivers (Phillips, flat head and screwdriver watch repair kits), Stanley knives and spare blades, tape measures (up to 30 m+), silicone grease, superglue, neoprene glue, duct tape, electrical tape, packaging tape, hose clamps (Jubilee clips) and cable ties (various sizes) - Sample containers, appropriate to samples - Thin foam/bubble wrap sample jar pockets - Aluminium foil - Laptop computer and backup (with appropriate software) - UPS unit plus spare - Hand-held GPS plus spare unit - Nitrile gloves - Decontamination cleaning product (e.g. Decon 90, or dichloromethane for cleaning of the slick sampler fishing pole) - Eskies with ice blocks (frozen) - Consumables (e.g. batteries)

Sampling Environment	Equipment Requirements
Offshore (e.g. Commonwealth waters)	Mandatory - Survey navigation software plus GPS unit/vessel GPS access and/or handheld GPS plus spare - 3 × bomb samplers and/or Niskin Bottles (plus 2 spares and 2 extra spare messenger weights) - \WQ profiler with self-recording polycyclic aromatic hydrocarbon fluorimeter, pH meter, and conductivity/ temperature/depth (CTD) sensors - GO nets (pre-cleaned or new pre-packaged nets) - AGI slick samplers with fishing pole, line and disposable floats (which will be discarded after every sampling attempt) - Wide-mouth amber glass jars with Teflon-lined lid (min. 350 ml) for sampling - surface hydrocarbons and for GO nets - 2 × extendable sampling pole/boat hooks Optional (additions to the water quality (WQ) profiler): - turbidity logger - particle analyser - coloured dissolved organic matter (CDOM) fluorimeter - chlorophyll fluorimeter - dissolved oxygen (DO) sensor - Wave glider(s)** with: hydrocarbon fluorimeter - CTD sensor - DO sensor weather station current profiler
Coastal (e.g. State waters to ≤100 m water depth)	- Survey navigation software plus GPS unit/vessel GPS access and/or handheld - GPS plus spare - 3 × bomb samplers, Niskin Bottles and/or van Dorn water samplers (plus 2 spares and 2 extra spare messenger weights) - WQ profiler with self-recording polycyclic aromatic hydrocarbon fluorimeter, pH meter, and conductivity/ temperature/depth (CTD) sensors - GO nets (pre-cleaned or new pre-packaged nets) - AGI slick samplers with fishing pole, line and disposable floats (which will be discarded after every sampling attempt) - Wide-mouth amber glass jars with Teflon-lined lid (min. 350ml) for sampling surface hydrocarbons and for GO nets - 2× extendable sampling pole/boat hooks Optional: - Additions to the WQ profiler: - turbidity logger - particle analyser - coloured dissolved organic matter (CDOM) fluorimeter - chlorophyll fluorimeter - dissolved oxygen (DO) sensor
Intertidal zone (e.g. shorelines)	- Wide-mouth amber glass jars with Teflon-lined lid (min. 350 ml - 2 × extendable sampling pole/boat hooks - Booms and absorbent pads

Table 12 Core SMP1 Logistical Requirements

Component	Requirement
OSMP equipment logistics	OSMP mobilisation will require consideration of the process of supply of equipment and mobilisation of survey equipment consignments to each survey unit. Each survey unit will have specific equipment needs, which will be sourced from a range of suppliers/service providers. Batches of bulk-ordered items will need to be broken down and split into survey team consignments (based on pre-prepared equipment lists). This will require organisation of personnel and suitable location(s). Single-order items may be shipped directly to survey deployment locations (e.g. ports) where possible.
Core field survey team	Intertidal surveys: - 2 technical personnel (Field Lead and Field Technician) - Vessel-based surveys: - 2 technical personnel (Field Lead and Field Technician) - 1 operational personnel (Party Chief)
Survey platform requirements	Vehicles for intertidal surveys: - 4WD off-road vehicles (preferably mine-rated) - Off-road trailers for shelter and sample transport - Quad bikes may be appropriate in some areas Vessel specifications: - Sufficient deck space for sampling - Covered area of deck for shelter from the elements - Sample storage space (refrigerated) - Access at stern or via gunwale for deployment of sampling equipment - Hi-Ab, crane and/or A-frame (suitably rated) - Winches with sufficient winch wire (rated to a minimum of 2T) - Winch with sufficient Dyneema - Deckhands with appropriate certifications - Deck hoses (freshwater and seawater) - Dynamic positioning systems (DPS) preferable (critical in offshore deep-water environments) - Indoor table access with direct access to work deck - Access to bridge (for Party Chief) - GPS access/outputs - Sufficient bunking space for vessel crew and field survey teams - Sufficient crew to allow 24-hour operations where appropriate - Potential for dual deployments (in offshore environments) - Potential requirement for tender vessel (small, shallow-draft vessel) for shallow water sampling
Sample transfer requirements	Vessel-based surveys are likely to require regular pick-up of samples to enable shipment and analysis within holding times.
Data management	2 × 2 TB external hard drives with password protection to allow transfer of data with returning field personnel

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APPENDIX M

Commercial Fisheries Compensation Protocol for the Bonaparte MC3D MSS

NATIONAL ENERGY RESOURCES AUSTRALIA

Creating connections for growth

NATIONAL ENERGY RESOURCES AUSTRALIA

COLLABORATIVE SEISMIC ENVIRONMENT PLAN PROJECT

COMMERCIAL FISHING INDUSTRY ADJUSTMENT PROTOCOL

Loss of catch – Displacement – Fishing gear loss or damage

Revision	Date	Purpose
A	May 2020	Engagement with WAFIC/NTSC/CFA
B	August 2020	Broader commercial fishing industry consultation
C5	February 2021	Round 2 commercial fishing industry consultation
1	May 2021	Final published document

Contents

1. Commercial Fishing Industry Adjustment Protocol Overview

1.1. Purpose

This protocol establishes a baseline standard to underpin seismic survey adjustment for loss of catch, displacement and fishing gear loss or damage, between the oil and gas and commercial fishing industries.

The purpose of this protocol is to provide a practical, evidence-based process and reasonable monetary adjustment to a commercial fisher for loss of catch, displacement, and fishing gear loss or damage. Adjustment is available during a seismic survey and as appropriate, for a period after a seismic survey conducted under an Environment Plan (EP) that references and is therefore subject to this protocol.

1.2. Background

In 2018, National Energy Resources Australia (NERA), established the Collaborative Seismic Environment Plan (CSEP) Project, including an industry consortium, to seek approval from the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for seismic survey activities in an area in Commonwealth waters off Western Australia (WA) and the Northern Territory (NT) from 2021 and beyond. The CSEP Project is aimed at achieving fundamental and long-term improvements to the way that seismic activities are planned with consideration for commercial fishing activities.

NERA is an Industry Growth Centre funded by the Australian Government, tasked with the transformation of Australia's energy sector through innovation, collaboration, and efficiency. NERA is the facilitator of the CSEP Project and does not conduct petroleum activity.

1.3. Commitment

CSEP Project consortium members (refer **Appendix 1**) commit to minimising potential impacts on commercial fishing and the fish stocks that support the industry primarily through avoidance of fishing activities. However, consortium members recognise that their activities may, from time-to-time, take place in the same area and at the same time as commercial fishing. Minimising interference with each other's rights and interests is also reflected in primary petroleum and fishing legislation[1].

Best endeavours will be made to avoid, minimise and mitigate potential impacts on the commercial fishing industry before the adjustment processes contained in this protocol are applied.

1.4. Scope

This protocol covers a commercial fisher (refer definition) who fishes as a normal part of their commercial fishing activity within an Adjustment Area (refer definition) during and/or for a specified period after, a seismic survey conducted under an EP that references and is

[1] For relevant statutory information refer to section 280 *Offshore Petroleum and Greenhouse Gas Storage Act 2006*, section 124 *Petroleum (Submerged Lands) Act 1982* (WA), section 124 *Petroleum (Submerged Lands) Act 1981* (NT), and section 171 *Fish Resources Management Act 1994*.

therefore subject to this protocol. Adjustment is also available for fishing outside of an Adjustment Area in circumstances where a commercial fisher is unable to, or chooses not to, continue fishing within an Adjustment Area.

1.5. Consultation

This protocol has been developed by the CSEP Project Steering Committee in consultation with State, Territory and Commonwealth commercial fishing licence holders in fisheries that are active within the CSEP Project proposed operational area. Consultation has also included:

- Western Australian Fishing Industry Council (WAFIC)
- Northern Territory Seafood Council (NTSC),
- Commonwealth Fisheries Association (CFA),
- Seafood Industry Australia deferred involvement in the CSEP project to WAFIC,
- Department of Primary Industry and Regional Development (DPIRD) (WA),
- Fisheries Division in the Department of Industry, Tourism and Trade (NT),
- Australian Fisheries Management Authority,
- Department of Industry, Science, Energy and Resources,
- Australian Petroleum Production & Exploration Association (APPEA) and
- International Association of Geophysical Contractors (IAGC).

1.6. Definitions

- **Adjustment Area** – An area extending 10 kilometres[2] around the perimeter of a 3D or 4D seismic survey active source area (refer **Appendix 6** for explanatory diagram). ***NOTE****: Spatial parameters of an Adjustment Area for a 2D survey will require case-by-case specification due to the differing survey layout.*
- **Acquisition Area** - The primary target area for a seismic survey in which seismic data will be recorded.
- **Active Source Area** - An area including and around the Acquisition Area in which the seismic energy source (airgun array) can be active. This includes survey line run-ins and run-outs.
- **Catch Per Unit of Effort (CPUE)** - For the purposes of this protocol the catch will be defined in kilograms of landed catch and the unit of effort will be defined in hours (decimal hours where available) fished for trawl, hours fished or kilometres of line set or number of hooks per kilometre for line fishing, or number of trap lifts, resulting in the landed catch e.g. CPUE=kilograms per (trawl/line) hour or trap lift.
- **Commercial fisher** – for the purpose of this protocol, a commercial fisher is the entity, person, licence holder, company or affected business who would have received the revenue from the landed catch that is the subject of a claim under this protocol, or who can show they have incurred the cost of lost or damaged fishing gear or displacement.
- **Fishing gear** - Fishing equipment deployed in the water by a vessel engaged in commercial fishing activity.

[2] 10 kilometres is proposed as a reasonable distance around the Active Source Area and consistent with existing industry standards.

- **Landed catch** - The whole landed weight as detailed in Government catch and effort information provided for the purpose of this protocol, or as recorded in statutory Catch and Disposal Records. Fish that is processed in any way before landing, for example gutted and gilled or headed, should be converted back to whole weight for the purpose of this protocol.
- **Market price**[3] – The price received by a commercial fisher at the point of first landing, excluding any price margins for marketing, transport, sales commissions, value adding or packaging. In respect to a claim under this protocol. The market price should reflect the price at the time the loss of catch was incurred by the claimant.
- **Statistical fishing block** - Government statistical grid/block numbering system used to record commercial fishing activity data and referred to in this protocol as a block.
- **Titleholder** – The Titleholder is the registered holder of the Access Authority, Special Prospecting Authority, Exploration Permit, Retention Lease or Petroleum Production Licence over which the seismic survey will be acquired, as detailed in the environment plan for the seismic survey subject to this protocol.
- **Historical fishing activity, block** - A statistical fishing block, or fishing event location (latitude/longitude) plotted within the 10x10nm grid system, with fishing activity detailed in Government catch and effort information or as recorded in a statutory Catch and Disposal Record for at least two out of the previous five years prior to a relevant seismic survey conducted under this protocol.

1.7. Operation of the protocol

Notification of the establishment of an Adjustment Area will be provided to relevant commercial fishing licence holders in writing no less than 28 days before a seismic survey starts. Notification is to be provided in the form of a map plus digital files in formats such as KML, GPX or shapefiles (also refer to CSEP Commercial Fishing Operational Protocol).

Fishers (the fishing vessel/licence) must have established previous fishing history, at a minimum of two out of the previous five years, for all block(s) or fishing event(s) for which they wish to make a claim for loss of catch or displacement adjustment under this protocol.

To receive adjustment under this protocol, a commercial fisher must be able to show that they would have received the revenue from the landed catch that is the subject of a claim or show that they have incurred the cost of lost or damaged fishing gear.

Adjustment under this protocol is dependent on a commercial fisher continuing to carry out their fishing activities to the best of their ability and to mitigate and limit financial loss despite the occurrence of a seismic survey. Adjustment is not available where a fisher chooses to move away from a survey and makes no attempt to fish within the survey Adjustment Area.

Note that this protocol will be documented in the EP developed by the CSEP project as a control measure to manage potential impacts to commercial fishing licence holders and will therefore be subject to inspection under NOPSEMA’s environmental inspection program.

[3] Note Western Australian Fishing Industry Council Report *Final Report of GVP – Beach Price Reference Group. Finfish and Crabs. 8 May 2015.*

2. Commercial Fishing Adjustment Available Under This Protocol

2.1. Loss of catch adjustment

Evidence-based loss of catch adjustment under this protocol relates to fish lawfully caught and retained by a fishing vessel under a Western Australian, Northern Territory or Commonwealth fishing licence. The adjustment process applies to historical fishing activity over established fishing grounds, and not to speculative fishing activity.

The loss of catch adjustment process applies to commercial fishing activity conducted by a licensed fishing vessel within an Adjustment Area, and other fished areas during a month. For each month where adjustment is claimed, the licensed fishing vessel must conduct fishing within an Adjustment Area, unless a fishing trip spans two months where each month will be considered to have satisfied this requirement.

Loss of catch adjustment is available for the period of a survey and for six months after a survey is completed[4]. This adjustment process assumes that any loss of catch experienced will be evident in a reduced CPUE for that fishing vessel (or license if subject to boat replacement) compared to previous years for the same eligible claim block/fishing event location by species by month.

Loss of catch assessments will be conducted using the seismic survey period catch and effort data per month plus the previous 10 years (by same block/fishing event location & month) where available.

2.1.1. Method of assessing loss of catch adjustment

Treatment of catch and effort data to determine eligible fishing events to be included in the adjustment assessment process

As detailed in this protocol, adjustment is available for fishing activity where it can be shown there is a minimum of 2 out of the prior 5 years where fishing activity has taken place in the same block or fishing event location that is the subject of a claim. This requirement applies to the Adjustment Area and for any other block/fishing event location/area for which adjustment is being claimed.

The first step in conducting a loss of catch adjustment assessment will be to determine which fishing activity is eligible for adjustment under this protocol.

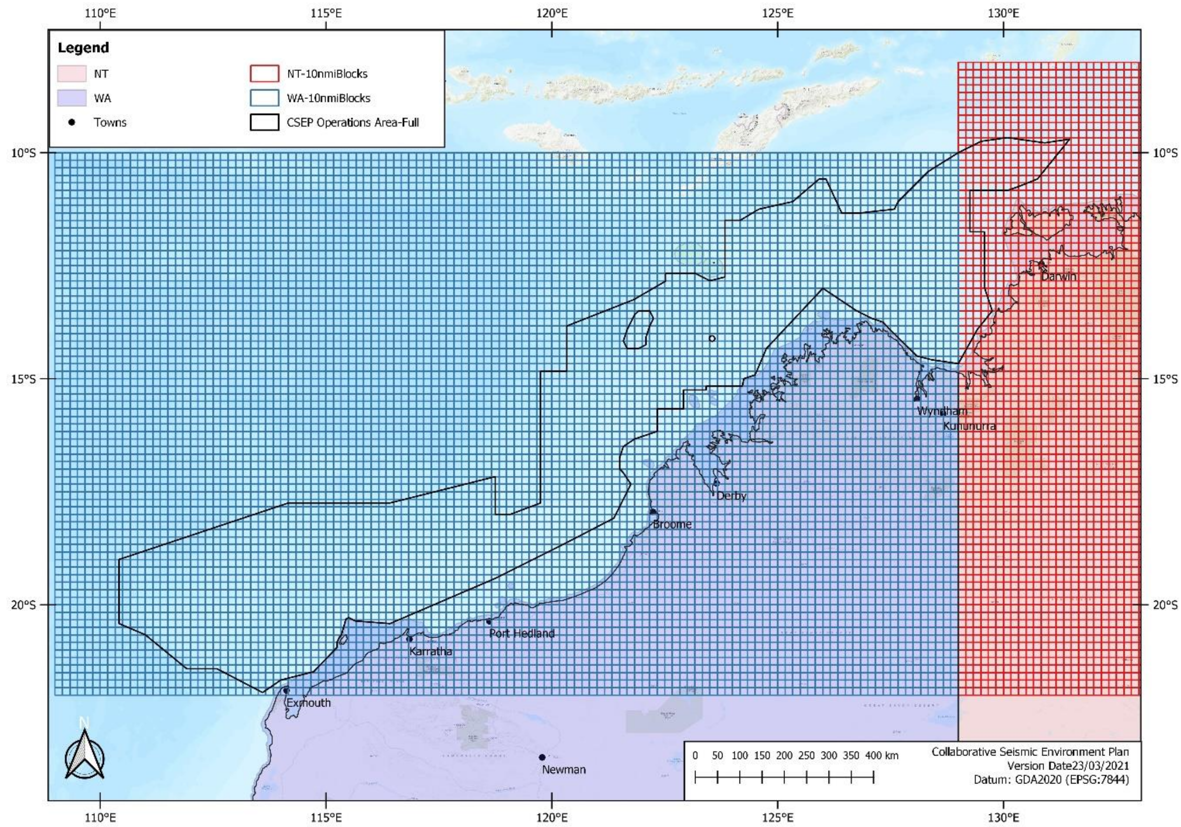
Where catch and effort data is provided in 10x10nm statistical grid format, the same block by month will be checked for the 5 years preceding the survey year to ascertain the minimum requirement of a minimum of 2 years fishing activity within the previous 5 years. Where catch and effort data is provided in larger than 10x10nm statistical grid format, applicants may be asked for additional positional information for blocks that partially overlap the Adjustment Area, or are outside of the Adjustment Area, to assess the minimum fishing history requirement.

Where catch and effort data is provided by the location of each fishing event by latitude and longitude coordinates the existing WA and NT 10x10nm statistical grid system will be used to assess the minimum fishing history requirement. The start point of each fishing event will

[4] Temporal parameters for a 2D survey will be considered on a case-by-case basis.

plotted within the 10nm grid system to aid the assessment of previous fishing history by allocating each event to a 10nm block to determine fishing events eligible to be included in the adjustment assessment process. Note that assessors have the flexibility to make judgements that will enhance the statistical accuracy of an assessment and/or provide balanced practical assessment outcomes.

The WA and NT 10x10nm grid system is illustrated below. The two grid systems align and cover the CSEP Operational Area. Claims in blocks west of 129° East longitude will use the WA grid and East of 129° will use the NT grid. Claims overlapping 129° East can use either grid.



Map showing WA and NT fishing activity reporting grid systems

2.1.2. Calculating an average CPUE

Catch and effort history covering the prior 10 years is required to provide an average CPUE value that is subject to minimal influence from fish stock recruitment and environmental fluctuations.

CPUE will be defined in kilograms of landed catch and the unit of effort will be defined in hours (decimal hours where available) fished for trawl, hours fished, or kilometres of line set or number of hooks per kilometre for line fishing or number of trap lifts, resulting in the landed catch, for example CPUE=kilograms per trawl/line hour or trap lift. Average CPUE will be based on the mean catch and effort values of all eligible fishing events per claim month.

It is recognised that in some cases 10 years of catch history data may not be available and where this occurs an assessor should determine an appropriate historical average CPUE based on the information available in the application and any other information that an assessor deems appropriate.

The use of 10 years prior catch history and the intention of this protocol is that assessments are conducted based on the available catch and effort information. However, an assessor may also consider significant catch trends within a fishery and/or management changes if they are thought to materially affect resulting catch rates or landed catch volumes.

2.1.3. Loss of catch adjustment assessment method

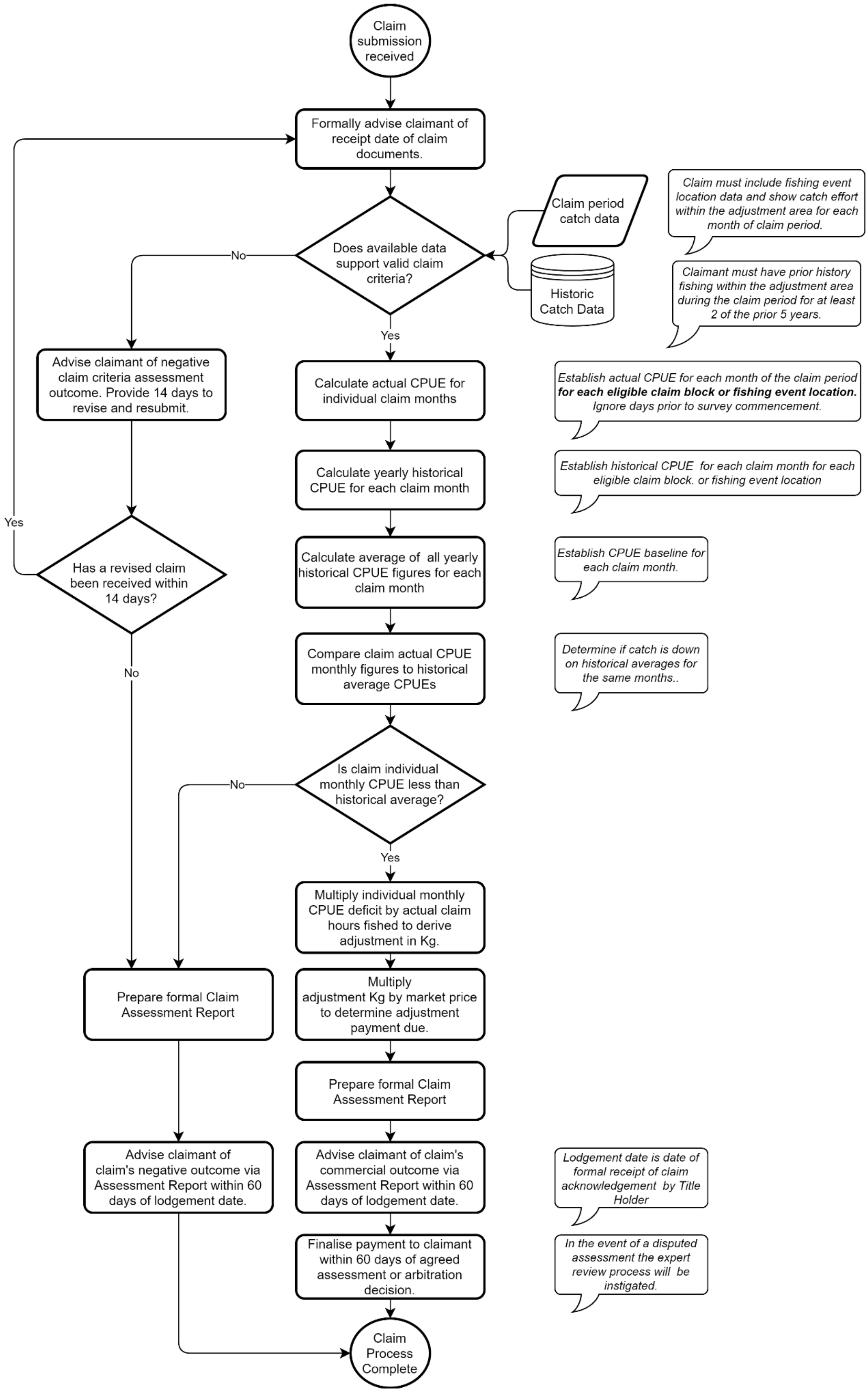
1. Claim month must contain fishing activity within the Adjustment Area, unless a fishing trip spans two consecutive months, where it will be considered that this requirement has been met for both months.
2. Claimant must have historical fishing activity (refer definition) for each block or fishing event location subject to a claim.
3. Yearly historical average CPUEs (up to 10 years) will be calculated for all eligible fishing events fished in the claim month, by species, and then averaged to provide a baseline historical average CPUE for the claim month.
4. The claim month actual average CPUE will be calculated for eligible fishing events by species by month.
5. The actual average CPUE will be compared to the historical average CPUE for the same block/fishing events and month and adjustment will be established where there is a shortfall.
6. The shortfall in CPUE will be multiplied by the unit of effort (hours, kilometers of line set/number of hooks per kilometer, number of trap lifts) fished for that claim month, and then the species market price, to provide the amount of monetary adjustment due for that month.
7. Adjustment may be calculated per individual species or combined as appropriate.

2.1.4. Adjustment method loss of catch adjustment calculation example

Claim month April 2020	Species narrow barred mackerel. Troll hours fished 100. Market price $17 per kg. Total catch 8,200kgs.
Claimant has historical fishing activity within Adjustment Area prior to April 2020	Condition met
Claimant fished in Adjustment Area during April 2020	Condition met
April historical baseline CPUE	100 kgs per hour
April 2020 CPUE	82 kgs per hour
Shortfall in CPUE	18 kgs per hour
Shortfall multiplied by 100 hours fished in April 2020	1,800 kgs
1,800 kgs multiplied by market price of $17 per kg	$30,600
Monetary adjustment due for April 2020	$30,600

The full loss of catch assessment process is detailed in the flow chart on the following page.

2.1.5. Loss of catch assessment flow chart



2.1.6. Exceptions to loss of catch assessment method information requirements.

1. Where a fisher is unable to provide 10 years prior catch and effort data due to Government confidentiality requirements or other reason, an assessment may still be conducted subject to the claim assessor being satisfied that an accurate assessment can still be conducted using the volume of data available.
2. If requested by the claimant, an assessment may be conducted using a fisher's own catch and effort data where a claim assessor forms the view that the data is consistent with Government data accuracy and formatting and that the data is suitable to conduct an accurate assessment.

The loss of catch adjustment process under this protocol does not cover circumstances where there may be discussions and/or agreement reached between a seismic survey title holder and a commercial fisher prior to a survey taking place, that it is not appropriate for fishing to occur within the area of a seismic survey. Likewise, if a commercial fisher feels that they will be disadvantaged by a seismic survey due to alternative suitable fishing grounds not being available to them during the seismic survey, then they should engage with the titleholder ahead of a survey commencing.

A commercial fisher wishing to lodge a claim for adjustment should notify the survey titleholder of their intention to lodge a claim as soon as possible after the conclusion of a seismic survey and a claim may be lodged up to 12 months after the conclusion of the seismic survey.

2.2. Displacement

In addition to the loss of catch adjustment provisions outlined above, if a commercial fisher is unable to fish in their historical fishing area (refer definition) within an Adjustment Area during a seismic survey and incurs costs over and above the normal running costs for a fishing trip while relocating to another historical fishing area, then costs associated with increased distance/transit time, fuel and crewing will be considered under this protocol for monetary adjustment. For displacement, an alternative fishing ground must be within 50 kilometres of the Adjustment Area.

Displacement will be assessed based on a comparison of the above-mentioned running costs per day at sea against the previous yearly average.

NOTE: The CSEP project team is investigating the development of an alternative displacement method using a default nautical mile rate adjustment payment for additional miles covered in a month compared to same month in previous years. The default rate could be set for individual fisheries and/or classes of vessels. This alternate method may be introduced as the default displacement process when available and then included in future revisions to this protocol.

A commercial fisher who decides it is necessary to relocate to another fishing ground because of a seismic survey subject to this protocol and wants to be considered for displacement adjustment must notify the titleholder of the seismic survey, where possible, prior to undertaking the relocation. Evidence must also be provided to substantiate fishing gear in use at the claim time.

A claim for displacement must be made within 6 months of the conclusion of a seismic survey.

2.3. Fishing gear loss or damage

A commercial fisher may lodge a claim in accordance with this protocol if they experience accidental loss or damage of deployed fishing gear from physical contact with a seismic survey vessel and/or its in-water equipment or supporting vessels during a seismic survey subject to this protocol.

Through pre-survey notifications and communications, titleholders and commercial fishers should have an awareness of survey and fishing activities and make all reasonable efforts to avoid direct interaction and fishing gear loss or damage. It should be noted that seismic survey vessels carrying out seismic acquisition are limited in their manoeuvrability.

If fishing gear loss or damage occurs, the commercial fisher should immediately notify the titleholder.

When lodging a claim, the claimant should clearly document when, where and how the gear damage or loss occurred and where possible, the name and details of vessel(s) involved in the incident. A claim should include a quote (two where possible) with costs associated with repairing or replacing the lost or damaged fishing gear.

As a result of assessing the claim, by mutual agreement with the claimant, the titleholder may offer to cover the cost of repairing or replacing the damaged fishing gear or providing like-for-like replacement equipment.

In association with a claim for fishing gear loss or damage, the value of any foregone catch from the lost or damaged fishing gear for the duration of that fishing trip may also be included. Adjustment for foregone catch shall be based on the average CPUE for the month that the lost or damaged fishing gear incident took place. If insufficient information is available for that month, then the same month in the previous year can be used. Claims for forgone catch may only be based on the proportionate loss of catch resulting from the lost or damaged fishing gear for the period of the fishing trip where the loss was suffered.

In the event a claim for forgone catch has been submitted, the titleholder may (at their sole expense) enlist the services of an independent person or organisation to assess the claim. If agreement cannot be reached between the claimant and titleholder then refer to the independent expert review provisions in the *How long will it take to deal with my claim and independent expert review process* section of this protocol.

A claim for fishing gear loss or damage must be lodged within 6 months of the conclusion of the survey.

3. Claim Information and Assessment Process

A titleholder conducting a seismic survey in accordance with an EP subject to this protocol will provide a contact point to relevant commercial fishers relating to lodging a claim or notification regarding loss of catch, displacement, or fishing gear loss or damage. Contact information will also be provided to WAFIC, NTSC and CFA as the respective peak commercial fishing industry bodies.

All information provided in an application under this protocol must be kept confidential by the titleholder, an assessor or expert reviewer of a claim and any other person who has access to the information.

Provided a claimant can demonstrate the required previous fishing history within an Adjustment Area, if all the remaining information requirements set out in this protocol are not available to a claimant, then such claims will be considered on a case-by-case basis.

An option for applicants lodging a claim is to authorise an assessor to access the relevant fishing catch and effort information directly with the appropriate Government Department. Alternatively, applicants may provide the required Government catch and effort information with their claim application.

Applicants will receive confirmation of a claim being lodged with the titleholder. If an assessor forms the view that the information lodged with a claim is not sufficient to conduct a meaningful assessment or support the application, then the claimant will be advised in writing and given 14 days to respond to the assessor. If no response is received within 14 days, then the assessment will be completed, and the claimant advised of the outcome.

Claims will be assessed by separate monthly fishing activity, with each month assessment outcome not influencing or impacting on another month assessment outcome. This protocol outlines the adjustment processes in a manner to provide consistent assessments over time. However, assessors have the flexibility to make judgements that will enhance the statistical accuracy of an assessment and/or provide balanced practical assessment outcomes.

For fully documented applications that meet the Adjustment Area historical fishing activity requirement, whether successful or not, clerical costs relating to preparing, submitting, and engaging in the adjustment process under this protocol, up to a value of $2,000 per claim, will be reimbursed by the survey titleholder as part of the claim process. A statement outlining time and resource costs to support an amount up to $2000 should be included with an application. Clerical costs that exceed $2,000 may also be included with a claim and reimbursed under this protocol if evidenced by documentation.

3.1. Who can lodge a claim and when?

A commercial fisher (refer definition) who suffers a loss of catch, displacement or gear loss or damage whilst operating in and around a seismic survey Adjustment Area, subject to this protocol can lodge an adjustment claim.

A person so authorised may lodge a claim on behalf of a commercial fisher. Claims may be lodged by a person, company, or association on behalf of more than one commercial fisher, provided that the required individual catch history is provided and there is evidence of the authority to lodge the claim on behalf of others.

A loss of catch claim can be submitted up to 12 months after the conclusion of a seismic survey.

3.2. What information do I need to lodge a claim?

Claimants will need to be able to identify the relevant vessel and licence(s) that are involved in the claim, and to provide evidence of the entity that would have received the revenue that is the subject of a loss of catch claim. A key information requirement when lodging a loss of catch claim will be to either authorise access to the relevant Government catch and effort data or provide the catch and effort data with the application.

Full details on the information required to be lodged with a claim are contained in the application forms at **Appendix 2- Loss of catch, Appendix 3- Displacement and Appendix 4 – Fishing gear loss or damage.**

Each claim should relate to only one seismic survey and associated titleholder.

3.3. Who will assess my claim and what information will be in the report?

Subject to a claim being lodged, the titleholder of a seismic survey (at their expense) in consultation with the claimant, will engage a suitably experienced/qualified independent person or organisation as the assessor of the claim.

The titleholder is to provide the assessor with a letter of instruction/project brief, which is to be provided to the claimant as part of the assessment report.

An assessment report prepared by an assessor should include the following information:

- a copy of the letter of instruction/project brief received by an assessor when engaged to carry out the independent assessment,
- confirmation (or otherwise) that the information provided in the claim is sufficient to conduct a meaningful assessment,
- a summary of the claim details (survey, applicant, vessel, month(s)),
- for a loss of catch claim, monthly CPUE assessments as outlined in this protocol including an estimation of any loss of catch (in kilograms) and its market price, and
- any other information, comments, or views relevant to the assessment that the assessor may wish to include.

Upon receiving and considering the assessment report, the titleholder will provide a copy of the report to the claimant and offer to meet with the claimant to discuss/address the claim.

3.4. How long will it take to deal with my claim?

An appropriately documented claim (including relevant catch and effort information) should be assessed, and a report provided to the claimant, within 60 days of the lodgement date of the claim. If an assessor is authorised to access catch and effort data, then the 60 day time period begins upon receipt of the necessary catch and effort data. If an appropriately documented claim report cannot be made available to the claimant within 60 days of a claim being lodged or receipt of catch and effort information as appropriate, and no mutual agreement to extend the time-period has been entered into, then the titleholder (at their expense) in consultation with the claimant, shall appoint a suitably experienced/qualified independent person or organisation to provide an expert review of the claim.

Included as part of the settlement of each claim, will be a binding agreement that summarises the claim outcomes and an agreement by the claimant that acceptance of the settlement negates any further claims for the same species and month(s) of that seismic survey.

3.5. Independent expert review of a claim

If a claimant disagrees with a claim assessment outcome and cannot reach agreement with the titleholder, they may opt to go to an independent expert review (funded by the titleholder of the survey).

If a claim is subject to independent expert review, then as part of that process, both the claimant and the titleholder shall be given the opportunity to address the assessor to state their position, prior to an independent expert review decision being reached.

An independent expert reviewer must provide a view as to whether the claim assessment process has been conducted in line with the requirements of the protocol. The independent expert reviewer may also consider any additional information deemed appropriate by him or herself, including information provided by either the claimant or the titleholder. An independent expert review decision is binding on the claimant and the titleholder and may differ from the initial assessment report.

A timeline diagram setting out the relevant time frames under this protocol can be found at **Appendix 5**.

3.6. How long will it take for me to be paid adjustment?

Once a claimant and titleholder agree with a claim outcome, or an expert reviewer has issued a report, the titleholder will provide monetary adjustment to the claimant within 60 days.

4. Protocol Review and Maintenance

This protocol will remain in force for the validity period of an accepted EP resulting from the NERA CSEP project, anticipated to be a five-year term from date of acceptance by NOPSEMA. The protocol will be subject to review and update by the CSEP Project Steering Committee at least once in each 12-month period during the validity period of the EP. Changes will be considered in consultation with WAFIC, NTSC and CFA (and their stakeholders as appropriate) and subject to agreement by the CSEP Project Steering Committee.

Appendix 1: CSEP Project Consortium Members (as at March 2021)

National Energy Resources Australia (NERA)

BGP (Exploiter Pte Ltd)

CGG Services (Australia) Pty Ltd

ConocoPhillips Australia Pty Ltd

Ion Energy (GX Technology Australia Pty Ltd)

IPB Petroleum Limited

Inpex Operations Australia Pty Ltd

Petroleum Geo-Services (PGS) Australia Pty Ltd

Santos Limited

Searcher Seismic Pty Ltd

Shell Australia Pty Ltd

TGS-NOPEC Geophysical Company Pty Ltd

Appendix 2: Loss of Catch Application Form

National Energy Resources Australia - Collaborative Environment Plan Project

Commercial Fishing Industry Adjustment Protocol - Application Form for Loss of Catch claim

Application Form - Commercial Fishing Adjustment Protocol - Loss of Catch	
Survey Details	
Seismic survey name	
Survey titleholder	
Claimant Details	
Name of person/company making claim	
Address	
Email	
Contact number	
I am the entity that would have received the revenue from the catch that is the subject of this claim. Please include evidence of above statement	Yes or No
I wish to authorise direct access to my catch and effort history relevant to this application.	Yes/No (If yes then authorisation holder to sign here)
Relevant authorisation holder details (if different from claimant)	
Name	
Address	
Email	
Contact number	
Authorisation/licence(s) name and number	
Claim details	
Months for which loss of catch adjustment is being claimed	

Application Form - Commercial Fishing Adjustment Protocol - Loss of Catch	
Market price information – please include documentary evidence of price received from normal buyer/processor for catch relevant to loss of catch claim.	
Catch and effort information for blocks/area by month by species for which loss of catch is being claimed plus previous 10 years. If 10 years Government catch history is not available and/or or you wish to provide your own validated catch history, please indicate here.	Indicate whether Government or own catch and effort data is being provided and number of previous years of data available.
NOTE: If any information is not available from Government and fishers own catch data is being submitted, then copies of the relevant statutory catch and effort fishing returns should be submitted with the claim.	
Catch and effort information should be provided in the form of: • Vessel • Year • Month • Fishery • Blocks fished provided at the highest (e.g., 10x10nm) available block resolution, or fishing event locations (by latitude and longitude). • Block days including fishing events in identified area/blocks per month. • Fishing hours (in decimal hours) showing the duration of each fishing event at highest available block/fishing event resolution. • Whole weight calculated based on the reported landed weight and listing the relevant conversion factor(s) if applicable.	
Other relevant information may be submitted with a claim and will be assessed on a case by case basis. Questions regarding the claim process may be directed to a person nominated by the titleholder.	
Please list the documents provided with your application	
1.	
2.	
3.	
4.	

Appendix 3: Displacement Application Form

National Energy Resources Australia - Collaborative Seismic Environment Plan Project

Commercial Fishing Industry Adjustment Protocol - Application Form for Displacement claim

Application Form - Commercial Fishing Adjustment Protocol - Displacement	
Survey Details	
Seismic survey name	
Survey titleholder	
Claimant Details	
Name of person/company making claim	
Address	
Email	
Contact number	
I am the entity that would have received the revenue from the catch that is the subject of this claim. Please include evidence of above statement	Yes or No
Relevant authorisation holder details (if different from claimant)	
Name	
Address	
Email	
Contact number	
Authorisation/licence(s) name and number	
Claim details	
Evidence of the additional distance, fuel and crew costs incurred by the relocation of the fishing operation.	Attach receipts/evidence of costs for claim month. Include vessel track data.
Evidence of previous year daily (at sea) average distance, fuel and crew costs	Attach receipts/evidence of costs for previous year.

Application Form - Commercial Fishing Adjustment Protocol - Displacement
Include five years catch data preceding the year of the claim in the following form: • Vessel • Year • Month • Fishery • Fishing event location/blocks fished provided at the highest available block resolution. • Whole weight calculated based on the reported landed weight and listing any relevant conversion factor(s). Note that 5 years of catch data is required for displacement purposes to show recent fishing history has occurred within an Adjustment Area. If less than 5 years catch data available, then claim assessor should evaluate appropriate method of assessment.
Please list the documents provided with your application
1.
2.
3.
4.

Appendix 4: Fishing Gear Loss Or Damage Application Form

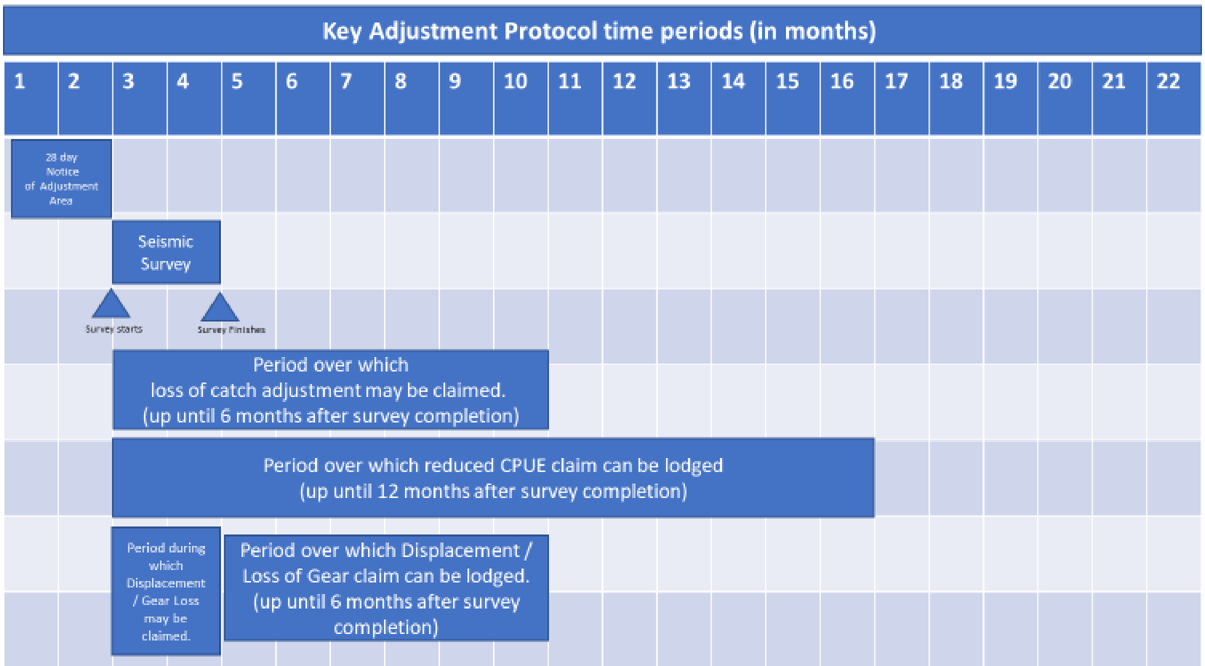
National Energy Resources Australia - Collaborative Seismic Environment Plan Project

Commercial Fishing Industry Adjustment Protocol – Application Form for fishing gear loss or damage claim

Application Form - Commercial Fishing Adjustment Protocol – Fishing gear loss or damage	
Survey Details	
Seismic survey name	
Survey titleholder	
Claimant Details	
Name of person/company making claim	
Address	
Email	
Contact number	
I am the entity that has incurred the costs of the lost or damaged fishing gear that is the subject of this claim. If claiming for loss of catch, I am the entity that would have received the revenue from the catch that is the subject of this claim. Please include evidence of above statements.	Yes or No and supporting information.
I wish to authorise direct access to my catch and effort history relevant to this application.	Yes/No (If yes then authorisation holder to sign here)
Relevant authorisation holder details (if different from claimant)	
Name	
Address	
Email	
Contact number	
Authorisation/licence(s) name and number	

Application Form - Commercial Fishing Adjustment Protocol – Fishing gear loss or damage	
Claim details	
Evidence of notification to the titleholder of the gear loss and/or damage incident.	
Information describing when, where and how the gear damage and/or loss occurred.	
Where possible, the name and details of vessel(s) involved in the incident.	
A claim should include a quote (two where possible) with costs associated with repairing or replacing the lost or damaged fishing gear.	
Estimate of any proportionate loss of catch including market price, plus catch and effort information sufficient to calculate CPUE for claim month or same month in previous year.	
Please list the documents provided with your application	
1.	
2.	
3.	
4.	

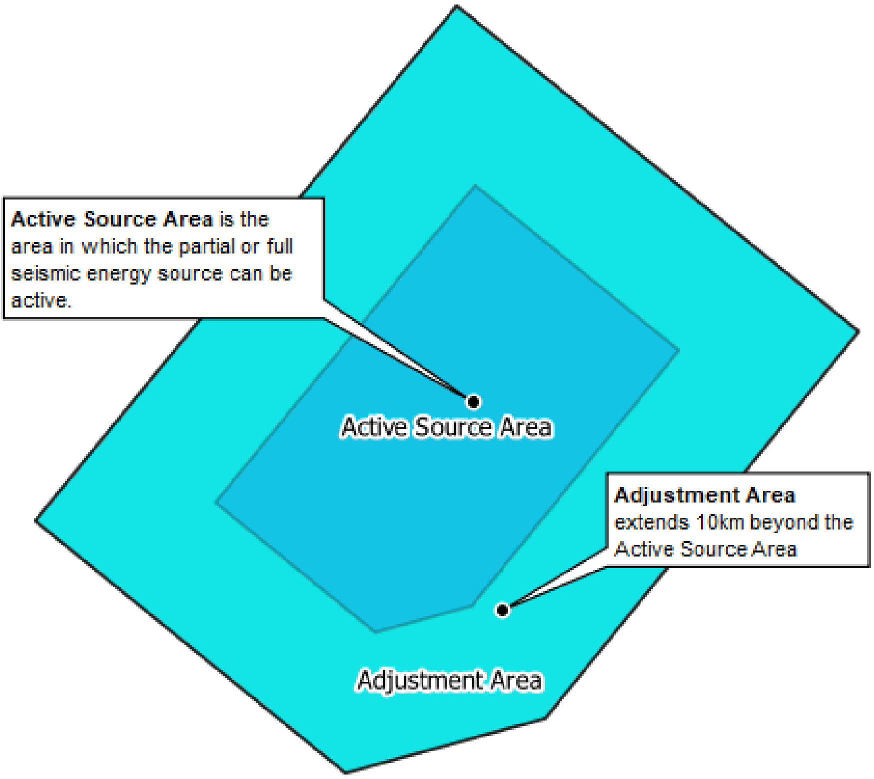
Appendix 5: Adjustment Protocol Timeframes



Timeframes for processing a claim

1. Claims to be finalised within 60 days of being lodged, or receipt of catch and effort information, unless mutual agreement reached between claimant and titleholder to extend time frame.
2. If agreement cannot be reached between the titleholder and claimant within the prescribed times above then the titleholder, in consultation with the claimant, must appoint an independent expert reviewer to decide the claim.
3. Subject to an independent expert review decision, the titleholder shall settle the claim in accordance with the decision within 60 days.

Appendix 6: Diagram Showing Example of An Adjustment Area



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