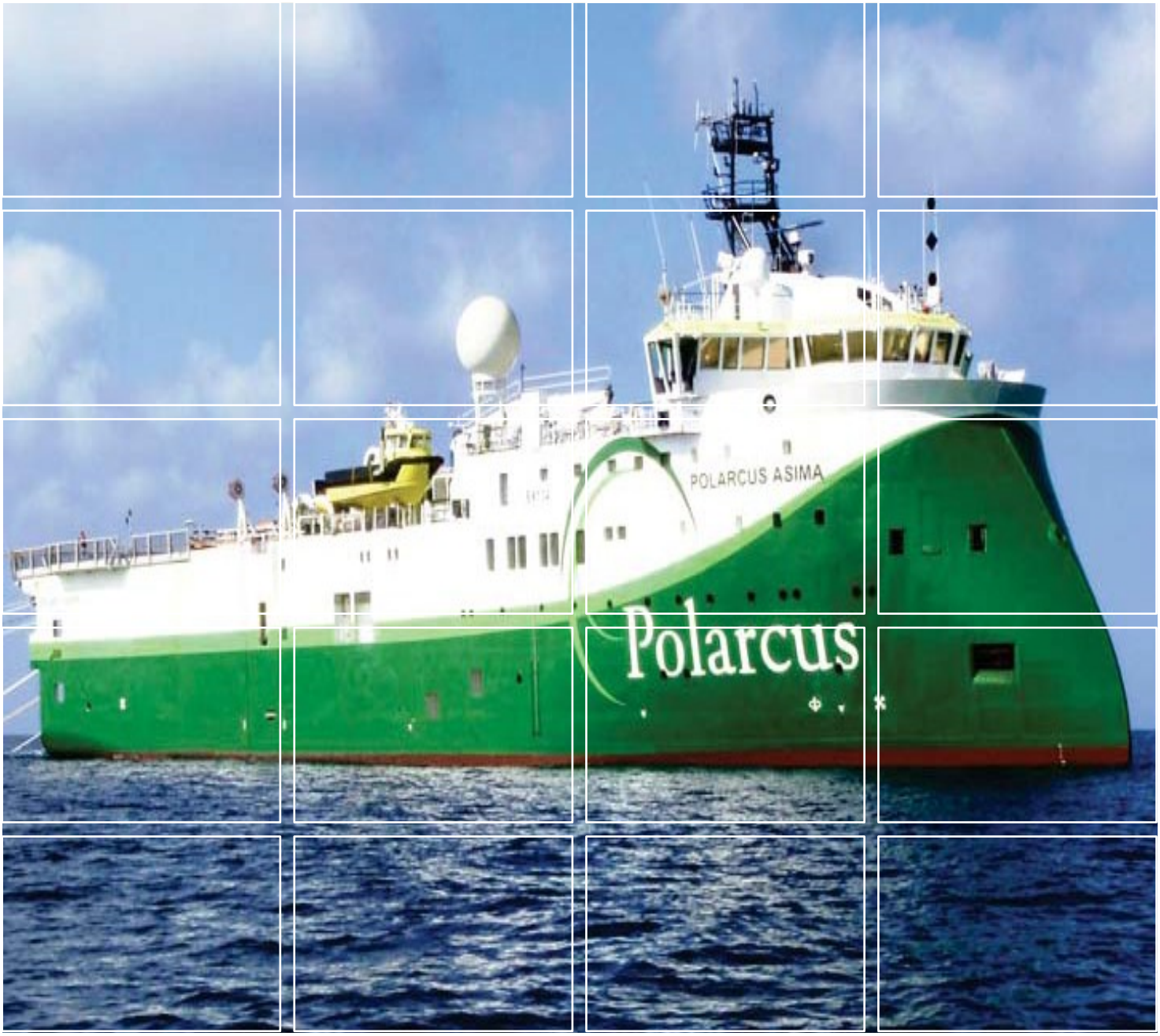

Environment Plan Summary Zénaïde 3D Marine Seismic Survey 2017 - 2018

Polarcus Seismic Limited

Revision 1: 18 December 2017

0413457 (EP Summary)
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Environment Plan Summary

Zénaïde 3D Marine Seismic Survey 2017 – 2018

18 December 2017

Reference: 0413457 (EP Summary)

Prepared by
Environmental Resources Management Australia

Document Revision History

Revision No.	Purpose/Change	Date
1	Submission to NOPSEMA	18/12/2017

CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

Acronym/ Abbreviation	Definition
ºC	Degrees centigrade
3D MSS	Three-dimensional marine seismic survey
AA	Access Authority
ADIOS	Automated Data Inquiry for Oil Spills
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AHO	Australian Hydrographic Office
ALARP	As low as reasonably practicable
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
BIA	Biologically Important Area
BOM	Bureau of Meteorology
BWM-T	Class notation for vessels with ballast water treatment complying with International Convention for the Control and Management of Ship's Ballast Water and Sediments
CEO	Chief Executive Officer
CLEAN-DESIGN	Class notation for vessels that are designed, built and operated in a way that gives additional protection to the environment
COLREGS	International Regulations for Preventing Collisions as Sea
COO	Chief Operations Officer
cui / cu. in.	Cubic inches
CV	Curriculum Vitae
DEWHA	Department of the Environment, Water, Heritage and the Arts
DNV	Det Norske Veritas
DOE	Department of the Environment
DOF	Department of Fisheries
DPIRD	Department of Primary Industries and Regional Development (Fisheries)
EHSQ	Environment, Health, Safety and Quality
ENVID	Environmental Risk Assessment
EP	Environment Plan

Acronym/ Abbreviation	Definition
EPBC	*Environment Protection and Biodiversity Conservation Act*
ERP	Project Emergency Response Plan
GHG	Greenhouse Gas
GPS	Global Positioning System
HSE	Health, Safety and Environment
Hz	Hertz
in^3	Cubic inches
IAPP	International Air Pollution Prevention
ICPC	International Cable Protection Committee
IMO	International Maritime Organization
IMS	Invasive marine species
IOPP	International Oil Pollution Prevention
ISPP	International Sewage Pollution Prevention
ITOPF	International Tanker Owners Pollution Federation
IUCN	International Union for Conservation of Nature
KEFs	Key Ecological Features
Km	Kilometres
Km^2	Square kilometres
m	Meters
m/s	Meter per second
m^3	Cubic metres
MARPOL	(Marine Pollution) International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978
MFO	Marine fauna observer
MGO	Marine Gas Oil
MNES	Matters of National Environmental Significance
MOP	Marine Oil Pollution
MOSCP	Marine Oil Spill Contingency Plan
MOU	Memorandum of Understanding
MSDS	Material Safety Data Sheet

Acronym/ Abbreviation	Definition
National Plan	National Plan for Maritime Environmental Emergencies
NAUT-AW	Vessel class notation for enhanced nautical safety, incorporating a grounding avoidance system
NES	National Environmental Significance
Nm	Nautical miles
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NOx	Nitrogen Oxides
NRSMPA	National Representative System of Marine Protected Areas
NSW	New South Wales
NZS	New Zealand Standards
OPEP	Oil Pollution Emergency Plan
OPGGS (E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act 2006*
OPRC	Oil Pollution Preparedness, Response and Cooperation
OSMP	Operational and Scientific Monitoring Programs
OSRC	Oil Spill Response Coordination
POB	Persons on board
Polarcus	Polarcus Seismic Limited
POLREP	Oil Pollution Reports
ppm	Parts per million
psi	Per square inch
JRCC	Joint Rescue Coordination Centre
SA	South Australia
SEL	Sound exposure level
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
SIMAP	Spill Impact Model Application Package
SITREPS	Situation Reports
SOLAS	Safety of Life at Sea

Acronym/ Abbreviation	Definition
SOPEP	Shipboard Oil Pollution Emergency Plan
SPA	Special Prospecting Authority
SPS	Special Purpose Ships
STCW95	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1995 Revision
ULSTEIN	Ulstein Group, provider of ship designs, shipbuilding and solutions in power and control systems, heavylift, crane & barge services
UNCLOS	United Nations Convention on the Law of the Sea
UV	Ultraviolet
WA	Western Australia
ZPI	Zone of Potential Influence

1 INTRODUCTION

The Zénaïde 3D Marine Seismic Survey (MSS) is a three-dimensional multi-client marine seismic survey proposed by Polarcus Seismic Limited (Polarcus) to be undertaken in Commonwealth waters located approximately 50 km off the Kimberley coast of northern Western Australia (WA). The Operational Area is located approximately 110 km north of Kalumburu in WA and approximately 370 km west from Darwin (*Figure 1.1*). The Acquisition Area covers an area of approximately 2,860 km^2 within the Bonaparte Basin (title block WA-522-P) and is 60 km from the mainland coast. The full-fold acquisition area is located in water depths of approximately 67 m - 97 m. Water depths in the wider Operational Area range from approximately 48 m – 97 m.

The Zénaïde 3D MSS is anticipated to commence as early as December 2017 following the acceptance of this Environmental Plan (EP) by NOPSEMA for the proposed activities. The survey is currently required to be completed by 30th April 2018, although this EP is proposed to remain valid until 31st December 2018 to allow for any unforeseeable schedule changes. The final timing of the survey will take into account client scheduling requirements, the seasonality of environmental and socio-economic sensitivities, vessel availability, weather conditions and other operational considerations.

An EP for the Zénaïde 3D MSS (NOPSEMA reference 4171) was accepted by NOPSEMA on 7th December 2017 and is valid until 31st December 2018. This document provides a summary of the EP.

1.1 EP NOMINATED LIAISON PERSON

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Email:	glenn.werth@polarcus.com

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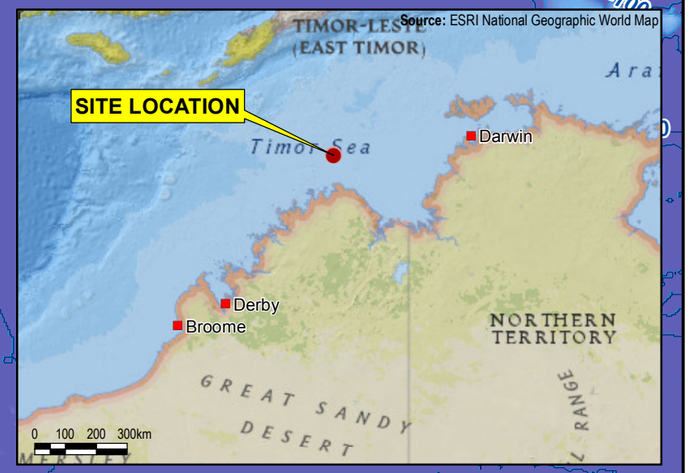

Gale Bank

Van Cloon Shoal

Favell Bank

Baldwin Bank

Penguin Shoal

Bassett-Smith Shoal

WA

KALUMBURU

Zénaïde Operational Area (GDA 94)

Point	Latitude	Longitude
1	-13° 16' 32.267"	126° 28' 36.272"
2	-13° 5' 13.627"	126° 19' 42.420"
3	-12° 43' 52.399"	126° 19' 56.026"
4	-12° 44' 26.926"	127° 34' 16.812"
5	-13° 16' 56.229"	127° 33' 55.669"

Zénaïde Acquisition Area (GDA 94)

Point	Latitude	Longitude
1	-12° 52' 25.481"	127° 14' 42.017"
2	-12° 57' 49.563"	127° 20' 9.316"
3	-13° 11' 30.406"	127° 20' 8.395"
4	-13° 11' 14.339"	126° 45' 8.410"
5	-13° 9' 54.964"	126° 45' 8.404"
6	-13° 9' 54.954"	126° 40' 8.414"
7	-13° 4' 54.971"	126° 40' 8.421"
8	-13° 4' 54.977"	126° 35' 8.415"
9	-12° 59' 54.976"	126° 35' 8.406"
10	-12° 59' 54.968"	126° 30' 8.418"
11	-12° 52' 1.049"	126° 30' 8.565"

Legend

- Proposed Acquisition Area
- Proposed Operational Area
- Coastal Waters (State Jurisdiction)
- 80m Depth Contour within Operational Area
- 60m Depth Contour within Operational Area
- 100m Depth Contour
- 20m Depth Contours (between 20 and 80 m)

Data source:
Zénaïde MC3D Areas - Client Provided 14 July 2017
Bathymetry Grid and Depth Contours - GA Australian Bathymetry 2009

Survey Location

1.1

Drawing No:	0413457b_Zenaide_G001_R3.mxd		Polarcus Zénaïde MC3D Environment Plan
Date:	03/11/2017	Drawing Size: A3	
Drawn By:	DR	Reviewed By: JE	Client: Polarcus Seismic Limited

Coordinate System: GDA 1994 MGA Zone 52

0 10 20 30km

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2 DESCRIPTION OF THE ACTIVITY

2.1 LOCATION

The Zénaïde 3D MSS Acquisition Area and Operational Area are located in the North-west Marine Region (NWMR) and in the Western Joseph Bonaparte Gulf Shelf sub-region (*Figure 1.1*).

The Acquisition Area comprises the area within which Polarcus currently anticipate the full-fold 3D seismic data acquisition will be undertaken and covers approximately 2,860 km^2 (*Figure 1.1*). The Acquisition Area overlaps the northern part of petroleum title block WA-522-P. Water depths within the Acquisition Area range from approximately 67 to 97 m.

The Operational Area incorporates the necessary space for vessel manoeuvring and ancillary activities (i.e. additional area for the purpose of line run-ins, run-outs, source testing, soft starts and turns etc.). The Operational Area covers approximately 7,900 km^2 and overlaps parts of petroleum title blocks WA-459-P to the east of the Acquisition Area and WA-34-R to the west of the Acquisition Area. The Operational Area is approximately 50 km from the north coast of Western Australia, approximately 110 km north of Kalumburu and approximately 375 km west from Darwin.

2.2 ACTIVITY DETAILS

The petroleum activity that forms the basis for this EP is the undertaking of a marine seismic survey. The seismic survey will be acquired using a seismic vessel towing both the seismic source (an array of 'airguns' which discharge compressed air underwater to create an oscillating bubble pattern) and the receivers (one or more cables or 'streamers' several kilometres in length containing 'hydrophones' to detect the returning signal and transmit it back to the vessel along the streamer).

Polarcus intend to acquire approximately 2,860 km^2 of seismic data during the Zénaïde 3D MSS in water depths of 67 m – 97 m. The seismic survey vessel will typically acquire seismic data along a series of adjacent and parallel lines in a "racetrack"- like pattern. At the end of each line, the vessel will turn in a wide arc to position for another parallel line in the opposite direction. When the vessel completes the line, it will turn again to follow another line offset approximately 750 m from the first. This pattern is repeated until the required coverage is completed. Acquisition lines will be in an east-west orientation (*Figure 2.1*).

Associated activities undertaken within the Operational Area in support of undertaking the survey are likely to include refuelling and resupply, use of support and supply vessels as required, and crew changes.

Key details of the Zénaïde 3D MSS relevant to the purpose and objectives of this EP are summarised in *Table 2.1* and described below.

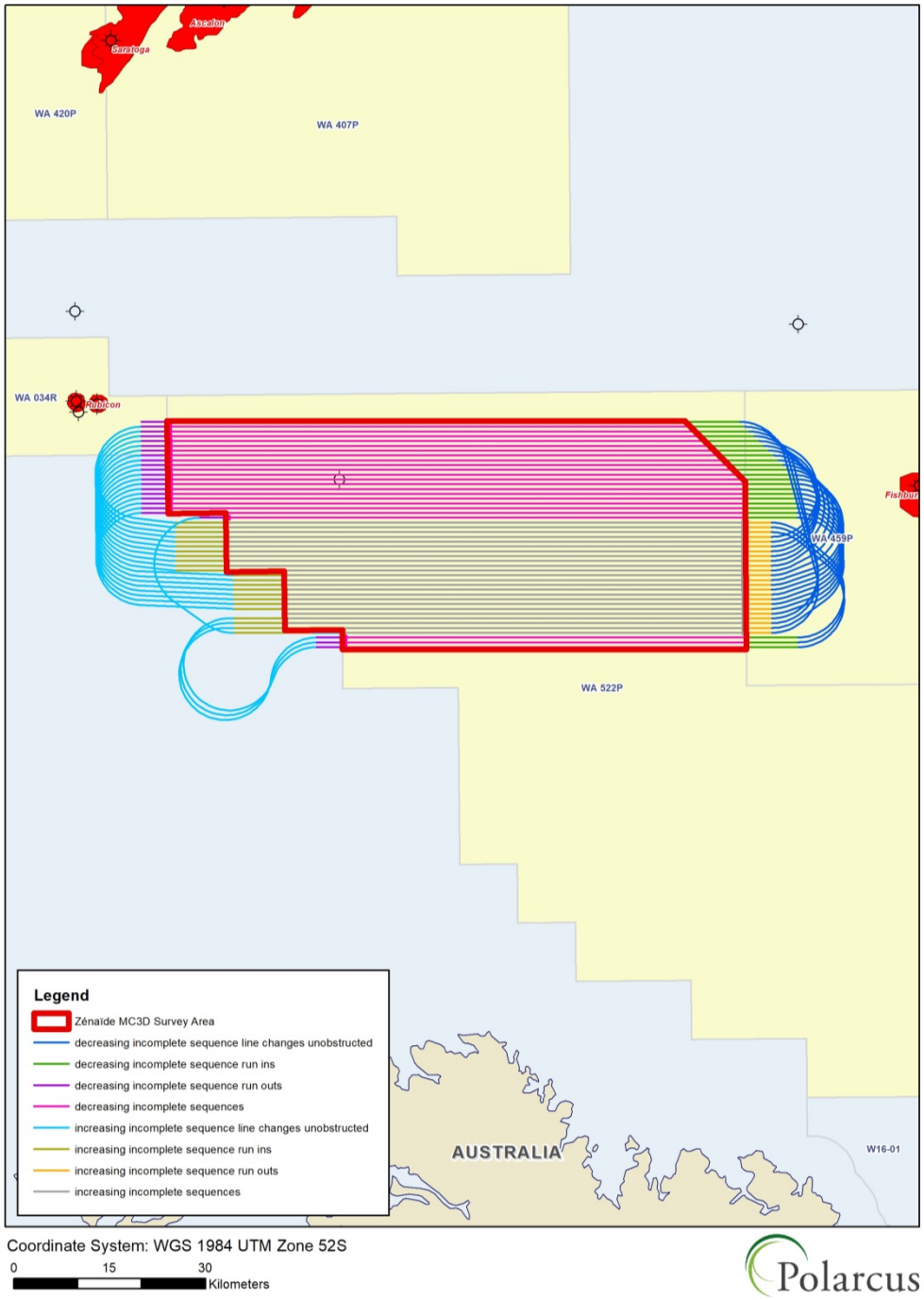


Figure 2.1 Indicative SurvOpt line plan for the Zénaïde 3D MSS Acquisition Area

Table 2.1 Key Seismic Survey Details

Feature	Indicative Information
Seismic vessel	
Number	One purpose built seismic vessel
Class	ULSTEIN SX124/134 and DNVGL CLEAN-DESIGN
Length	90-95 m
Beam	19-21 m
Gross tonnage	6,500-7,500 tonnes
Fuel type	Marine Gas Oil (MGO)
Fuel capacity	1,540-1,925 m^3
Largest fuel tank size	280 m^3
Number of personnel	60
Seismic Source	
Type	Airgun / three subarrays
Size	3,090 cubic inches
Pressure	2,000 pounds per square inch (psi) (nominal)
Source levels (McPherson et al. 2017)	249 dB re 1µPa @ 1 m (Pk) 225 dB re 1μPa^2.s @ 1 m (0.01–2 kHz)
Towing depth	5 – 10 m
Streamer	
Type	Solid
Number	10
Length	8,100 m (towed up to ~8,900 m behind the vessel)
Spacing	150 m
Towing depth	Approximately 15 m
Seismic Activity	
Speed	Approximately 4.5 knots
Seismic line spacing	Approximately 750 m
Discharge interval	Every approximately 12.5 m (approximately 5 seconds) along survey lines
Line orientation	East-West
Logistics	
Number of support vessels	Two
Refuelling	At sea every 10 to 14 days
Crew change	Via helicopter transfers every 35 days

2.3 SCHEDULE

The Zénaïde 3D MSS is proposed to commence acquisition as soon as December 2017 and will be completed before 31st December 2018.

The maximum number of data acquisition days will be 45 days. The total duration of the activity within the Operational Area, from first deployment to final retrieval and demobilisation, will be 60 days. This activity duration accounts for some operational and weather downtime, although it is possible that due to unforeseeable weather or operational circumstances some delay could occur and/or the seismic vessel may be required to temporarily depart from the Operational Area. However, the maximum total activity duration within the Operation Area will be 60 days and the maximum acquisition duration will be 45 days. The exact start and end dates for the Zénaïde 3D MSS will depend upon availability of vessels and the weather conditions.

3 DESCRIPTION OF THE ENVIRONMENT

This section describes the existing environment of the Operational Area and the Zone of Potential Influence (ZPI), the area that may be affected in the event of a credible "worst-case" hydrocarbon spill scenario.

3.1 REGIONAL CONTEXT

The Operational Area is located in Commonwealth waters within the Northwest Shelf (NWS) Province (*Figure 3.1*). The NWS Province is part of the wider North West Marine Region (NWMR) as defined under the Integrated Marine and Coastal Regionalisation of Australia (National Oceans Office and Geoscience Australia 2005). The region comprises Commonwealth waters from the Western Australian/ Northern Territory border to Kalbarri, south of Shark Bay and covers 1.07 million km^2 of tropical and subtropical waters (DEWHA 2008b).

3.2 PHYSICAL ENVIRONMENT

3.2.1 Climate

The climate of the region is characterised by two distinct seasons; a mild, dry winter during the months of April to September and a hot, wet summer during the months of October to March. There are often distinct transition periods between the summer and winter regimes, which are characterised by periods of relatively low winds.

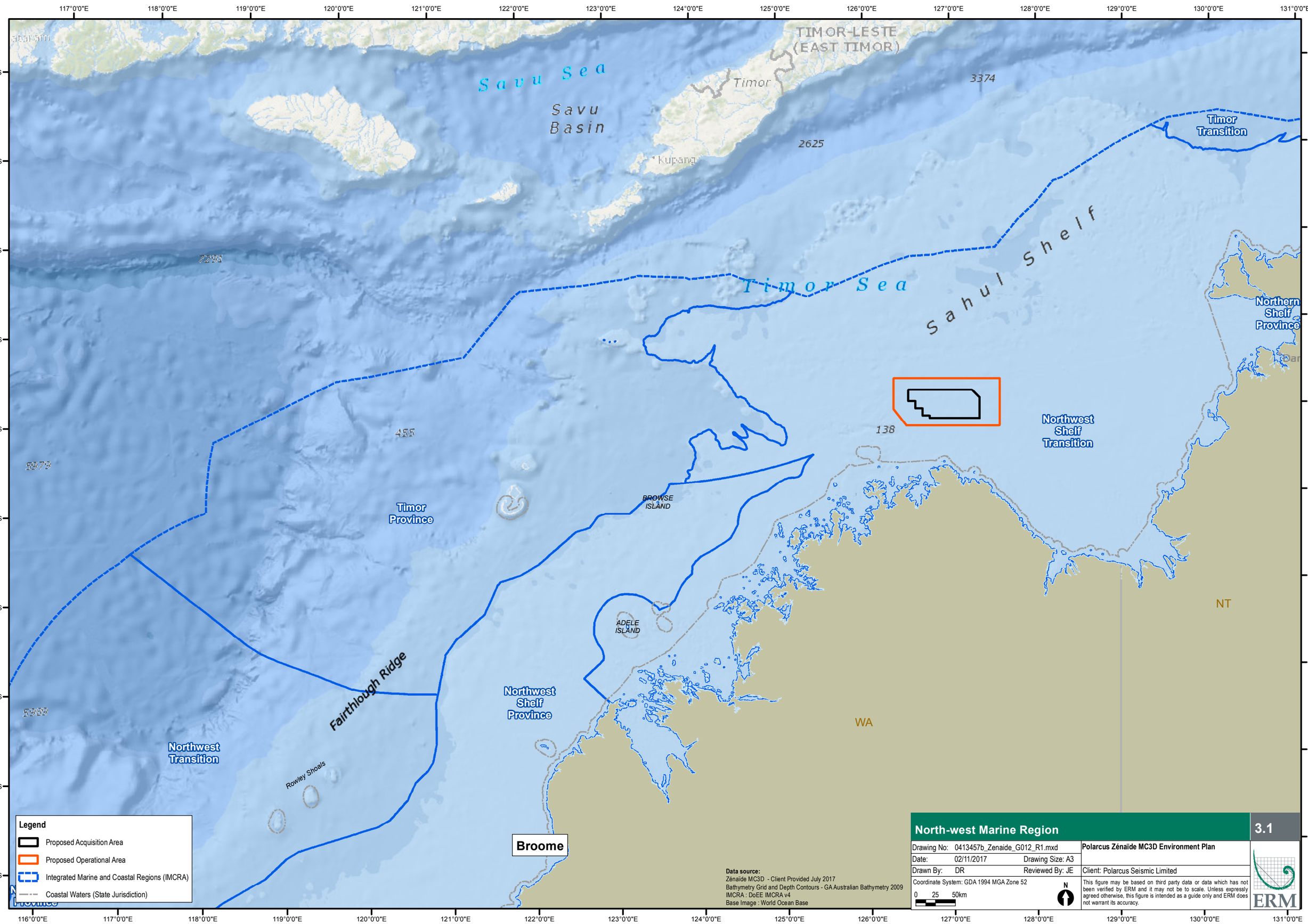
3.2.2 Tides

Tides in the region are semi-diurnal (two high tides and two low tides per day) and have a pronounced spring-neap cycle (DEWHA, 2008b). The region exhibits a considerable range in tidal height, from micro tidal ranges (<2 m) south-west of Barrow Island to macro tidal (>6 m) north of Broome (Holloway 1983; Brewer *et al.* 2007).

3.2.3 Waves

The wave climate in the region is influenced by sea and swell waves. Main swells in the region are from the south to the east (Andel and Veevers 1967). Waves within the region reflect the direction of the synoptic winds and flow predominantly from the south-west in the summer and from the east in the winter (Pearce *et al*. 2003).

Annual significant wave heights of up to 2.5 m occur in the Timor Sea while annual significant wave heights of only 0.25 m occur along the coastal region, with wave heights increasing with distance from the shore.


TIMOR-LESTE
(EAST TIMOR)
Timor
Savu Sea
Savu
Basin
Kupang
3374
2625
2293
Timor
Transition
Timor Sea
Sahul Shelf
Northern
Shelf
Province
455
138
Northwest
Shelf
Transition
5279
BROWSE
ISLAND
Timor
Province
ADELE
ISLAND
Fairthlough Ridge
Northwest
Shelf
Province
5283
NT
WA
Northwest
Transition
Rowley Shoals
Broome
Legend
Proposed Acquisition Area
Proposed Operational Area
Integrated Marine and Coastal Regions (IMCRA)
Coastal Waters (State Jurisdiction)
Data source:
Zénaïde MC3D - Client Provided July 2017
Bathymetry Grid and Depth Contours - GA Australian Bathymetry 2009
IMCRA : DoEE IMCRA v4
Base Image : World Ocean Base
North-west Marine Region
3.1
Drawing No: 0413457b_Zenaide_G012_R1.mxd
Polarcus Zénaïde MC3D Environment Plan
Date: 02/11/2017
Drawing Size: A3
Drawn By: DR
Reviewed By: JE
Client: Polarcus Seismic Limited
Coordinate System: GDA 1994 MGA Zone 52
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This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
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3.2.4 Currents

The Operational Area is dominated by surface currents heavily influenced by both tidal motions and The Indonesian Throughflow (ITF), which transports warm waters from the Pacific Ocean into the Indian Ocean through the Indonesian seas. The strength of the ITF is seasonal with it being weakened during the wet season when the strong south-westerly winds cause intermittent reversals of the currents (Brewer et al. 2007). The ITF and Leeuwin Current are strongest during late summer and winter (Holloway & Nye 1985; James *et al.* 2004). The Leeuwin Current, which originates in the region, flows southward along the edge of the continental shelf and is primarily a surface flow (up to 150 m deep).

3.2.5 Sea Temperature and Salinity

Sea temperatures and salinity in the region are heavily influenced by the warm, low salinity waters of the ITF. Surface waters have summer sea surface temperatures of approximately 26 ºC and winter temperatures of approximately 22 ºC (DEWHA 2008b).

3.2.6 Water Quality

The region is characterised by low background levels of metals and organics (Wenziker et al. 2006). The ITF brings in warm oligotrophic (low in nutrients) waters from the western Pacific Ocean through to the Indian Ocean (DEWHA 2008b).

3.2.7 Bathymetry and Geomorphology

The Acquisition and Operational Areas are located in the NWMR on the middle continental shelf which exhibits various geomorphic features. The geomorphic features present in the Operational Area, as described by (Przeslawski *et al*. 2011), include terrace, sill, basin and bank/shoal features (*Figure 3.2*).

The Acquisition Area has a depth range of 67 m to 97 m, while the Operational Area has a depth range of 48 m to 97 m. The KEF Carbonate banks and terrace of the Sahul Shelf System intersect the Acquisition Area (*Figure 3.3*). Two shoals located at the northern and western boundary of the Operational Area are Van Cloon Shoal and Penguin Shoal. Situated in the wider ZPI is Gale Bank, Baldwin Bank, Favell Shoal and Basset-smith Shoal. Also located in the wider area are the KEFs; Carbonate banks and terrace of the Sahul Shelf System, carbonate banks and terrace system of the Van Diemen rise and the pinnacle of the Bonaparte Basin.

The depth characteristics and distances to relevant banks and shoals are presented in *Table 3.1*.

Table 3.1 Banks and Shoals within or adjacent to the Operational Area

Bank/Shoals	Approximate shallowest depth [1]	Distance from Acquisition Area	Distance from Operational Area
Penguin Shoal	10 m	60 m contour is 60 km west	60 m contour is 32 km west
Gale Bank	22 m	60 m contour is 46 km NW	60 m contour is 27 km NW
Baldwin Bank	16 m	60 m contour is 20 km west	60 m contour is 1 km west
Van Cloon Shoal	14 m	60 m contour is 10.5 km to NW	60 m contour intersects; 40 m contour 5 km north
Favell Bank	22 m	60 m contour is 38 km NW	60 m contour is 17 km NW
Basset-Smith Shoal	5 m	60 m contour is 90 km WSW	60 m contour is 62 km WSW
Unnamed bank to the north of the north-eastern corner of the Acquisition Area	48 m	60 m depth contour located 8 km to the north	Minimum depth within the Operational Area is 48 m.
Unnamed bank to the east of the north-eastern corner of the Acquisition Area	50 m	60 m depth contour located 1.8 km to the east	Minimum depth within the Operational Area is 50 m, located 9 km north-east of the Acquisition Area.

1. National Imagery and Mapping Agency (2004); Geoscience Australia (2009)

3.2.8 Sedimentology

Sediments of the middle shelf region are predominantly influenced by tidal processes, including internal tides. The region comprises large areas of seabed that are dominated by soft sediments. The Joseph Bonaparte Gulf is an area of soft substrate expanses with localised rocky outcrops, gravel deposits, and raised features.

The soft sediments typically consist of sandy and muddy substrate, occasionally made up of patches of coarser sediments with accumulations of coral and gravel deposits (Baker *et al*. 2008). High concentrations of mud with localised bands of sand and gravel occur along the carbonate banks and terrace of the Sahul Shelf (Baker *et al*. 2008).

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128°0'0"E
13°0'0"S
14°0'0"S
WA

Legend

- Proposed Acquisition Area
- Proposed Operational Area
- Coastal Waters (State Jurisdiction)

Geomorphology

- Land
- Bank/shoals
- Basin
- Deep/hole/valley
- Pinnacle
- Plateau
- Reef
- Shelf
- Sill
- Terrace
- Tidal-sandwave/sand-bank

Data source:
Zénaïde MC3D - Client Provided July 2017
Bathymetry Grid and Depth Contours - GA Australian Bathymetry 2009
Geomorphology : Geomorphic Features of the Australian Margin GA 2006
Base Image : World Ocean Base

Geomorphology

3.2

Drawing No:	0413457b_Zenaide_G013_R1.mxd	**Polarcus Zénaïde MC3D Environment Plan**
Date:	02/11/2017	Drawing Size: A3
Drawn By:	DR	Reviewed By: JE
Client: Polarcus Seismic Limited		

Coordinate System: GDA 1994 MGA Zone 52

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3.3 ECOLOGICAL ENVIRONMENT

3.3.1 Key Ecological Features

Key Ecological Features (KEFs) are components of the Commonwealth marine environment recognised for their regional importance for either the region's biodiversity or ecosystem function and integrity (Commonwealth of Australia 2012). KEFs that are relevant to the Zénaïde 3D MSS are summarised in *Table 3.2* and shown in *Figure 3.3*, which also presents the level of overlap between KEFs and the Operational Area.

3.3.2 Plankton Communities

The primary driver of planktonic primary productivity in the region is from seasonal influences. In the tropical northern regions of Australia, higher phytoplankton concentrations, as indicated by surface chlorophyll concentrations, generally occur during the winter months (June to August) and are lower in summer (December to February) (Hayes *et al*. 2005), although there is some variability.

The sporadic/short-lived and potentially localised episodes of nutrient upwelling that occur in the region have the potential to influence higher plankton concentrations. Warm water from the ITF is thought to drive nutrients from deep water to shallower water within the euphotic zone up to 100 metres in depth (DEWHA, 2008). Such productivity may also be influenced by seasonal weather patterns such as monsoonal storms, tides and winds (Brewer et al. 2007).

Table 3.2 Key Ecological Features located in and around the Operational Area (Commonwealth of Australia 2012)

Key Ecological Feature	Present in Operational Area?	Present in ZPI?	Values	Description
The carbonate banks and terrace of the Sahul Shelf system	Yes	Yes	Unique seafloor feature with ecological properties of regional significance	Regionally important because of its likely ecological role in enhancing biodiversity and local productivity relative to its surrounds. The carbonate banks and terrace of the Sahul Shelf support a high diversity of organisms including reef fish, sponges, soft and hard corals, gorgonians, bryozoans, ascidians and other sessile filter feeders. The banks are known to be foraging areas for loggerhead, olive ridley and flatback turtles. Cetaceans and green and largetooth sawfish are likely to occur in the area. The carbonate banks and terraces of the Sahul Shelf System can extend to near-surface water (20 -30 m depth), however in the Acquisition Area the shallowest depth is 59 m. Therefore, in the presence of an oil spill, the carbonate banks and terraces would not be impacted due to the oil spill being confined to the surface layers.
Pinnacles of the Bonaparte Basin (North and North-West regions)	No (approximately 25 km north from the Operational Area at closest point)	Yes	Unique seafloor feature with ecological properties of regional significance	The pinnacles provide areas of hard substrate in an otherwise soft sediment environment and so are important for sessile species. The basin supports a high diversity of organisms including sessile benthic invertebrates, hard and soft corals, sponges, whips, fans, bryozoans and aggregations of demersal fish species such as snappers, emperors and groupers. Marine turtles including flatback, loggerhead and olive ridley are known to forage around the pinnacles. The flatback turtles are known to feed on squid eggs laid on the hard substrate of the pinnacles. The pinnacles of the Bonaparte Basin can extend to near surface (10 m – 20 m).

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Gale Bank
Van Cloon Shoal
Favell Bank
Baldwin Bank
Penguin Shoal
Bassett-Smith Shoal
WA
KALUMBURU

Legend

- Proposed Acquisition Area
- Proposed Operational Area
- Coastal Waters (State Jurisdiction)

Key Ecological Features

- Carbonate bank and terrace system of the Sahul Shelf
- Carbonate bank and terrace system of the Van Diemen Rise
- Pinnacles of the Bonaparte Basin

Data source:
Zénaïde MC3D - Client Provided July 2017
Bathymetry Grid and Depth Contours - GA Australian Bathymetry 2009
Key Ecological Features - DoEE KEF 2015

Key Ecological Features

3.3

Drawing No: 0413457b_Zenaide_G003_R2.mxd		Polarcus Zénaïde MC3D Environment Plan
Date: 02/11/2017	Drawing Size: A3	
Drawn By: DR	Reviewed By: JE	Client: Polarcus Seismic Limited

Coordinate System: GDA 1994 MGA Zone 52
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3.3.3 Benthic Habitats and Communities

The Operational Area is located on the middle continental shelf. The Operational Area features various geomorphic features including basins, sills, plateaus, shelves, banks and shoals (*Figure 3.2*).

Basin

Within the Operational Area is a low-relief expanse of unconsolidated sediment making up the Joseph Bonaparte Basin. A study conducted by Geoscience Australia in 2013 (Nichol et al., 2013) of the Oceanic Shoals AMP (*Figure 3.7*) found that the plains of the AMP are predominately covered by sandy silts with little hard substrates. The study found the plains to have sparse epifaunal communities likely due to increased unconsolidated sediments. The Oceanic Shoals showed signs of bioturbation, indicating an abundant infaunal community.

Plateau

Located in the western section of the Operational and Acquisition Area is the plateau geomorphic feature, a large relatively flat elevation that is usually higher than the surrounding relief with one or more relatively steep sides. A plateau feature is located in the south-western section of the Operational Area between 60 and 80 m depth. Plateaus are one of the least complex geomorphic features within the Operational Area and generally will have a high amount of homogenous soft sediments with potentially small areas of hard substrate (Przeslawski et al. 2011).

Sills

Sills occur as a sea floor barrier of relatively shallow depth restricting water movement between basins. Sills and ridges are characterised by soft sediments with high variation in epifaunal species richness. Seabed sediments on ridges contain moderate proportions of mud (similar to terraces and banks) and low proportions of gravel and carbonate (similar to plains and valleys). Sponge and octocoral populations may be present in the Operational Area though infaunal species richness is likely to be low (Przeslawski et al. 2011).

Banks and Shoals

Banks and shoals are elevated features with a relatively high proportion of hard substrate that may support patches of octocorals and sponges (Przeslawski et al. 2011). Banks and shoals comprising the southern edge of the wider Carbonate banks and terrace of the Sahul Shelf KEF intersect the Acquisition Area (*Figure 3.3*). Van Cloon Shoal is located on the north-west edge of the Operational Area and other banks and shoals occur on the eastern edge of the Operational Area. While the geomorphic features within the Operational Area have been defined as bank/shoal based on water depths less than 80 m, the bathymetry within the Acquisition Area (59 - 97 m) is on the lower limit of water depths where banks typically occur (20 – 60 m) (Przeslawski et al. 2011). Banks are located on the east side of the Operational Area, with Gale Bank, Baldwin Bank, Favell Shoal, Penguin Shoal and Basset-Smith Shoal present within the ZPI.

The bank and shoal geomorphological features between 11 m and 60 m depth are described as supporting relatively diverse and abundant epibenthic assemblages, comprising a mix of hard and soft substrata. Overall, banks and shoals were described supporting relatively low cover of epibenthos (28% total sessile invertebrates, 15% octocorals and 13% sponges) (Przeslawski et al. 2011).

The patches of rock outcrops supported relatively dense communities of soft octocorals (≤ 50% cover e.g. hydroids, sea whips, gorgonians), sponges (≤ 40% cover), and some very low coverage of diverse hard corals in shallow areas (Przeslawski et al. 2011). In contrast, the soft-sediments that interspersed these rock outcrops supported only low numbers of sponges and octocorals, along with low levels of bioturbation (Przeslawski et al. 2011). Banks also supported a diverse array of associated mobile fauna, such as crinoids, urchins, starfish and brittlestars (Przeslawski et al. 2011).

INPEX (2010) also took a limited number of samples at banks and shoals to the north-east and west of the Zénaïde Operational Area. These sites were described as sandy substrates with variable levels of abundance of sea fans, feather stars, soft corals, sea whips and sponges.

Surveys of other banks and shoals in this region by Heyward *et al.* (2010; 2011a; 2013) and ERM (2012) for PTTEP Australasia can also infer the benthic habitats and communities that may be associated with the bank features in the Zénaïde Operational Area. The shallowest areas of banks and shoals (mostly 20-30 m depth) have been found to comprise diverse, low relief reef areas supporting moderate to high cover of algae, hard corals, octocorals and sponges. Bare stones and rubble are also extensive and ubiquitous components of the benthos of the shoals down to 40 m depth, interspersed with the more diverse benthic primary producer organisms (Heyward et al. 2010; 2011a; 2013). Hard corals were typically found down to approximately 30 m depth, and observed to decline significantly as depths extended to 40-50 m. Hard coral cover beyond these depths was sparse and deeper portions of the upper slopes were predominately characterized by sand and scattered rubble patches with lower diversity and more sparsely populated filter-feeding biota such as sea fans, sea whips and sponges (ERM 2012).

Based on the information above, it is expected that the benthic habitats within the Acquisition Area and the broader Operational Area would consist of sandy substrate supporting a varying abundance of epifauna such as octocorals and sponges. Hard or reef forming coral presence is expected to be relatively low, due to the depths of the Operational Area (48 m) and the Acquisition Area (67 m) at the shallowest points.

Coral Reef Communities

Coral reef habitats have a high diversity of corals, associated fish and other species of both commercial and conservation importance. No coral reefs have been identified within the Operational Area. Troughton Island is the nearest fringing coral reef habitat, located approximately 50 km from the Operational Area, and the mainland being located approximately 51 km away from the Operational Area.

3.3.4 Fish Assemblages

The region contains a diverse range of fish of tropical Indo-west Pacific affinity that are characterised by high levels of endemism and species diversity (Allen *et al*. 1988; Commonwealth of Australia 2012; DEWHA 2008a). The North-west Transition Bioregion supports more than 505 species of demersal fish, of which 64 species are considered endemic (Last *et al*. 2005).

Fish Assemblages Associated with Banks and Shoals

The carbonate banks of the Sahul Shelf System are generally understood to host diverse fish communities.

Site-attached fish communities are typically associated with small, isolated patches of coral reef, where fish are able to move locally among the available habitat, but where their home range and potential for larger-scale fish movements beyond these areas may be prevented by the absence of contiguous and adjoining habitats (Ault and Johnson 1998; Nagelkerken 2009). The banks/shoals within the Operational Area (including those of the Carbonate bank and terrace system of the Sahul Shelf) may support some patchy coral reef and calcareous reef habitats supporting variable distributions of sponges, soft corals and other filter feeders, and it is therefore expected that some of these banks/shoals may support some site-attached fish. Coral and other abundant benthic primary producer habitat are more likely to be present in water depths less than 30 m, declining between 40 and 50m depth, and minimal to no coral cover is expected at depths greater than 60 m (Heyward *et al*. 2011a; 2013), and subsequently the presence of site-attached fish at those depths is not expected.

The highest levels of fish species richness and total abundance are generally observed at shallow depths (less than 30 m) and in association with reef substrate (Heyward et al 2011a; 2013). In water depths greater than 30 m, fish assemblages gradually become more dominated by species that are less restricted by habitat (many occur in a variety of habitats) and across large depth ranges (i.e. they are not restricted to specific habitats), although some site-attached species also occur in lower abundance in association with patches of reef and other biota down to approximately 60 m.

At depths greater than 60 m, fish assemblages are expected to be dominated by free-roaming species such as snappers, emperors and sharks.

3.3.5 Spawning of Commercially Targeted Fish Species

Seasonal spawning periods for commercial species occur throughout the year. The spawning seasons for a number of key commercially targeted species occur in the wider region. The WA Department of Fisheries (2013) guidance statement on undertaking seismic surveys in Western Australian waters reports the following key species and spawning periods in the North Coast Fisheries Bioregion:

- Blacktip shark (*Carcharhinus tilstoni and C. limbatus*): November to December;
- Rankin cod (*Epinephelus multinotatus*): August to October;
- Sandbar shark (*Carcharhinus plumbeus*): October to December;
- Spanish mackerel (*Scomberomorus commerson*): August to November: and
- Pink snapper (*Pagrus auratus*): May to July (rare occurrence in this region).

A desktop review of the ecological characteristics of these species suggests that the preferred spawning habitats for the majority of those identified by DOF primarily include hard/rocky substrates, reefs, and/or shallow coastal waters. Many of the identified species spawn in coastal waters and the Operational Area is not expected to be of particular significance for spawning of these species compared to anywhere else in the region.

Goldband snapper and red emperor also spawn throughout the region and have been identified as significant indicator species that may spawn within and around the Operational Area. Consultation with the WA Department of Primary Industries and Regional Development (DPIRD, formerly Department of Fisheries) and a comprehensive desktop review indicated that adult goldband snapper occur in continental shelf waters in depths of 40-245 m, in association with offshore reefs, shoals, and areas of hard flat bottom with occasional benthos or vertical relief, and often form large schools (Ovenden *et al.* 2004; Newman *et al*. 2008). ERM (2012) also recorded adult goldband snapper over relatively featureless sediment habitats in 80 m to 90 m water depths in the Montara, Padthaway, Bilyara and Tahbilk gas fields, in the south-western part of the Operational Area, but did not observe this species at similar depths on the slopes of shoals in the region. Juveniles typically occur on uniform sedimentary habitat with no relief (Newman *et al*. 2008).

The Department of Fisheries (2013) guidance statement reports that goldband snapper spawns between January and April with a peak predicted in March. However, consultation with Principal Research Scientists at DPIRD (Fisheries) identified that:

- The species is more typically found between approximately 50 m and 200 m water depths, with evidence of a greater concentrations associated with submerged ancient coastline between 80 m and 140 m depths;
- The species is a schooling species and likely spawn throughout their range, noting the concentration of adults between 80 m and 140 m depth contours;

- Goldband snapper are serial/multiple batch spawners, releasing multiple batches of eggs into the water column over a wide area during the spawning period, and likely spawn every few days throughout the spawning period, or in response to environmental cues such as water temperature and the moon cycle;
- Recent data collection and analyses undertaken since the Department of Fisheries (2013) Guidance Statement was published, indicates that spawning more likely occurs between September and May, with peaks occurring between December and March;

Although goldband snapper are understood to be broadcast spawners, it is also understood that eggs and larvae do not travel long distances between regions and there is limited genetic connectivity between the northern Kimberley stock and stocks in the Timor and Arafura Seas, the west Kimberley stock around Broome, and the Pilbara and Exmouth stocks (Lloyd et al. 2000; Newman et al. 2000; Ovenden et al. 2002; Newman et al. 2008; Department of Fisheries 2015). The Kimberley stock and its spawning biomass are assumed to be separate, as both larval dispersal and movement of adults between the stocks is understood to be negligible (Department of Fisheries 2015; Newman et al. 2008; Lloyd et al. 2000; Newman et al. 2000; Ovenden et al. 2002).

While adults are understood to be a relatively vagile (free to move) species, the genetic subdivision indicates constrained home ranges and limited migration of adults over long distances, potentially where significant changes in water depth or other factors may influence adult movements (Ovenden *et al*. 2004). The range of the North Kimberley stock is therefore considered separate from the adjacent Timor and Arafura Seas stocks to the east, Indonesian stocks to the north, and the west Kimberley (Broome) stock. The geographical extent of the north Kimberley stock appears to encompass genetically similar sub-stocks identified over the following range (Lloyd *et al*. 2000; Newman *et al*. 2000; Ovenden *et al.* 2002; Department of Fisheries 2015):

- at least as far to the west as 14.9^{o}S, 122.0^{o}E (Lynher Bank), but unlikely as far west as the Broome stock sampled at 17.5^{o}S, 120.5^{o}E;
- including areas near Vulcan Shoal sampled at approximately 12.5.0^{o}S, 124.3^{o}E; and
- at least as far east as 12.0^{o}S, 126.0^{o}E, but unlikely as far east as the Timor Sea stock sampled at 10.2^{o}S, 129.5^{o}E.

Red emperor may also spawn in offshore waters in the region. They are widely distributed across the continental shelf in up to 180 m water depths and are associated with reefs, lagoons, epibenthic communities, limestone sand flats and gravel patches (Newman *et al*. 2008). The species spawns between at least October and March, with a peak in October (Newman et al. 2008, Department of Fisheries 2013). The species is also a serial batch spawner, releasing multiple batches of eggs into the water column over a wide area during the spawning period. While movement of adults between the Gascoyne, Pilbara and Kimberley stocks is understood to be limited, the stocks across northern Australia (from north Queensland to the mid-west coast of WA) are understood to be biologically

connected, with genetic homogeneity maintained by the wide dispersal of pelagic eggs and larvae between these regions (Newman *et al*. 2008; Department of Fisheries 2015).

Also of note in proximity to the Operational Area is the single known spawning ground for southern bluefin tuna in the Indian Ocean, extending between northern WA and Java from 7° S to 20° S. Spawning grounds are broadly understood to occur approximately 125 km to the west of the Operational Area (DOE 2015a; Majkowski *et al*. 1988) (*Figure 3.5*). Spawning occurs between August and April (with a peak period from October to February) (DOE 2015a).

3.3.6 Threatened and Migratory Species Overview

A search of the EPBC Act Protected Matters Database was undertaken to identify the likelihood of occurrence of listed fauna within and around the Operational Area (including a 10 km buffer) and the ZPI (including a 200km buffer). The search identified 20 threatened species, 20 threatened and migratory species and 36 migratory bird species. The following sections describe the identified listed threatened and migratory species.

3.3.7 Birds

Many migratory shorebirds (including those frequenting offshore islands) and seabird species are known to occur in the region. Migratory shorebird species forage and rest in the region on their way between Northern Hemisphere breeding grounds and Northern Australian feeding grounds, known as the East Asian–Australasian Flyway.

Thirty-four species of seabird listed as threatened, migratory and/or marine under the EPBC Act are known to occur regularly in the North-west Marine Region; another seven listed species may infrequently occur (DEWHA, 2008b). Nine sole migratory birds and two threatened and migratory bird species were identified by a search of the EPBC Act Protected Matters Database as potentially occurring in the Operational Area through foraging, feeding, breeding or other related behaviours.

The three estuaries at the head of the Joseph Bonaparte Gulf (located approximately 200 km away from the Operational Area) (the Keep, Victoria and Fitzmaurice Rivers) support seabird and shorebird colonies of 10,000–15,000 birds. The Anson Bay to Fog Bay area, on the eastern side of the Joseph Bonaparte Gulf, is one of the most important areas for colonial waterbird breeding in the Northern Territory. There is extensive shorebird feeding and roosting habitat in Fog Bay, Anson Bay and the Little Moyle River (DEWHA, 2008b).

The Operational Area is located 51 km from the nearest coastline, and 50 km from the nearest island, Troughton Island. Troughton Island and the surrounding waters are foraging areas for a number of bird species. The BIAs of two birds overlaps with the Operational Zone, the Lesser Frigatebird and Lesser Crested Tern.

126°0'0"E
127°0'0"E
128°0'0"E
13°0'0"S
14°0'0"S

Gale Bank
Van Cloon Shoal
Favell Bank
Baldwin Bank
Penguin Shoal
Bassett-Smith Shoal

Lesser Crested Tern
Lesser Crested Tern
Lesser Crested Tern
Lesser Frigatebird
Lesser Crested Tern
Lesser Frigatebird
Lesser Crested Tern
Roseate Tern
Roseate Tern
Lesser Crested Tern
Lesser Crested Tern
Roseate Tern
Little Tern
Roseate Tern
Roseate Tern
Lesser Crested Tern
Lesser Crested
Roseate Tern
Roseate Tern
Little Tern

WA
KALUMBURU

Legend
- Proposed Acquisition Area
- Proposed Operational Area
- Coastal Waters (State Jurisdiction)
- Biologically Important Areas - Seabirds

Data source:
Zénaide MC3D - Client Provided July 2017
Bathymetry Grid and Depth Contours - GA Australian Bathymetry 2009
Biologically Important Areas : DoEE BIA 2016

Biologically Important Areas - Seabirds

3.4

Drawing No:	0413457b_Zenaide_G007_R2.mxd		**Polarcus Zénaïde MC3D Environment Plan**
Date:	02/11/2017	Drawing Size: A3	
Drawn By:	DR	Reviewed By: JE	Client: Polarcus Seismic Limited

Coordinate System: GDA 1994 MGA Zone 52

0 10 20 30km

N

ERM

3.3.8 Marine Reptiles

Marine Turtles

Six threatened and migratory turtle species were identified in the EPBC Act Protected Matters Database search as having the potential to occur in the vicinity of the Operational Area.

There are several BIAs for turtle species throughout the region, including along the Kimberley coastline and islands in close proximity to the Operational Area. In addition, 'Habitat Critical' areas have recently been identified in the Recovery Plan for Marine Turtles in Australia (Department of the Environment and Energy 2017) to supplement the BIA dataset, and these draft areas are presented in *Figure 3.5*. A summary of all existing and proposed nesting and internesting BIAs and Habitat Critical Areas within 200 km of the Operational Area is presented in *Table 3.3* No internesting or nesting BIAs or Habitat Critical overlap with the Operational Area.

Foraging BIAs are also presented in *Figure 3.5*. These include the following:

- Flatback, olive ridley and loggerhead turtles are known to forage on the carbonate banks of the Sahul Shelf and the limestone pinnacles of the Bonaparte Basin. This area is identified as a year-round foraging BIA for the species (*Figure 3.5*). Approximately 800 km^2 of the north-eastern part of the Acquisition Area overlaps the BIA (approximately 3% of the BIA).

- A year-round foraging BIA for the green turtle and olive ridley turtles overlaps approximately 90 km^2 (less than 1% of the BIA) of the south-east corner of the Operational Area, but is located approximately 18 km south-east of the Acquisition Area (*Figure 3.5*).

Based on the information above, foraging and transient turtles are likely to be encountered year-round throughout the Operational Area. Internesting BIAs do not occur within the Operational Area. It is recognised that adult turtles will be present throughout the year and as they move between internesting and foraging habitats in this region.

Sea snakes

At least 20 species of sea snake occur within the region (DEWHA 2008b). Amongst these species, two threatened and 18 listed marine sea snake species were identified to be listed on the EPBC Act Protected Matters Database search as potentially occurring in the Operational Area. The two threatened species identified, namely the short-nosed sea snake and the leaf-scaled sea snake, are endemic to WA.

No significant coral reefs are understood to occur within the Operational Area and so sea snakes are expected to occur in low numbers.

Table 3.3 Turtle nesting and internesting BIAs and Habitat Critical areas within 200 km of the Operational Area (Department of the Environment and Energy 2017)

Species	*Nesting Location*	*Internesting buffer*	*Time of Year*
Green Turtle (North West Shelf stock)	Cassini Island (120 km SW from the Operational Area)	20 km BIA buffer (100 km SW from the Operational Area)	November - March
	Maret Island (205 km SW from the Operational Area)	20 km Habitat Critical area buffer (not yet digitised – approximately 185 km SW from the Operational Area)	
	Mainland east of Mary Island to mainland adjacent to Murrara Island including all offshore islands (>60 km SW from the Operational Area)	20 km Habitat Critical area buffer (40 km SW from the Operational Area)	
Flatback Turtle (Cape Domett stock)	Cape Domett and Lacrosse Island (180 km SE from the Operational Area)	90 km BIA buffer (90 km SE from the Operational Area) 60 km habitat critical area buffer (120 km SE from the Operational Area)	All Year (Peak: August – September)
Flatback Turtle (Kimberley stock)	Maret Island (205 km SW from the Operational Area)	60 km Habitat Critical area buffer (not yet digitised – approximately 145 km SW from the Operational Area)	May - July
	Montilivet Islands (170 km SW from the Operational Area)	60 km Habitat Critical area buffer (not yet digitised – approximately 110 km SW from the Operational Area)	
	Cassini Island (120 km SW from the Operational Area)	60 km Habitat Critical area buffer (not yet digitised – approximately 60 km SW from the Operational Area)	
	Coronation Islands and Lamarck Island (220 km SW from the Operational Area)	60 km Habitat Critical area buffer (not yet digitised – approximately 160 km SW from the Operational Area)	
	Napier-Broome Bay Islands, near Kalumbaru (West Governor Island, Sir Graham Moore Island) (65 km south of the Operational Area)	60 km Habitat Critical area buffer (not yet digitised – approximately 5 km south of the Operational Area; ~15 km south of the Acquisition Area)	

126°0'0"E
127°0'0"E
128°0'0"E
13°0'0"S
14°0'0"S

Gale Bank
Van Cloon Shoal
Favell Bank
Baldwin Bank
Penguin Shoal
Bassett-Smith Shoal
WA
KALUMBURU

Legend

- Proposed Acquisition Area
- Proposed Operational Area
- Coastal Waters (State Jurisdiction)

Biologically Important Areas

- Flatback Turtle
- Loggerhead Turtle
- Olive Ridley Turtle
- Green Turtle

Data source:
Zénaïde MC3D - Client Provided July 2017
Bathymetry Grid and Depth Contours - GA Australian Bathymetry 2009
Biologically Important Areas : DoEE BIA 2016, Marine Turtle Critical Habitat BIA 2017

Biologically Important Areas - Marine Turtles

3.5

Drawing No:	0413457b_Zenaide_G006_R2.mxd		Polarcus Zénaïde MC3D Environment Plan
Date:	06/11/2017	Drawing Size: A3	
Drawn By:	DR	Reviewed By: JE	Client: Polarcus Seismic Limited

Coordinate System: GDA 1994 MGA Zone 52
0 10 20 30km
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ERM

3.3.9 Marine Mammals

Species of marine mammals are known to occur in the region and have wide distributions that are associated with feeding and migration patterns linked to reproductive cycles. There are 25 species of marine mammals that occur in the waters of the region. This includes threatened and or/migratory species, which were identified by a search of the EPBC Act Protected Matters Database as potentially occurring in and around the Operational Area.

There are no known important breeding and foraging habitats for listed marine mammals within the Operational Area.

Several biologically important areas for cetacean species have been identified within the wider region:

- The Australian snubfin dolphin breeding/calving BIA is located along the Kimberley coastline approximately 40 km from the Operational Area (*Figure 3.6*). Therefore, encounters within the Operational Area are unlikely or would be limited to low numbers.

- The Indo Pacific Humpback Dolphin foraging BIA is located along the Kimberley coastline approximately 65 km from the Operational Area (*Figure 3.6*). Therefore, encounters within the Operational Area are unlikely or would be limited to low numbers. The species was not identified in the *EPBC Act* Protect Matters Search results for the Operational Area plus a 10 km buffer.

- The pygmy blue whale migration BIA is over 330 km to the north-west of the Operational Area (*Figure 3.6*) where it passes along the shelf edge at depths between 500 m and 1,000 m. The broader distribution BIA is located 180 km to the north-west. Therefore, pygmy blue whales are expected to be rare in the Operational Area.

- The humpback whale migration BIA extends along the length of the coast of Western Australia, to its northernmost extent offshore of the Kimberley region (*Figure 3.6*). The northern boundary of the BIA is approximately 219 km south-west from the Operational Area. As part of the BIA, Camden Sound (over 300 km away) is recognised as the main humpback whale breeding and calving ground (DSEWPaC 2012a). Therefore, humpback whales are expected to be rare in the Operational Area.

3.3.10 Sharks and Rays

Eleven species of threatened and/or migratory sharks and rays were identified by a search of the EPBC Act Protected Matters Database as potentially occurring in and around the Operational Area, many of which are typically found in coastal waters.

The BIA foraging area for the Whale Shark is located approximately 72 km to the west of the Operational Area *(Figure 3.6*).

125°0'0"E
126°0'0"E
127°0'0"E
128°0'0"E
129°0'0"E
12°0'0"S
13°0'0"S
14°0'0"S

Mangola Shoal
Pee Shoal
Jabiru Shoals
Unnamed Shallow Areas
Unnamed Shallow Areas
Goeree Shoal
Eugene McDermott Shoal
Gale Bank
Van Cloon Shoal
Favell Bank
Baldwin Bank
Penguin Shoal
Bassett-Smith Shoal
KALUMBURU
WA

Legend

- Proposed Acquisition Area
- Proposed Operational Area
- Coastal Waters (State Jurisdiction)

Biologically Important Areas

- Australian Snubfin Dolphin
- Indo-Pacific Humpback Dolphin
- Humpback Whale
- Pygmy Blue Whale
- Whale Shark

Data source:
Zénaïde MC3D - Client Provided July 2017
Bathymetry Grid and Depth Contours - GA Australian Bathymetry 2009
Biologically Important Areas : DoEE BIA 2016

Biologically Important Areas - Marine Mammals

3.6

Drawing No:	0413457b_Zenaide_G004_R3.mxd		Polarcus Zénaïde MC3D Environment Plan
Date:	02/11/2017	Drawing Size: A3	
Drawn By:	DR	Reviewed By: JE	Client: Polarcus Seismic Limited

Coordinate System: GDA 1994 MGA Zone 52

0 10 20 30km

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ERM

3.3.11 Timing of Key Ecological Sensitivities

Table 3.4 shows the approximate timing of key ecological sensitivities that may occur within or in proximity to the Operational Area.

Table 3.4 Timing of Key Ecological Sensitivities within or in proximity to the Operational Area

	January	February	March	April	May	June	July	August	September	October	November	December
Corals: spawning												
Green turtle: North West Shelf genetic stock nesting												
Green turtle: foraging												
Flatback turtle: foraging												
Flatback turtle: Cape Dormet genetic stock nesting												
Flatback turtle: Kimberley genetic stock nesting												
Hawksbill turtle: foraging												
Olive Ridley Turtle: foraging												
Blue whales: northern migration												
Blue whales: southern migration												
Whale shark: foraging												
Goldband snapper spawning												
Red emperor spawning												
Key:	Peak Times											

3.4 SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

3.4.1 Protected Areas

A network of Australian Marine Parks (AMPs) has been formed around Australia as part of a national representative system of marine protected areas.

The Zénaïde 3D MSS is located within the North and North-west Networks. The Kimberley and Oceanic Shoals Marine Parks are the closest, located adjacent to the Operational Area and within the ZPI. These protected areas are shown in *Figure 3.7* and described below, including their key conservation values.

The proposed North Kimberley Marine Park is located within WA State waters, approximately 30 km from the Operational Area. The marine park is located beyond the extent of the ZPI, as defined through hydrocarbon spill modelling. The Joseph Bonaparte Gulf Marine Park is also located beyond the extent of the ZPI.

3.4.2 Commercial Fisheries

The diverse range of habitats and species within the region has allowed for various fisheries to develop and operate throughout the region.

Based on information regarding effort expected from these fisheries within the Operational Area from the latest AFMA fisheries status report (AFMA 2015) and the latest State of the Fisheries reports (Fletcher et al. 2017), the distribution and habitat preferences of the target species, fishing techniques and seasonality, the fisheries with the potential to interact with the Zénaïde 3D MSS are:

- Northern Prawn Fishery
- Kimberley Prawn Managed Fishery
- Northern Demersal Scalefish Fishery
- Mackerel Managed Fishery
- Northern Shark Fishery (Joint Authority Shark Fishery and Western Australia North Coast Shark Fishery)

3.4.3 Petroleum Exploration and Production

The region currently supports a number of industries including petroleum exploration and production. Approved and prospective petroleum development or exploration activities exist within the region, although no production licences or offshore facilities currently exist within or adjacent to the Operational Area. The INPEX Ichthys Gas Export Pipeline passes within the north-west corner of the Operational Area but is not within the Acquisition Area (*Figure 3.10*).

Table 3.5 Australian Marine Parks within and surrounding the Operational Area

Reserve Name	Overview	Conservation and Natural Values
Australian Marine Parks (AMPs)		
Oceanic Shoals **Multiple Use Zone – IUCN Category VI**	• Forms part of the proposed North Network • The Oceanic Shoals Marine Park has a total surface area of 71,744 km^2 with water depths ranging between 15 – 500 m (DOE 2015e). • The Oceanic Shoals Marine Park is located approximately 19 km north of the Acquisition Area and approximately 4 km north of the Operational Area.	• Important resting area for turtles between egg laying (internesting area), for the threatened flatback turtle and olive ridley turtle • Important foraging area for the threatened loggerhead turtle and olive ridley turtle • Four key ecological features represented in the reserve o Carbonate bank and terrace system of the Van Diemen Rise (unique sea-floor feature) o Carbonate banks of the Joseph Bonaparte Gulf (enhanced productivity, unique sea-floor feature) o Pinnacles of the Bonaparte Basin (enhanced productivity, unique sea-floor feature) o Shelf break and slope of the Arafura Shelf (unique sea-floor feature)
Kimberley **Only the Multiple Use Zone – IUCN Category VI is within the ZPI**	• Forms part of the proposed North-west Network • The Kimberley Marine Park has a total surface area of 74,469 km^2 with water depths ranging between 15 – 800 m (DOE 2015b). • The Operational Area abuts the Multiple Use Zone, overlapping just 0.07 km^2. The Acquisition Area is located over 20 km to the north-east of the Multiple Use Zone.	• Important foraging areas for migratory seabirds, migratory dugongs, migratory whale sharks, dolphins and threatened and migratory marine turtles • Breeding and calving habitat for inshore dolphins • Important migration pathway, calving and nursery areas for the protected humpback whale (not within the Zénaïde ZPI) • Migratory pathway for pygmy blue whales (not within the Zénaïde ZPI) • Breeding habitat for seabirds • Internesting and nesting habitat for marine turtles, including important nesting sites for green turtles • Adjacent to important foraging and pupping areas for sawfish • Two ecological features are included in the reserve: o Ancient coastline (an area of enhanced productivity attracting baitfish) o Continental slope demersal fish communities (the second richest area for demersal fish species in Australia).

126°0'0"E
127°0'0"E
128°0'0"E
13°0'0"S
14°0'0"S

Oceanic Shoals CMR

Gale Bank
Van Cloon Shoal
Favell Bank
Baldwin Bank
Penguin Shoal
Bassett-Smith Shoal

Kimberley CMR

WA

KALUMBURU

Joseph Bonaparte Gulf CMR

Legend

- Proposed Acquisition Area
- Proposed Operational Area
- Coastal Waters (State Jurisdiction)

Commonwealth Marine Reserves

- Multiple Use Zone (IUCN VI)

Data source:
Zénaïde MC3D - Client Provided July 2017
Bathymetry Grid and Depth Contours - GA Australian Bathymetry 2009
Marine Reserves : DoEE CAPAD Marine 2016

Commonwealth Marine Reserves

3.7

Drawing No:	0413457b_Zenaide_G002_R2.mxd		Polarcus Zénaïde MC3D Environment Plan
Date:	02/11/2017	Drawing Size: A3	
Drawn By:	DR	Reviewed By: JE	Client: Polarcus Seismic Limited

Coordinate System: GDA 1994 MGA Zone 52

0 10 20 30km

N

ERM

125°0'0"E
126°0'0"E
127°0'0"E
128°0'0"E
12°0'0"S
13°0'0"S
14°0'0"S

Gale Bank
Van Cloon Shoal
Favell Bank
Baldwin Bank
Penguin Shoal
Bassett-Smith Shoal

KALUMBURU
WA

Legend

- Proposed Acquisition Area
- Proposed Operational Area
- Coastal Waters (State Jurisdiction)
- Kimberley Prawn Managed Fishery
- Northern Prawn Fishery (Commonwealth - AFMA Managed Fishery)
- Pearling Leases

Pearl Oyster Fishery

- Kimberley Development Zone
- Pearl Oyster Managed Fishery Zone 3

Data source:
Zénaïde MC3D - Client Provided July 2017
Bathymetry Grid and Depth Contours - GA Australian Bathymetry 2009
Commonwealth Fisheries : GA 2006
WA Fisheries : WA Department of Fisheries 2015

Pearl Oyster and Prawn Fisheries

3.8

Drawing No:	0413457b_Zenaide_G005_R2.mxd		**Polarcus Zénaïde MC3D Environment Plan**
Date:	02/11/2017	Drawing Size: A3	
Drawn By:	DR	Reviewed By: JE	Client: Polarcus Seismic Limited

Coordinate System: GDA 1994 MGA Zone 52

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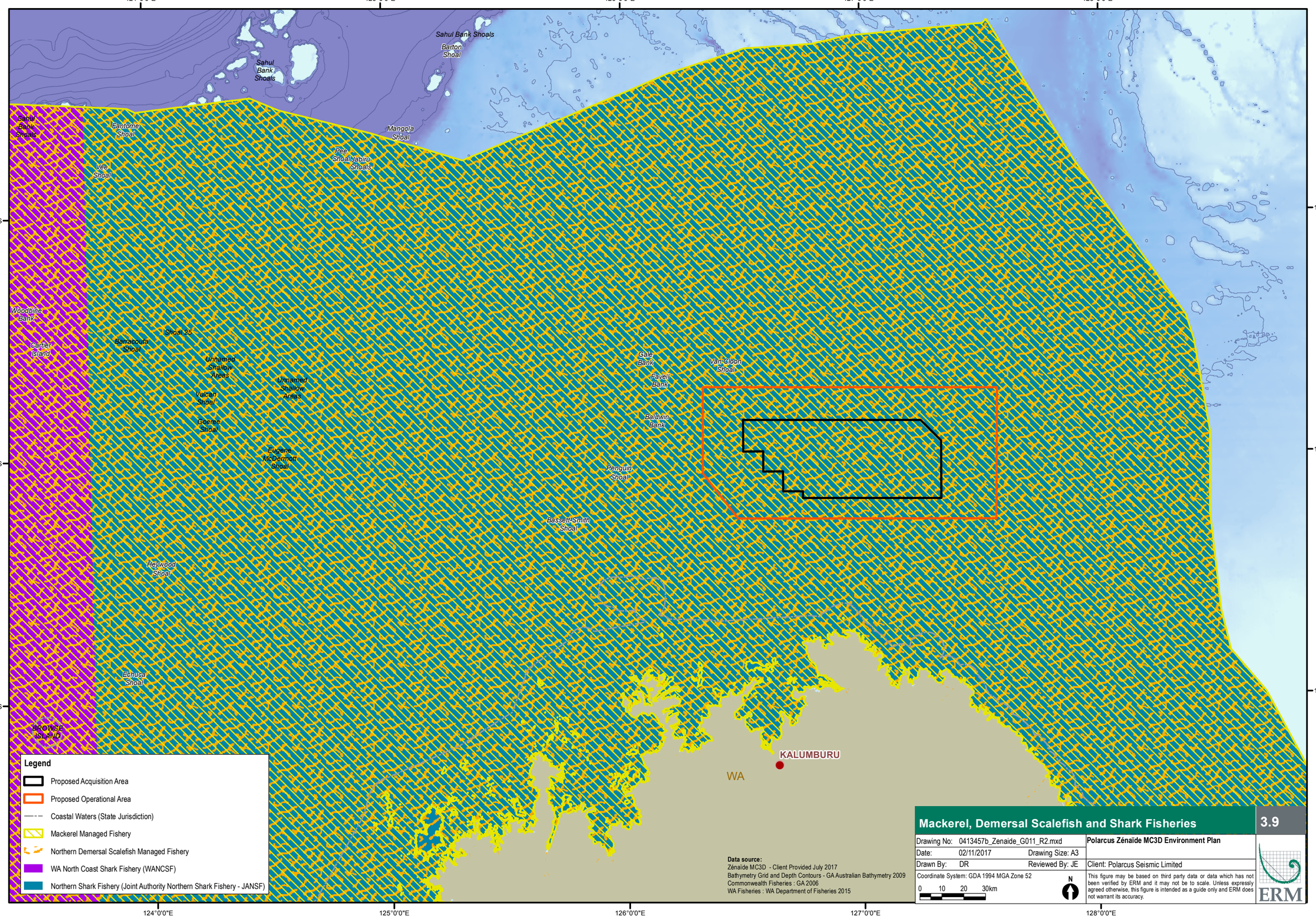
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Sahul Bank Shoals
Barton Shoal
Sahul Bank Shoals
Fantome Shoal
Mangola Shoal
Pee Shoal
Jabiru Shoals
Vee Shoal
Woodbine Bank
Cartier Island
Barracouta Shoal
Shoal 25
Unnamed Shallow Areas
Vulcan Shoal
Goeree Shoal
Unnamed Shallow Areas
Eugene McDermott Shoal
Cale Bank
Favell Bank
Van Cloon Shoal
Baldwin Bank
Penguin Shoal
Bassett-Smith Shoal
Heywood Shoal
Echuca Shoal
BROWSE ISLAND
KALUMBURU
WA
Legend
Proposed Acquisition Area
Proposed Operational Area
Coastal Waters (State Jurisdiction)
Mackerel Managed Fishery
Northern Demersal Scalefish Managed Fishery
WA North Coast Shark Fishery (WANCSF)
Northern Shark Fishery (Joint Authority Northern Shark Fishery - JANSF)
Data source:
Zénaide MC3D - Client Provided July 2017
Bathymetry Grid and Depth Contours - GA Australian Bathymetry 2009
Commonwealth Fisheries : GA 2006
WA Fisheries : WA Department of Fisheries 2015
Mackerel, Demersal Scalefish and Shark Fisheries
3.9
Drawing No: 0413457b_Zenaide_G011_R2.mxd
Polarcus Zénaïde MC3D Environment Plan
Date: 02/11/2017
Drawing Size: A3
Drawn By: DR
Reviewed By: JE
Client: Polarcus Seismic Limited
Coordinate System: GDA 1994 MGA Zone 52
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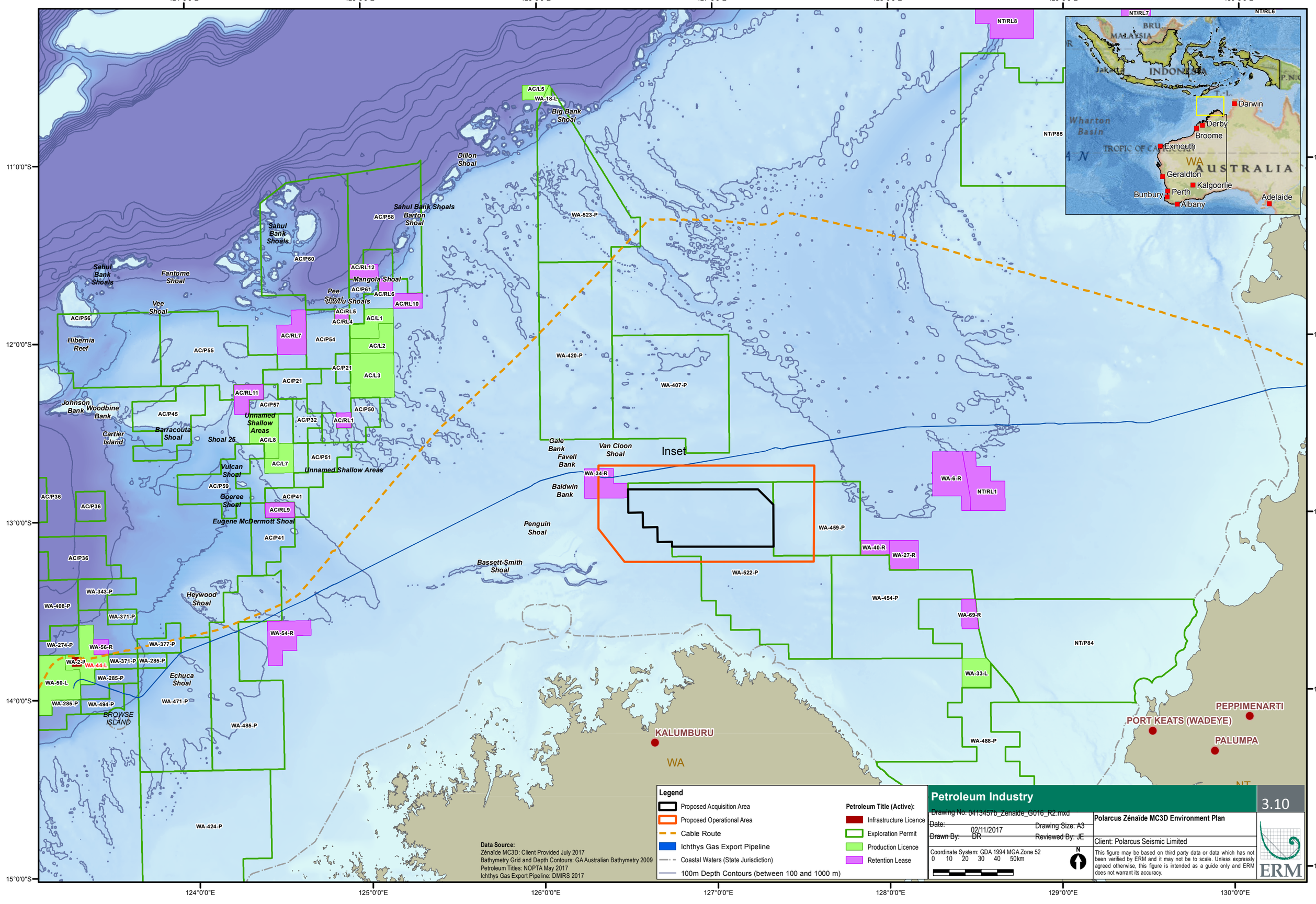
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13°0'0"S
14°0'0"S
15°0'0"S
NT/RL8
NT/RL7
NT/RL6
NT/P85
AC/L5
WA-18-L
Big Bank Shoal
Dillon Shoal
Sahul Bank Shoals
Barton Shoal
AC/P58
AC/P60
AC/RL12
Mangola Shoal
AC/P61
AC/RL6
AC/RL10
Pee Shoal
Sahul Bank Shoals
AC/RL5
AC/RL4
AC/L1
AC/L2
AC/L3
AC/RL7
AC/P54
AC/P55
AC/P56
Fantome Shoal
Vee Shoal
Hibernia Reef
AC/P21
AC/RL11
AC/P57
AC/P45
Johnson Bank
Woodbine Bank
Cartier Island
Barracouta Shoal
Unnamed Shallow Areas
AC/P32
AC/RL1
AC/P50
Shoal 25
AC/L8
AC/L7
AC/P51
Unnamed Shallow Areas
Vulcan Shoal
AC/P59
Goeree Shoal
AC/P41
AC/RL9
Eugene McDermott Shoal
AC/P36
WA-343-P
WA-408-P
WA-371-P
WA-274-P
WA-56-R
WA-377-P
WA-2-R
WA-44-L
WA-371-P
WA-285-P
WA-50-L
WA-285-P
WA-285-P
WA-494-P
BROWSE ISLAND
Heywood Shoal
Echuca Shoal
WA-54-R
WA-471-P
WA-485-P
WA-424-P
WA-523-P
WA-420-P
WA-407-P
Gale Bank
Favell Bank
Van Cloon Shoal
Baldwin Bank
Penguin Shoal
Bassett-Smith Shoal
Inset
WA-34-R
WA-6-R
NT/RL1
WA-459-P
WA-40-R
WA-27-R
WA-522-P
WA-454-P
WA-69-R
NT/P84
WA-33-L
WA-488-P
KALUMBURU
WA
PEPPIMENARTI
PORT KEATS (WADEYE)
PALUMPA
NT
Wharton Basin
INDONESIA
MALAYSIA
BRU
Jakarta
P.N.G
T.-L.
Darwin
Derby
Broome
Exmouth
TROPIC OF CAPRICORN
WA
AUSTRALIA
Geraldton
Kalgoorlie
Perth
Bunbury
Albany
Adelaide
Legend
Proposed Acquisition Area
Proposed Operational Area
Cable Route
Ichthys Gas Export Pipeline
Coastal Waters (State Jurisdiction)
100m Depth Contours (between 100 and 1000 m)
Petroleum Title (Active):
Infrastructure Licence
Exploration Permit
Production Licence
Retention Lease
Data Source:
Zénaïde MC3D: Client Provided July 2017
Bathymetry Grid and Depth Contours: GA Australian Bathymetry 2009
Petroleum Titles: NOPTA May 2017
Ichthys Gas Export Pipeline: DMIRS 2017
Petroleum Industry
3.10
Drawing No: 04134575_Zenaide_G016_R2.mxd
Date: 02/11/2017
Drawing Size: A3
Drawn By: DR
Reviewed By: JE
Polarcus Zénaïde MC3D Environment Plan
Client: Polarcus Seismic Limited
Coordinate System: GDA 1994 MGA Zone 52
0 10 20 30 40 50km
N
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3.4.4 *Commercial Shipping*

Major shipping routes in the region are associated with entry to the ports of Dampier, Port Headland and Darwin Port. Darwin Port is the closest port to the Operational Area, over 300 km away.

In consultation with AMSA, it is expected that vessel traffic will be present within the Acquisition Area during the time of the survey (*Figure 3.11*). These vessels are mainly travelling to and from Darwin and around to the west coast of Australia.

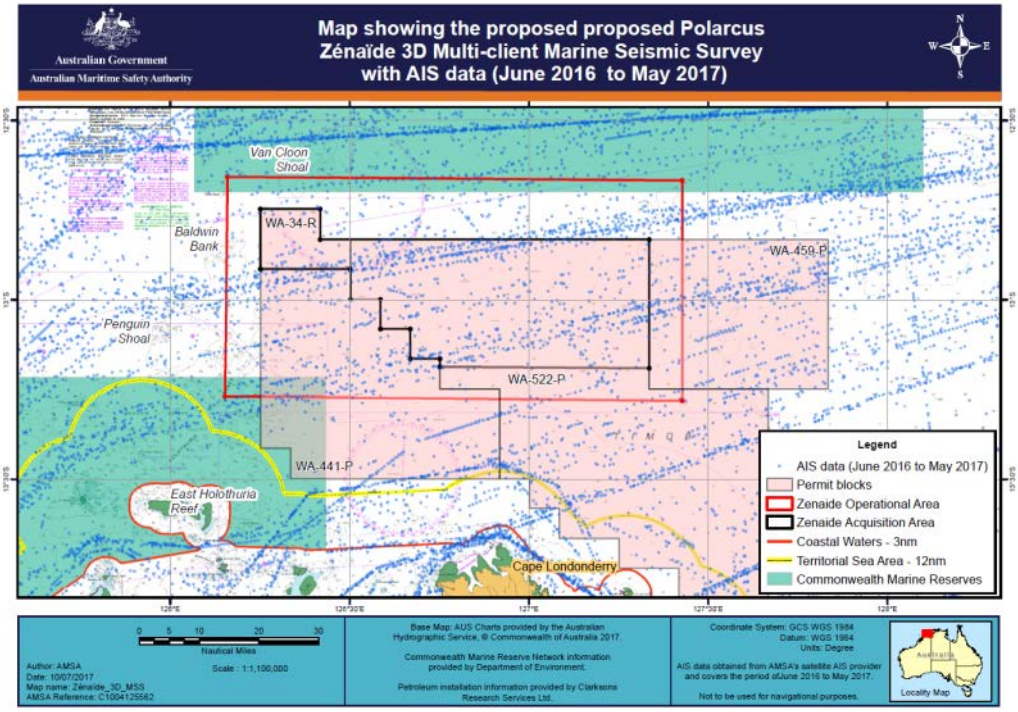

Figure 3.11 Commercial shipping within the vicinity of the Operational Area (provided by AMSA, July 2017)

3.4.5 *Tourism and Recreation*

Most recreational and tourism activities in the region occur predominantly in WA State waters adjacent to population centres, such as Broome, and not within the Commonwealth waters of the Operational Area. Tourism in the region typically peaks during the dry season (May to October), which includes activities such as recreational fishing, diving, snorkelling, wildlife watching and boating (Commonwealth of Australia 2012).

Although tourism activities are limited in the region, some Kimberley tour operators are reported to offer cruises along the north Kimberley coast, although these are not understood to occur near the Operational Area.

3.4.6 *Defence Activities*

Customs Coastwatch, Navy and Customs vessels undertake civil and maritime surveillance within the region with the primary purpose of monitoring the passage of illegal entry vessels and illegal fishing activity within these areas.

Cartier Island (approximately 300km away from the Operational Area) and the area within a 10 km radius surrounding the island is a gazetted Defence Practice Area, although no longer in active use for military exercise (Commonwealth of Australia 2002).

4 STAKEHOLDER CONSULTATION

4.1 RELEVANT STAKEHOLDERS

Relevant stakeholders were identified as:

- Departments and agencies of the Commonwealth to which the activities to be carried out may be relevant;
- Departments and agencies of the State of Western Australia to which the activities to be carried out may be relevant;
- Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out; and
- Any other person or organisation that Polarcus consider relevant.

The identified relevant stakeholders are listed in *Table 4.1*.

Polarcus understand that the list of relevant stakeholders is not exhaustive and additional stakeholders may be identified as part of ongoing consultation. Should additional stakeholders be identified prior to, or during the survey, these stakeholders will be contacted, provided information about the survey and invited to make comment.

Table 4.1 Identified Relevant Stakeholders

Commonwealth Government	
Australian Fisheries Management Authority (AFMA)	Department of Environment and Energy - Marine Reserves
Australian Hydrographic Service (AHS) (Maritime Safety - Notice to Mariners)	Australian Marine Mammal Centre
Australian Marine Safety Authority	Department of Industry, Innovation and Science
Maritime Border Command (MBC), Broome (*formerly Border Protection Command)*	Federal Member for Durack
Department of Communications and the Arts	Australian Marine Oil Spill Centre
Department of Defence	
Western Australian State Government	
Department of Mines, Industry Regulation and Safety *(formerly Department of Mines and Petroleum)*	Department of Biodiversity Conservation and Attractions *(formerly Department of Parks and Wildlife)*
Department of Primary Industries and Regional Development *(formerly Department of Department of Fisheries)*	Shire of Derby West Kimberley
Department of Transport (Maritime Environmental Emergency Response)	Shire of Wyndham East Kimberley
Department of Water and Environmental Regulation *(formerly Department of Environmental Regulation)*	Member of Parliament for Kimberley
Northern Territory Government	
Department of Infrastructure, Planning and Logistics	Environment Protection Authority
Commercial Fisheries & Associations	

Western Tuna and Billfish Fishery (Commonwealth)	Commonwealth Fisheries Association
Skipjack Tuna Fishery (Commonwealth)	Western Australian Fishing Industry Council
Southern Bluefin Tuna Fishery (Commonwealth)	Australian Southern Bluefin Tuna Industry Association
Northern Prawn Fishery (Commonwealth)	Australian Council of Prawn Fisheries
Northern Demersal Scalefish Fishery (NDSF) (State) - All individual licence holders	Northern Prawn Fishery Industry Pty Ltd
Northern Demersal Scalefish Fishery - Glenn Davis, (Northern Wildcatch Seafood Australia Pty Ltd)	Australian Fishing Trade Association
Northern Shark Fishery (State) - All individual licence holders	Pearl Producers Association
Mackerel Managed Fishery (State) - Individual licence holders	WA Seafood Exporters
Kimberley Prawn Fishery (State) - Individual licence holders	Westmore Seafoods / Australia Bay Seafoods
Pearl Oyster Managed Fishery (State) - All individual licence holders	
Recreational Fishing, Charters and Marine Tourism Operators	
Australian Recreational Fishing Foundation	Kimberley Bird Watching
Recfishwest	Kimberley Air Tours
Tourism Western Australia	Kimberley Whale Watching
One Tide Charters	Kimberley Outback Tours
Unreel Adventure Safaris	True North Adventure Cruises
KAS Helicopters	Ocean Dream Charters
Kingfisher Tours	The Great Escape Charter Company
Aviair	Kimberley Quest
Peregrine Bird Tours	
Environmental Non-Government Organisations	
The Wilderness Society	The Conservation Council of WA
Save the Kimberley	World Wildlife Fund
Environs Kimberley	International Fund for Animal Welfare
Australian Conservation Foundation	
Land Councils	
Northern Land Council	Kimberley Land Council Aboriginal Corporation
Oil and Gas Industry	
Woodside Energy Ltd	Octanex Bonaparte Pty Ltd
Eni Australia B.V.	Australian Marine Oil Spill Centre
Santos Offshore Pty Ltd	INPEX
Other relevant stakeholders	
Telstra	Broome Port
Nextgen Networks	Broome Chamber of Commerce and Industry

4.2 CONSULTATION RESULTS

A summary of the key issues and concerns raised by stakeholders during consultation, including an assessment of the merits of objections and claims, and full copies of the consultation records are included in *Annex A*.

4.3 ONGOING CONSULTATION

Polarcus will continue to engage with the applicable Commonwealth and Western Australian authorities and other relevant stakeholders (as identified during the course of the consultation described here) prior to and during the Zénaïde 3D MSS, as appropriate. This includes ongoing engagement to inform stakeholders about key milestones and activities and any other relevant information or changes.

Ongoing stakeholder consultation commitments are outlined in *Table 4.2*.

Table 4.2 Ongoing Consultation Arrangements

Trigger / Event	Stakeholders	Timing	Method and Information
Prior to Survey Commencement			
Pre-planning	Other seismic operators with EPs accepted by NOPSEMA	Pre-planning	Phone/email to confirm potential location and timing of other seismic acquisition
Planned survey commencement date confirmed	All stakeholders.	To be sent at least 4 weeks prior to the scheduled acquisition commencement date.	Emails and/or letters to include: • Proposed commencement date; • Proposed duration and/or completion date; • Location and coordinates; • Details of communication (e.g. daily lookaheads) during the survey and details of how to register for updates.
During Survey			
Daily update	All stakeholders	Daily	Email detailing: • Location/survey lines planned for upcoming 48 hour period, including coordinates; • On-the-water interaction/ safety requirements or advice • Any other on-the-water progress updates (e.g. schedule delays).
N.B. On-the-water communication to vessels via radio will also be undertaken as required.			
Survey Completion			
Survey complete	All stakeholders	Within 2 weeks of completion and demobilisation from Operational Area.	Emails and/or letters to include: • Completion date; • If the survey vessel is planned to return and/or future survey phases under the EP.
Environment Plan and Activity Updates			
NOPSEMA acceptance of the EP	All stakeholders	To be sent within 1 week of the EP Summary being published.	Email or letter notification confirming date of acceptance and including URL to EP Summary on NOPSEMA website.
Significant modification of the Activity		As soon as identified	Email or letter notification followed by meetings, phone calls, email or other correspondence as required.

Trigger / Event	Stakeholders	Timing	Method and Information
New stage (increase in Acquisition Area, Operational Area or EP timeframe) Revision and resubmission of the accepted EP			Initial notification shall provide opportunity for stakeholders to comment. Stakeholders to be provided with sufficient information and time to review and respond to information and matters should be reasonably addressed prior to resubmission of the EP.

5 RISK ASSESSMENT METHOD

5.1 RISK ASSESSMENT APPROACH

The risk assessment was undertaken in accordance with the Polarcus Risk Assessment Procedure, Risk Management Procedure and the Polarcus Risk Matrix (*Figure 5.1*). The Polarcus Risk Assessment and Risk Management procedures are aligned with the Australian Standard/New Zealand Standard (AS/NZS) ISO 31000:2009 Risk Management and Handbook 203:2012 Managing Environment-related Risk (Standards Australia/Standards New Zealand 2009 and 2012, respectively).

The risk assessment process consisted of the following steps:

- Identification of potential environmental hazards associated with the seismic survey's planned activities and credible unplanned events;
- Identification of physical, biological, and socioeconomic receptors within the environment that may be affected by the activities (planned and unplanned), as well as identification of particular environmental values and sensitivities;
- Evaluation of the potential consequences of these hazards to the identified receptors with legal requirements and inherent design in place but without other controls, and determination of the 'inherent' risk;
- Identification of appropriate alternative, additional or improved controls (i.e. those in addition to legal requirements and inherent design) to reduce impacts and risks to levels that are demonstrably ALARP;
- Evaluation of the residual impacts and risks with the proposed controls in place;
- Evaluation of whether the impacts and risks are reduced to acceptable levels; and
- Development of environmental performance outcomes, performance standards, and measurement criteria.

A risk assessment was undertaken in August 2017, to identify and assess the risks associated with the survey.

The workshop was supported by background literature and discussions with relevant seismic operations personnel, vessel management personnel and environmental specialists. The identification of risks and the selection of appropriate controls for these risks were also informed by Polarcus experience in conducting other seismic surveys in Australia and elsewhere.

The risks were determined using the Polarcus Risk Matrix (*Figure 5.1*) and interpreted in accordance with *Table 5.1* (further descriptions of consequence) and *Table 5.2* (interpretation of risk). Where several potential impacts were identified for an activity, the consequence and likelihood categories were determined based on the worst credible potential impacts.

People	Environment	Property Value Technical	Reputation	Security	Severity	Never Heard Of "A"	Rarely Occurs "B"	Occasionally Occurs "C"	Regularly Occurs "D"	Occurs All the Time "E"
No health effect. No Injury	No Discharge	Less than $ 5K	No Impact	No Harm	0					
Slight work related illness FAC	Slight Discharge <5 liters	Less than $ 50K.	Slight Impact	Slight Breach Handled Internally	1					
Minor work related illness RWC or MTC	Minor Discharge >5 liters - <100	Less than $500K	Minor Impact Limited Exposure	Minor breach Local Authorities	2					
Extensive work related illness. LTI	Extensive Discharge >100 liters - <1m³	Less than $5M.	Extensive Impact National Exposure	Extensive Breach Threat to Operations	3					
Fatality or Major illness	Major Discharge >1m³ - <10m³	Less than $10M	Major Impact Regional Exposure	Major Breach Loss of Operations	4					
Fatalities or Major Illnesses (multiples)	Massive Discharge >10m³	Exceeding $10M.	Massive Impact International Exposure	Massive Breaches Company Lockdown	5					

Manage for Continuous Improvement	Incorporate Risk Reduction Measures	Intolerable Risk – All Stop

Figure 5.1 Polarcus Risk Matrix

Table 5.1 ***Further Description of Environmental Consequences***

Severity Ranking	Severity Label	Description
0	None	No environmental consequences
1	Slight	Slight environmental damage where restoration can be handled internally and no breaches of legislative requirements have been made
2	Minor	Large-scale damage to the environment with no lasting effects, restoration can be handled internally and a single breach of legislative requirements
3	Extensive	Environmental damage requiring external resources for restoration and involving many breaches of legislative requirements
4	Major	Severe environmental damage requiring extensive measures for restoration and involving widespread breaches of legislative requirements
5	Massive	Persistent severe environmental damage resulting in ongoing breaches of legislative requirements and major financial consequences

Table 5.2 ***Interpretation of Risk***

Risk Ranking	Interpretation
LOW RISK	No additional controls are required if ALARP. Consideration may be given to effective solutions or improvements that impose no significant cost burden. Monitoring is required to ensure that the controls are maintained.
MEDIUM RISK	Efforts should be made to reduce the risk, but the cost of prevention should be measured and limited. Risk reduction methods should be implemented within a defined time period.
HIGH RISK	Work should not be started or continued until the risk has been reduced to an acceptable level. If it is not possible to reduce the risk even with unlimited resources, work has to remain prohibited.

5.2 IDENTIFICATION OF CONTROLS AND DEMONSTRATION OF ALARP

For those hazards for which the inherent risk was not deemed low, further controls were developed to reduce the likelihood of the impact occurring (i.e. preventative) and/or reduce the consequence of the impact (i.e. mitigation) to in turn reduce the risk to ALARP.

In accordance with the Polarcus Risk Management Procedure, the following hierarchy of controls was applied:

- **Eliminate:** Redesign the activity or substitute a substance so the hazard is removed or eliminated;
- **Reduce:** Replace the material or process with a less hazardous one and one which does not introduce another hazard;
- **Isolate:** Measures to prevent the hazard escalating;
- **Control:** Identifying and implementing procedures, administrative controls, competency and training;

- **Discipline:** Ensuring that all controls are monitored, reviewed and enforced.

The following criteria were used to determine whether impacts and risks were ALARP:

- No reasonably practicable alternatives/substitutes to the activity are available that could eliminate, isolate or provide a net reduction in the risk to environmental values or sensitivities;
- No reasonably practicable additional controls (e.g. engineering, administrative or procedural controls) are available that could provide a net reduction in the risk to environmental values or sensitivities; and
- No reasonably practicable improvements are available that could increase the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility.

In making this determination, consideration was given to trade-offs of implementing the alternatives or additional controls in terms of cost, technical, environmental, safety and logistical implications.

5.3 DEMONSTRATION OF ACCEPTABILITY

The following criteria are used to determine whether impacts and risks were acceptable:

- The level of risk is determined to be low or medium (*Table 5.2*);
- The activities, the identified impact and risk and/or the identified control measures are compliant with applicable legislation;
- The activities, the identified impact and risk and/or the identified control measures are consistent with Conservation Advice, Recovery Plans, and/or other industry guidelines and standards and corporate policies, standards and procedures;
- The activities and the identified impacts and risks will not result in a significant or long-term impact to the values of Australian Marine Parks, and the activity is not inconsistent with the Zones Management Prescriptions or IUCN Reserve Management Principles;
- The activities, the identified impact and risk and/or the identified control measures are consistent with the following principles of Ecologically Sustainable Development, as set out in section 3A of the EPBC Act, and the precautionary principle where relevant;
- Relevant stakeholder objections, claims, concerns or information have been considered during the assessment of impacts and risks and selection of control measures, where they are considered to have merit.

Acceptable levels are evaluated independently of ALARP and the acceptability criteria are considered when selecting the environmental performance outcomes that apply to managing a particular impact or risk.

6 ENVIRONMENTAL RISKS AND MANAGEMENT – PLANNED ACTIVITIES

This section describes and assesses the potential environmental impacts associated with the planned / routine aspects of the Zénaïde 3D MSS. Based on the risk assessment undertaken for this EP, the hazards, impacts and risks associated with the following aspects are described and discussed in the subsections below:

- Physical presence;
- Underwater sound emissions;
- Liquid discharges;
- Solid waste management;
- Artificial light emissions;
- Atmospheric emissions; and
- Introduction of invasive marine species (IMS).

6.1 PHYSICAL PRESENCE

6.1.1 Entanglement / Collision with Marine Fauna

Details of Impacts and Risks and Control Measures

Hazard/Threat:
The physical presence of vessels and towed equipment has the potential to result in collision or entanglement with marine fauna.
Receptors:
EPBC Act listed species, including threatened and migratory cetaceans, marine turtles, whale sharks and dugongs.
Adopted Control Measures:
Seismic vessels and support vessels (taking into account the limited manoeuvrability of the former) will comply with 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; and • not exceeding a speed of 6 knots within the caution zone of a cetacean (300 m).
Seismic vessels and support vessels (taking into account the limited manoeuvrability of the former) will also take action to avoid approaching or drifting closer than 50 m to a turtle or dugong.
Seismic vessels and support vessels (taking into account the limited manoeuvrability of the former) will also adopt measures consistent with the DPaW Whale Shark Management Programme (2013), including: • taking action to avoid approaching or drifting closer than 30 m of a whale shark; and • not exceeding 8 knots within 250 m of a whale shark.
Two MFOs will be present on the seismic vessel and supported by trained crew.
If safe and practicable to do so, fauna found to be entangled in wet equipment shall be returned to the ocean.
Turtle guards will be fitted on tail buoys or tail buoys will be designed to prevent turtles becoming trapped.
All collisions with cetaceans in Commonwealth waters will be reported to the National Ship Strike Database.
Details of Residual Impacts and Risks:
The potential impact associated with the physical presence of vessels and towed equipment is the risk of

collision or entanglement with marine fauna resulting in injury or mortality, including foraging marine turtles and transient cetaceans, whale sharks and dugongs.

Research shows that faster vessels have a greater risk of collision with marine fauna than slower-moving vessels. There have been no reported cases of marine fauna becoming entangled in seismic equipment in Australian waters. Given the proposed vessel speed and avoidance controls and the fact that the seismic survey vessel will be moving at 4.5 knots during seismic data acquisition, the risk is limited. Close-range encounters with marine fauna are expected to be infrequent and limited to isolated individuals in the immediate vicinity of the operating vessels and survey array.

As a result, marine fauna injury or mortality as a result of collision or entanglement is highly unlikely and there is no risk of population-level impacts or threats of serious / irreversible environmental damage. The residual impacts and risks have therefore been assessed as Low.

Risk Ranking:	Consequence	Likelihood	Risk Ranking
Inherent Risk:	Extensive (3)	Rare (B)	**Low**
Residual Risk:	Extensive (3)	Rare (B)	**Low**

6.1.2 Disruption/Interference with Other Marine Users

Details of Impacts and Risks and Control Measures

Hazard/Threat:
The potential hazard associated with the physical presence of vessels and equipment in the Operational Area is disruption/interference with other users.
Receptors:
• Commercial fishing vessels • Commercial shipping transiting the region • Occasional vessels associated with other petroleum developments in the region
Adopted Control Measures:
Notice to Mariners issued prior to commencement of survey activities.
Daily reporting to AMSA JRCC.
Notification will be provided to fisheries stakeholders, 4 weeks prior to commencement of each survey phase, indicating location and expected timing. Notification will also be provided to fisheries stakeholders within 2 weeks of completion of each survey phase.
Daily lookahead reports detailing the upcoming 48 hours survey events will be provided via email to stakeholders to register for the service
Polarcus will observe petroleum safety zones, which typically apply up to 500 m from the outermost point of petroleum production facilities. Vessels will only operate within these zones with facility titleholder or operator approval, and in accordance with close-pass procedures.
Adherence with requirements of the International Regulations for Preventing Collisions as Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea as implemented in Commonwealth Waters through the Navigation Act 2012 and associated Marine Orders Parts 21, 30, 59 - navigation, collision, support vessels, including: • Appropriate lighting, navigation and communication to inform other users. • Use of radar and 24/7 watch.
Minimum 40 km separation between the Zénaïde 3D MSS seismic vessel and other operating seismic vessels of potential concurrent seismic surveys in the region of the Operational Area during data acquisition activities.
At least one support vessel will accompany each seismic vessel when the seismic vessel is in operation and when safe to do so (e.g. outside of inclement weather periods). The support vessel will conduct advanced scouting to ensure that fishing vessels or other activities in the area and are provided with advance notice to move away from the path of the survey vessel.
Streamers marked with tail buoys.

Details of Residual Impacts and Risks:			
The seismic vessel will typically move along planned seismic lines at a constant speed of approximately 4.5 knots and will proactively and collaboratively manage operational information between Polarcus, other seismic operators in the area and fishers active in the Operational Area. The limited manoeuvrability of the seismic vessel means that fishers may be asked to take measures to avoid the seismic vessel and towed equipment or remove fishing gear such as traps and lines to avoid interaction. Communication will be maintained with fisheries stakeholders with the aim of minimising impacts and improving planning and resource sharing. Some commercial shipping may also be asked to deviate from their intended routes to avoid the seismic vessel and towed array, but given the inherent controls identified above, no significant navigational implications or changes in shipping traffic patterns are expected. The residual impacts and risks have therefore been assessed as Low.			
Risk Ranking:	**Consequence**	**Likelihood**	**Risk Ranking**
Inherent Risk:	Slight (1)	Occasional (C)	**Low**
Residual Risk:	Slight (1)	Occasional (C)	**Low**

6.2 UNDERWATER SOUND EMISSIONS

Underwater sound will be generated by the seismic source, general vessel activities (including engine sound and operation of thrusters) and helicopter movements during crew transfers.

Seismic sound is characterised by high energy pulses of low frequency sound. The frequency of the sound produced from each seismic pulse is primarily less than 2 kHz, with the highest levels at frequencies in the range of 10-500 Hz (McCauley 1994). The rate of sound attenuation from the seismic source is dependent on local sound propagation characteristics, including seawater temperature and salinity profiles, water depth, bathymetry and the geoacoustic properties of the seabed (McCauley 1994). While the seismic pulses are directed downwards, horizontal propagation may be detected over long distances due to the high intensity and low frequency properties of the sound source.

The area over which seismic sound may adversely impact marine species depends upon multiple factors including the extent of sound propagation relative to the location of receptors, and the sensitivity and range of spectral hearing of different species (Slabbekoorn et al. 2010; Popper and Hawkins 2012).

The potential impacts and risks have been assessed for the following receptor categories, with controls proposed to reduce the impacts and risks to ALARP and acceptable levels:

- Marine mammals
- Marine turtles
- Sharks and rays
- Birds
- Site-attached fish assemblages
- Other demersal and pelagic fish assemblages
- Fish spawning
- Plankton, fish eggs and larvae

- Benthic invertebrates
- Commercial fisheries

Potential cumulative impacts and risks from multiple seismic surveys operating in the region, and the potential impacts and risks from vessel and helicopter noise have also been assessed.

6.2.1 Marine Mammals

Details of Impacts and Risks and Control Measures

Hazard/Threat:
Without adequate control measures in place, high intensity impulsive sound emitted from the seismic source has the potential to impact marine mammals in the following ways: • Hearing impairment as a result of high sound levels at close range to the seismic source, including: o permanent (permanent threshold shift (PTS); or o temporary threshold shift (TTS); • Behavioural disturbance impacts.
Receptors:
Transient EPBC Act listed cetacean species and dugongs.
Adopted Control Measures:
Minimum source size selected (3,090 cui) to acquire survey data and meet the geophysical objectives of the survey.
Part A of EPBC Policy Statement 2.1 will be applied in full to mitigate potential impacts to cetaceans, including: • Observation zone: 3+ km horizontal radius from the seismic source. • Low power zone: 2 km horizontal radius from the seismic source. • Shut-down zone: 500 m horizontal radius from the seismic source. • Pre-Start-up Visual Observations • Soft-start Procedures • Start-up Delay Procedures • Operational Shut-down and Low-power Procedures • Night-time and Low Visibility Procedures • Sighting Reports
Two MFOs will be on board the seismic vessel and on duty during daylight hours during the survey.
Adaptive management measures for cetaceans: If three cetacean-instigated power-down or shut-down situations occur during a 24 hour period (commencing from the time of the first whale instigated shut-down):, the seismic vessel will relocate to an alternative survey line (taking into account the whale's travel direction and speed) and will not return within 24 hours.
A 500 m shut-down zone from the operating source, as per the shut-down zone for whales in EPBC Act Policy Statement 2.1, will also be applied to dugongs.
Crew, survey personnel and MFOs will be briefed in the marine fauna observation, separation distance estimation, controls and reporting requirements relevant to this EP, including adaptive management measures.
No operation of the seismic source at full volume during soft-starts, full-fold acquisition lines or run-outs within 15 km of the Oceanic Shoals Marine Park or Kimberley Marine Park, although source testing may occur anywhere within the Operational Area.

Details of Residual Impacts and Risks:
Based on acoustic modelling and with the proposed controls in place, impacts to marine mammals such as cetaceans and occasional dugongs, are primarily expected to be localised behavioural avoidance impacts up to 13.6 km from the seismic source. There are no expected long-term ecological implications for snubfin dolphin breeding/calving, humpback dolphin foraging, the pygmy blue whale migration, humpback whale migration/ breeding /calving, or dugongs. PTS and TTS impacts are unlikely given the proposed control measures. However, should such impacts occur, the potential consequence of PTS /TTS impacts to a small number of individuals are considered Extensive (3). Given the location of the Acquisition Area, the absence of critical habitats (feeding, breeding, calving, resting or confined migratory routes), relatively low numbers of marine mammals expected to be encountered in the Acquisition Area and the control measures proposed the likelihood of such consequences occurring is Rare (B). The residual impacts and risks, with the control measures in place, have therefore been assessed as Low.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Extensive (3)	Occasional (C)	**Moderate**
Residual Risk:	Extensive (3)	Rare (B)	**Low**

6.2.2 Marine Reptiles

Details of Impacts and Risks and Control Measures

Hazard/Threat:
High intensity impulsive sound emitted from seismic sources has the potential to impact marine reptiles in the following ways: • Mortal injury or recoverable injury to marine turtles at very close range to the seismic source. • Permanent or temporary hearing impairment (recoverable injury or TTS) at close range to the seismic source. • Behavioural disturbance impacts.
Receptors:
• EPBC Act listed marine turtle and sea snake species • Potential Habitat Critical internesting areas for flatback turtles have been identified approximately 15 km south of the Acquisition Area • Approximately 3% of a year-round foraging BIA for flatback, loggerhead and olive ridley turtles overlaps the Acquisition Area • Less than 1% of a year-round foraging BIA for green turtles overlaps the south east corner of the Operational Area
Adopted Control Measures:
Minimum source size selected (3,090 cui) to acquire survey data and meet the geophysical objectives of the survey.
Soft-start procedures to provide receptors with advanced opportunity to move away from the source, if able.
A 500 m shut-down zone from the operating source, as per the shut-down zone for whales in EPBC Act Policy Statement 2.1, will also be applied to turtles.
No operation of the seismic source within 250 m of the 60 m depth contour, where preferred turtle foraging habitat is more likely to be present within the defined turtle foraging BIA.
No operation of the seismic source at full volume during soft-starts, full-fold acquisition lines or run-outs within 15 km of the Oceanic Shoals Marine Park or Kimberley Marine Park, although source testing may occur anywhere within the Operational Area.
Details of Residual Impacts and Risks:
Based on acoustic modelling and with the proposed controls in place, impacts to marine turtles are expected to be behavioural. Behavioural impacts are predicted to a maximum distance of 7.9 km, which does not affect the flatback turtle internesting habitats and so nesting and internesting behaviours are

not expected to be impacted. The potential for injury is limited to approximately 226 m from the seismic source, which can be effectively mitigated through the implementation of a 500 shut-down zone. Behavioural impacts are expected to be short term and localised, limited to within several kilometres of the survey lines. No displacement from critical habitat or BIAs, or population level impacts are expected. Given the distance from known sea snake habitats, no behavioural or physical injury impacts to sea snakes are anticipated.

The potential consequence of injury to turtles is considered Extensive (3), but the likelihood of such consequences occurring is Rare (B). The residual impacts and risks, with the control measures in place, have therefore been assessed as Low.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Extensive (3)	Occasional (C)	**Moderate**
Residual Risk:	Extensive (3)	Rare (B)	**Low**

6.2.3 Sharks and Rays

Details of Impacts and Risks and Control Measures

Hazard/Threat:

High intensity impulsive sound emitted from seismic sources has the potential to impact sharks and rays in the following ways:

- Physiological injury at very close range to the seismic source.
- Behavioural avoidance impacts.

Receptors:

Foraging whale sharks

Adopted Control Measures:

Minimum source size selected (3,090 cui) to acquire survey data and meet the geophysical objectives of the survey.

Soft-start procedures to provide receptors with advanced opportunity to move away from the source, if able.

A 500 m shut-down zone from the operating source, as per the shut-down zone for whales in EPBC Act Policy Statement 2.1, will also be applied to whale sharks.

No operation of the seismic source at full volume during soft-starts, full-fold acquisition lines or run-outs within 15 km of the Oceanic Shoals Marine Park or Kimberley Marine Park, although source testing may occur anywhere within the Operational Area.

Details of Residual Impacts and Risks:

The Operational Area is 72 km away from the foraging BIA for whale sharks. Some transient individuals may be present in the area between September and November. Sharks and rays are regarded as being less sensitive to sound pressure than bony fish but they are likely to be responsive to low-frequency sounds.

Given the protected status of the whale shark and the tendency for individuals to be present in surface waters where they may be detected through visual observation, a 500 m shut-down zone will be implemented for whale sharks as per the shut-down zone for whales required under EPBC Act Policy Statement 2.1, thereby reducing the risk of this species being present in close proximity to the powered seismic source.

Whale sharks may show avoidance behaviour to the seismic source and are unlikely to remain close enough to the source to suffer physical injury or changes in hearing. With the proposed controls in place, injury is highly unlikely and impacts are therefore predicted to be behavioural. The residual impacts and risks, with the control measures in place, have therefore been assessed as Low.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Extensive (3)	Occasional (C)	**Moderate**
Residual Risk:	Extensive (3)	Rare (B)	**Low**

6.2.4 Birds

Details of Impacts and Risks and Control Measures

Hazard/Threat:
Seabirds and migratory shore birds diving or foraging near the seismic source may be exposed momentarily to seismic sound resulting in a startle response.
Receptors:
Seabirds and migratory shore birds
Adopted Control Measures:
Minimum source size selected (3,090 cui) to acquire survey data and meet the geophysical objectives of the survey.
No operation of the seismic source at full volume during soft-starts, full-fold acquisition lines or run-outs within 15 km of the Oceanic Shoals Marine Park or Kimberley Marine Park, although source testing may occur anywhere within the Operational Area.
Details of Residual Impacts and Risks:
Migratory shorebirds and seabird species are known to occur in the region. The foraging BIAs of two bird species overlaps with the Operational Area, the Lesser Frigatebird and Lesser Crested Tern. These species breed during March to September and March to June, respectively. It is likely these species will be present in the Operational Area; however, there is no specific information concerning the populations of seabirds utilising the waters of the Operational Area. Only birds foraging within the Acquisition Area have the potential to be exposed to increased sound levels generated by the operating seismic source. Although birds at the surface of the water in proximity to the seismic vessel have limited potential to be affected by sound emissions underwater due to the limited transmission of sound energy between the water/air interface, birds displaying underwater foraging behaviours such as diving may be exposed to underwater sound if they dive near the seismic vessel when the seismic source is in operation. However, given the likely avoidance response from fish, it is unlikely that birds will forage near the operating seismic source. Additionally, this is likely to only affect individual birds, resulting in a startle response with affected birds expected to move away from the area of the active source as a result. Impacts to bird populations from sound emissions resulting from the Zénaïde 3D MSS are therefore not expected. The residual impacts and risks, with the control measures in place, have therefore been assessed as Low.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Slight (1)	Rare (B)	**Low**
Residual Risk:	Slight (1)	Rare (B)	**Low**

6.2.5 Site-Attached Fish Assemblages

Details of Impacts and Risks and Control Measures

Hazard/Threat:
Without adequate control measures in place, high intensity impulsive sound emitted from the seismic source has the potential to impact site-attached fish in the following ways: • Mortal injury or recoverable injury to fish at very close range to the seismic source. • Temporary changes in hearing (temporary threshold shift; TTS) experienced by fish exposed to high sound levels for prolonged periods. • Behavioural impacts resulting from disturbance, or masking or interfering with biologically important sounds. Potential impacts to other demersal and pelagic fish (those that aren't considered to be site-attached) are assessed separately in *Section 6.2.6*. Potential impacts to fish spawning are addressed separately in *Section 6.2.7*. Potential impacts to fish eggs and larvae are addressed separately in *Section 6.2.8.*

Receptors:
Site-attached fish assemblages associated with shallow benthic features such as banks located adjacent to the Acquisition Area.
Adopted Control Measures:
Minimum source size selected (3,090 cui) to acquire survey data and meet the geophysical objectives of the survey.
Soft-start procedures to provide receptors with advanced opportunity to move away from the source, if able.
No operation of the seismic source within 250 m of the 60 m depth contour.
The operating seismic source will not return to within 1.6 km of the closest point of approach of an acquisition line to the 60 m depth contour within 24 hours to allow for recovery and limit the potential for additional auditory hair cell damage from cumulative exposures.
The source levels of the 3,090 cui seismic source will be verified upon deployment using a near-field hydrophone bubble test to confirm that levels do not exceed source levels predicted by the GUNDALF source model. Should levels be exceeded, Polarcus will implement adaptive management to reduce the source output to levels that are equal to or less than the GUNDALF source model predictions prior to commencement of acquisition lines.
No operation of the seismic source at full volume during soft-starts, full-fold acquisition lines or run-outs within 15 km of the Oceanic Shoals Marine Park or Kimberley Marine Park, although source testing may occur anywhere within the Operational Area.
Details of Residual Impacts and Risks:
Site-attached fish have limited ranges and are therefore considered to be more sensitive to the effects of high sound levels from the seismic source. Potential impacts have been assessed based on an analysis of depth contours corresponding with the distribution of benthic habitats and fish assemblages, as reported during field surveys of the banks, shoals and other representative areas of seabed within the region (Heyward *et al.* 2011a; ERM 2012; Heyward *et al.* 2013). Such studies indicate that site-attached fish species are abundant in shallow reef areas of shoals (less than 30 m), but decreased significantly in depths of 40-50 m. Fish species in water depths greater than 60 m are expected to be larger and more free-ranging and are therefore considered less sensitive to the effects of seismic sound as they would be expected to display avoidance behaviours and return to the area once the seismic source has passed. The Zénaïde 3D MSS Acquisition Area excludes all banks and shoals less than 60 m deep. The 60 m contour of the closest bank is located approximately 1.8 km to the east of the Acquisition Area. Therefore, limited exposure of shallow bank habitats or site-attached fish is expected. Based on acoustic modelling, operation of the seismic source will be excluded within 250 m of the 60 m depth contour of the nearest bank feature located at the eastern boundary of the Acquisition Area to reduce the risk of injury occurring to potential site-attached fish. With the proposed controls in place, impacts to site-attached fish are expected to be temporary, potentially involving behavioural avoidance reactions with the potential for TTS to occur in some fishes exposed on the adjacent bank slopes between 50 and 60 m depth if they do not or cannot move to avoid exposure. Such impacts are expected to be temporary, recoverable and are not expected to result in any lasting population level impacts or longer ecological implications. The residual impacts and risks, with the control measures in place, have therefore been assessed as Low.

	Consequence	Likelihood	Risk Ranking
Inherent Risk:	Minor (2)	Occasional (C)	**Low**
Residual Risk:	Minor (2)	Occasional (C)	**Low**

6.2.6 *Other Demersal and Pelagic Fish Assemblages*

Details of Impacts and Risks and Control Measures

Hazard/Threat:

Without adequate control measures in place, high intensity impulsive sound emitted from the seismic source has the potential to impact fish in the following ways:

- Mortal injury or recoverable injury to fish at very close range to the seismic source.
- Temporary changes in hearing (temporary threshold shift; TTS) experienced by fish exposed to high sound levels for prolonged periods.
- Behavioural impacts resulting from disturbance, or masking or interfering with biologically important sounds.

Potential impacts to site-attached fish assemblages associated with shallow banks and shoals are assessed separately in *Section 6.2.5*.

Potential impacts to spawning are addressed separately in *Section 6.2.7*.

Potential impacts to fish eggs and larvae are addressed separately in *Section 6.2.8.*

Receptors:

- Demersal and pelagic fish species including key commercial species.

Adopted Control Measures:

Minimum source size selected (3,090 cui) to acquire survey data and meet the geophysical objectives of the survey.

Soft-start procedures to provide receptors with advanced opportunity to move away from the source, if able.

Details of Residual Impacts and Risks:

Demersal and pelagic fish within the open waters Acquisition Area are generally expected to include numerous free-roaming species, with naturally large ranges in the order of several kilometres or even hundreds to thousands of kilometres.

Fish are expected to exhibit a range of temporary behavioural changes, in response to the approaching seismic source. Based on a comprehensive review of studies, behavioural responses may include changes in orientation, swim speed, tightening of school structure and change in position in the water column within several kilometres from the source, and at closer ranges may include stronger startle and flee responses with fish returning to normal behaviours shortly after the seismic source has passed (e.g. within an hour) (Pearson et al. 1992; Santulli et al. 1999; McCauley et al. 2000; Simmonds and MacLennan 2005; Fewtrell and McCauley 2012; Peña et al. 2013; Popper et al. 2014 [and references therein]; Carroll et al. 2017 [and references therein]). Also, the implementation of soft-start procedures (as recommended in the Department of Fisheries (2013) guidance statement on undertaking seismic surveys in Western Australian waters) will provide fish with advanced opportunity to move away from the source, and so injury and TTS impacts are not expected.

In addition to short-term behaviours, some studies have noted that avoidance behaviours led to changes in local abundance and distribution, with fish potentially moving from less than 5 km to over 30 km from survey lines, with local abundance and distribution returning to normal within three to five days, indicating that the effects are temporary (Engas et al. 1996; Slotte et al. 2004). It could not be confirmed how much changes in local abundance and distribution in these studies could be attributed to the seismic survey or if natural large scale feeding migrations occurring at the time of the experiments or other natural factors also contributed.

Therefore, impacts are expected to include localised and temporary changes in behaviour, local abundance and distribution. The residual impacts and risks, with the control measures in place, have therefore been assessed as Low.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Slight (1)	Regular (D)	**Low**
Residual Risk:	Slight (1)	Regular (D)	**Low**

6.2.7 Fish Spawning

Details of Impacts and Risks and Control Measures

Hazard/Threat:

Without adequate control measures in place, high intensity impulsive sound emitted from the seismic source has the potential to result in behavioural changes in fish or masking of fish vocalisations, which may temporarily divert efforts away from spawning aggregations, egg production and recruitment success (Hawkins and Popper 2017).

Potential impacts to fish eggs and larvae are addressed separately in *Section 6.2.8.*

Receptors:

Fish spawning and recruitment, in particular key indicator commercial species:

- Goldband snapper
- Red emperor

Adopted Control Measures:

Minimum source size selected (3,090 cui) to acquire survey data and meet the geophysical objectives of the survey.

Soft-start procedures to provide receptors with advanced opportunity to move away from the source, if able.

During the peak goldband snapper spawning season (1st December to 31st March), the number of days spent acquiring seismic data will be limited to a maximum of 45 days.

Details of Residual Impacts and Risks:

The potential impacts to fish spawning, principally the commercial indicator species, red emperor and goldband snapper have been assessed based on:

- The potential spatial overlap between the area affected by sound (fish behaviour and masking effects) with the area utilised by the stocks for spawning;
- The potential temporal overlap between the duration of planned acquisition phases and the duration of the available spawning periods and peak spawning periods;
- The likelihood of a phase of acquisition overlapping with a critical area for spawning aggregations;
- The likelihood of the activity reducing the available spawning biomass and stock recruitment success, taking into account natural variability.

Red emperor and goldband snapper are broadcast multiple batch spawners that spawn throughout their range and release millions of eggs throughout their spawning periods. Red emperor spawn between October and March, with a peak in October, and occur in water depths up to 180 m. Polarcus has been advised by DoF that goldband snapper spawn between September and May with a peak spawning period between December and March. Goldband snapper generally occur between 50 m and 200 m water depth, and are typically more concentrated between the 80 m and 140 m depth contours. Specific areas of aggregation are not known. Cues for spawning may include environmental cues such as water temperature and the moon cycle.

Red emperor stocks occur across northern Australia and biological connectivity and genetic homogeneity is maintained between the different stocks by dispersal of eggs and larvae throughout its range. Goldband snapper stocks, however, are found to be genetically distinct from other adjacent stocks (e.g. Pilbara, Broome, Timor Sea, Arafura Sea stocks), which has implications for stock recruitment if the spawning biomass is impacted. There is also currently some uncertainty about the status and sustainability of the stock. Therefore, goldband snapper is considered to be potentially more sensitive.

To estimate the largest area where spawning behaviour may be influenced by sound from the Zénaïde 3D MSS, the most extensive impacts and ranges identified in the scientific literature for changes in fish behaviour, abundance and distribution were used as a proxy and applied to the entire Acquisition Area.

Recognising that there is some uncertainty about the status and sustainability of the stock, and some assumptions and uncertainty are attributed to this method assessment, Polarcus has considered limiting the temporal overlap with the peak goldband snapper spawning period (December to March) to a maximum of 45 days.

Accounting for the spatial and temporal overlap, this equates to between 1.4% and 2.5% of the total suspected goldband snapper spawning area and peak spawning period. In addition, habitats in the

vicinity of the Operational Area are of limited value relative to habitats available within the wider region. Given the connectivity of red emperor stocks, the impacts to red emperor spawning are predicted to be negligible. The residual impacts and risks, with the control measures in place, have therefore been assessed as Low.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Extensive (3)	Occasional (C)	**Moderate**
Residual Risk:	Minor (2)	Occasional (C)	**Low**

6.2.8 Plankton, Fish Eggs and Fish Larvae

Details of Impacts and Risks and Control Measures

Hazard/Threat:

High intensity impulsive sound emitted from the seismic source has the potential to result in the mortality or physical impairment of plankton, with potential secondary impacts to the food source of other organisms, and/or potential impacts to eggs and larvae biomass which could in turn impact recruitment.

Receptors:

- Phytoplankton and zooplankton (primary productivity and food source)
- Fish eggs and larvae (spawning and recruitment)

Adopted Control Measures:

Minimum source size selected (3,090 cui) to acquire survey data and meet the geophysical objectives of the survey.

Details of Residual Impacts and Risks:

Potential impacts and risks to plankton have previously been understood to be highly limited and localised. Considering the impact thresholds proposed by Popper et al. (2014), the acoustic modelling undertaken by McPherson et al. (2017) indicates that potential for mortality to eggs and larvae could occur within approximately 140-226 m from the source. However, recent research by McCauley et al. (2017) may indicate that the extent of impacts to plankton, eggs and larvae could be greater (potential mortality to 178 dB re 1 µPa (Pk-Pk pressure) and therefore up to 9 km from the seismic source.

The potential impacts have been assessed based on modelling completed by Richardson *et al.* (2017), which adopts the impact thresholds suggested in McCauley et al. (2017). As the vessel and seismic source will be constantly moving and zooplankton populations are constantly being replenished by currents from non-impacted areas, the modelling demonstrated that zooplankton mortality rates are potentially detectable above natural levels in close proximity to the survey area, but are not likely to be discernible at the regional and subregional scale (150 km distance). Zooplankton biomass generally showed a decline until Day 22 of the Richardson *et al.* (2017) simulations, and then biomass increased relatively until the end of the simulated survey; this reflects the movement of water through the survey area and the recovery of the zooplankton biomass as it moves into non-impacted areas, which indicates that beyond a certain duration (i.e. ~22 days) the seismic acquisition area and duration contributes less to changes in overall biomass in the region relative to natural mortality rates and rates of recovery. Zooplankton biomass also returned to normal levels within the survey area within 3 days (Richardson *et al.* 2017).

Natural zooplankton mortality rates can vary considerably spatially and temporally and can be as high as ~60%, approximately 1/3 of which may be caused by non-predatory factors, indicating how difficult it would be to detect significant impacts of seismic pulses on plankton above natural levels. At the scales considered, the potential for significant impacts and risks to eggs and larvae biomass in the water column is considered to be localised and temporary and the risk is considered to be low.

Non-predatory zooplankton mortalities also leave nutrient- and carbon-rich carcasses behind to be scavenged in the water column and on the seafloor by opportunistic feeders for several days (during which time, the live zooplankton biomass in any given location is also likely to have been largely replenished via currents from non-impacted areas) and therefore the loss of zooplankton is not expected to make a discernible impact on food resources.

The residual impacts and risks, with the control measures in place, have therefore been assessed as Low.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Minor (2)	Occasional (C)	**Low**
Residual Risk:	Minor (2)	Occasional (C)	**Low**

6.2.9 Benthic Invertebrate Communities

Details of Impacts and Risks and Control Measures

Hazard/Threat:

Underwater sound associated with the operation of the seismic source has the potential to cause physiological impacts to benthic invertebrates.

Receptors:

Benthic macro-invertebrate communities, including:

- Sessile benthic invertebrates (e.g. molluscs)
- Mobile benthic invertebrates (e.g. crustaceans)
- Sponges, soft corals and other soft filter feeders

Adopted Control Measures:

Minimum source size selected (3,090 cui) to acquire survey data and meet the geophysical objectives of the survey.

Soft-start procedures to provide receptors with advanced opportunity to move away from the source, if able.

Details of Residual Impacts and Risks:

There is a general lack of convergence on the magnitude and extent of impacts reported in the scientific literature and thresholds are not defined. However, benthic invertebrates lack a gas-filled bladder and do not hear sound like fish, or mammals do. Invertebrates are therefore regarded as being less sensitive to sound than fish. They do however detect the particle acceleration component of a sound wave. In many studies, benthic invertebrates show no evidence of significant impacts. Based on the worst-case impacts reported in studies, impacts to benthic invertebrates may include:

- Sub-lethal impacts to crustaceans, such as statocyst impairment and reduced immune response function, although no long term ecological implications on survival are expected.
- Potential sub-lethal impacts to sessile molluscs and infauna such as impaired reflexes, and potentially some chronic effects that lead to mortality of a very small proportion of bivalves at close range, over and above natural mortality rates.
- Increased movement and behavioural avoidance of waters beneath the source by mobile invertebrates such as cephalopods.

The above impacts are expected to be localised and limited to invertebrates directly beneath the seismic source or, based on the levels reported in Day *et al*. (2016a, 2016b), within approximately 200-300 m range of the seismic source.

Therefore, some macro-invertebrates may experience some sub-lethal affects or a small increase in mortality rates of a small proportion of invertebrates as a result of chronic effects of exposure at close range. However, the ecological implications of these impacts on benthic communities are not expected to be significant or long term in the context of the natural spatial and temporal variability observed in the benthic communities in this region. Given that macro-invertebrate infauna and epifauna occur relatively sparsely across the majority of the Acquisition Area, the localised horizontal extent of potentially significant impacts, and the potential for subsequent recruitment and recovery (over weeks or months at most), no long-term population and community level impacts are expected and there is no threat of serious or irreversible environmental damage.

The residual impacts and risks, with the control measures in place, have therefore been assessed as Low.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Slight (1)	Regular (D)	**Low**
Residual Risk:	Slight (1)	Regular (D)	**Low**

6.2.10 *Commercial Fisheries*

Details of Impacts and Risks and Control Measures

Hazard/Threat:

Increased sound levels associated with seismic acquisition may modify the behaviour, local abundance and distribution of commercially targeted fish species in proximity to the Acquisition Area which could affect commercial catch rates.

Receptors:

Commonwealth and WA-managed fisheries that potentially operate in or near the Acquisition Area:

- Northern Prawn Fishery (trawl);
- Kimberley Prawn (trawl);
- Mackerel Managed Fishery (trolling or handline);
- Northern Demersal Scalefish Fishery (primarily trap with some line fishing);
- Northern Shark Fishery (Joint Authority Shark Fishery and Western Australia North Coast Shark Fishery) (line fishing) should fishing recommence in 2017/18.

Adopted Control Measures:

Minimum source size selected (3,090 cui) to acquire survey data and meet the geophysical objectives of the survey.

A Notice to Mariners will be issued prior to each survey phase mobilisation and following demobilisation.

Notification will be provided to fisheries stakeholders, 4 weeks prior to commencement of each survey phase, indicating location and expected timing. Notification will also be provided to fisheries stakeholders within 2 weeks of completion of each survey phase.

Daily lookahead reports detailing the upcoming 48 hours survey events will be provided via email to stakeholders who register for the service

Details of Residual Impacts and Risks:

Based on available research, the potential impacts to fish catches may vary. As a worst case, reduced local abundance and catch rates may occur within the area being surveyed and to ranges of up to a few tens of kilometres. Such impacts typically last only for the duration of the sound exposure (hours) or for up to approximately five days following cessation of the survey.

The fisheries that overlap the Acquisition Area operate over wider areas than will be exposed to the seismic sound during the survey. Given the spatial extents of the fisheries, only a portion of the area and fish targeted by fisheries may be affected by the survey and fish catches are expected to be available in other areas. Available data indicates that the survey is proposed to be conducted in areas where no significant fishing activity occurs and, therefore, disturbance to fishing operations and catch rates is expected to be minimal. Communication with fishery licence holders and the relevant agencies is a critical component of the proposed mitigation and to better enable resource sharing and transparency.

The residual impacts and risks, with the proposed control measures in place, have therefore been assessed as Low.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Minor (2)	Occasional (C)	**Low**
Residual Risk:	Minor (2)	Occasional (C)	**Low**

6.2.11 *Cumulative Seismic Sound Impacts*

Cumulative impacts from seismic sound can potentially occur when:

- Multiple seismic surveys occur in a region at the same time, leading to an increase in sound exposure to the same receptors; or
- Seismic surveys occur one after the other in the same area over time.

A review of seismic survey activities published on the NOPSEMA website and information gathered during stakeholder consultation has been undertaken to identify other marine seismic surveys that have been completed or are planned in the same area as the Zénaïde 3D MSS.

This section therefore assesses the potential for cumulative impacts associated with:

- The Zénaïde 3D MSS being undertaken in an area where other seismic surveys have occurred previously; and
- The Zénaïde 3D MSS being undertaken at the same time as another seismic survey within the area.

It is noted that multi-client data is acquired and sold to multiple petroleum block titleholders. Like Polarcus, other seismic operators will have sought commercial undertakings with petroleum block titleholders for the 3D data they acquire. For commercial reasons, it is very unlikely that a petroleum block titleholder would purchase data from more than one multi-client seismic operator and as such, it is likely that not all multi-client surveys (and possibly only one) will actually proceed. By the nature of multi-client seismic acquisition, the potential for multiple proprietary seismic surveys over the same area by individual petroleum block titleholders is generally avoided.

Assessment of Potential Cumulative Impacts from Previous Seismic Surveys

Cumulative impacts from successive surveys in the same area can occur when the timing between surveys is less than the recovery rate of any potential impacts to receptors.

Table 6.1 presents a summary of the marine seismic surveys that have been undertaken in the last 5 years within 100 km of the Zénaïde 3D MSS. The footprint of impacts resulting from the Zénaïde 3D MSS have been assessed as being more localised, but 100 km was selected as a conservative search criteria.

In some instances it has not been possible to confirm whether surveys have been undertaken or not, the dates surveys were completed, or the final areas that were acquired and any overlap with the Zénaïde 3D MSS Acquisition Area. Therefore, for the purposes of the assessment, it has been conservatively assumed that surveys have gone ahead within the areas and timescales proposed in their respective EPs.

Based on the review, no cumulative impacts are expected to have occurred between the Zénaïde 3D MSS and other previous surveys.

Table 6.1 Other marine seismic surveys completed within 100 km of the Zénaïde 3D MSS in the last 5 Years

Year	Company	Survey Title	Survey Location	Survey Status and Timing	Comments
2013	Santos Offshore Pty Ltd	Fishburn 2D Seismic Survey	2D lines were completed adjacent to and overlapping the proposed Zénaïde Acquisition Area.	Completed in 2013.	The survey was completed 4 years ago. Therefore, no cumulative impacts with the Zénaïde 3D MSS are possible.
2014	GX Technology Australia Pty Ltd	Westralia SPAN Marine Seismic Survey	Large multi-basin SPAN survey. The nearest seismic line was 35 km to south west of the Zénaïde 3D MSS Acquisition Area.	Completed prior to the end of Q2 2014.	It could not be confirmed if or when the proposed lines were acquired, but the SPAN survey was completed over 3 years ago. Therefore, no cumulative impacts with the Zénaïde 3D MSS are possible.
2017	Santos Offshore Pty Ltd	Fishburn WA-459-P 3D Seismic Survey	The Fishburn survey area was located approximately 10 km to the east of the Zénaïde Acquisition Area.	Completed 24/06/2017 – 12/07/2017	The survey area does not overlap the Zénaïde Acquisition Area. Any impacts resulting from the survey are expected to have fully recovered prior to the Zénaïde 3D MSS commencing. Therefore, no cumulative impacts with the Zénaïde 3D MSS are expected.

Details of Potential Cumulative Impacts from Concurrent Seismic Surveys

Over the scheduled period of the Zénaïde 3D MSS other seismic surveys are also planned to occur in the region. However, for commercial reasons, it is likely that not all of the proposed surveys will actually proceed. Polarcus will endeavour to minimise the potential for interaction between simultaneous seismic surveys (should they occur at the same time) to minimise both potential disruptions to operations as well as potential cumulative sound impacts to the environment and other marine users.

For operational reasons (to prevent acoustic interference and preserve seismic data integrity) a minimum separation distance of at least 40 km will be maintained between the Zénaïde 3D MSS seismic source and any other concurrently operating seismic sources during data acquisition activities. Given this separation distance, underwater sound from the seismic sources is not anticipated to combine to significantly raise the sound pressure levels to which receptors may be exposed. This is because, for example, where sound levels from two sources combine through constructive interference, a doubling of sound pressure corresponds with an increase in SPL of 6 dB (e.g. Hass 2013).

While overall sound levels are not expected to be significantly elevated, it is acknowledged that the result of multiple seismic vessels operating concurrently will represent a wider spatial area of potential exposure to seismic sound for receptors.

To understand what other known potential seismic surveys may occur near the Zénaïde 3D MSS Acquisition Area, a review was undertaken of the seismic surveys that:

- may occur within 100 km of the Zénaïde 3D MSS;
- may occur within the same EP timeframes; and
- either have an EP accepted by NOPSEMA or have submitted an EP to NOPSEMA and is currently under assessment.

The results show that there are currently no planned seismic surveys near the Zénaïde 3D MSS Acquisition Area with accepted EPs in place. One multi-basin seismic survey (PGS Rollo Multi-client Marine Seismic and CSEM Surveys) currently has an EP being assessed by NOPSEMA. This seismic survey have been considered for potential cumulative impacts with the Zénaïde 3D MSS.

Marine Fauna (mammals, reptiles, sharks)

Short-term behavioural impacts resulting from the Zénaïde 3D MSS are predicted to occur up to a maximum of between approximately 8 km and 14 km for marine mammals and turtles (depending upon location and water depth) and at lesser distances for other marina fauna (see *Sections 6.2.1* to *6.2.10*). Species are expected to be transient and no changes to migration or other important life stages are expected.

Taking the proposed 40 km minimum separation between two operating seismic vessels into consideration, no significant discernible cumulative impacts to marine

fauna are expected. The cumulative risk is therefore considered to be Low and Acceptable given that there is no threat of serious or irreversible environmental damage.

Fish

Behavioural impacts in fish are expected to be most apparent in fish between several hundred metres and several kilometres from the Zénaïde 3D MSS survey lines, returning to normal within as little as an hour. It is acknowledged that, based on the available scientific literature, some changes in abundance and distribution of fish may be apparent in the Acquisition Area for up to approximately 5 days, as well as some less significant and shorter term changes in abundance and distribution out to approximately 37 km.

Taking the proposed 40 km minimum separation into consideration, no cumulative overlap of strong behavioural responses is expected. Some mild changes in fish abundance and distribution could occur as a result of exposure from two operating seismic surveys when they are at their closest, but such changes are expected to return to normal within a few hours or days. There is also a very low likelihood of two 2D or 3D seismic surveys occurring in close proximity over similar timeframes.

The cumulative risk is therefore considered to be Low and Acceptable given that there is no threat of serious or irreversible environmental damage.

Fish Spawning

The Zénaïde 3D MSS may partially overlap with the peak goldband snapper spawning period, but the risks are expected to be low.

It is acknowledged that there is the potential for the proposed Polarcus Cygnus 3D MSS to also occur within the region during the spawning period. The Polarcus Cygnus 3D MSS is located over 130 km from the Zénaïde Acquisition Area and seismic acquisition will not occur concurrently for the two surveys.

Should both surveys overlap with the goldband snapper spawning period to some degree, there would be no spatial overlap with the same areas of potential aggregation given the minimum 130 km separation. Therefore, cumulative impacts are expected to be limited from the Cygnus and Zénaïde surveys.

The cumulative risk is therefore considered to be Low and Acceptable given that there is no threat of serious or irreversible environmental damage.

Plankton, Fish Eggs and Larvae

Based on the maximum worst case mortality exposure suggested by McCauley *et al.* (2017) and modelling completed by Richardson *et al*. (2017), impacts to zooplankton are only expected to be significant within a short range (e.g. 15 km) of seismic survey areas. Beyond 22 days of acquisition, Richardson *et al*. (2017) found that no further relative increase in zooplankton mortality occurs due to recruitment of zooplankton via currents from adjacent areas, and conditions return to normal within a few days of a survey ceasing. At the regional scale, these impacts are not expected to be

significant Richardson *et al*. (2017). Further, natural mortality rates can be as high as 60%, and not entirely as a result of predation, therefore, limited impacts are expected relative to the natural variation in zooplankton concentrations and mortality rates. Taking the proposed 40 km separation into consideration, the cumulative impacts to plankton are expected to be negligible.

The cumulative risk is therefore considered to be Low and Acceptable given that there is no threat of serious or irreversible environmental damage.

Benthic Invertebrates

The maximum worst case impacts reported for invertebrates include sub-lethal impacts such as statocyst impairment, temporary reduced immune response function, temporary impaired reflexes, and potentially some chronic effects that lead to mortality of a very small number of sessile benthic invertebrates over and above natural mortality rates. For the Zénaïde 3D MSS, such impacts are expected to occur at close range to the seismic source (e.g. ~100 m). In the context of natural mortality, recruitment and recovery rates, the impacts to overall benthic communities are expected to be negligible.

Currently, no other seismic surveys are planned to occur that overlap the planned Zénaïde Acquisition Area. Should there be some overlap in other future areas, cumulative impacts may only occur if more than one survey occurs within weeks of the preceding survey, which is unlikely to occur.

The cumulative risk is therefore considered to be Low and Acceptable given that there is no threat of serious or irreversible environmental damage.

Commercial Fisheries

Cumulative impacts to commercial fisheries could occur if multiple seismic surveys occur concurrently or in quick succession within an area, resulting in increased avoidance by target fish species. As highlighted in *Section 6.2.10*, the expected range and duration of impacts to fish abundance, distribution and catch rates is relatively small compared to wider areas within which the fisheries operate. However, Polarcus recognises that clear and regular communication with fisheries stakeholders is required in order to provide timely information on the location and timing of different surveys in order to facilitate better planning and resource sharing. Therefore, Polarcus will notify stakeholders prior to the commencement of the Zénaïde 3D MSS and will provide regular updates to fishery licence holders during survey operations with the relevant stakeholders. The cumulative risk is therefore considered to be Low.

6.2.12 *Vessel and Helicopter Noise*

Details of Impacts and Risks and Control Measures

Hazard/Threat:

The potential hazard associated with vessel and helicopter noise is the potential to cause behavioural disturbance to marine fauna.

Receptors:

Marine fauna that may potentially be impacted by vessel and helicopter noise include:

- Cetaceans
- Marine turtles
- Whale sharks
- Dugongs
- Birds

Adopted Control Measures:

Vessel activities will be undertaken in accordance with 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; and
- not exceeding a speed of 6 knots within the caution zone of a cetacean (300 m).

Consistent with the requirements of the EPBC Regulations 2000 - Part 8 Division 8.1 for cetaceans, seismic vessels and support vessels (taking into account the limited manoeuvrability of the former) will also take action to avoid approaching or drifting closer than 50 m to a turtle or dugong.

Seismic vessels and support vessels (taking into account the limited manoeuvrability of the former) will also adopt measures consistent with the DPaW Whale Shark Management Programme (2013), including:

- taking action to avoid approaching or drifting closer than 30 m of a whale shark; and
- not exceeding 8 knots within 250 m of a whale shark.

Helicopter movements will be undertaken in accordance with EPBC Regulations 2000 – Part 8 Division 8.1, including:

- helicopters not to operate at a height lower than 1650 feet within a horizontal radius of 500 metres of a cetacean
- helicopters not to approach a cetacean from head on.

Details of Residual Impacts and Risks:

Given there are no high energy impulsive sound sources associated with the routine operation of helicopters and vessels, there may be some localised behavioural disturbance of marine fauna in the immediate vicinity of vessels during operations, but physiological effects on fauna are not anticipated. Some transient marine fauna individuals may choose to avoid the immediate proximity of the vessel, but this is not expected to have any widespread or longer term impacts on their behaviour or populations. Seabirds are generally understood to be undeterred by vessel noise.

Some minor behavioural disturbance may occur for short periods if marine fauna are present near the surface in the vicinity of landing helicopters. This would be limited to a temporary change in behaviour due to avoidance of the area, but is not expected to have any longer term impacts. Seabirds are expected to avoid the immediate vicinity of a helicopter, but again no long term impacts are anticipated.

The residual impacts and risks, with the control measures in place, have therefore been assessed as Low.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Slight (1)	Occasional (C)	**Low**
Residual Risk:	Slight (1)	Occasional (C)	**Low**

6.3 LIQUID AND SOLID WASTE DISPOSAL

6.3.1 Liquid Waste Discharges from Vessels

Details of Impacts and Risks and Control Measures

Hazard/Threat:

Without adequate control measures in place, the potential hazards associated with liquid waste discharge into the Operational Area are:

- Temporary and localised reduction in water quality; and
- Minor and temporary toxicity on marine biota

Receptors:

Water quality and marine biota

Adopted Control Measures:

Sewage will be managed in accordance with MARPOL Annex IV and AMSA Marine Order 96, using an IMO-approved sewage treatment plant, a sewage comminuting and disinfecting system or a sewage holding tank as applicable depending on vessel gross tonnage or people capacity (as evidenced by a current International Sewage Pollution Prevention (ISPP) Certificate).

In accordance with MARPOL Annex IV and AMSA Marine Order 96:

- 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.

Vessels will have facilities on board of a standard capable of macerating or grinding putrescible wastes and screening to less than 25 mm in diameter, prior to discharge while the vessel is moving and ≥3 Nm from land.

Vessels > 400 gross tonnes will have an oil discharge monitoring and control system and oil filtering equipment on board, hold a current IOPP Certificate and maintain an oil usage management log book, in accordance with MARPOL 73/78.

Treated bilge water will be discharged only when the vessel is moving and the oil discharge monitoring and control system and oil filtering equipment is operating to ensure oil in water content of <15 ppm.

If oil discharge monitoring and control system and oil filtering equipment is unavailable, bilge water mixtures will be retained on-board for on shore disposal.

Oil discharge monitoring and control systems on board the survey vessels will be maintained and calibrated (15 ppm) to ensure monitoring readings are accurate.

Details of Residual Impacts and Risks:

Impacts resulting from the discharge of domestic liquid wastes are expected to be negligible, as treated discharges would rapidly disperse in close proximity to the release location given surface currents and the assimilative capacity of the open ocean environment. Planned/routine discharge of domestic wastes has the potential to temporarily create a localised increase in nutrient levels resulting in minor and temporary ecological impacts (e.g. changes in the availability of light, certain nutrients and/or dissolved oxygen).

Modelling of domestic waste discharges (10 m^3/day) undertaken by Woodside (2014) indicated that discharges were rapidly diluted in the upper water column (less than 10 m depth) with no significant lasting elevations in water quality parameters (e.g. total nitrogen, total phosphorous, and selected metals) above background levels 50 m from the source. Therefore, the extent of impacts is expected to be highly localised to the discharge location.

With the proposed management and discharge controls in place, discernible impacts to water quality and marine biota are not expected in the open water location of the Zénaïde 3D MSS. The consequence of reduction in water quality and impacts to marine biota is therefore slight given the nature and scale of the impact, though any changes would rarely be discernible. The residual risk associated with the management and disposal of liquid waste discharges has been determined to be low.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Slight (1)	Rare (B)	**Low**
Residual Risk:	Slight (1)	Rare (B)	**Low**

6.3.2 Solid Waste Management on Vessels

Details of Impacts and Risks and Control Measures

Hazard/Threat:

If solid wastes on board vessels are not managed or disposed of appropriately, small quantities of solid waste (e.g. packaging and other domestic waste products) may be released with the potential to impact the environment. The potential hazards associated with the discharge of solid wastes in the Operational Area are:

- Temporary and localised reduction in water quality; and
- Interactions with marine biota (e.g. contact, entanglement, ingestion).

Receptors:

Water quality and marine biota

Adopted Control Measures:

In accordance with MARPOL Annex V and Marine Order 95:

- Vessels > 100 t (or certified for >15 persons on board) will have a Waste Management Plan
- Vessels >400 T (or certified for >15 persons on board) will have a waste management log book

Bins available for the segregation of waste in accordance with the vessel Waste Management Plan, and bins are fitted with lids/cargo nets for waste with potential to be wind-blown (e.g. paper, cardboard).

Solid hazardous and non-hazardous wastes generated during the survey are segregated on board the vessels and are either incinerated (using an IMO-approved incinerator, on seismic vessel only) or appropriately disposed of at a licensed onshore facility in accordance with the Vessel Waste Management Plan.

Food waste will be macerated to <25 mm diameter and then only discharged when the vessel is moving and is more than 3 NM from the nearest land.

Non-hazardous waste generated on board the vessel will be recycled or re-used where practical and possible.

Solid waste generated during the survey on board the vessel will be minimised where practical, as identified during the pre-survey environmental checklist.

Details of Residual Impacts and Risks:

Impacts resulting from the routine management of sold hazardous and non-hazardous wastes are expected to be negligible, as there will be no planned discharge of solid wastes to the marine environment. Discharge of solid wastes has the potential to temporarily create a localised change in water quality and temporary ecological impacts (e.g. changes in the availability of light, certain nutrients and/or dissolved oxygen). Solid wastes may also be blown off the vessel, which could have the potential to result in fauna mortality or injury through ingestion or entanglement. Windblown waste would be rare as wastes will be stored in closed containers.

With the proposed management and discharge controls in place, discernible impacts to water quality and marine biota are not expected in the open water location of the Zénaïde 3D MSS. The consequence of reduction in water quality and impacts to marine biota is therefore slight given the nature and scale of the impact, though any changes would rarely be discernible.

The residual impacts and risks, with the control measures in place, have therefore been assessed as low.

Residual Risk Ranking:	Consequence	Likelihood	Risk
	Slight (1)	Rare (B)	**Low**
	Slight (1)	Rare (B)	**Low**

6.4 ATMOSPHERIC EMISSIONS

Details of Impacts and Risk Control Measures

Hazard/Threat:
Atmospheric emissions have the potential to result in a localised reduction in air quality in the immediate vicinity of the vessel exhaust and to contribute to greenhouse gases (GHG) in the atmosphere.
Receptors:
Air quality in the immediate vicinity of the vessel exhaust and global levels of GHG in the atmosphere.
Adopted Control Measures:
In accordance with MARPOL 73/78 Annex VI (Prevention of Air Pollution) and Marine Orders 97: • Vessels to have a valid IAPP Certificate (International air pollution prevention certificate) • Incinerator will be certified to meet prescribed emissions standards • Diesel engines >130kW certified to meet prescribed emission standards
Vessels will use MGO grade fuel during the survey, which will have an ultra-low sulphur content of (≤3.5% by mass).
Vessel engines and incinerators maintained according to manufacturer's specification
Fuel usage for the survey will be recorded
Details of Residual Impacts and Risks:
Impacts resulting from the atmospheric emissions are expected to be negligible, as emissions would rapidly disperse in close proximity to the release location. The vessels present in the Operational Area will generate atmospheric emissions from power generation and waste incineration. Atmospheric emissions have the potential to result in a localised reduction in air quality in the immediate vicinity of the vessel exhaust and to contribute to Australian and global levels of greenhouse gases in the atmosphere. Due to the low emission levels and very low background levels of pollutants, it is anticipated that emissions resulting from the survey will only result in a short term and localised reduction in air quality, with emissions quickly dispersing back to within background levels. No lasting effect on sensitive receptors is likely. Given the low level of emissions anticipated, survey emissions only represent a small contribution to overall Australian and global GHG emissions to the atmosphere. With the proposed management and controls in place, discernible impacts to air quality are not expected in the vicinity of the Zénaïde 3D MSS. The consequence of reduction in air quality is therefore low given the nature and scale of the impact, though any changes would rarely be discernible. The residual impacts and risks have therefore been assessed as low.

Risk Ranking:	Consequence	Likelihood	Risk
Inherent Risk	Slight (1)	Regular (D)	**Low**
Residual Risk	Slight (1)	Regular (C)	**Low**

6.5 ARTIFICIAL LIGHT EMISSIONS

Details of Impacts and Control Measures

Hazard/Threat:
Artificial light resulting from navigational and safety lighting for seismic survey/support vessels may disrupt marine fauna behaviour.
Receptors:
Marine fauna sensitive to artificial lighting (i.e. turtles, fish and seabirds).

Adopted Control Measures:
Reduce lighting as far as practicable, whilst not jeopardising safety (e.g. non-essential lighting to be turned off when not in use).
Identify opportunities to further reduce lighting during pre-survey environmental checklist.
Crew instructed/briefed to minimise unnecessary external lighting where practicable.
Details of Residual Impacts and Risks:
Impacts resulting from artificial lighting during acquisition are expected to be negligible. Due to the size of the vessel and the height above sea level where lights will be positioned, it is expected that light emissions will be limited to localised offshore attraction/repulsion of marine fauna species, including marine turtles, fish and seabirds. Artificial lighting has the potential to temporarily create an attraction/repulsion of marine fauna species, including marine turtles, fish and seabirds. The transient nature of the survey, the predominantly open oceanic location of the Operational Area, and the minimum distance to known turtle nesting beaches and bird breeding colonies (>50 km from the Operational Area) fauna are unlikely to be are unlikely to be impacted. In addition, during acquisition, sound emissions from the seismic vessels are expected to act as a localised and temporary deterrent to approaching marine fauna (refer to *Section 6.2*). The survey is unlikely to generate light levels sufficient to disrupt natural behavioural patterns on a long term basis that could result in significant effects to the marine fauna populations in the region. With the proposed management controls in place, discernible impacts to marine fauna are not expected in the location of the Zénaïde 3D MSS from artificial light. The consequence of disrupting critical behaviours of marine fauna is therefore minor given the nature and scale of the impact, though any changes would rarely be discernible. The residual impacts and risks have therefore been assessed as low.

Risk Ranking:	Consequence	Likelihood	Risk
Inherent Risk	Minor (2)	Occasional (C)	**Low**
Residual Risk	Minor (2)	Rare (B)	**Low**

6.6 INTRODUCTION OF INVASIVE MARINE SPECIES

Details of Impacts and Risks and Control Measures

Hazard/Threat:
Introduction of IMS to the Operational Area has the potential to occur through: • biofouling of vessel hull; • exchange of ballast waters; and • biofouling of in-water survey equipment. If successfully established, IMS may result in: • Competition, predation or displacement of native species. • Alteration of natural ecological processes. • Introduction of pathogens with the potential to impact on ecological health.
Receptors:
Marine ecological communities (alterations to local ecosystems)
Adopted Control Measures:
Vessel hull and niches confirmed to be free of IMS prior to mobilisation into Australian waters.
Survey and support vessels will have all necessary Department of Agriculture and Water Resources biosecurity approvals prior to mobilisation, including pre-arrival reporting clearance in accordance with the *Biosecurity Act 2015* for vessels entering Australian territorial waters.
All vessels will comply with key requirements of the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia, 2009) of which key

requirements are:

- Maintenance of biofouling electronic records outlining marine fouling management actions
- Completion of an IMS risk assessment prior to vessel entry into Australian waters which concludes a low risk of IMS presence
- In-water equipment free of marine fouling prior to the commencement of the survey

All vessels will maintain a current anti-fouling coating 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*.

Streamers will be inspected, maintained and cleaned during retrieval (e.g. due to transit, crew change, inclement weather) to reduce biofouling.

Exchange of ballast water will only occur > 12 nm from land and in water depths of > 50 m in accordance with the Australian Ballast Water Management Requirements (Department of Agriculture and Water Resources 2017).

BWM-T class (IMO approved) ballast water management system on board the seismic vessel treats water to reduce the risk of any living organisms being present prior to discharge.

Survey and support vessels will have a Ballast Water Management Plan and a ballast water record system/book, consistent with the Australian Ballast Water Management Requirements (Department of Agriculture and Water Resources 2017).

Details of Residual Impacts and Risks:

Impacts resulting from the introduction of marine species from ballast water and biofouling (submersible equipment and seismic/support vessels) are expected to be negligible. IMS once introduced are irreversible and can have significant impacts on the marine ecosystem as they are likely to have little or no natural competition or predation, resulting in IMS outcompeting native species for food or space, preying on native species or changing the nature of the environment. This will result in an alteration of natural ecological processes and the potential to introduce pathogens.

Vessels operating in offshore environments are less likely to accumulate or translocate marine pests than vessels that spend prolonged periods in shallow port or coastal waters (Commonwealth of Australia 2009; Wells *et al*. 2009). Therefore, highly disturbed, shallow water environments such as ports and marinas are more susceptible to colonisation than open-water environments, such as the Operational Area, where the rate of dilution and the degree of dispersal are high (Williamson and Fitter 1996; Paulay *et al*. 2002).

With the proposed management controls in place, discernible impacts to ecological marine communities are not expected in the open water location of the Zénaïde 3D MSS. The consequence to marine biota is extensive given the nature and scale of the impact, though any changes would rarely be discernible.

The likelihood of IMS establishment in the Operational Area is further reduced with the controls in place, but remains Rare (B). The residual impacts and risks have therefore been assessed as low.

Risk Ranking:	Consequence	Likelihood	Risk
Inherent Risk	Extensive (3)	Rare (B)	**Low**
Residual Risk	Extensive (3)	Rare (B)	**Low**

7 EVIRONMENTAL RISKS AND MANAGEMENT - UNPLANNED EVENTS

This section describes and assesses the potential environmental impacts associated with credible unplanned events that could occur during the Zénaïde 3D MSS. Based on the risk assessment method undertaken for this EP, the impacts and risks associated with the following unplanned events are described in the subsections below:

- hydrocarbon and chemical spills; and
- loss of equipment

7.1 HYDROCARBON AND CHEMICAL SPILLS

7.1.1 Vessel Fuel Tank Rupture

Details of Impacts and Risks and Control Measures

Hazard/Threat:
Surface hydrocarbon exposures resulting from an accidental MGO spill from a vessel fuel tank rupture (280 m3) have the potential to result in the following adverse effects on the environment: • Toxic effects on marine fauna that come into contact with surface hydrocarbons; • Disruption to other marine users from the presence of the slick. Entrained hydrocarbon exposures within the top 10 m of the water column have the potential to result in the following adverse effects on the environment: • Toxic effects to fish ingesting or contacting entrained hydrocarbons; and • Toxic effects on plankton, juvenile fish, eggs and larvae that may become entrained with hydrocarbon droplets.
Receptors:
• Marine fauna, including EPBC Act listed species such as turtles, cetaceans, dugongs, whale sharks and birds • Pelagic fish, eggs and larvae • Other marine users, including fisheries and commercial shipping
Adopted Control Measures:
Vessels utilise MGO which is stored in multiple fuel tanks on board. Fuel tanks can be isolated and contents transferred between them.
Seismic vessels have a double hull design making a rupture highly unlikely, even in a collision situation.
Radar on board each seismic vessel is fitted with a collision alarm, and seismic vessels have DNVGL NAUT-AW class notation for enhanced nautical safety, incorporating a grounding avoidance system.
Vessels will maintain appropriate lighting, shapes, navigation and communication at all times to inform other users of the position and intentions of the vessel, in compliance with the Navigation Act 2012 and associated Marine Orders.
A 24 hour visual, radio and radar watch will be maintained for vessels in the vicinity of the Operational Area.
Other users who may be present in the Operational Area will be advised of survey activities through: • Pre-mobilisation consultation; • Notice to Mariners issued by the AHS prior to survey mobilisation and following demobilisation; and • Daily reports provided to the AMSA JRCC.
All vessels over 400 t (MARPOL 73/78 Annex I) hold approved and tested SOPEPs and crew are trained

in its implementation.

In the event of a spill to the marine environment, the OPEP presented in *Section 0* will be followed.

Details of Residual Impacts and Risks:

Marine fauna

Surface MGO exposures are expected to be limited to several kilometres and fall below 10 g/m^2 within 24 hours of a spill occurring. Therefore, given the relatively short-term and localised exposure potential, sub-lethal and lethal impacts to transient marine fauna from inhalation, ingestion or skin contact are expected to be limited to individuals or groups of fauna that forage within the localised area of the slick during the first 24 hours, though there is the potential for some less severe sub-lethal impacts to occur if patchy residues of the slick are inhaled or ingested within approximately 48 hours of the spill occurring. While this could potentially result in the mortality of some turtles, marine mammals and birds, it is highly unlikely that the number of animals that would be encountered and impacted by the slick would result in population and stock level impacts. The potential consequence to marine fauna is assessed to be Extensive (3).

Pelagic fish, eggs and larvae

The low probability of low exposures of entrained hydrocarbon droplets in the top 10 m of the water column has the potential to impact marine organisms such as juvenile fish, larvae and planktonic organisms that may become entrained with the hydrocarbon droplets and risk chronic exposure impacts, or if entrained hydrocarbons adhere to fishes' gills.

Given the low, patchy exposures that could potentially occur as a worst case, and that key fish species associated in the region are understood to be broadcast spawners, releasing large numbers of eggs in the region on multiple occasions during a season, the proportion of juveniles, eggs and larvae that may be affected during the short duration of the spill is expected to be negligible. Therefore, the potential consequence to pelagic fish, eggs and larvae is expected to be Slight (1).

Other marine users

Considering the maximum predicted extent of moderate surface hydrocarbon exposures (>10 g/m^2) is up to 36 km from a release site and the short-term presence of such exposures (approximately 24 hours), it is anticipated that the impacts on other activities would be relatively localised and short-term. Further, the maximum area of the slick at any time is expected to cover only several kilometres. Therefore, the potential consequence on other marine users and activities is considered Minor (2).

With the proposed preventative and mitigative controls in place, the likelihood of a vessel incident occurring, and resulting in a fuel tank rupture and the loss of a full 280 m3 tank volume, and resulting in the impacts described above is considered to be Rare (B). The residual risk has been determined to be Low.

Marine Fauna e.g. Turtles, Mammals, Birds (Surface Exposures)			
Risk Ranking	**Consequence**	**Likelihood**	**Risk**
Inherent Risk:	Extensive (3)	Rare (B)	**Low**
Residual Risk:	Extensive (3)	Rare (B)	**Low**
Pelagic Fish, Eggs and Larvae (Entrained Exposures)			
Risk Ranking	**Consequence**	**Likelihood**	**Risk**
Inherent Risk:	Slight (1)	Rare (B)	**Low**
Residual Risk:	Slight (1)	Rare (B)	**Low**
Other Marine Users – Commercial Fisheries and Shipping (Surface Exposures)			
Risk Ranking	**Consequence**	**Likelihood**	**Risk**
Inherent Risk:	Minor (2)	Rare (B)	**Low**
Residual Risk:	Minor (2)	Rare (B)	**Low**

7.1.2 *Vessel Refuelling Failure*

Details of Impacts and Risks and Control Measures

Hazard/Threat:

An accidental MGO spill during vessel refuelling (up to 25 m^3) has the potential to result in the following adverse effects on the environment:

- Toxic effects on marine fauna that come into contact with surface hydrocarbons;
- Toxic effects to juvenile fish, eggs and larvae from entrained hydrocarbon droplets.

Receptors:

- Marine fauna, including EPBC Act listed species such as turtles, cetaceans, dugongs, whale sharks and birds
- Pelagic fish, eggs and larvae

Adopted Control Measures:

Bunkering contractor selection is made in accordance with the contractor selection procedure to ensure the contractor will use dry-break couplings.

Refuelling undertaken in accordance with Polarcus Bunkering Procedure including:

- Refuelling will only be undertaken during daylight hours and in suitable weather conditions.
- Completion of the Permit to Work Refuelling At Sea Checklist and Bunkering Checklist ensuring that anti-pollution equipment is ready and scuppers plugged before bunkering commences.
- Spill kits are available on board the seismic vessel and crew are trained in their use.

All vessels over 400 t (MARPOL 73/78 Annex I) hold approved and tested SOPEPs and crew are trained in its implementation.

In the event of a spill to the marine environment, the OPEP presented in *Section 0* will be followed.

Details of Residual Impacts and Risks:

A refuelling spill of up to 25 m^3 of MGO may result in localised exposure of receptors to localised surface and entrained hydrocarbons. Potential exposures to spilt surface oil >10 g/m^2, considered representative of potential lethal and sub-lethal impacts to marine fauna such as turtles, cetaceans and birds are expected to be limited to a localised area for a few hours or less than a day. Therefore, worst case impacts are expected to be limited to sub-lethal impacts or potential mortality to a small number of individuals Entrained exposures are also expected to be low, resulting in limited interactions with small numbers of fish, eggs and larvae in the upper water column that are largely incidental in nature.

The localised and short term impacts that are predicted to occur to marina fauna and fish following weathering, dispersion and degradation in the open water environment of the Operational Area are therefore assessed to be Low.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Minor (2)	Occasional (C)	**Low**
Residual Risk:	Minor (2)	Rare (B)	**Low**

7.1.3 *Single Point Failure*

Details of Impacts and Risks and Control Measures

Hazard/Threat:

Accidental spills of up to 1 m^3 of hydraulic fluids or chemicals are expected to result in a localised and short term reduction in water quality with the potential to result in toxic effects on marine fauna.

Receptors:

- Marine fauna, including EPBC Act listed species such as turtles, cetaceans, dugongs, whale sharks and birds
- Pelagic fish, eggs and larvae

Adopted Control Measures:
Hydraulic fluids and chemicals will be selected in accordance with the Polarcus Chemical Control Procedure and will be selected to have the lowest environmental toxicity possible whilst meeting operational performance requirements.
Storage, handling and use of hazardous substances (including hydraulic fluids and chemicals) shall be in accordance with the product's Safety Data Sheet (SDS)
Spill kits and scupper plugs are available on board the seismic vessel and crew are trained in their use
All vessels over 400 t (MARPOL 73/78 Annex I) hold approved and tested SOPEPs and crew are trained in its implementation.
Spills will be reported through the Polarcus Incident Reporting Procedure and waste materials managed in accordance with the vessel Waste/Garbage Management Plan.
Details of Residual Impacts and Risks:
The accidental release of up to 1 m^3 of hydraulic fluids or chemicals to the marine environment may result in a localised reduction in water quality. Hydraulic fluids spilt overboard have the potential to result in toxicity effects to marine fauna and fish in the immediate vicinity of the spill release location, through direct contact or accidental ingestion. Given the open water dispersive location of the Operational Area, the extent and duration of potential exposures, impacts to marine fauna and fish is expected to be highly localised and short term, and limited to the vicinity of point of discharge. Therefore, impacts are considered to result in a minor consequence and the residual risk has been determined to be Low with the proposed preventative controls in place.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Minor (2)	Occasional (C)	**Low**
Residual Risk:	Minor (2)	Rare (B)	**Low**

7.1.4 Spill Response Options

Spill response mitigation measures will be implemented as appropriate to reduce the likelihood of impacts to key marine environmental receptors Based upon the outcome of the predictive spill modelling and the properties of MGO, the following spill response options are considered applicable for potential MGO spills:

- Source control, which will include locating the source of the leakage and may also include isolating the tanks, transferring oil to slack or empty tanks, ceasing bunkering operations or using scupper plugs;
- Monitor and evaluate the trajectory and extent of the spill; and
- Assisted natural dispersion using propeller wash, if advised by the Control Agency, AMSA, and deemed safe.

The above spill response options are not expected to introduce additional hazards to the marine environment or to result in significant additional potential impacts. The response options of source control, monitor and evaluate and assisted natural dispersion will use existing survey and/or support vessels, and the potential impacts associated with the use vessels is evaluated in *Section 6.1.2* for planned activities.

7.2 LOSS OF EQUIPMENT

Details of Impacts and Risks and Control Measures

Hazard/Threat:

The loss of equipment overboard has the potential to:

- disrupt other users of the Operational Area; and
- result in disturbance to the seabed.

Receptors:

- Other marine users (e.g. commercial fisheries and shipping)
- Benthic habitats and communities

Adopted Control Measures:

Streamers will be deployed and retrieved in accordance with the Polarcus Deployment and Recovery of Streamers Procedure, of which key requirements include:

- Ensuring weather conditions are appropriate for deployment and retrieval;
- Ensuring tail buoy GPS is operational;
- Monitoring deployment and retrieval closely;
- Checking for physical damage;
- Ensuring connection devices are in serviceable condition;
- Storing all birds, floats, retrievers and acoustic racks immediately following recovery.

Streamers shall be fitted with redundant retainers, tail buoys and relative GPS.

Solid streamers shall be used for the survey.

All lifting gear used for deployment and retrieval of equipment over the vessel shall be load rated for the working load.

AMSA JRCC and relevant stakeholders known to be in the Operational Area will be notified in the event of equipment loss.

At least one support vessel will accompany the seismic vessel at all times and will, if necessary, assist in the recovery of lost equipment.

Details of Residual Impacts and Risks:

In the event that equipment is lost, other users of the Operational Area may be required to make minor diversions to avoid the equipment, until it can be retrieved. The potential for such interactions will be limited to a short period of time while equipment is retrieved. Should disruption occur it is only expected to affect individual users and cause temporary disruption through avoidance of a highly localised area. Given the nature and size of the equipment to be used during the survey, lost equipment is not expected to result in a navigational hazard.

Dropped equipment may also disturb benthic habitats. As described in Section 4.3.2, the majority of benthic habitats in the Operational Area comprise mostly sediments with sparse areas of sponges, soft corals and filter feeders. Occasional calcareous rock outcrops may occur in places such as in association with carbonate banks located around the Operational Area. Such habitats are well represented throughout the region. Given the size of equipment used for the survey, only a relatively small area of the seabed would be disturbed and lasting impacts are not expected.

Therefore, impacts are considered to result in a minor consequence and the residual risk has been determined to be Low.

Risk Ranking	Consequence	Likelihood	Risk
Inherent Risk:	Slight (1)	Occasional (C)	**Low**
Residual Risk:	Slight (1)	Rare (B)	**Low**

8 IMPLEMENTATION STRATEGY

The Implementation Strategy in the EP describes:

1. The Polarcus Environmental Management System (EMS);
2. Roles and responsibilities, competency and training;
3. Arrangements for ongoing stakeholder consultation and notifications.
4. Compliance assurance arrangements, including arrangements for monitoring, review and reporting of environmental performance; and
5. Preparedness for responding to oil pollution emergencies through an OPEP and appropriate arrangements for environmental monitoring;

The Polarcus Zénaïde 3D MSS will be undertaken in accordance with the control measures, environmental performance outcomes, environmental performance standards and measurement criteria defined in the NOPSEMA-accepted EP, applicable legislation and the Polarcus Environmental Management System.

8.1 COMPLIANCE ASSURANCE

Compliance with this EP will be assured and reviewed via daily on-board meetings, on-board HSE committee meetings, and via internal audit and monitoring programs described below.

8.1.1 Monitoring and Recording

Monitoring will be undertaken for the Zénaïde 3D MSS, and records kept as detailed in *Table 8.1*.

Table 8.1 Monitoring and Recording Summary

Discharge/Incident	Parameters	Record	Responsibility
Atmospheric Emissions			
Engine emissions	Quantity of marine diesel used by the seismic vessel	Engineers log	Vessel Master
Discharges to Sea			
Oily water discharges	The volume of oily water discharge from the seismic vessel.	Oil usage management electronic records	Vessel Master
Food waste	The volume of food-scraps discharged from the seismic vessel	Waste management electronic records	Vessel Master
Sewage/Grey water discharge	The volume of sewage and grey water discharged from the seismic vessel	Engineers log	Vessel Master
Disposal of Wastes			
Hazardous wastes	Volume of hazardous wastes transferred onshore.	Waste management electronic records/oil usage management electronic records	Vessel Master
Non-hazardous wastes	Volume of non-hazardous wastes transferred onshore	Waste management electronic records	Vessel Master

Discharge/Incident	Parameters	Record	Responsibility
Marine Fauna Interaction			
Cetacean, whale shark, dugongs and turtle sightings	Details required on the Whale and Dolphin Sighting reports (DOEE)	Sighting records	MFO
Collisions with cetaceans in Commonwealth waters will be reported to the National Ship Strike Database.	Location, timing, species, vessel speed, what happened	National Ship Strike Database https://data.marinemammals.gov.au/report/shipstrike/new	MFO
Marine User Interaction			
Vessel Interaction/ Complaints	Communications with other vessels	Ships log	Vessel Master

8.1.2 Review and Reporting of Environmental Performance

Polarcus will undertake an internal review of the environmental performance of the Zénaïde 3D MSS on completion of each survey phase. The outcomes of the review will be incorporated into environmental management measures applied to future activities to further improve Polarcus' environmental performance, and will be included in Environmental Performance Reports submitted to NOPSEMA within two months of completing the Zénaïde 3D MSS.

8.1.3 Management of Change and New Information

In order to ensure that impacts and risks are continually reduced to the residual levels described and the requirements of legislation will continue to be met, Polarcus will undertake periodic verification of environmental inputs used to inform the evaluation of impacts and risks in the EP, including identifying updates to legislative requirements and environmental information.

Any new or increased impacts or risks that may arise from the verifications will be managed through the Polarcus Management of Change Procedure.

8.1.4 EP Review and Resubmission

New information, changes or updates will be considered against Regulation 17 of the OPGGS (E) Regulations, to determine if resubmission of the EP to NOPSEMA is required. Relevant sub regulations and triggers for EP resubmission under Regulation 17 include the following:

- 17(1) New Activity
- 17(5) Significant modification of the activity
- 17(5) New stage of the activity
- 17(6) New or increased environmental impact or risk.
- 17(7) Change in Titleholder

8.1.5 Audits

Polarcus will maintain a compliance register that will serve as an audit tool during the Zénaïde 3D MSS. Audits will be completed:

- Prior to the commencement of each survey phase
- A minimum one compliance audit per acquisition phase

8.1.6 Management of Non-conformance

Non-conformances and opportunities for improvement will be identified and corrective actions will be tracked to completion in accordance with the Polarcus Incident Reporting Procedure and Risk Management Procedure.

Polarcus will carry forward non-conformances identified during the Zénaïde 3D MSS for consideration in future seismic surveys to assist with continuous improvement in environmental management controls and performance outcomes.

8.2 OIL POLLUTION EMERGENCY PLAN

In order to encompass the nature and scale of the survey and respond to the identified credible spill scenarios, the overall Oil Pollution Emergency Plan (OPEP) for the survey encompasses multiple levels of planning and response capability. The overall seismic survey OPEP is therefore represented by various levels of emergency plan, which comprise of:

- Vessel(s) SOPEP – for spills contained on the vessel or spills overboard which can be managed by the vessel; and
- The National Plan for Maritime Environmental Emergencies (National Plan) (AMSA 2014) - for spills from vessels which affect Commonwealth waters and waters of the Ashmore and Cartier Territory.

AMSA is the jurisdictional authority and control agency for spills from vessels which affect Commonwealth waters and waters of the Ashmore and Cartier Territory.

In the unlikely event of a spill of hydrocarbons or chemicals to the marine environment, Polarcus will notify AMSA. AMSA will advise of any response actions required.

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Annex A

Stakeholder Consultation

	STAKEHOLDER	Date of Correspondence	To / From Stakeholder	Summary of Contact / Correspondence	Summary of Objection / Claim / Query	Assessment of Merit of Objection or Claim / Comment	Statement of the Polarcus Response / Proposed Response
Commonwealth Government							
	Australian Fisheries Management Authority (AFMA)	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Australian Fisheries Management Authority (AFMA)	27/07/2017	To stakeholder	Email sent to AFMA requesting feedback, summary fact sheet was included in the email.	N/A	N/A	N/A
	Australian Fisheries Management Authority (AFMA)	27/07/2017	From stakeholder	AFMA stating the Western Tuna and Billfish Fishery and Western Skipjack Fishery does not typically operate in the Bonaparte Basin and is unlikely to operate during the proposed period and therefore believe they will not be impacted by the proposed survey. AFMA have forwarded email to industry associations for comment.	N/A - Information provided	N/A - Information provided and incorporated into EP	Information acknowledged in email to stakeholder 27/7/2017
	Australian Fisheries Management Authority (AFMA)	27/07/2017	To stakeholder	ERM acknowledging that the Western Tuna and Billfish Fishery and Western Skipjack Fishery will not be impacted by the proposed survey.	N/A	N/A	
	Australian Fisheries Management Authority (AFMA)	02/08/2017	From stakeholder	AFMA informing Polarcus that Southern Bluefin Tuna Fishery, Western Skipjack and Western Tuna and Billfish Fishery exist in the are although historically have a very low level of effort. AFMA also recommends in the future to directly contact fishing industry stakeholders, despite low levels of effort. AFMA also notes that the fishing industry have previously expressed concerns with seismic surveys and encourage thorough consultation.	N/A - Information provided	N/A - Advice / request for further information only. No objection or claim made. Information incorporated into EP.	Information acknowledged and in email to stakeholder 27/7/2017 including confirmation that fisheries stakeholders are engaged.
	Australian Fisheries Management Authority (AFMA)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Australian Fisheries Management Authority (AFMA)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Australian Hydrographic Service (AHS) (Maritime Safety - Notice to Mariners)	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Australian Hydrographic Service (AHS) (Maritime Safety - Notice to Mariners)	07/07/2017	From stakeholder	AHS responded to acknowledge email.	N/A	N/A	N/A
	Australian Hydrographic Service (AHS) (Maritime Safety - Notice to Mariners)	13/07/2017	From stakeholder	Stakeholder requesting 3 weeks notice once activity dates have been confirmed to allow stakeholder enough time to enable appropriate Notice to Mariners action to be promulgated.	AHS advise 3 weeks notice to be provide for NtM	N/A - Advice / request for further information only. No objection or claim made. Information incorporated into EP.	Timeframes included in EP. 3 weeks notice will be provided to AHS.
	Australian Hydrographic Service (AHS) (Maritime Safety - Notice to Mariners)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Australian Marine Safety Authority (AMSA) (Marine Safety Division and Emergency Response Division)	07/07/2017	To stakeholder	Email and summary factsheet sent directly to stakeholder describing the proposed activity and requesting feedback. Additional information was requested regarding; vessel traffic, level of support, notification of a spill and spill response regarding Commonwealth waters and state or territory waters.	N/A	N/A	N/A
	Australian Marine Safety Authority (AMSA) (Marine Safety Division and Emergency Response Division)	13/07/2017	From stakeholder	Email received from AMSA with advice regarding vessel traffic within the Operational Area. AMSA mentioned heavy vessel traffic is expected within the Acquisition Area. AMSA suggests to maintain exceptional communication with commercial shipping in the area. AMSA also mentioned the survey vessel must display the appropriate day shapes, lights, streamers and reflective tail buoys, to indicate the vessel is towing and is therefore restricted in her ability to manoeuvre as well as visual and radar watches must be maintained on the bridge at all time. AMSA also requests to notify AMSA's Joint Rescue Coordination Centre 24-48hrs before the operation starts and to notify AHS no less than 4 weeks prior to operation.	AMSA advised of vessel traffic in Operational Area and requirements for shapes, lighting, markings, visual and radar watches, and notification of JRCC and AHS.	N/A - Advice / request for further information only. No objection or claim made. Information incorporated into EP.	N/A
	Australian Marine Safety Authority (AMSA) (Marine Safety Division and Emergency Response Division)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Maritime Border Command (MBC), Broome (formerly Border Protection Command (BPC))	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Maritime Border Command (MBC), Broome (formerly Border Protection Command (BPC))	07/07/2017	From stakeholder	Stakeholder requesting information on, whether the vessel is going to import during the duration of the proposed activity.	Request for information regarding vessel arrival	N/A - Advice / request for further information only. No objection or claim made.	Phone call and follow up email made to stakeholder 18/07/2017 to clarify intent of early engagement and information. Stakeholder confirmed their interest is operational and they do not need to be notified until surevy confirmed and ahead of arrival in Australian waters.
	Maritime Border Command (MBC), Broome (formerly Border Protection Command (BPC))	18/07/2017	To stakeholder	Clarification given to the stakeholder on the proposed activities, the purpose of the email and why Border Command has been chosen as a potential stakeholder. ERM suggests to Border Command that stakeholder consultation be carried out at the time of operation (and directly by Polarcus) instead of during the Environmental Plan stage.	N/A	N/A	N/A
	Department of Immigration and Border Protection (formerly the Australian Customs and Border Protection Service)	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Department of Immigration and Border Protection (formerly the Australian Customs and Border Protection Service)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Department of Immigration and Border Protection (formerly the Australian Customs and Border Protection Service)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Department of Agriculture and Water Resources (Biosecurity) - Marine Pests Unit / Maritime National Coordination Centre (MNCC)	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Department of Agriculture and Water Resources (Biosecurity) - Marine Pests Unit / Maritime National Coordination Centre (MNCC)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Department of Agriculture and Water Resources (Biosecurity) - Marine Pests Unit / Maritime National Coordination Centre (MNCC)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Department of Communications and the Arts	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Department of Communications and the Arts	31/07/2017	From stakeholder	Department confirming receipt of information and informing Polarcus that the North West Cable System, is not within the immediate vicinity of the proposed MSS (attached map). The department also informed Polarcus of the fact that the Ichthys Gas Export Pipeline appears to transverse the Acquisition Area and therefore recommend contacting INPEX Australia and the National Offshore Petroleum Titles Administrator.	Advice received regarding locations of cables and INPEX Ichthys pipeline	N/A - Advice / request for further information only. No objection or claim made.	Email acknowldgement sent 9/8/2017 confirming pipeline no longer within revised Acquisition Area
	Department of Communications and the Arts	09/08/2017	To stakeholder	Email sent to Department acknowledging receipt of information regarding Ichthys Gas Export Pipeline. A map was attached with the updated Zénaïde Boundaries. ERM informed the Department that the Acquisition Area no longer overlaps with the pipeline.	N/A	N/A	N/A
	Department of Communications and the Arts	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Department of Communications and the Arts	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	N/A
	Department of Defence	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Department of Defence	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the	N/A	N/A	N/A
	Department of Defence	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	N/A
	Department of Environment and Energy - Marine Reserves	07/07/2017	To stakeholder	Email sent directly to the stakeholder with a summary factsheet describing the proposed activity and requesting feedback. Polarcus understands the Operational Area overlaps with the Oceanic Shoals and Kimberley Commonwealth Marine Reserve (CMR) and will address the sound impacts to these regions within the EP.	N/A	N/A	N/A
	Department of Environment and Energy - Marine Reserves	04/08/2017	From stakeholder	Email from DoEE regarding marine reserves. DoEE noted that the Operational Area overlaps with the multiple use zones of the Kimberley and Oceanic Shoals Commonwealth Marine Reserves. The DoEE would like Polarcus to incorporate the potential impacts of the activity on the conservation values and the risk to those values in the EP. DoEE also informed Polarcus of the public release of draft management plans for marine reserves in Australia. DoEE would like to be informed of when the EP is approved and notification of any planned operations that may impacts on reserve values. Ongoing correspondence be directed to marinereserves@environment.gov.au	Information received regarding location of marine reserves and expectation to consider impacts to reserve values. Request notificatino when EP approved and planned operations.	N/A - Advice / request for further information only. No objection or claim made.	Email acknowledgement sent 9/8/2017 confirming boundaries have been revised and no longer include the reserves, but impacts will be considered. Stakeholders will be notified when EP approved and prior to commencment of survey.
	Department of Environment and Energy - Marine Reserves	09/08/2017	To stakeholder	Email sent to Renee Bowling, acknowledging receipt of information, informing Marine Reserves of the revised Acquisition/Operational Areas and attached a map of the updated Zénaïde boundaries with the CMRs.	N/A	N/A	N/A
	Department of Environment and Energy - Marine Reserves	10/08/2017	From stakeholder	Email sent from Marine Reserves acknowledging email and thanking ERM for supplying them with the updated Zénaïde boundaries.	N/A - email of acknowledgement	N/A	N/A
	Department of Environment and Energy - Marine Reserves	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Department of Environment and Energy - Marine Reserves	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	N/A
	Australian Marine Mammal Centre	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Australian Marine Mammal Centre	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the	N/A	N/A	N/A
	Australian Marine Mammal Centre	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	

	Department of Industry, Innovation and Science	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Department of Industry, Innovation and Science	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the	N/A	N/A	N/A
	Department of Industry, Innovation and Science	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	National Native Title Tribunal	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	National Native Title Tribunal	07/07/2017	From stakeholder	Stakeholder confirming receipt of email and requesting for information on what information the stakeholder can provide. Stakeholder has provided ERM with a form to fill out, for our own perusal in regards to conducting a search of there registry for any Native Title issues present in the Operational Area.	Stakeholder asked what information is required from them	N/A - Advice / request for further information only. No objection or claim made.	Email response on 17/07/2017 confirming the National Native Title Tribunal we require no additional information from them and requesting feedback on the information provided in the information sheet.
	National Native Title Tribunal	17/07/2017	To stakeholder	Response to previous email, informing the National Native Title Tribunal we require no additional information from them and requesting feedback on the information provided in the information sheet.	N/A	N/A	N/A

	Federal Member for Durack	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Federal Member for Durack	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the	N/A	N/A	N/A
	Federal Member for Durack	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
State / Territory Government							
	Department of Mines, Industry Regulation and Safety (formerly Department of Mines and Petroleum (DMP))	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Department of Mines, Industry Regulation and Safety (formerly Department of Mines and Petroleum (DMP))	07/08/2017	From stakeholder	Email from DMIRS confirming receipt of information and factsheet. DMIRS have review the information and do not require any further information at this stage. DMIRS have provided Polarcus with the Consultation Guidance Notes for information on reporting incidents. DMIRS also requests Polarcus to provide DMP with a pre-start notification confirming start dates and a cessation notification to a designated email.	Stakeholder confirmed no further information required but provided guielines on reporting incidents to State. Request pre-start and cessation notifications.	N/A - Advice / request for further information only. No objection or claim made.	Email sent 9/8/2017 confirming advice
	Department of Mines, Industry Regulation and Safety (formerly Department of Mines and Petroleum (DMP))	09/08/2017	To stakeholder	Email sent to DMIRS acknowledging receipt of information, and will take on board the advice provided.	N/A	N/A	N/A
	Department of Mines, Industry Regulation and Safety (formerly Department of Mines and Petroleum (DMP))	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Department of Primary Industries and Regional Development (formerly WA Department of Fisheries (DOF))	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development (formerly WA Department of Fisheries (DOF))	14/07/2017	Meeting with stakeholder	Meeting with Hans Kemps. Hans provided an overview of the Department's recent ecological risk assessment for seismic involving industry. Shallow waters (<100m) are a concern to the Department. Key issues that the Department expect to be addressed include potential impacts to: o Fisheries activities – Hans explained that 'FishCUBE' would be launched in a few months, providing up to date catch data maps for each fishery. o Fish, including key life stages such as spawning, eggs and larvae – Hans flagged the recent McCauley et al (2017) publication in Nature about the potential impacts of seismic to Zooplankton o Mobile and sessile benthic invertebrates – Hans flagged concerns in relation to sessile epifauna and infauna and what the implications of lower trophic level impacts might be General discussion also had around scientific understanding of impacts and impact thresholds used in assessments. The stakeholder engagement process was clarified with Hans, noting that further assessment will be undertaken and the assessments could be provided to the Department for comment prior to submission to NOPSEMA.	Key issues that the Department expect to be addressed include potential impacts to: o Fisheries activities. o Fish, including key life stages such as spawning, eggs and larvae, noting recent McCauley et al (2017) publication in Nature about the potential impacts of seismic to Zooplankton o Mobile and sessile benthic invertebrates and what the implications of lower trophic level impacts might be	Impacts to fisheries activities, fish (including key life stages such as spawning, eggs and larvae, noting recent McCauley et al (2017)) and invertebrates will be assessed in the EP and the r	Risk assessments will be provided to the Department prior to submission.
	Department of Primary Industries and Regional Development (formerly WA Department of Fisheries (DOF))	27/07/2017	To stakeholder	Phone conversation with DoF (Hans Kemp) requesting any formal feedback following the meeting. DoF have agreed to provide feedback by the 4th of August.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development (formerly WA Department of Fisheries (DOF))	07/08/2017	From stakeholder	Email from DoF in response to initial email dated 7 July. The main points/issues raised: - Fisheries are in the process of reviewing it's guidance to proponents of seismic surveys (Guidance Statement) - Fisheries do not receive adequate information (factsheets) to provide project-specific advice - Cumulative impacts and how 40 km separation between seismic vessels can be effective -An informed assessment of risks and potential impacts with the proposed activities is to be included in the EP -Appropriate impact management and risk control measures are expected -DoF encourages proponents of seismic surveys to commit to supporting research efforts investigating the impacts of seismic surveys -DoF encourages proponents to avoid, where possible seismic activities in shallow waters <50 m depth; and minimise the intensity of the seismic array as much as possible at all time (particularly in waters <250 m depth) -Proponents to assess the risk of impacts on zooplankton and benthic invertebrate communities and flow on to other trophic levels. -Proponents to maintain stakeholder engagement with WAFIC, Recfishwest and relevant representative bodies. -DoF requires proponents to minimise biosecurity risks and avoid committing offence under the Fish Resources Management Act 1994 (biofouling risk assessment tool and biofouling management plan/record book.	-An informed assessment of risks and potential impacts with the proposed activities is to be included in the EP -Appropriate impact management and risk control measures are expected to mange risks to ALARP and Acceptable levels. -DoF encourages proponents to avoid, where possible seismic activities in shallow waters <50 m depth; and minimise the intensity of the seismic array as much as possible at all time (particularly in waters <250 m depth) -Proponents to assess the risk of impacts on zooplankton and benthic invertebrate communities and flow on to other trophic levels. -Proponents to maintain stakeholder engagement with WAFIC, Recfishwest and relevant representative bodies. -DoF requires proponents to minimise biosecurity risks and avoid committing offence under the Fish Resources Management Act 1994 (biofouling risk assessment tool and biofouling management plan/record book. - Cumulative impacts and how 40 km separation between seismic vessels can be effective -DoF encourages proponents of seismic surveys to commit to supporting research efforts investigating the impacts of seismic surveys	All items identified by the Department have been assessed in the EP. Impact assessments include control measures deemed appropriate by Polarcus to manage risks to ALARP and Acceptable levels. Shallow water habitats and fish assemblages have been considered and site-specific and activity specific risk assessments have been undertaken. The risk is considered to be low, with the potential for shallow banks and shoals <60m to be areas where risks are greatest, and Polarcus will apply control measures around such areas to prevent injury to fish. Zooplankton has been assessed and considers the McCauley et al (2017) research. However, the risks are not significant given natural variability and recruitment from unimpacted areas. Subsequent risks to eggs, larvae, recruitment and food sources are also considered to be low. Impacts to benthic invertebrates have been found to be limited to sub-lethal and very minor impacts to above natural mortality rates. Biosecurity risks (biofouling and ballast water) will be managed in accordance with Australian requirements, and vessel inspections and risk assessments will be undertaken to confirm vessels are free of IMS. Vessels will have biofouling management plans and log books Cumulative effects have been assessed based on known other known planned seismic surveys. Impacts from Zenaide will be minor and short duration and therefore cumualtive impacts are not expected. Stakeholders queries have merit, but Polarcus considers these to have been adequately assessed and managed to low, ALARP and acceptable levels. Polarcus acknowledges that research may improve knowledge, but the Zenaide 3D MSS in isolation is not intended to implement research.	Risk assessments along with summary of risk assesment outcomes and controls will be provided to the Department prior to submission.
	Department of Primary Industries and Regional Development (formerly WA Department of Fisheries (DOF))	09/08/2017	To stakeholder	Email sent to Hans Kemp, acknowledging receipt of information and ERM will provide a response once assessment of information has been undertaken.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development (formerly WA Department of Fisheries (DOF))	23/08/2017	To stakeholder	Email sent to Hans Kemp, at the DoF. ERM provided the Department with the draft risk assessment sections for the impacts to fish spawning, plankton, eggs and larvae, invertebrate communities, and commercial fisheries for the Zénaïde and Cygnus 3D MSS. A summary of the Zénaïde and Cygnus 3D MSS risk assessments and control measures were also provided.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development (formerly WA Department of Fisheries (DOF))	30/08/2017	From stakeholder	Email received from the Department. The Department intends to provide ERM with comments/feedback on the information provided dated 23/08/2017. The Department was not able to provide a response to the comments, due to the timeframe. The department thinks a 4-week turn-around timeframe is reasonable.	Stakeholder considers that there has been insufficient time to respond.	Timeframe acknowledged, but timeframe is driven by Polarcus commitment to client to submit 1st September 2017.	Email sent to the Department 31/8/2017 acknowledging that the Department has not yet been able to review or provided a comment. Polarcus would still like to hear from the Department even though Polarcus are contractually obligated to submit the Zénaïde 3D EP on the 01/09/2017. Polarcus looks forward to receiving the Departments comments.
	Department of Primary Industries and Regional Development (formerly WA Department of Fisheries (DOF))	31/08/2017	To stakeholder	Email sent to the Department acknowledging that the Department has not yet been able to review or provided a comment. Polarcus would still like to hear from the Department even though Polarcus are contractually obligated to submit the Zénaïde 3D EP on the 01/09/2017. Polarcus looks forward to receiving the Departments comments.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development (formerly WA Department of Fisheries (DOF))	01/09/2017	To stakeholder	Emails received from the Department acknowledging receipt of email and will respond formally to email dated 23/08/2017 next week.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	07/09/2017	From stakeholder	Email received from the Department of Fisheries in response to ERM email dated 23/08/2017. The main points raised: -The fisheries normally expects a 4-6 week timeframe and the advice provided is current for 6 months. -Fisheries notes that the Zénaïde MSS, is reasonably well-defined, avoids activities in shallow waters up to 60 m in depth, is confined to a spatial envelope of ~3300 km2 and is proposed to be completed by December 2018, which facilitates the identification and assessment of potential impacts on aquatic resources and fisheries -The fisheries facilitated a qualitative assessment of risks posed by seismic surveys on finfish and invertebrates in December 2016 - the consensus risk levels agreed to on the day indicated that airgun arrays with the capacity between 2000 and 4500 cui pose a high or severe risk. -With respect to benthic invertebrates the under representation of potential impacts i particularly evident in both Cygnus and Zénaïde. -The Department provided information of the potential effects to scallops and lobsters from seismic surveys. -The impact on fish spawning adopted by Polarcus on goldband snapper is to be appropriate but note that the result of this assessment are not directly transferable to other species. -Fisheries are concerned about the implications of the findings with respect to zooplankton reported by McCauley et al. (2017). -Cumulative impact assessments should include considerations of pressures from all relevant sources - WA fisheries is concerned about the potential in WA for adjacent surveys to be conducted within the Sam season. -The fisheries noted that no monitoring has been proposed and that even sound source verification of acoustic modelling was only considered as a means for informing adaptive management around shoals. -Fisheries is of the view that the risk assessment conducted for the Polarcus Zénaïde MSS, addresses most of our key concerns in relation to risks of impact on aquatic resources and fisheries, and that the proposed impact management and risk control measures appear to be reasonable. However, Fisheries notes that the assessment of cumulative impacts should be more comprehensive	-The fisheries normally expects a 4-6 week timeframe and the advice provided is current for 6 months. -Fisheries notes that the Zénaïde MSS, is reasonably well-defined, avoids activities in shallow waters up to 60 m in depth, is confined to a spatial envelope of ~3300 km2 and is proposed to be completed by December 2018, which facilitates the identification and assessment of potential impacts on aquatic resources and fisheries -The fisheries facilitated a qualitative assessment of risks posed by seismic surveys on finfish and invertebrates in December 2016 - the consensus risk levels agreed to on the day indicated that airgun arrays with the capacity between 2000 and 4500 cui pose a high or severe risk. -With respect to benthic invertebrates the under representation of potential impacts i particularly evident in both Cygnus and Zénaïde. -The Department stated that research into the potential effects to scallops and lobsters from seismic surveys (Day et al. 2016) should be considered. -The impact on fish spawning adopted by Polarcus on goldband snapper is to be appropriate but note that the result of this assessment are not directly transferable to other species. -Fisheries are concerned about the implications of the findings with respect to zooplankton reported by McCauley et al. (2017). -Cumulative impact assessments should include considerations of pressures from all relevant sources - WA fisheries is concerned about the potential in WA for adjacent surveys to be conducted within the same season. -The fisheries noted that no monitoring has been proposed and that even sound source verification of acoustic modelling was only considered as a means for informing adaptive management around shoals. -Fisheries is of the view that the risk assessment conducted for the Polarcus Zénaïde MSS, addresses most of our key concerns in relation to risks of impact on aquatic resources and fisheries, and that the proposed impact management and risk control measures appear to be reasonable. However, Fisheries notes that the assessment of cumulative impacts should be more comprehensive.	-The risk assessment undertaken for the purposes of the EP is supported by site-specific and activity-specific modelling, and takes a broad range of recent published research into account. Therefore, the risk assessment and proposed control measures in the EP are considered to be robust and appropriate for reducing risks to ALARP and acceptable levels. -The environmental risk assessment conducted for the Zénaïde 3D MSS EP took into account the findings of the Day et al. (2016) study with respect to lobsters and scallops, and the findings of McCauley et al. (2017) and Richardson et al. (2017) studies concerning potential impacts to zooplankton. The risk is considered to be low and therefore the Departments concerns are considered to have been addressed. -As outlined in the EP, the focus of the assessment was primarily on goldband snapper due to the various stocks in the region being biologically distinct. Therefore, the goldband snapper spawning biomass was considered to be potentially more sensitive to disturbance. Red emperor (and other species) are considered less sensitive than goldband snapper, as genetic homogeneity between different regions and stocks across northern Australia is maintained by dispersal of eggs and larvae throughout their range. - It is not the purpose of cumulative impact assessment to assess the impact of all activities and other natural stressors. - Sound verification has is deemed impracticable - there are no reliable methods to assess received levels at seabed at such short ranges and deviation from predictions over such short ranges is unlikely. -Polarcus can confirm that the Zénaïde 3D MSS will not be acquired concurrently with the Cygnus 3D MSS acquisition and a minimum separation distance of 40 km shall be maintained between the Polarcus seismic source and another seismic source, although it is highly unlikely that two surveys would occur concurrently over the same area.	Detailed response provided to the Department on 5/10/2017 covering the following: -The risk assessment undertaken for the purposes of the EP is supported by site-specific and activity-specific modelling, and takes a broad range of recent published research into account. Therefore, the risk assessment and proposed control measures in the EP are considered to be robust and appropriate for reducing risks to ALARP and acceptable levels. -The environmental risk assessment conducted for the Zénaïde 3D MSS EP took into account the findings of the Day et al. (2016) study with respect to lobsters and scallops, and the findings of McCauley et al. (2017) and Richardson et al. (2017) studies concerning potential impacts to zooplankton. The risk is considered to be low and therefore the Departments concerns are considered to have been addressed. -As outlined in the EP, the focus of the assessment was primarily on goldband snapper due to the various stocks in the region being biologically distinct. Therefore, the goldband snapper spawning biomass was considered to be potentially more sensitive to disturbance. Red emperor (and other species) are considered less sensitive than goldband snapper, as genetic homogeneity between different regions and stocks across northern Australia is maintained by dispersal of eggs and larvae throughout their range. - It is not the purpose of cumulative impact assessment to assess the impact of all activities and other natural stressors. - Sound verification has is deemed impracticable - there are no reliable methods to assess received levels at seabed at such short ranges and deviation from predictions over such short ranges is unlikely. -Polarcus can confirm that the Zénaïde 3D MSS will not be acquired concurrently with the Cygnus 3D MSS acquisition and a minimum separation distance of 40 km shall be maintained between the Polarcus seismic source and another seismic source, although it is highly unlikely that two surveys would occur concurrently over the same area.
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	08/09/2017	To stakeholder	Email sent to Hans Kemp at the Fisheries, acknowledging the information received from the fisheries dated 07/09/2017.	N/A	N/A	N/A

	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	02/10/2017	From stakeholder	Email sent from Hans Kemp informing ERM, that he will inform ERM once the program comes online. Hans said the program will be very useful as he has had a preliminary view of the program 2 months ago.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	05/10/2017	To stakeholder	Email sent to the Department. The main points addressed: -The risk assessment undertaken for the purposes of the EP is supported by site-specific and activity-specific modelling, and takes a broad range of recent published research into account. Therefore, the risk assessment and proposed control measures in the EP are considered to be robust and appropriate for reducing risks to ALARP and acceptable levels. -The environmental risk assessment conducted for the Zénaïde 3D MSS EP took into account the findings of the Day et al. (2016) study with respect to lobsters and scallops, and the findings of McCauley et al. (2017) and Richardson et al. (2017) studies concerning potential impacts to zooplankton. The risk is considered to be low and therefore the Departments concerns are considered to have been addressed. -As outlined in the EP, the focus of the assessment was primarily on goldband snapper due to the various stocks in the region being biologically distinct. Therefore, the goldband snapper spawning biomass was considered to be potentially more sensitive to disturbance. Red emperor (and other species) are considered less sensitive than goldband snapper, as genetic homogeneity between different regions and stocks across northern Australia is maintained by dispersal of eggs and larvae throughout their range. - It is not the purpose of cumulative impact assessment to assess the impact of all activities and other natural stressors. - Sound verification has is deemed impracticable - there are no reliable methods to assess received levels at seabed at such short ranges and deviation from predictions over such short ranges is unlikely. -Polarcus can confirm that the Zénaïde 3D MSS will not be acquired concurrently with the Cygnus 3D MSS acquisition and a minimum separation distance of 40 km shall be maintained between the Polarcus seismic source and another seismic source, although it is highly unlikely that two surveys would occur concurrently over the same area.	N/A	N/A	
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	05/10/2017	From stakeholder	Thanks for the response to our comments on both Zenaide and Cygnus MSS. While there may still be some points on which we may have to agree to disagree, I think the exchange has been useful and Fisheries is pleased to see some significant changes to the Cygnus MSS that go a considerable way in addressing our concerns. At this stage, we have no further comments and I expect NOPSEMA to consider both points of view in their assessment of the EP.	Stakeholder considers there are issues "we will have to agree to disagree" and they expect NOPSEMA to consider both points of view in their assessment.	Fair enagement undertaken and attempt to address issues. Polarcus will consider feedback from NOPSEMA following assessment.	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	05/10/2017	To stakeholder	Email acknowledged and offered another meeting if useful to discuss some of the issues. Confirmed we have forwarded copies of DPIRD email and our response to NOPSEMA so that they are fully aware of these.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	06/10/2017	From stakeholder	Email from Hans agreeing that a follow up meeting would be a good idea once their new guidance statement is closer to being finalised.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	23/10/2017	To stakeholder	Email sent to DPIRD asking for the status of Fish Cube as the information that can be provided from the program will be beneficial. Currently, in order to communicate the location and timing of the Zénaïde and Cygnus survey activities as effectively as possible, notifications to fishers and ongoing consultation are expected to include: • Notifications to be sent to licence holders and fishery stakeholders at least 4 weeks prior to the commencement of survey activities, including confirmation of the location and expected timing. • Option for licence holders to register for daily look-ahead that inform of the survey lines that are proposed for the following day. • Notification to be sent to stakeholders within 2 weeks of completion. • Notifications will also be sent if there are any significant modifications to the activity or schedule.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	24/10/2017	From stakeholder	Email sent from Hans Kemp informing ERM, that he will inform ERM once the program comes online. Hans said the program will be very useful as he has had a preliminary view of the program 2 months ago.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	24/10/2017	From stakeholder	Hans further emailed informing ERM, Fish Cube will be online from early 2018, however ERM can request data from the program by contacting DataRequest@fish.wa.gov.au. Fish Cube is currently only accessible from inside our firewall and the spatial resolution sometimes will be in blocks 60nm by 60nm to prevent the dissemination of confidential data External stakeholders can download a data request form (general) from the Fisheries website at: http://www.fish.wa.gov.au/Sustainability-and-Environment/Fisheries-Science/Stock-assessment-and-data-analysis/Pages/Making-a-data-request.aspx	Advising that Fish Cube data is available	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	25/10/2017	To stakeholder	Email sent to stakeholder acknowledging receipt of information.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	25/10/2017	To stakeholder	Emails sent to datarequest@fish.wa.gov.au (FISH CUBE) requesting information on Northern Demersal Scalefish, Mackeral, Northern shark, Kimberley Prawn, Pearl Oyster and Recreational charter boats.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	31/10/2017	To stakeholder	Phone call to Department to follow up on data request. Department are not aware of the data request service and recommended speaking to Hans Kemps again.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	31/10/2017	To stakeholder	Phone call to Hans Kemps to ask about the data request. He will follow up and let us know.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	31/10/2017	From stakeholder	Email from Hans Kemps to confirm he has spoken to Veronique Vanderklift who has led the development of Fish Cube and will get in touch today or tomorrow.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	31/10/2017	From stakeholder	Call from Veronique Vanderklift to confirm requirements. Fish Cube can be queried by month, but if only one vessel has fished in a block, data cannot be included as it is considered confidential. Fish Cube cannot be queried by quarter. Therefore, data is available for the whole calendar year. It was agreed that shapefiles could be provided for blocks by calendar year for NDSF, Kimberley Prawn and Mackerel fisheries. Data Use Agreement to be signed.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	31/10/2017	From stakeholder	Email from Veronique Vanderklift. The email was in regards to obtaining data for the Fish Cube system. Attached to the email was a data use agreement for ERM to fill out.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	31/10/2017	To stakeholder	Email from ERM requesting additional information on the termination date in relation to the Data Use Agreement.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	01/11/2017	From stakeholder	Email from Veronique Vanderklift providing ERM with additional information on the termination date.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	02/11/2017	To stakeholder	Email sent to Veronique Vanderklift - attached the Data Use Agreement.	N/A	N/A	N/A
	Department of Primary Industries and Regional Development - Fisheries Division (Formerly Department of Fisheries)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	WA Department of Transport (DOT) (Maritime Environmental Emergency Response)	07/07/2017	From stakeholder	Email and summary factsheet sent directly to stakeholder describing the proposed activity and requesting feedback. Additional information was requested regarding; vessel traffic, level of support, notification of a spill and spill response regarding Commonwealth waters and state or territory waters.	N/A	N/A	N/A
	WA Department of Transport (DOT) (Maritime Environmental Emergency Response)	27/07/2007	From stakeholder	DoT noted that they can only respond on matters related to oil spill response and any other matter needs to be taken up with other Departments. DoT provided two documents for guidance: WestPlan- Marine Oil Pollution (WestPlan - MOP) Offshore Petroleum Industry Guidance Note - Marine Oil Pollution: Response and Consultation Arrangements.	N/A - State response document provided for information.	N/A - Advice / request for further information only. No objection or claim made.	N/A
	WA Department of Transport (DOT) (Maritime Environmental Emergency Response)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	WA Department of Transport (DOT) (Maritime Environmental Emergency Response)	01/11/2017	From stakeholder	Email sent from stakeholder informing ERM that the information has been passed onto the Environmental Officer whom is currently on leave until 16 November.	N/A	N/A	N/A
	WA Department of Transport (DOT) (Maritime Environmental Emergency Response)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	

	Department of Water and Environmental Regulation (formerly Department of Environmental Regulation)	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Department of Water and Environmental Regulation (formerly Department of Environmental Regulation)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Department of Water and Environmental Regulation (formerly Department of Environmental Regulation)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	NT Marine Safety Branch, NT Department of Transport	07/07/2017	To stakeholder	Email and summary factsheet sent directly to stakeholder describing the proposed activity and requesting feedback. Additional information was requested regarding; vessel traffic, level of support, notification of a spill and spill response regarding Commonwealth waters and state or territory waters.	N/A	N/A	N/A
	NT Marine Safety Branch, NT Department of Transport	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	NT Marine Safety Branch, NT Department of Transport	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	NT Environment Protection Authority (NT EPA)	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	NT Environment Protection Authority (NT EPA)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	NT Environment Protection Authority (NT EPA)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	WA Department of Biodiversity Conservation and Attractions	08/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	WA Department of Biodiversity Conservation and Attractions (formerly Department of Parks and Wildlife)	06/10/2017	From stakeholder	The Department phoned, informing ERM the correct email address to use for future emails is: embadmin@dbca.wa.gov.au	N/A	N/A	N/A
	WA Department of Biodiversity Conservation and Attractions (formerly Department of Parks and Wildlife)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	WA Department of Biodiversity Conservation and Attractions (formerly Department of Parks and Wildlife)	31/10/2017	To stakeholder	Email sent from stakeholder informing ERM/Polarcus that all correspondence is to be directed to EMBAdmin@dbca.wa.gov.au and all other accounts are to be removed.	N/A	N/A	N/A
	WA Department of Biodiversity Conservation and Attractions (formerly Department of Parks and Wildlife)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Member of Parliament for Kimberly	09/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Member of Parliament for Kimberly	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Shire of Derby West Kimberley	10/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Shire of Derby West Kimberley	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Shire of Derby West Kimberley	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Shire of Wyndham East Kimberley	11/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Shire of Wyndham East Kimberley	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Shire of Wyndham East Kimberley	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Commercial Fisheries & Associations							
	Western Tuna and Billfish Fishery (Commonwealth) - AFMA	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Western Tuna and Billfish Fishery (Commonwealth) - AFMA	27/07/2017	From stakeholder	Email from Don Bromhead at AFMA confirming Western Tuna and Billfish Fishery (and Western Skipjack Fishery) does not typically operate in the Bonaparte Basin and is extremely unlikely to in the period you are proposing, and therefore will not be impacted by the proposed survey.	Advice received regarding low level of Western Tuna and Billfish Fishery (and Western Skipjack Fishery)activity	Information to be included in EP	N/A
	Western Tuna and Billfish Fishery (Commonwealth) - AFMA	27/10/2017	To stakeholder	Update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The letter also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Western Tuna and Billfish Fishery (Commonwealth) - AFMA	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Skipjack Tuna Fishery (Commonwealth) - AFMA	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Skipjack Tuna Fishery (Commonwealth) - AFMA	27/10/2017	To stakeholder	Update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The letter also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Skipjack Tuna Fishery (Commonwealth) - AFMA	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Southern Bluefin Tuna Fishery (Commonwealth) - AFMA	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Southern Bluefin Tuna Fishery (Commonwealth) - AFMA	27/10/2017	To stakeholder	Update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The letter also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Southern Bluefin Tuna Fishery (Commonwealth) - AFMA	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Northern Prawn Fishery (Commonwealth) - AFMA	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Northern Prawn Fishery (Commonwealth) - AFMA	27/10/2017	To stakeholder	Update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The letter also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Northern Prawn Fishery (Commonwealth) - AFMA	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Northern Demersal Scalefish Fishery (NDSF) (State) - All individual licence holders	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Northern Demersal Scalefish Fishery (NDSF) (State) - All individual licence holders	27/10/2017	To stakeholder	Update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The letter also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Northern Demersal Scalefish Fishery (NDSF) (State) - All individual licence holders	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	17/07/2017	To stakeholder	Follow up email sent to stakeholder requesting feedback in relation to the seismic survey.	N/A	N/A	N/A
	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	31/07/2017	To stakeholder	Follow up email sent to stakeholder requesting feedback in relation to the seismic survey.	N/A	N/A	N/A
	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	04/08/2017	From stakeholder	Email from NWSA objecting to the survey in regards to the same reasons as those mentioned in the Polarcus Cygnus Survey. NWSA attached communication from previous survey as reference to the reasons of objection. NWSA do not see any additional risks posed in the Zénaïde survey compared to the Cygnus survey. The main issues raised by NWSA from previous surveys is that NWSA believes ongoing seismic surveys are having detrimental impact on their business. NWSA objects to seismic surveys being conducted on prime fish grounds during the spawning season of Goldband Snapper and Red Emperor. NWSA believes seismic surveys are creating a behavioural change in the target species. NWSA requests that the Cygnus survey occur outside the goldband snapper and red emperor spawning seasons.	Objection raised on basis that NWSA believes seismic surveys are having a detrimental impact on their business by occuring in fishing grounds during spawning season, particularly for goldband snapper and red emperor. Requests surveys conducted outside of spawning season.	Impacts to spawning have been assessed in the EP. Applying a conservative assessment method, sound from the survey is expected to have limited spatial overlap with spawning habitat and duration of survey will result in limited temporal overlap. Given natural variability evident in spawning biomass and recruitment, the risk is considered to be low.	Impact and risk assessments as well as summary of control measures/time restrictions to be provided to stakeholder prior to submission to NOPSEMA.

	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	09/08/2017	To stakeholder	Email sent to Glenn Davis acknowledging concerns and that ERM are currently assessing the potential impacts to goldband snapper and red emperor spawning. ERM will inform Glenn of the outcome of these assessments.	N/A	N/A	N/A
	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	23/08/2017	To stakeholder	Email sent to Glenn Davis with a response to his initial email dated 04/08/2017. Glenn was provided the risk assessments for Zénaïde and Cygnus 3D MSS (species sensitivity, acoustic modelling, site-attached fish, other demersal and pelagic fish, fish spawning, plankton, eggs and larvae, commercial fisheries and cumulative impacts). ERM also requested additional information from Glen: 1) what information would be most useful to him (line start and end coordinates, timing etc.), How would he prefer to receive on the water updates/notifications (e.g. via email or text message) and at what frequency would be useful to receive these updates (i.e. 24 hrs, weekly, fortnightly).	N/A	N/A	N/A
	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	27/09/2017	To stakeholder	Attempted phone call to Glenn Davis on Northern Wildcatch Seafood Australia office number. No answer. No option for voicemail/answer phone.	N/A	N/A	N/A
	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	23/10/2017	To stakeholder	Email sent to Glenn Davis to touch base regarding Zénaïde and Cygnus EPs asking if he had any other information regarding the risk assessment that were supplied to him on 23/08/2017. ERM have suggested jumping on a call to talk over any issues. Currently, in order to communicate the location and timing of the Zénaïde and Cygnus survey activities as effectively as possible, notifications and ongoing consultation are expected to include: • Notifications to be sent to licence holders and fishery stakeholders at least 4 weeks prior to the commencement of survey activities, including confirmation of the location and expected timing. • Option for licence holders to register for daily look-ahead that inform of the survey lines that are proposed for the following day. • Notification to be sent to stakeholders upon completion of surveys. • Notifications will also be sent if there are any significant modifications to the activity or schedule. ERM requesting if there is anything more that NWSA thinks Polarcus needs to consider for the two EPs.	N/A	N/A	N/A
	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	27/10/2017	To stakeholder	Attempted phone call to Glenn Davis on Northern Wildcatch Seafood Australia office number. No answer. No option for voicemail/answer phone.	N/A	N/A	N/A
	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	31/10/2017	To stakeholder	Attempted phone call to Glenn Davis on Northern Wildcatch Seafood Australia office number. No answer. No option for voicemail/answer phone.	N/A	N/A	N/A
	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	01/11/2017	To stakeholder	Email sent to Glenn Davis -Explained had tried calling a couple of times and requested talking re information on the location and seasonality of his fishing activities.	N/A	N/A	N/A
	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	03/11/2017	To stakeholder	Attempted phone call to Glenn Davis on mobile number. No answer. Left voicemail asking to get in touch.	N/A	N/A	N/A
	NDSF - Glenn Davis, NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Northern Shark Fishery (State) - All individual licence holders	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Northern Shark Fishery (State) - All individual licence holders	27/10/2017	To stakeholder	Update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The letter also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Northern Shark Fishery (State) - All individual licence holders	12/12/2017	To stakeholder	Letter update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Mackerel Managed Fishery (State) - Individual licence holders	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Mackerel Managed Fishery (State) - Individual licence holders	27/10/2017	To stakeholder	Update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The letter also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Mackerel Managed Fishery (State) - Individual licence holders	12/12/2017	To stakeholder	Letter update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Kimberley Prawn Fishery (State) - Individual licence holders	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Kimberley Prawn Fishery (State) - Individual licence holders	27/10/2017	To stakeholder	Update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The letter also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Kimberley Prawn Fishery (State) - Individual licence holders	12/12/2017	To stakeholder	Letter update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Commonwealth Fisheries Association (CFA)	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Commonwealth Fisheries Association (CFA)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Commonwealth Fisheries Association (CFA)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Western Australian Fishing Industry Council (WAFIC)	07/07/2017	To stakeholder	Email and summary factsheet sent directly to stakeholder describing the proposed activity and requesting feedback. The email also mentioned that the information was sent to the commercial fishing operations in the region.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	27/07/2017	To stakeholder	Email sent to WAFIC requesting feedback on previous email, with the fact sheet was attached.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	27/07/2007	From stakeholder	WAFIC acknowledging email and will respond to the initial email today.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	27/07/2007	From stakeholder	WAFIC is concerned regarding the shallower water depths within the survey area, stating these areas are prime water depths for fish aggregation and fish spawning. WAFCI request additional information in regards to the mitigation plan on protecting commercial fishing, fish spawning and fish aggregations. WAFIC is requesting information on if Polarcus have liaised with commercial fishers, and if Polarcus are aware of key fishing months and if the commercial fishing areas overlap with the survey area. WAFIC noted fish spawning months and locations need to be protected. WAFIC is concerned of the cumulative impacts of Cygnus and Zénaïde and would like a map of both to show the overlap of each survey. WAFIC believe that the two surveys in the similar area over a similar time frame is a multiplied impact to the commercial fishing sector. WAFIC is requesting information on if Polarcus plans to address the environmental issue (seismic surveys kill plankton) in relation to Cygnus and Polarcus surveys. WAFIC would also like to know if each EP will recognise that Polarcus is conducting two surveys in the north, overlapping time and overlapping location.	Concerns raised about seismic generally and are similar to concerns raised by DoF. - Concerned about seismic in shallow water where spawning aggregations may occur. - Requestes further information regarding mitigation for managing risks to commercial fisheries and spawning aggregations - Requests confirmation on who is being consulted - Concerned about cumulative impacts due to perceived overlap of Zenaide and Cygnus - Also requested cumulative impact assessment look at last 5 years of surveys - Requests new research on plankton is considered	- Reasonable request to consider impacts to spawning and recruitment - these will be reviewed and assessed in the EP - Details of consultation with other fishery stakeholders can be provided. - Cumulative impacts due to overlap between Zenaide and Cygnus are unfounded and have no merit given distance between the two areas - Cumulative impact assessment is not normally retrospective as this does not provide any information on what cumuative impacts were or may be. To be considered. - Plankton research to be considered in risk assessment	Responses to queries and map showing both Zenaide and Cygnus provided to WAFIC 4/8/2017
	Western Australian Fishing Industry Council (WAFIC)	31/07/2017	From stakeholder	WAFIC has contacted key license holders relevant to the acquisition area. An (unnamed) license holder in the Mackerel fishery has asked a few questions: Why do seismic operators insist on doing seismic surveys during the Mackerel season? (May - December) and why do seismic operators recognise that whales and dugongs are effected but not other fish species, such as mackerel and other finfish? WAFIC requesting response to this email and for it to be included in the EP.	Why do seismic operators insist on doing seismic surveys during the Mackerel season? (May - December) Why do seismic operators recognise that whales and dugongs are effected but not other fish species, such as mackerel and other finfish?	Seismic do not intentionally target the mackerel fishing season. There are many receptors and sensitivities to take into account. EPs do recognise and assess potential impacts to fish and fisheries.	Responses to queries provided to WAFIC on 4/8/2018 to forward to licence holder. Offered to have further discussion with them about areas and timing that are important to them.
	Western Australian Fishing Industry Council (WAFIC)	01/08/2017	To stakeholder	Email to WAFIC, accepting their response and requesting to contact by phone regarding the comments made in previous emails, to then follow up with an email confirmation.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	01/08/2017	From stakeholder	WAFIC suggested catching up in person to discuss the concerns/queries WAFIC has with the proposed activities, if possible.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	02/08/2017	To stakeholder	Email informing WAFIC a discussion in person will be hard to find time and to organise and suggests a phone conversation at a specified time will be more efficient.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	03/08/2017	From stakeholder	Email from WAFIC suggesting to meet with WAFIC and a commercial fisher (potentially from a Northern Demersal Scalefish operator with fishing activities that cross-over both Polarcus Eps) at WAFIC in Fremantle.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	03/08/2017	To stakeholder	Email sent to WAFIC, suggesting a face to face meeting in Fremantle at WAFIC on Monday (7/08/2017) afternoon (Sabrina, Joe and a representative from Polarcus will be attending the meeting). Additional information will be supplied by email in coming days.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	04/08/2017	To stakeholder	Email sent to WAFIC to touch base on meeting in Fremantle.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	04/08/2017	From stakeholder	Email from WAFIC informing Polarcus they have contacted Doug Gibson, who is very reluctant to make himself available. WAFIC requests that Glenn's (NWSA) queries are to be addressed before the in person meeting. WAFIC would also like the queries from the Mackerel fishery to be addressed by Polarcus prior to meeting in person. The overlap of Cygnus and Zénaïde also need to be addressed.	Requests that queries are addressed prior to meeting	Reasonable that initial responses are provided prior to meeting	Provide initial responses are provided prior to meeting

	Western Australian Fishing Industry Council (WAFIC)	04/08/2017	To stakeholder	Email sent to WAFIC regarding a response to email on July 27. - Details on fisheries stakeholders and summary of responses received to date provided. - Re water depth, the boundaries of the Acquisition Area have been revised and exclude neasrly all areas <60m. - Acknowledged that commercial fishing may occur in these areas and that resource sharing is a concern. Polarcus is conductin thorough assessment of impacts to fish and spawning. - Acknowledged ongoing consultation is important to aid communication and planning. We welcome suggestions on how liaison can be improved. - Offered to provide outcomes of risk assessments and control measures when assessments complete. - Duration of survey clarified. 45 - 60 days, not 14 months which is the validity period of the EP. - Seasonality of receptors, including fish and spawning will be considered and proposed if practicable, but may not be practicable to work around all. If there are areas overlapped by the survey that are known to be critical to a particular fishery or there are sensitive periods for each fishery, please let us know and we can take these into account. - Note that we are considering cumulative impact assessment and whether past 5 years included. Each EP (Cygnus and Zenaide) will acknowledge the other in terms of cumulative impacts - Provided map of Zenaide and Cygnus Operational Areas. Zenaide over 130 km from Cygnus. Impacts to fish behaviours in one survey area are not expected to overlap the impacts to fish behaviour in the other. We will also consider impacts to the commercial fishing sector.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	04/08/2017	To stakeholder	Email to WAFIC, informing WAFIC more information will be sent next week in response to WAFICs comments on Zénaïde.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	08/08/2017	To stakeholder	<u>Email sent to WAFCI addressing specific comments made from WAFIC in email dated 27 July :</u> -Polarcus have received responses from Norther Prawn Fishery and Northern Wildcatch Seafood Australia. NWSA have expressed concerns about spawning red emperor and goldband snapper. -The Acquisition and Operational Area boundaries have been revised (water depths 60 - 100 m). -Maintain good communication and provide advance notice of the timing of the survey to minimise interactions with fishers. -Zénaïde is expected to take 50-60 days to acquire and completed before 31 December 2018. -Environmental sensitives include fishing activities and fish spawning -Zénaïde and Cygnus are located 130 km a part, the impact to fishers from one survey will not impact the same fishers from the other survey. -Both Cygnus and Zénaïde will acknowledge cumulative impacts and other potential surveys . - Findings of zooplankton research to be captured in risk assessment and we can share outcomes of this prior to submission of the EP <u>Response to Mackerel fishery license holder - WAFIC 31 July</u> - Seismic surveys do not specifically target this period. Each survey is different and the timing depends on a number of factors (environmental sensitivities, weather, market demand, vessel availability etc.). In order to minimise interaction, advanced notice of the timing and location of the survey is important. If, however, there is any other information that you are able to share about the location, area and timing of mackerel fishing activities that you think we need to take into consideration, we would welcome this. - Potential impacts to fish and commercial fisheries are assessed along with whales, dugongs etc. In the Polarcus Zénaïde EP, impacts to fish are one of the main foci of the impact assessment and are likely to receive more detailed assessment than marine mammals.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	08/08/2017	From stakeholder	Email from WAFIC, acknowledging Polarcus' response to their questions. WAFIC requesting a face to face meeting.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	09/08/2017	To stakeholder	Email sent to WAFIC, discussing times to catch up for a face to face meeting.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	10/08/2017	From stakeholder	Email sent from WAFIC, discussing times to meet.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	10/08/2017	To stakeholder	Email sent to WAFIC, discussing times to meet. Glenn Werth Polarcus Regional Operations Manager located in Singapore will join for the call.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	14/08/2017	From stakeholder	Email sent from WAFIC, agreeing to a time to meet for a face to face meeting (Tuesday 15/08/2017 at 9am at WAFIC in Fremantle).	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	14/08/2017	To stakeholder	Email sent to WAFIC, requesting a number that Glenn from Polarcus can call to be transferred into the meeting.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	14/08/2017	From stakeholder	Email sent from WAFIC informing Polarcus and ERM to call reception for Polarcus representatives to be transferred into the board room.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	14/08/2017	To stakeholder	Email sent to WAFIC, thanking for instructions on how to be transferred into the board room.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	15/08/2017	Meeting	In person meeting at WAFIC in Fremantle. Sabrina, Glenn and Joe attended, Mannie from WAFIC attended. Discussion generally focussed on concerns that the overall fishing industry had about seismic and the NOPSEMA stakeholder process, including stakeholder fatigue and need for clearer information. Polarcus suggested that daily lookaheads could be provided. WAFIC agreed these may be useful. Polarcus offered to provide an example for feedback on what information would be useful to fishers. - Fishers believe that seismic scares off fish and they do not return. - Discussion regarding impacts to spawning and plankton included Polarcus' initial assessment which indicates limited spatial and temporal overlap, and low impact in the context of natural variability. - McCauley et al research on zooplankton has a number of limitations, but Polarcus has factored the research into the assessment. Again, in the context of natural variability, the impacts are considered to be small. Recruitment is not expected to be impacted due to broadscale of spawning and recruitment from waters across the region. Food source impacts also limited due to plankton from non-impacted areas and plankton remain in water column or are scavenged from bottom. - WAFIC again requested cumualtive impacts are considered and include past 5 years of surveys. Polarcus and ERM agreed to include. - Copies of draft risk assessment to be provided to WAFIC prior to submission of the EP to NOPSEMA.	- Stakeholder fatigue is an issue - Ongoing consultation is important - Perception that fish scared by seismic and do not return / recover - Concerns regarding impacts to spawning aggregations - Concerns regarding impacts to plankton/eggs/larvae - McCauley research to be included in risk assessment - Cumulative impact assessment to include past 5 years surveys - Agreed to receive copies of draft assessment	- Stakeholder fatigue acknowledged as issue. Ongoing consultation will be provided to notify fishers of surevy when confirmed - Daily lookaheads to be provided to stakeholders during the survey and to be included as control in EP. - Impacts to spawning will be addressed in EP but provisional findings indicate low risk - Impacts to plankton will be addressed in the EP including recent research, but preliminary assessment findings indicate limited impacts in conext of natural variability and limited flow onto recruitment or food. - Past 5 years surveys to be considered in cumulative impact assessment as requested by stakeholder. - Copies of risk assessments to be provided.	Copies of the draft risk assessments, addressing all of the issues raised to be provided to WAFIC prior to submission, along with summary of assessment outcomes and proposed control measures.
	Western Australian Fishing Industry Council (WAFIC)	23/08/2017	To stakeholder	Email sent to Mannie, at WAFIC. ERM provided WAFIC with the draft risk assessment sections for the impacts to fish for the Zénaïde and Cygnus 3D MSS. A summary of the Zénaïde and Cygnus 3D MSS risk assessments for fish, spawning, plankton, invertebrates, commercial fisheries and cumulative impacts were also provided. ERM also acknowledging and taking on board comments on cumulative impacts. An example of a daily lookahead was also provided for comment.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	30/08/2017	From stakeholder	Email received from WAFIC, providing comments from email date 23/08/2017. WAFIC acknowledges the EP will be submitted this Friday 1st September. The main points/concerns raised: -WAFIC does not support multi-year seismic environmental plans -WAFIC expectation that Polarcus will reengage with fishers after approval of the EP - Fish apparently do not return after seismic. Still have concerns -WAFIC are concerned of the impact of seismic activity on spawning (cumulative impacts/previous impacts) -WAFIC would like Polarcus to note there is an impact from the loss of zooplankton, however as a standalone impact it might not be significant, coupled with all other activities, the cumulative impact is real. Food source is impacted. -WAFIC is concerned if a vessel becomes available at short notice and a competitive price, WAFIC believe the good intentions of the EP will be sidelined. -WAFIC noted Western Australian commercial fishers have been significantly commercially compromised with zero financial compensation.	-WAFIC does not support multi-year seismic environmental plans -WAFIC expectation that Polarcus will reengage with fishers after approval of the EP - Fish apparently do not return after seismic. Still have concerns -WAFIC are concerned of the impact of seismic activity on spawning (cumulative impacts/previous impacts) -WAFIC would like Polarcus to note there is an impact from the loss of zooplankton, however as a standalone impact it might not be significant, coupled with all other activities, the cumulative impact is real. Food source is impacted. -WAFIC is concerned if a vessel becomes available at short notice and a competitive price, WAFIC believe the good intentions of the EP will be sidelined. -WAFIC noted Western Australian commercial fishers have been significantly commercially compromised with zero financial compensation.	- Ongoing consultation will be provided to notify fishers of surevy when confirmed - Concern that fish do not return has no merit. No reason for this and comprehensive review of research shows that fish abundance returns to normal within days after survey - Spawning impacts have been comprehensively researched. It is acknowledged that WAFIC still have concerns but assessment is through and controls have been included to limit number of days temporal overlap. - Concern that the EP will ignored has no merit. Polarcus must comply with the EP and conrols and performance standards	Email to be provided to confirm that ongoing consultation will be undertaken and notifications provided and to highlight scientific research underpinning our assessments and selsction of control measures.

	Western Australian Fishing Industry Council (WAFIC)	31/08/2017	To stakeholder	Email sent to WAFIC, acknowledging receipt of email and included a response to the comments raised by WAFIC. The main points: -The defined controls defined in the EP have performance standards set to each and therefore will need to comply with all controls. -The risk assessment sections in the EP are based on comprehensive reviews of the available scientific literature. -Polarcus will provide a notification to fisheries stakeholders, confirming locations and intended timings, prior to commencement. -Stakeholder engagement will continue to be ongoing throughout the life of the EP.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	23/10/2017	To stakeholder	Email sent to WAFIC regarding the EP, asking if there is any other information regarding the location and timing of fishing that Polarcus have not considered or are currently not aware of. ERM requesting to have a call or meeting this week if possible. Polarcus will mail notifications to licence holders at least 4 weeks prior to the commencement of survey activities and licence holders will be able to register for the daily look-ahead so they can understand specifically where the survey vessel is expected to be, progress, etc. Polarcus will also notify stakeholders once the survey is complete.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	23/10/2017	From stakeholder	Email from WAFIC, informing ERM, Mannie O Shea is unavailable to meet this week and she will be on holiday for 5 weeks from 25/10/2017. WAFIC have forwarded emails to key operators in the Polarcus survey region, asking them to directly respond to ERM. An additional email was sent in regards to the Cygnus MSS informing WAFIC, that Glenn at NWSA will be contacted.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	23/10/2017	To stakeholder	Email sent to WAFIC acknowledging that Mannie will be holiday. Currently, the assessments in the Zénaïde EP indicate limited potential for impacts to the spawning fish stocks and recruitment in the region. In terms of fishing activities, we also do not expect the Zénaïde Operational Area to exclude fishing from any critical areas. ERM requesting to jump on a call to have a quick chat.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	23/10/2017	From stakeholder	Email sent from WAFIC informing ERM WAFIC have passed on email to key fishers in the area. The ongoing issues WAFIC have with all seismic environmental plans is that proponents are their representatives seeking 'specific areas or timings in regards to fishing operations" is difficult at any given day and at any give location this can vary.	WAFIC states that 'specific areas or timings in regards to fishing operations" is difficult at any given day and at any give location this can vary.	Noted that area and timing of fishing activities are difficult to determine.	N/A
	Western Australian Fishing Industry Council (WAFIC)	24/10/2017	To stakeholder	Email sent to WAFIC clarifying that ERM are not expecting to understand exactly where and when fishing will occur, but to identify if there are primary areas that are commonly targeted, which could potentially vary depending on the time of year.	N/A	N/A	N/A
	Western Australian Fishing Industry Council (WAFIC)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.		N/A	
	Western Australian Fishing Industry Council (WAFIC)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Australian Southern Bluefin Tuna Industry Association	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Australian Southern Bluefin Tuna Industry Association	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Australian Southern Bluefin Tuna Industry Association	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Australian Council of Prawn Fisheries	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Australian Council of Prawn Fisheries	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Australian Council of Prawn Fisheries	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Northern Prawn Fishery Industry Pty Ltd	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Northern Prawn Fishery Industry Pty Ltd	10/07/2007	From stakeholder	Stakeholder requesting additional information (shape files for the operational and acquisition areas) to assess the potential impact on the Northern Prawn Fishery.	Requested shapefiles	N/A - Advice / request for further information only. No objection or claim made.	Shapefiles to be provided
	Northern Prawn Fishery Industry Pty Ltd	12/07/2017	To stakeholder	Email sent to the stakeholder with shapefiles of the proposed Acquisition and Operational Areas. Also notified the stakeholder of change to the Acquisition and Operational Areas. Requesting feedback on proposed change to operational and acquisition area.	N/A	N/A	N/A
	Northern Prawn Fishery Industry Pty Ltd	19/07/2017	To stakeholder	Email sent to stakeholder with the updated shapefiles of the new proposed Acquisition and Operational Areas. Stakeholder alerted to the Acquisition Area being reduced and the Operational Area increased to the east.	N/A	N/A	N/A
	Northern Prawn Fishery Industry Pty Ltd	27/07/2017	To stakeholder	NPF was contacted by phone, however there was no answer. Email was sent requesting feedback.	N/A	N/A	N/A
	Northern Prawn Fishery Industry Pty Ltd	01/08/2017	From stakeholder	NPF emailed confirming receipt of the information provided and is currently reviewing it. NPF will provide a response within the week.	N/A	N/A	N/A
	Northern Prawn Fishery Industry Pty Ltd	10/08/2017	To stakeholder	NPF was contacted by phone, however there was no answer. Email was sent requesting feedback.	N/A	N/A	N/A
	Northern Prawn Fishery Industry Pty Ltd	14/08/2017	From stakeholder	Email sent from NPF apologising for missing ERMs call. NPFI are currently reviewing the information and will provide a response this week.	N/A	N/A	N/A
	Northern Prawn Fishery Industry Pty Ltd	18/08/2017	To stakeholder	Email sent to NPF informing them we are currently in the process of completing the risk assessments for Zénaïde. NPF was provided the link to the Santos Fishburn EP (refer to pg. 89) on the main area for the NPF.	N/A	N/A	N/A
	Northern Prawn Fishery Industry Pty Ltd	27/10/2017	To stakeholder	NPF was contacted by phone twice, however there was no answer - a message was left asking if they had any further comments or feedback regardining the timing or location of the MSS and requesting a call back.	N/A	N/A	N/A
	Northern Prawn Fishery Industry Pty Ltd	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification. This email also asked NPF if they had any further comments or feedback regardining the timing or location of the MSS.	N/A	N/A	N/A
	Northern Prawn Fishery Industry Pty Ltd	01/11/2017	To stakeholder	NPF was contacted by phone, however there was no answer.	N/A	N/A	N/A
	Northern Prawn Fishery Industry Pty Ltd	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Australian Fishing Trade Association (AFTA)	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Australian Fishing Trade Association (AFTA)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Australian Fishing Trade Association (AFTA)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Pearl Producers Association (PPA)	07/07/2017	To stakeholder	Email and summary factsheet sent directly to the stakeholder describing the proposed activity and requesting feedback. Polarcus understands the nearest pearling activity is located 96 km from the Acquisition Area and anticipates no impacts to the pearling license holders. Attached to the email was a copy of the Acquisition Area and the Pearling activities.	N/A	N/A	N/A
	Pearl Producers Association (PPA)	17/07/2017	To stakeholder	Email sent to stakeholder requesting feedback in relation to the seismic survey.	N/A	N/A	N/A
	Pearl Producers Association (PPA)	27/07/2007	To stakeholder	Email sent to PPA requesting feedback with the attached fact sheet and map of the Acquisition Area and pearling leases.	N/A	N/A	N/A
	Pearl Producers Association (PPA)	10/08/2017	To stakeholder	Phone call to PPA, Aaron answered and will call in the next few days regarding a response to our emails or he will respond directly via email addressing his concerns/interests.	N/A	N/A	N/A
	Pearl Producers Association (PPA)	18/08/2017	To stakeholder	Email sent to Aaron, informing PPA we are currently completing risk assessments for Zénaïde. From our understanding the nearest pearling lease is 96 km from the Acquisition Area and therefore no impacts are expected but please contact us if any queries.	N/A	N/A	N/A
	Pearl Producers Association (PPA)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Pearl Producers Association (PPA)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	WA Seafood Exporters	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	WA Seafood Exporters	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	WA Seafood Exporters	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	

	Westmore Seafoods / Australia Bay Seafoods	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Westmore Seafoods / Australia Bay Seafoods	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Westmore Seafoods / Australia Bay Seafoods	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Recreational Fishing, Charters, Marine Tourism Operators							
	Australian Recreational Fishing Foundation	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Australian Recreational Fishing Foundation	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Australian Recreational Fishing Foundation	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Recfishwest	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Recfishwest	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Recfishwest	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Tourism Western Australia	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Tourism Western Australia	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Tourism Western Australia	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	One Tide Charters	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	One Tide Charters	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	One Tide Charters	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Unreel Adventure Safaris	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Unreel Adventure Safaris	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Unreel Adventure Safaris	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	KAS Helicopters	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	KAS Helicopters	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	KAS Helicopters	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Kingfisher Tours	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Kingfisher Tours	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Kingfisher Tours	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Aviair	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Aviair	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Aviair	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Peregrine Bird Tours	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Peregrine Bird Tours	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Peregrine Bird Tours	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Kimberley Bird Watching	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Kimberley Bird Watching	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Kimberley Bird Watching	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Kimberley Air Tours	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Kimberley Air Tours	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the	N/A	N/A	N/A
	Kimberley Air Tours	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Kimberley Whale Watching	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Kimberley Whale Watching	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Kimberley Whale Watching	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Kimberley Outback Tours	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Kimberley Outback Tours	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the	N/A	N/A	N/A
	Kimberley Outback Tours	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	True North Adventure Cruises	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	True North Adventure Cruises	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the	N/A	N/A	N/A
	True North Adventure Cruises	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Ocean Dream Charters	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Ocean Dream Charters	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Ocean Dream Charters	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	The Great Escape Charter Company	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	The Great Escape Charter Company	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	The Great Escape Charter Company	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Kimberley Quest	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Kimberley Quest	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Kimberley Quest	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Ports and Shipping							
	Port of Broome	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Port of Broome	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Port of Broome	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
	Kimberley Ports Authority	07/07/2017	From stakeholder	Stakeholder responding with acknowledgement of email. Stakeholder responded with no objections with the proposed activity and stated they will circulate the information to the environmental and commercial departments.	Confirmed no objections	N/A	N/A
	Kimberley Ports Authority	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Kimberley Ports Authority	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	

Environmental Non-Governmental Organisations						
The Wilderness Society	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
The Wilderness Society	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
The Wilderness Society	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Save the Kimberley	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
Save the Kimberley	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
Save the Kimberley	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Environs Kimberley	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
Environs Kimberley	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
Environs Kimberley	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Australian Conservation Foundation	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
Australian Conservation Foundation	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
Australian Conservation Foundation	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
The Conservation Council of WA	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
The Conservation Council of WA	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
The Conservation Council of WA	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
World Wildlife Fund	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
World Wildlife Fund	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
World Wildlife Fund	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
International Fund for Animal Welfare (IFAW)	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
International Fund for Animal Welfare (IFAW)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
International Fund for Animal Welfare (IFAW)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Land Councils						
Northern Land Council	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
Northern Land Council	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
Northern Land Council	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Kimberley Land Council Aboriginal Corporation	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
Kimberley Land Council Aboriginal Corporation	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
Kimberley Land Council Aboriginal Corporation	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Industry						
Telstra	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
Telstra	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
Telstra	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Nextgen Networks	07/07/2017	To stakeholder	Email sent directly to the stakeholder with a summary factsheet sent describing the proposed activity and requesting feedback. Polarcus understands the Operation area is 70km south-east of the North West Cable System, however asks for feedback regarding Nextgen interests/projects in the area.	N/A	N/A	N/A
Nextgen Networks	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
Nextgen Networks	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Woodside Energy Ltd	10/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
Woodside Energy Ltd	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
Woodside Energy Ltd	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Eni Australia B.V.	10/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
Eni Australia B.V.	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
Eni Australia B.V.	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Santos Offshore Pty Ltd	10/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
Santos Offshore Pty Ltd	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
Santos Offshore Pty Ltd	03/11/2017	From stakeholder	Email sent from Sam Jarvis requesting all future stakeholder correspondence to be sent to Samantha.jarvis@santos.com. Santos would like to obtain daily look ahead reports for Zenaide. Daily look aheads are to be sent to Stakeholder.Enquiries@santos.com	Registered for daily lookaheads.	N/A	Confirmed added for daily lookaheads
Santos Offshore Pty Ltd	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	N/A
Santos Offshore Pty Ltd	12/12/2017	To stakeholder	Email received from Santos, informing Polarcus to direct all future correspondence to michael.giles@santos.com	N/A	N/A	N/A
Octanex Bonaparte Pty Ltd	10/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
Octanex Bonaparte Pty Ltd	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
Octanex Bonaparte Pty Ltd	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Broome Chamber of Commerce and Industry	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
Broome Chamber of Commerce and Industry	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the	N/A	N/A	N/A
Broome Chamber of Commerce and Industry	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Inpex	09/08/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback. Email sent to INPEX alerting Inpex that the Ichthys Gas Export Pipeline is located within the area. The Zénaïde Acquisition Area, does not overlap with the pipeline however, there is potential interaction with vessel activity. Requesting feedback if INPEX have any concerns.	N/A	N/A	N/A
Inpex	09/08/2017	From stakeholder	Automatic response acknowledging receipt of email.	N/A	N/A	N/A

	Inpex	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
		12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	
Oil Spill Response Agencies (Non-Government)							
	Australian Marine Oil Spill Centre (AMOSC)	07/07/2017	To stakeholder	Email and summary factsheet sent describing the proposed activity and requesting feedback.	N/A	N/A	N/A
	Australian Marine Oil Spill Centre (AMOSC)	27/10/2017	To stakeholder	Email update sent to stakeholders informing them the EP has been submitted to NOPSEMA. A link was provided to the EP status on NOPSEMAs website. The email also outlined the ongoing consultation methods including the option to register for the daily activity look-ahead notification.	N/A	N/A	N/A
	Australian Marine Oil Spill Centre (AMOSC)	12/12/2017	To stakeholder	Email update sent to stakeholders informing them of EP acceptance, survey commencement and vessel details.	N/A	N/A	

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