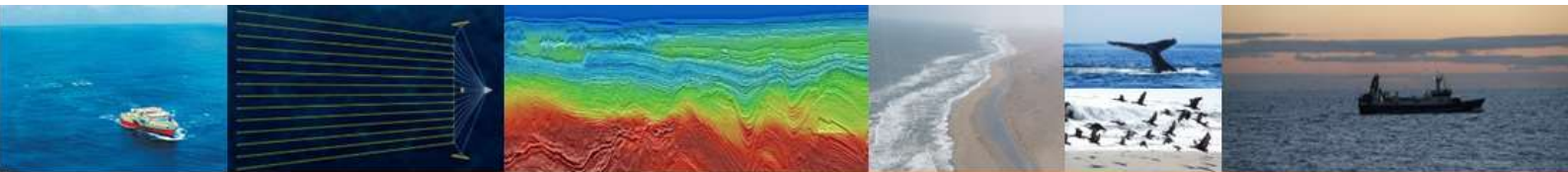


PGS Exploration (UK) Limited

Final Environmental Management Plan (EMP) Report to Support the Application
for a New Environmental Clearance Certificate (ECC) for the Proposed
Multiclient/Proprietary 2D / 3D Seismic Survey covering Blocks 2310,
2311B, 2311A, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512B,
2512A, 2513, 2611, and Portions of Blocks, 2210B, 2210A,
2211Bb, 2211Ba, 2212B, 2612B, 2612A, and 2613,
WALVIS, ORANGE, AND LÜDERITZ BASINS OFFSHORE NAMIBIA



November 2023

PGS Exploration (UK) Limited
4 The Heights, Brooklands, Weybridge
Surrey, KT13 0NY
UNITED KINGDOM

SUMMARY INFORMATION

Proponent

PGS Exploration (UK) Limited

MEFT New ECC Application Reference No.

APP-002496

Project Title / Subject on the New ECC

New Environmental Clearance Certificate (ECC) for the Proposed Multiclient/Proprietary 2D / 3D Seismic Survey covering Blocks 2310, 2311B, 2311A, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512B, 2512A, 2513, 2611, and Portions of Blocks, 2210B, 2210A, 2211Bb, 2211Ba, 2212B, 2612B, 2612A, and 2613, **Walvis, Orange, and Lüderitz Basins Offshore Namibia**

Petroleum Exploration Activities

Multiclient/Proprietary 2D / 3D Seismic Survey Operations

Location of the Proposed Survey Area of Interest for Mew ECC Application

Blocks 2310, 2311B, 2311A, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512B, 2512A, 2513, 2611, and Portions of Blocks, 2210B, 2210A, 2211Bb, 2211Ba, 2212B, 2612B, 2612A, and 2613, Walvis, Lüderitz and Orange Basins, Offshore Namibia.

National Regulatory Framework

Environmental Management Act (EMA), 2007, (Act No. 7 of 2007) and Environmental Impact Assessment (EIA) Regulations No. 30 of 2012

Proponent Address

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CITATION: *Risk-Based Solutions (RBS), 2023. Final Environmental Management (EMP) Report to Support the Application for a New Environmental Clearance Certificate (ECC) for the Proposed Multiclient/Proprietary 2D / 3D Seismic Survey covering Blocks 2310, 2311B, 2311A, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512B, 2512A, 2513, 2611, and Portions of Blocks, 2210B, 2210A, 2211Bb, 2211Ba, 2212B, 2612B, 2612A, and 2613, Walvis, Orange, and Lüderitz Basins Offshore Namibia.*

**DR SINDILA MWIYA, TEAM LEADER / ENVIRONMENTAL ASSESSMENT PRACTITIONER
(EAP), PERMITTING / DE-RISKING ADVISORS / ENVIRONMENTAL CONSULTANTS
DECLARATION**

I, Dr Sindila Mwiya, working for Risk-Based Solutions (RBS) CC, the Permitting / De-Risking Advisors / Environmental Consultants and being the Environmental Assessment process Team Leader and EAP for the preparation of the Final Environmental Management Plan (EMP) Report to support the application for a new Environmental Clearance Certificate (ECC) for the proposed Multiclient/Proprietary 2D / 3D Seismic Survey over the Area of Interest (AOI) covering Blocks 2310, 2311B, 2311A, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512B, 2512A, 2513, 2611, and Portions of Blocks, 2210B, 2210A, 2211Bb, 2211Ba, 2212B, 2612B, 2612A, and 2613, Walvis, Lüderitz and Orange Basins, Offshore Namibia, by PGS Exploration (UK) Limited (the Proponent), hereby declares that:

1. This Environmental Management Plan (EMP) Report has been prepared in accordance with the provisions of the Petroleum (Exploration and Production), 1991, (Act No. 2 of 1991), Petroleum Laws Amendment Act, 1998, (Act 24 of 1998), the Environmental Management Act, 2007, (Act No. 7 of 2007), all other applicable national laws, and Regulations and Good International Industry Practice (GIIP).
2. I am highly qualified and experienced in environmental assessments and management, marine seismic survey operations, offshore oil and gas exploration and production operations and hold a PhD with research interests, academic training, and technical knowledge in Engineering Geology, Geotechnical, Geoenvironmental and Environmental Engineering, Artificial Intelligence and Knowledge-Based Systems with special focus on EIAs, EMPs, EMSs, SEAs, SEMP and ESG with respect to subsurface resources (minerals, petroleum, water) and energy in arid and semiarid environments.
3. I am an Engineering and Environmental Geologist with extensive technical knowledge and experience in conducting environmental assessments, management, and monitoring for offshore and onshore subsurface resources (petroleum, solid state minerals, water, geothermal), exploration and utilisation and have undertaken more than 300 projects since 2004, including more than seventy (70) oil and gas exploration and production related environmental assessments, management, and monitoring projects in different parts of the World.
4. I have performed the work relating to this project in an objective manner, even if the outcomes will result in views or Records of Decision that may not be favourable to the Stakeholders or the Proponent, and.
5. I am an independent consultant not related to the Proponent, I co-own and operate an independent company (Risk-Based Solutions CC) which is not related to the Proponent. Except for the fees payable for professional consulting services rendered to the Proponent, I have no shares, interests, or involvement in the license, financial or other affairs or business or operational decisions of either the Proponent or the decision-making structures of Government.



.....
Dr Sindila MWIYA

Environmental Assessment Practitioners (EAPs)\Team Leader
Permitting / De-Risking Advisors / Environmental Consultants
RISK-BASED SOLUTIONS (RBS) CC

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NONTECHNICAL SUMMARY

Petroleum Geo-Services (PGS) Exploration (UK) Limited here in referred as (“**PGS**”) (the “Proponent”) intends to apply for an Environmental Clearance Certificate (ECC) to acquire Multiclient/Proprietary 2D/3D seismic survey activities over an Area of Interest (AOI) covering Blocks 2310, 2311B, 2311A, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512B, 2512A, 2513, 2611, and Portions of Blocks, 2210B, 2210A, 2211Bb, 2211Ba, 2212B, 2612B, 2612A, and 2613 falling in the Walvis, Lüderitz and Orange Basins, offshore Namibia.

The Proposed AOI falls in water depths ranging from ca-200 m to more than ca-4000m, from east to west, respectively. The Multiclient/Proprietary 2D/3D seismic survey activities are planned to be implemented from January 2024. The proposed survey will be undertaken over multiple survey events and seasons using one (1) or two (2) own or third-party chartered survey vessels compliant to the International Convention for the Prevention of Pollution from Ships (MARPOL) and Namibian Maritimes legal requirements.

The proposed Multiclient/Proprietary 2D/3D seismic survey activities are listed activities in Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007) and Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 and cannot be undertaken without an Environmental Clearance Certificate (“ECC”). The Proponent is required to have undertaken environmental assessment comprising Scoping, Environmental Impact Assessment (“EIA”) and Environmental Management Plan (“EMP”) to support the application for ECC. In fulfilment of this environmental requirements, the Proponent appointed Risk-Based Solutions (RBS) CC as the Environmental Consultant to prepare all the required reports and apply for the ECC with respect to the proposed Multiclient/Proprietary 2D/3D seismic survey operations in the Walvis, Lüderitz and Orange Basins, offshore Namibia.

The first survey event of proposed Multiclient / Proprietary 2D/3D seismic survey activities may commence from January 2024, if the ECC is granted by the Environmental Commissioner in the Ministry of Environment, Forestry and Tourism. The proposed survey will be undertaken over multiple survey events and annual seasons using survey vessels that are compliant to the International Convention for the Prevention of Pollution from Ships (MARPOL) and Namibian Maritimes legal requirements.

This Environmental Management Plan (“EMP”) Report is prepared based on the findings and recommendations of the impact assessment results presented in the Environmental Impact Assessment (“EIA”) Report. This EMP Report provides key mitigations measures with respect to the significant impacts that the proposed Multiclient / Proprietary 2D/3D seismic survey activities are likely to have on the receiving marine environments (physical, biological, socioeconomic and ecosystem). The mitigation measures cover the entire outlined project area in the Walvis, Lüderitz and Orange Basins, offshore Namibia and the immediate surrounding areas with respect to routine and non-routine or accidental events / activities during the mobilisation and pre-survey preparation, actual survey, and post survey / demobilisation operations project stages.

The environmental assessment process inclusive of the preparation of the EIA and this EMP Report has been undertaken in accordance with the provisions of Petroleum (Exploration and Production) Act 1991 (Act 2 of 1991) and associated amendments, the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 and the Environmental Management Act, 2007 as well as international best practices. Key project alternatives as described in the EIA Report includes the following:

- ❖ Project location and the no-action alternative.
- ❖ Other marine users, and potential user conflicts, influence on the ecosystem function, services, use values and non-use or passive.

Detailed mitigation measures and monitoring plan have been developed and are presented in this EMP Report for implementation and monitoring by the Proponent. The mitigation measures presented in this EMP merged the Proponent’s international best practices mitigations measures with local species events such as the whale migration corridors and timings, key fish spawning areas and timing, key

fishing seasons, breeding and feeding areas as well as several unique marine ecosystems of the Walvis, Lüderitz and Orange Basins, offshore Namibia.

The overall EMP framework and mitigation measures presented in this report are tailored-made to Namibia's southern offshore environment and considered the peak primary and secondary Whales migration periods in Namibia of between May-July and October–November, respectively, as well as the probability of encountering whales outside these peak migration periods. Offshore seismic survey, especially 3D survey, can only be undertaken in the Namibian waters during calm summer weather window months between November-March. Temporary, operational and other key avoidance mitigatory measures have been considered in this EMP to mitigate for the likely overlaps of marine mammal migratory periods and other marine users with the suitable weather window for undertaking seismic survey in the Namibian marine environment.

In addition to the company's strict compliance with all the relevant national regulations and standards, the Proponent has taken into considerations the international standards of protection developed through the Joint Nature Conservation Committee (JNCC) "guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys", and the Energeo Alliance's, formerly known as the International Association of Geophysical Contractors (IAGC), "recommended mitigation measures for cetaceans during geophysical operations".

These international best industry practices have proved to be effective in several different countries like Canada, Australia, Norway, and the United States. These guidelines have been developed based on noise attenuation modelling, international experiences during seismic acquisition and a cautious approach to the disturbance of marine mammals from seismic surveys. The following is the summary of the basis for the temporary, operational and other key avoidance mitigatory measure as presented in this EMP report with respect to the proposed Multiclient / Proprietary 2D/3D seismic survey activities in the Walvis, Lüderitz and Orange Basins, offshore Namibia:

1. Seasonality and timing.
2. Establishment of buffer zones.
3. Use of Marine Mammal Observer (MMO).
4. Use of Fisheries Liaison Officers (FLOs).
5. Use of Passive Acoustic Monitoring (PAM) Technology.
6. Soft starts' and 'pre-activation' observations.
7. Termination of activation in the 500m exclusion zone with respect to marine mammals.
8. Marine Animal Monitoring and Mitigation Plan aboard the Survey Vessel.
9. The use of Turtle friendly tail buoys.
10. The use of support vessel and fisheries liaison officer.
11. Pollution and spill prevention and management.
12. Compliance to all MARPOL (marine pollution) regulations and waste disposal procedures, and.
13. Adoption of the precautionary principles in the absence of any specific mitigation measures being provide in this updated, the Proponent shall always adopt the precautionary approach.

Good communication and pre-notification practices will limit unnecessary disruption and delays to other marine users. Due consideration should be given to the presence of all fishing vessels while running survey lines and communication channels should be kept open to avoid close encounters. Additionally,

support vessels moving to/from Lüderitz Bay may encounter commercial fishing vessels of other fishing sectors and potentially cause disruption, but on a very short-term.

Adherence to prescribed maritime communication procedures will limit any likely encounters. In the interests of amicable co-use of the marine resources, and for marine safety, the following procedures should mitigate any negative interactions with the fishing vessels:

- 1) The surveyor must formally notify the Petroleum Commissioner (MME) of the survey, stating the proposed location of the survey lines, the commencement date and the anticipated duration.
- 2) This information should also be relayed to all affected parties (Directorate of Maritime Affairs, Namibian Ports Authority, South African HydroSAN and the MFMR Monitoring, Control and Surveillance Unit - Walvis Bay).
- 3) In the interest of good relations, direct communication and facilitation with any vessels in the area at the time of the survey is important. Openness to the possibilities of adjusting survey lines and trawling location to cause minimum disruption of operations to both parties.
- 4) Good communications through MFMR to the fisheries (i.e., Association of Namibian Fishing Industries and the Namibian Large Pelagic and Hake Longlining Association) with pre-notification of survey activities and vessel paths (navigational co-ordinates of the survey area, timing and duration of proposed activities).
- 5) Notices to Mariners should be distributed timeously to fishing companies and directly to fishing vessels, stating the following: The co-ordinates of the proposed survey lines, timeframes and day-to-day location of the survey seismic vessel, safe operational limits of the survey vessel, and, movements of support vessels.
- 6) Radio Navigation Warnings and Notices to Mariners should be distributed via Navigational Telex (Navtext) and Lüderitz radio for the duration of the survey.
- 7) It is recommended that updates of the scheduled weekly survey plan be circulated to the operators of affected fishing vessels on a daily basis and notify trawlers when the survey may move into trawling areas.
- 8) Establish communications with the known long-line fishers if drifting buoys (with radar responders) are sighted.
- 9) Award compensation for damage to fishing gear and other proven direct impacts should it be shown the damage is as a direct result of negligence on the part of the contractor, and.
- 10) An experienced Fisheries Liaison Officer (FLO) should be deployed on board the survey vessel to initiate and facilitate radio communications with maritime vessels in the vicinity of the survey area. The FLO should report daily on vessel activity, ramp up procedures, environmental matters, fauna sightings, and respond and advise on action to be taken in the event of encountering fishing gear.

It is hereby recommended that the proposed Multiclient / Proprietary 2D/3D seismic survey activities covering the Walvis, Lüderitz and Orange Basins, offshore deep-water Namibia, shall go-ahead and be granted with an ECC.

The proposed Multiclient / Proprietary 2D/3D seismic survey in the Walvis, Lüderitz and Orange Basins, offshore deep-water Namibia can coexist with other proposed and ongoing marine related activities in the AOI (Table 1).

Based on the findings of the EIA Report (Table 1) and the mitigation measures provided in this EMP, the first annual survey event for the proposed Multiclient / Proprietary 2D/3D seismic survey activities is recommended to start from December where possible, if the ECC is granted by the Environmental

Commissioner. However, if the survey has to start before December due to the limited favourable weather window for conducting seismic survey in the Namibian waters which is from November-March, the Proponent shall implement the precautional principles, mitigation measures linked to international best practices as recommended by the Joint Nature Conservation Committee (JNCC) of the Energeco Alliance, formerly known as the International Association of Geophysical Contractors (IAGC), for protecting cetaceans during geophysical operations in addition to the other key mitigation measures as detailed in the EMP Report.

All environmental liabilities rest with the Proponent as ultimately responsible for the EMP implementation, environmental performance monitoring and reporting thereof to the Environmental Commissioner in the Ministry of Environment, Forestry, and Tourism as may be stipulated in the ECC to be issued.

A "Close Out" report shall be prepared and submitted to the Government (Ministry of Mines and Energy, (MME), Ministry of Environment, Forestry, and Tourism (MEFT), Ministry of Fisheries and Marine Recourse (MFMR) and the Ministry of Work and Transport (MWT), Department of Maritimes Affairs) after completing each event of the proposed Multiclient / Proprietary 2D/3D seismic survey activities operations.

Additionally, notifications to marinas shall be issued supported by continuous communications and monitoring during the actual survey operations. Seismic survey operations within the proposed AOI should not coincide with the MFMR stock assessment survey as shown in Table 1.

The following is the summary of the EMP recommendations to be implemented and monitored by the Proponent with respect to the proposed Multiclient / Proprietary 2D/3D seismic survey activities over the Walvis, Lüderitz and Orange Basins, offshore Namibia:

1. Procedure for commencement of operations.
2. Procedure for ongoing operations.
3. Procedure for testing source elements.
4. General practices.
5. Pollution prevention and management.
6. Spills prevention and management.
7. Overall compliances, and.
8. Adoption of the precautionary principles.

Table 1: RBS developed coexistence Knowledge-Based System Model Methodology (KBSMM) log framework fully validated and populated during the EIA process in identifying suitable window/s of opportunities for undertaking the proposed Multiclient/Proprietary 2D/3D seismic survey activities with respect to the receiving environment in the Walvis, Lüderitz and Orange Basins, offshore Namibia.

MONTH	KEY FISHING SEASON (KEY SPECIES)	MAIN SPAWNING ACTIVITIES (KEY SPECIES)		MINISTRY OF FISHERIES AND MARINE RESOURCES STOCK SURVEYS	KEY CETACEOUS PRESENCES / MIGRATORY TIMES	OTHER KEY USERS	WEATHER WINDOW	COMMENTS ON OFFSHORE SEISMIC SURVEY OPPORTUNITY WINDOW				
January	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster	Hake spawning occurs throughout the year with main spawning period between July -October	Cape Monk spawn throughout the years, with peaks in Jul & Sep for females & Aug for males	Hake Stock Survey	Rock Lobster Monthly Stock Survey	Whales Migration Primary Peak Period	Good	Impact – Hake Stock Survey (less than-1000m), Tuna migrating (Trip Seamount) SURVEY PLANNED TO START 2024				
February	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster			Impact – Hake Stock Survey (less than-1000m), Tuna migrating (Trip Seamount)								
March	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster			Impact – Tuna migrating (Trip Seamount)								
April	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster			Impact – Tuna migrating (Trip Seamount)								
May	Hake Trawl, Monk			No Impacts but unfavorable weather								
June	Snoek, Hake Trawl, Monk			Snoek, and Orange Roughy				Very Poor	No Impacts but unfavorable weather			
July	Hake Trawl, Monk								Impact – Orange Roughy spawning (shallow waters), Snoek migrating in deepwater			
August	Hake Trawl, Monk			Impact – Orange Roughy aggregated spawning, Snoek migrating in deepwater								
September	Surface Longline, Hake Trawl, Monk			Rock Lobster				Poor	Impact – Snoek migrating in deepwater			
October	Pole and line Tuna, Surface Longline, Monk								Rock Lobster Stock Survey	Whales Migration Secondary Peak Period	Moderate Mixed	Impact – Shallow water rock Lobster Stock Survey, Tuna migrating (Trip Seamount)
November	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster								Monk Stock Survey		Good	Impact – Monk Stock Survey (less than-1000m), Tuna migrating (Trip Seamount)
December	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster										Good	Impact – Tuna migrating (Trip Seamount)

1. INTRODUCTION

1.1 General Project Overview

Petroleum Geo-Services (PGS) Exploration (UK) Limited here in referred as (“**PGS**”) (the “**Proponent**”) is proposing to conduct a regional Multiclient (MC) or Proprietary / Exclusive 2D/3D seismic survey over and Area of Interest (AOI) situated in the Walvis, Lüderitz and Orange Basins, offshore, Namibia (Figs. 1.1-1.3). The following is the general summary of the proposed Multiclient/Proprietary 2D/3D seismic survey activities:

- ❖ **Proposed activities** – Multiclient or Proprietary (Exclusive) 2D/3D seismic survey.
- ❖ **Location** – Blocks 2310, 2311B, 2311A, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512B, 2512A, 2513, 2611, and Portions of Blocks, 2210B, 2210A, 2211Bb, 2211Ba, 2212B, 2612B, 2612A, and 2613, Walvis, Orange, and Lüderitz Basins Offshore Namibia. (Figs. 1.1-1.3).
- ❖ **Summary Example of the of the Seismic Specification:**
 - Source array details including:
 - Array pressure time history signature (preferably in electronic format – e.g. .sig file).
 - Power spectral density (amplitude spectrum) plots (preferably in electronic format – e.g. .sig file).
 - Airgun volume.
 - Peak and rms sound pressure level.
 - Shot rate.
 - Total number of shots per 24 h period.
 - Total number of shots per 24 h period = Approx. 5,206
 - Total number of shots for the full survey = Approx. 458,180
 - Copy of Gundalf or Nucleus report.
 - Vessel sail speed and line change times: Expected vessel speed = 4.2 knots. Line change duration expected to be 3.4 hours (nominal).
 - Shot spacing: 16.667m flip-flop-flap (50m per same source).
 - Source activation time (hours per day):
 - Source to be activated once every Approx. 7.7 seconds.
- ❖ **Water Depth of the AOI** – Ranges from ca-200m to -4000m from east to west respectively.
- ❖ **Nearest Namibian Port** –Port of Lüderitz or Walvis Bay.
- ❖ **Operating company** – PGS.
- ❖ **Survey vessel(s)** – To be confirmed and multiple vessels (2) may be used.
- ❖ **Type of Survey** – 2D/3D streamers depending on the type of survey to be undertaken per survey event.
- ❖ **Desired acquisition time** – First survey event of the proposed Multiclient / Proprietary 2D/3D seismic survey to start in December 2023 if an ECC is granted by the Environmental Commissioner, and.
- ❖ **Estimated survey duration**–Seventy (70) days per survey event and multiple survey events will be undertaken over the next three (3) years.

1.2 Spatial Scope, and Survey Coverage

The spatial scope of the proposed 2D / 3D seismic survey and impact assessment and management thereof covers the following (Figs. 1.1-1.3):

- ❖ Current outlined initial survey area covering and any future survey extension falling within the Walvis, Lüderitz and Orange Basins, Offshore Namibia defined as the immediate impact zone: The receiving environment in this area likely to be directly influenced by the survey activities will include a radius of 500 m safety exclusion zone around the survey vessel and surrounding areas where discharges to sea and sound may propagate and affect marine wildlife and immediate environment, and.
- ❖ Survey area broader impact zone include all the surrounding socioeconomic zones likely to be affected by the proposed survey operations and logistics including support vessels.

1.3 Proposed Project Implementation and Sources of Impacts

The following is the summary of the proposed project implementation stages as assessed in this Environmental Impact Assessment (EIA) Report with mitigation measures provided in the Environmental Management Plan (EMP) Report:

- (i) Mobilisation and pre-survey preparations.
- (ii) Actual survey operations.
- (iii) Post survey operations, and.
- (iv) Non-routine or accidental events.

The activities associated with proposed project have been characterised and grouped as follows:

- (i) Routine and physical presence of the survey and support vessels in the area including the Ports of Walvis Bay or Lüderitz, physical presence of survey and support vessels, Physical disturbance of the survey operations, sound generation from proposed 2D or 3D seismic survey source, including sound of the survey and support vessels engines, increased light levels from routine vessels operations, atmospheric emissions from routine operations of the survey and support vessels, and planned marine discharges, and.
- (ii) Accidental events covering: Unplanned marine discharges (e.g., minor spillages of fuel, lubricants / maintenance oils, loss of vessel, equipment or material, collision with marine wildlife during vessel operations, and, loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or another major event.

Logistic support will be provided through the existing facilities in the Ports of Walvis Bay or Lüderitz for supplies, fuelling and crew changeover as may be required and if required. No helicopter crew transfer support is anticipated except in event of an emergency.

1.4 Petroleum Geo-Services (PGS) Exploration (UK) Limited (The Proponent)

PGS is an integrated marine geophysics company with offices in 14 countries. Modern geophysics applies big data concepts to record and image Earth's subsurface and is one of the largest uses of compute power on the planet. The business supports the energy industry, including oil and gas, offshore renewables, Carbon Capture and Storage (www.pgs.com).

Product offerings span from survey planning and data acquisition, through advanced imaging, to reservoir analysis and interpretation. The company has multiple offshore seismic vessels, processing and imaging megacenters, three (3) main offices in Oslo, London and Houston, with presence in over ten (10) countries with headquarters in Oslo, Norway.

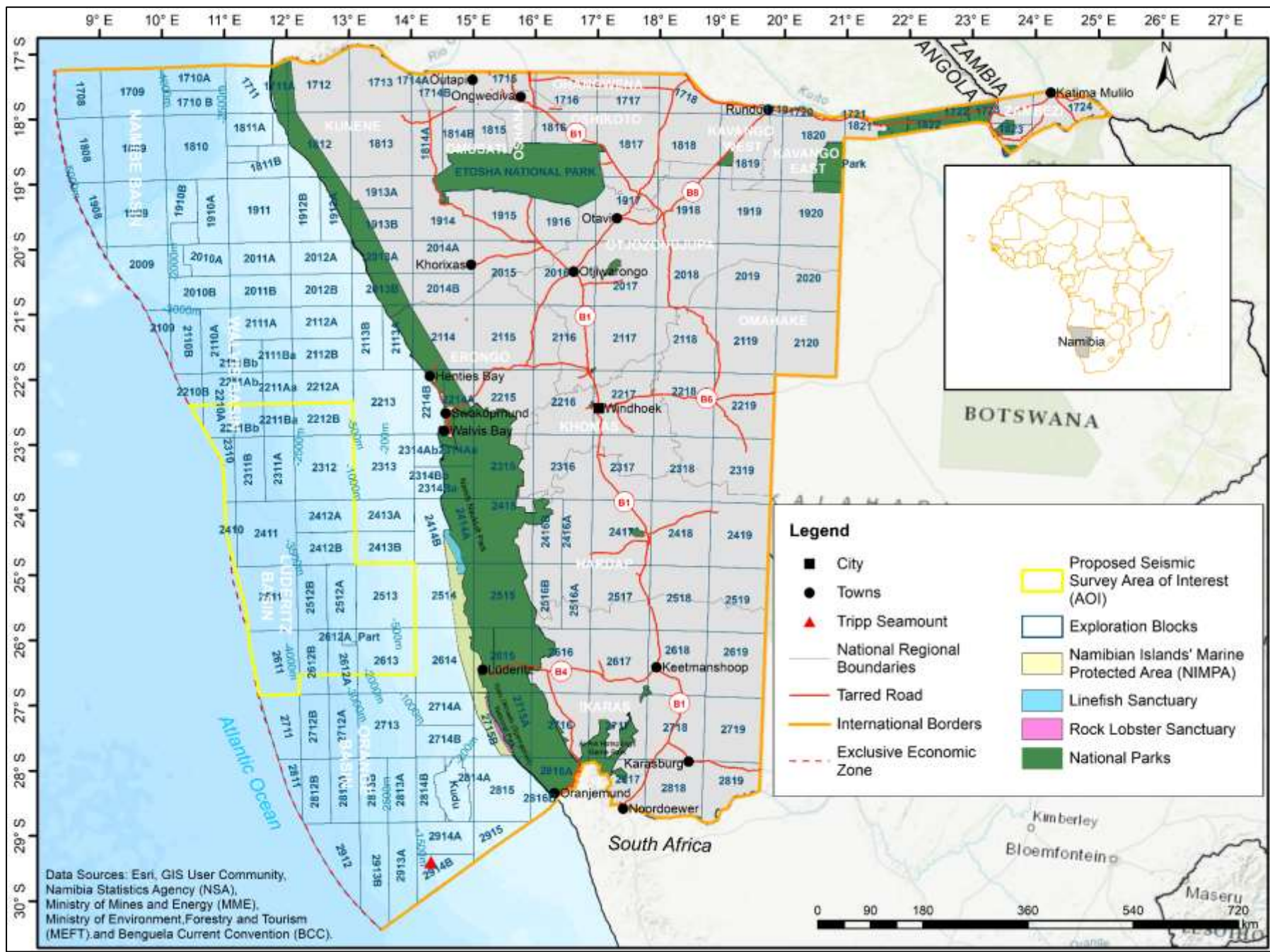


Figure 1.1: Regional location of the proposed 2D / 3D seismic survey coverage areas in the Walvis, Lüderitz and Orange Basins, offshore central Namibia.

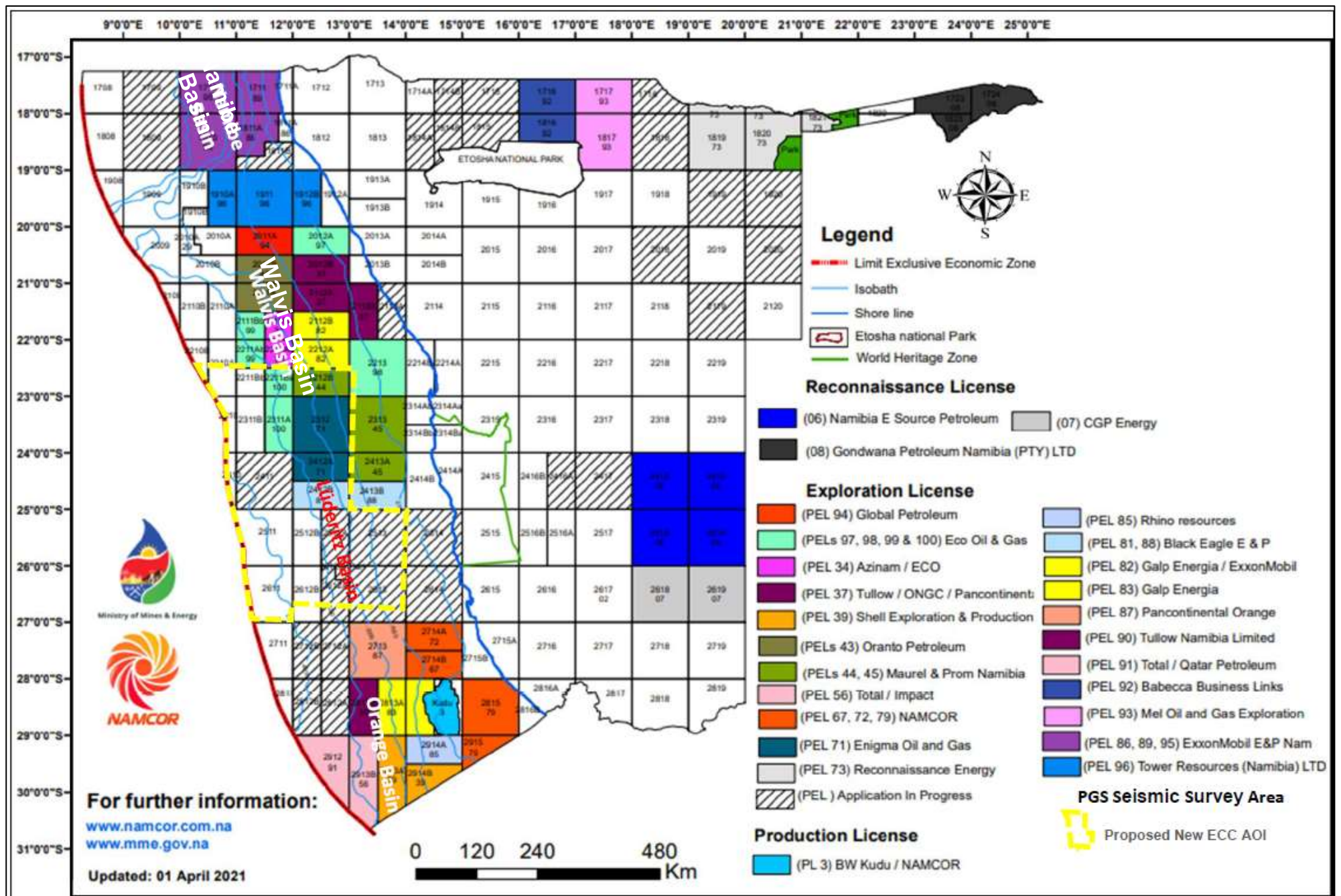


Figure 1.2: Hydrocarbon map of Namibia showing the proposed Multiclient/Proprietary 2D/3D seismic survey AOI falling in the Walvis, Lüderitz and Orange Basins, offshore Namibia (Modified Source: www.mme.gov.na).

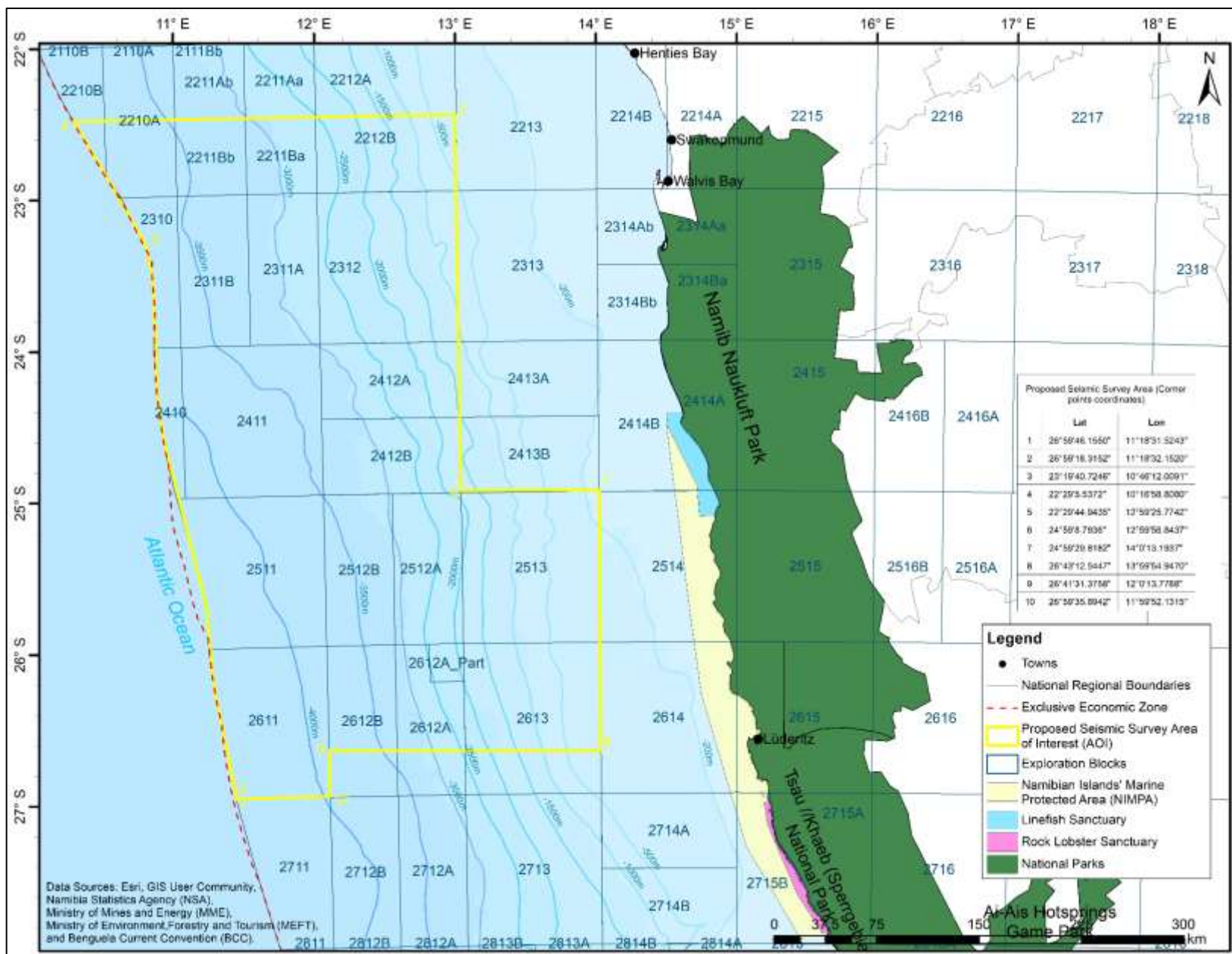


Figure 1.3: PGS proposed Multiclient/Proprietary 2D/3D seismic survey AOI covering Blocks 2310, 2311B, 2311A, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512B, 2512A, 2513, 2611, and Portions of Blocks, 2210B, 2210A, 2211Bb, 2211Ba, 2212B, 2612B, 2612A, and 2613, Walvis, Lüderitz and Orange Basins offshore Namibia with water depths ranging from ca-200 m to -4000m from east to west, respectively.

1.3 Project Motivation, Multiclient (MC), and Proprietary Surveys

1.3.1 Proposed Project Needs, and Desirability

Although offshore seismic survey operations in Namibia began as far back as 1968, a lot more still needs to be done to have a full understanding of the petroleum systems of the deep-water offshore Namibia. The datasets from the proposed 2D / 3D seismic survey by PGS will provide critical insight into the subsurface geological evolution, offshore basin architecture, depositional, structural history and delineate potential subsurface geological structures. The data sets to be acquired will:

- (i) Expand the overall offshore seismic survey data coverage for Namibia (Figs. 1.4 and 1.5), and.
- (ii) Enhance the interpretation contrast, confidence, and overall quality of the results over the anticipated subsurface structures within the AOI.

The results and data from the proposed survey are likely to increase the interest by multinational oil and gas companies in conducting oil and gas exploration activities in Namibia. The increase in exploration activities could lead to additional commercial discovery of economic petroleum reserves. Recent discovery of light oil by TotalEnergies Venus prospect in Petroleum Exploration License (PEL) 56 and Shell Upstream Namibia BV Graff-1 in PEL 39 are likely to propel Namibia into an oil and gas producing country in the next six (6) to ten (10) years (Fig. 1.6). The proposed 3D seismic survey can be classified as a localised operation, with short-term duration and aimed at supporting the development of fossil fuel opportunities offshore Namibia as well as support the development of other resources such as offshore wind energy, suitable industrial hydrogen sites and minerals resources.

1.3.2 Multiclient (MC), Proprietary Surveys and the Environmental Clearance Certificate

1.3.2.1 Multiclient (MC) Surveys

Geophysical and geological related surveys and data sets are acquired, processed, owned, stored and licensed on either a Multiclient (MC) or proprietary (Exclusive) contractual business arrangements.

1.3.2.2 Multiclient (MC) Surveys

Under a MC system, the seismic survey is conducted by a seismic contractor company over an area that might be covering either a single or multiple Petroleum Exploration Licenses (PELs) and unlicensed areas. The collected MC datasets are licensed to a number of clients on a non-exclusive basis. The data acquired is held under a MC seismic data library owned by the contractor and later may be transferred to a partner/s / Government depending on the contractual and confidentiality arrangements. The cost and findings from MC seismic survey data sets are shared among the different parties involved which may include: Seismic contractor, Government and Licence (PEL) holder/s.

1.3.2.3 Proprietary / Exclusive Surveys

Proprietary also called Exclusive seismic survey is undertaken for a single client or partnership, and the area of coverage is often limited to specific licensed (PEL) area. The cost of the survey and ownership of the data under a proprietary seismic survey business arrangement falls under the responsibilities of the individual license (PEL) holder. On relinquishment of the petroleum exploration rights, the seismic data sets collected is handed over to the Government.

1.3.2.4 Environmental Clearance Certificate for Multiclient (MC) or Proprietary Surveys

An Environmental Clearance Certificate (ECC) granted to a Proponent who is a seismic contractor may be used to acquire both MC and Proprietary (Exclusive) seismic survey, on conditions that all the contractual arrangements and data ownership requirements among the various parties involved in the partnership including the Government have been agreed. However, an ECC granted to a Proponent who is a license (PEL) holder may be used to acquire only Proprietary or Exclusive seismic survey data in line with provisions of the Petroleum Agreement with respect to the data ownership. The ECC applied for this project covers both MC and Proprietary (Exclusive) seismic survey business arrangements.

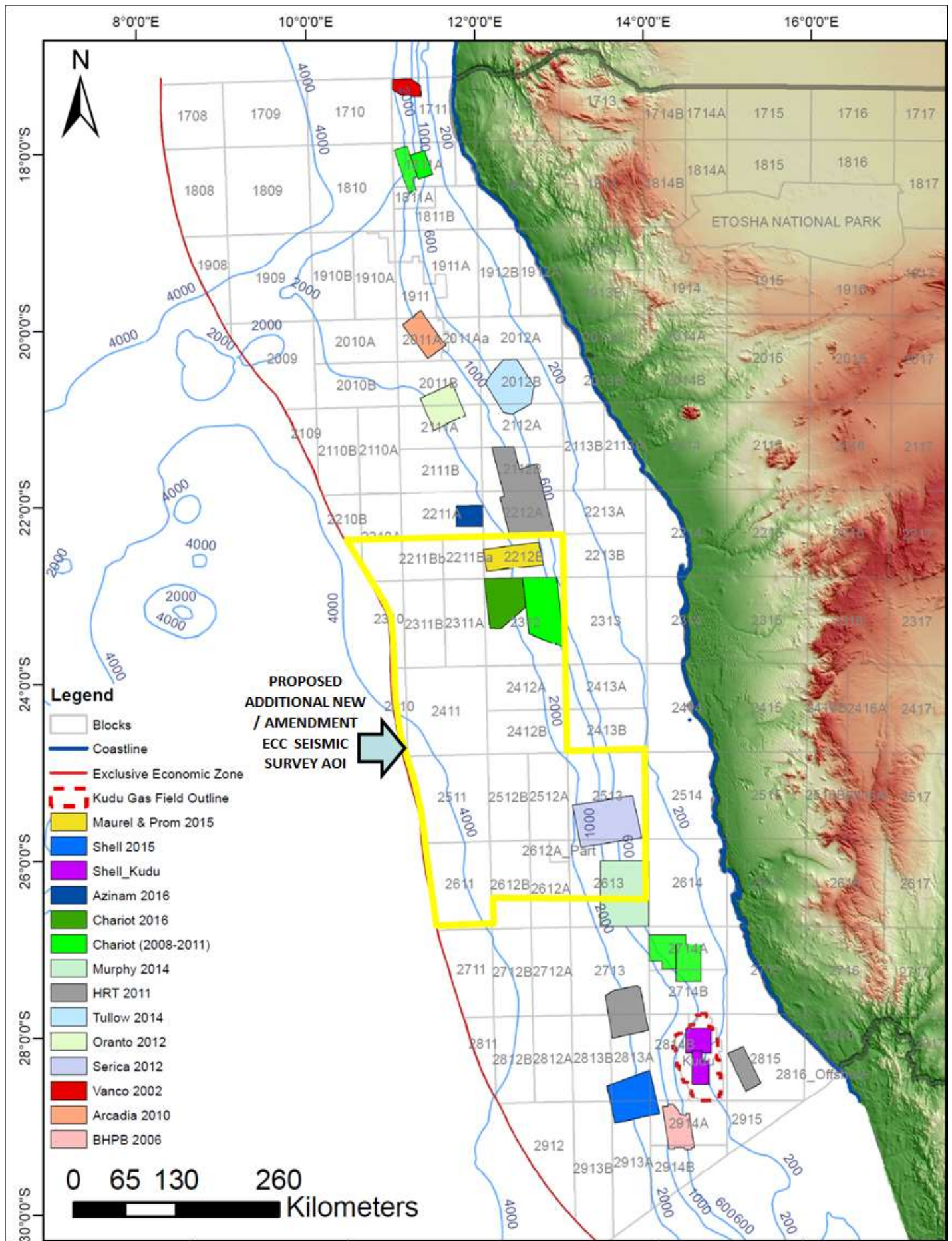


Figure 1.4: Overview of the 3D seismic survey database coverage of Namibia as of 2016 with respect to the proposed Multiclient/Proprietary 2D/3D seismic survey AOI covering Walvis, Lüderitz and Orange Basins offshore Namibia (Source: www.namcor.com.na).

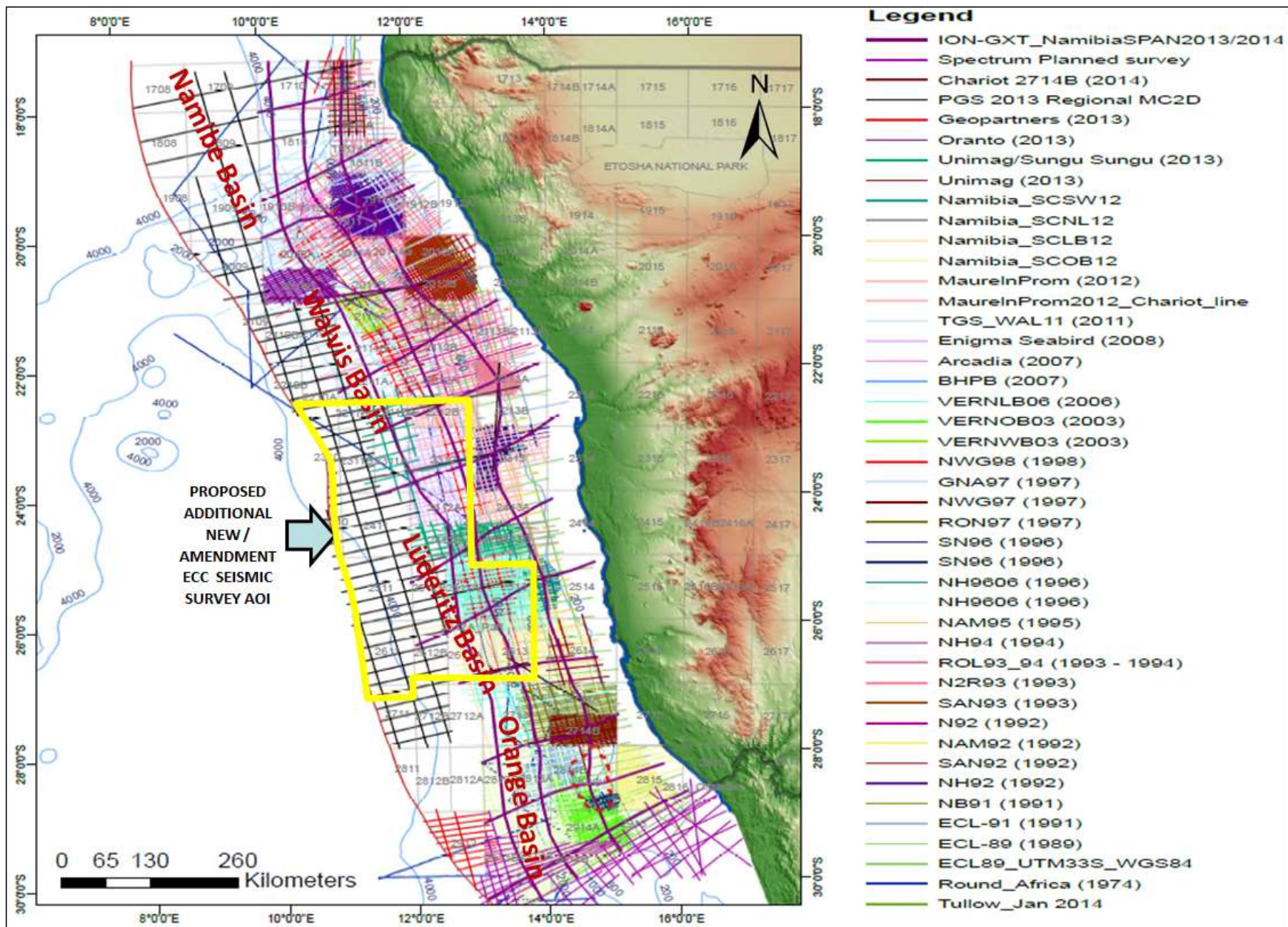


Figure 1.5: Overview of the 2D seismic survey database coverage of Namibia as of 2016 with respect to the proposed Multiclient/Proprietary 2D/3D seismic survey AOI covering Walvis, Lüderitz and Orange Basins offshore Namibia (Source: www.namcor.com.na).

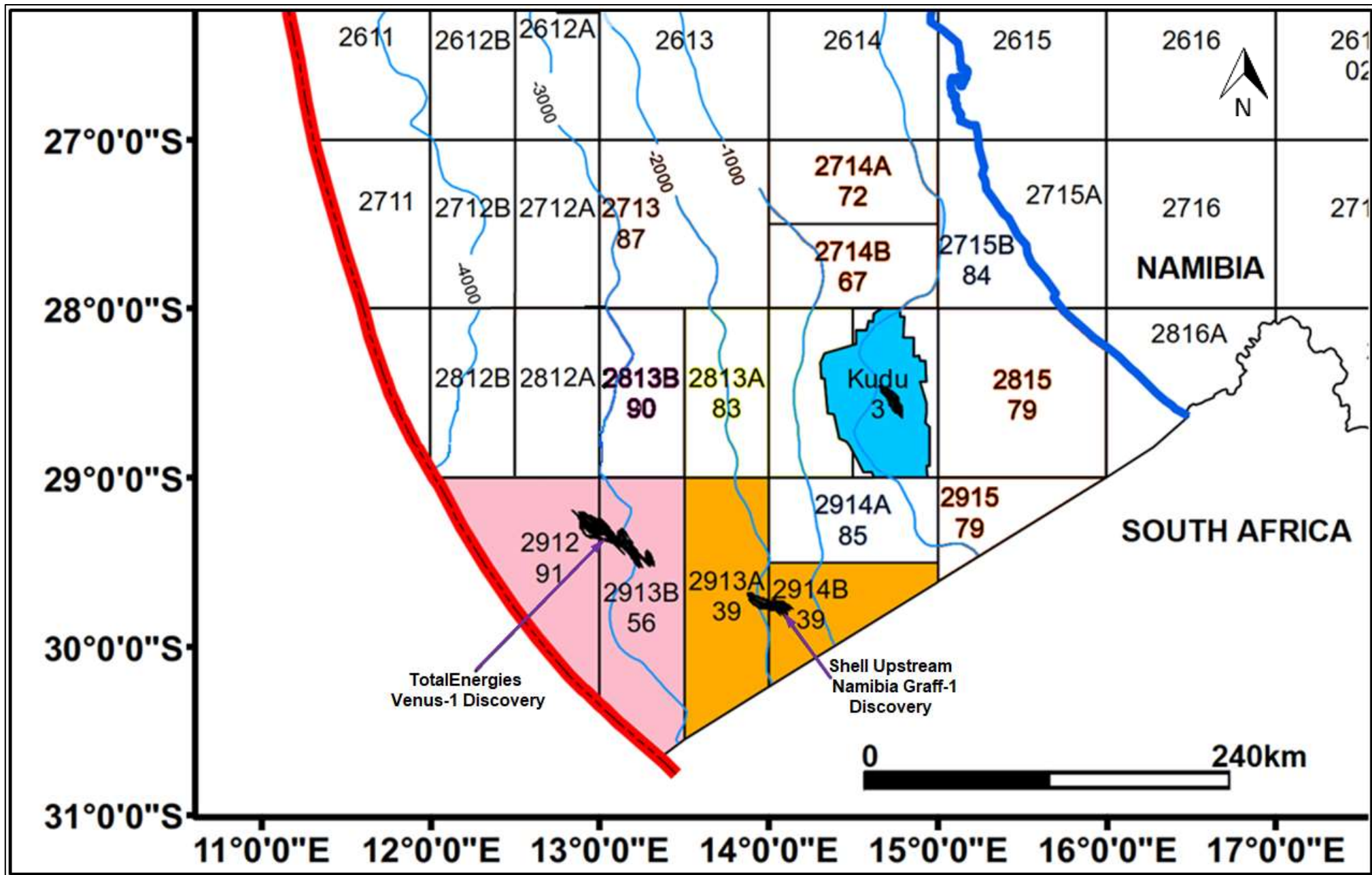


Figure 1.6: Locations of the known oil and gas discoveries offshore Namibia showing the Kudu Gas Field, the TotalEnergies Venus-1 discovery in Petroleum Exploration License (PEL) 56 covering Blocks 2912 and 2913B and the Shell Upstream Namibia BV Graff-1 discovery in PEL 39 covering Blocks 2913A and 2913B situated in the deep-water Orange Basin (Base map Source: www.mme.gov.na).

1.4 Permitting and Environmental Assessment Process

1.4.1 Permitting Process

Oil and gas exploration and production regulatory framework in Namibia provides for strict contractual obligations by a Proponent with respect to environmental performances. The proposed activities (2D / 3D seismic survey) fall under Petroleum (Exploration and Production), 1991, (Act No. 2 of 1991) is administered by the Petroleum Commissioner in the Ministry of Mines and Energy as the Competent Authority. Under Petroleum (Exploration and Production), 1991, (Act No. 2 of 1991) the implementation of a 2D / 3D seismic survey operations requires the Proponent to adhere to the Environmental Impact Assessment (EIA) Regulations, 2012 and the Environmental Management Act, 2007, (Act No. 7 of 2007) administered by the Environmental Commissioner in the MEFT.

Under the Environmental Impact Assessment (EIA) Regulations, 2012 and the Environmental Management Act, 2007, (Act No. 7 of 2007), the proposed 2D and 3D seismic survey cannot be undertaken without an Environmental Clearance Certificate (ECC). The Proponent (PGS) is required to have prepared EIA and EMP Reports to support the application for the ECC for the proposed seismic survey operations.

In fulfilment of the environmental requirements, the Proponent appointed Risk-Based Solutions (RBS) CC as the environmental / permitting de-risking Consultant, led by Dr Sindila Mwiya and supported by Ms Emerita Ashipala as the Environmental Assessment Practitioners (EAPs) to prepare this EIA and a separate Environmental Management Plan (EMP) Reports to support the application for the ECC. This EIA report has been prepared in accordance with the provisions of the EIA Regulations, 2012 and the Environmental Management Act, 2007, (Act No. 7 of 2007).

1.4.2 Assessment Approach

The Environmental Assessment process for this project has been undertaken in accordance with the applicable regulations and assessment procedure as shown in Fig. 1.7. The assessment process also took into considerations corporate governance requirements of the Proponent as well as all other relevant Namibian laws, regional (Southern Africa Development Community – SADC) and international environmental best practices and petroleum exploration protocols, standards, and practices applicable for marine seismic survey.

The general framework of the baseline data collection was as follows:

- ❖ Scoping (determination of geographical and other boundaries; preliminary assessment).
- ❖ Review of existing regulatory framework and institutional arrangements.
- ❖ Public and stakeholder consultation process.
- ❖ Specialist Assessments / studies to support the environmental / impact assessments.
- ❖ Reporting, impact identification and development of suggested mitigation measures, and.
- ❖ EIA Reporting, development of an Environmental Management Plan (EMP) with roles and responsibilities.

1.4.3 Spatial Scope, and Survey Coverage

The spatial scope of the proposed 2D / 3D seismic survey and impact assessment and management thereof covers the following (Fig. 1.7):

- ❖ Current outlined initial survey area covering and any future survey extension falling within the Walvis, Lüderitz and Orange Basins, Offshore Namibia defined as the immediate impact zone: The receiving environment in this area likely to be directly influenced by the survey activities will includes a radius of 500 m safety exclusion zone around the survey vessel and surrounding

areas where discharges to sea and sound may propagate and affect marine wildlife and immediate environment, and.

- ❖ Survey area broader impact zone include all the surrounding socioeconomic zones likely to be affected by the proposed survey operations and logistics including support vessels.

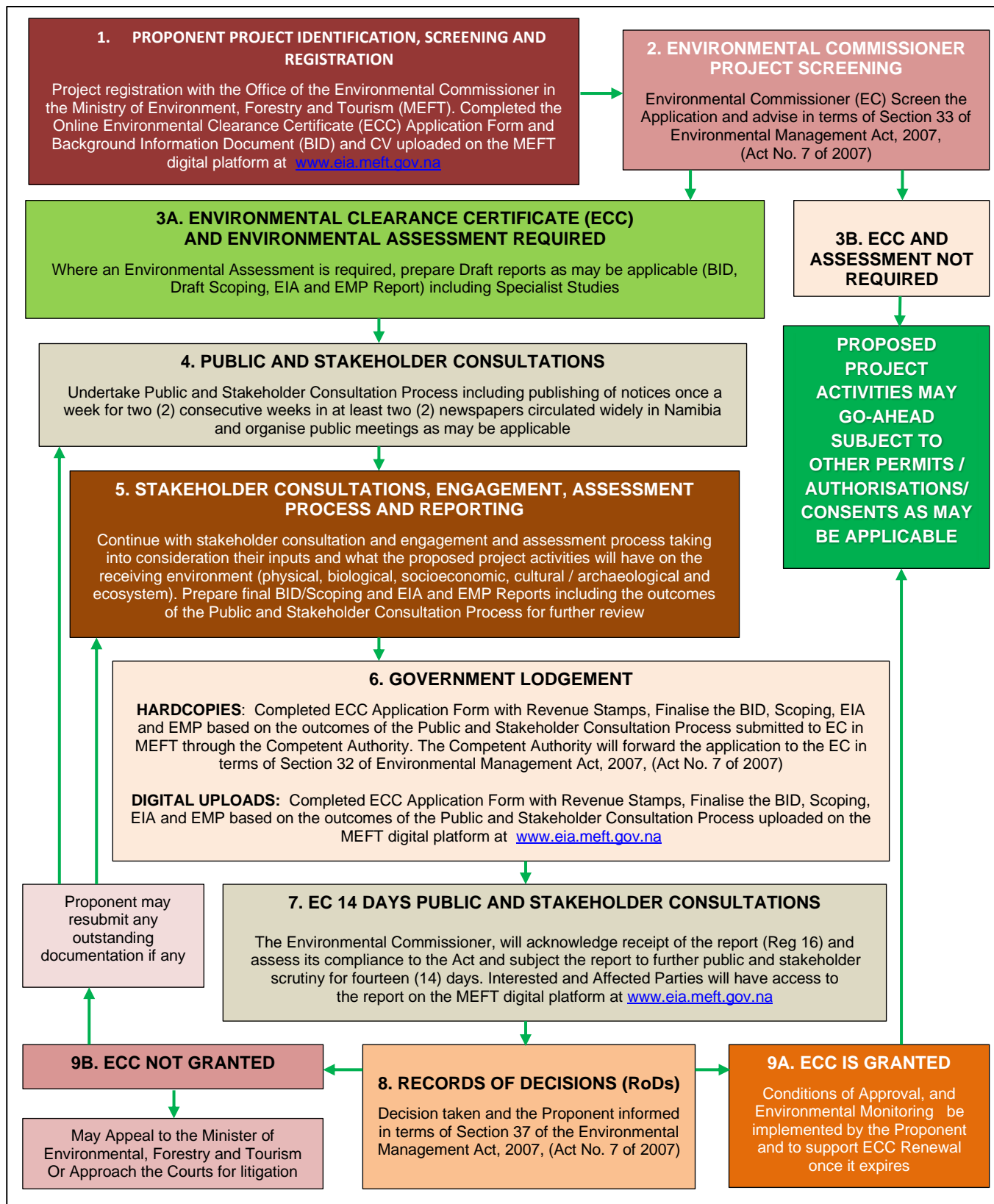


Figure 1.7: RBS schematic presentation of Namibia's Environmental Assessment procedure.

1.4.4 Data Sources, Reliability and Quality

Data source discussed in this section has been derived from the literature review of the publications by Government Ministries such as the Ministry of Fisheries and Marine Resources (MFMR) (www.mfmr.gov.na), Ministry of Environment, Forestry and Tourism (MEFT) (www.meft.gov.na), Ministry of Works and Transport (Department of Maritimes Affairs) (www.mwt.gov.na), Ministry of Mines and Energy (MME) (www.met.gov.na) and other organisations such as Namibia National Petroleum Corporation of Namibia (Namcor) (www.namcor.com.na), Benguela Current Commission (BCC) (www.benguelacc.org), Namibian Coast Conservation and Management project (NACOMA) (www.nacoma.org.na), and marine mammals, birds, commercial fishing and fisheries specialists and acoustic mathematical modelling studies undertaken by specialist consultants.

The quality and reliability of the available data sets used in this scoping report is of very high standard and is based on research publications and desktop studies validate by site-specific surveys such as the annual resources surveys undertaken by the Ministry of Fisheries and Marine Resources, Gardline site-specific predrilling survey undertaken for Repsol, other surveys undertaken by operators with respect to seismic and drilling operations.

Additional validation has been provided by environmental monitoring results undertaken by Risk-Based Solution (RBS) with respect to seismic and drilling operations undertaken in the Namibian offshore environment in the last eighteen (18) years for companies such as Shell Namibia B. V. Limited (Namibia/the Netherlands), BW Offshore (Singapore), Tullow Oil (UK), Petrobras Oil and Gas (Brazil) / BP (UK), REPSOL (Spain), HRT Africa (Brazil / USA), Chariot Oil and Gas Exploration (UK), Serica Energy (UK), Eco (Atlantic) Oil and Gas (Canada / USA), ION GeoVentures (USA), PGS UK Exploration (UK), TGS-NOPEC (UK), Maurel & Prom (France), GeoPartners (UK), and Sinterneftegaz Namibia LTD (Russia).

1.4.5 Desktop, Specialist Assessments and Mitigation Measures

Desktop studies were conducted to review the available reports, and to design plans and maps to compile relevant marine biophysical and socioeconomic information of the project area. Marine biophysical studies covered the review of the proposed 2D and 3D seismic survey method existing environmental baseline such as oceanographic setting, circulations and characteristics, marine mammals, birds, commercial fishing and fisheries data sets. Based on the review of the existing data sets and recommendations of the Background Information Document (BID) / Scoping report, the following specialist assessments have been undertaken as part of the EIA process.

- (i) Living marine resources covering fish, fishing seasons, birds, mammals and related ecosystem variability, and.
- (ii) Acoustic modelling with respect to the likely negative impact of the proposed 2D and 3D seismic survey on key living marine resources likely to be found in the proposed area of interest.

In terms of the key mitigation measures, international best industry practice and guidelines for minimising the risk of injury and disturbance to marine mammals from seismic survey have been developed by the Joint Nature Conservation Committee (JNCC) and recommended by the EnerGeo Alliance to which the Proponent is a member.

Best industry practices which are based on the Best Practicable Environmental Option (BPEO) have proved to be effective in a number of different countries like Canada, Australia, Norway and the United States. These guidelines have been developed based on noise attenuation modelling, international experiences during seismic acquisition and a cautious approach to the disturbance of marine mammals from Seismic Survey.

The following are the example summary of some of key mitigation measures that have been included in the EMP report and to be implemented by the Proponent with respect to the proposed 2D and 3D seismic survey:

- ❖ Seasonality and survey implementation timing.
- ❖ Establishment of buffer zones.

- ❖ Use of Marine Mammal Observer (MMO).
- ❖ Use of Fisheries Liaison Officers (FLOs).
- ❖ Use of Passive Acoustic Monitoring (PAM) Technology.
- ❖ Soft starts' and 'pre-activation' observations.
- ❖ Termination of activation in the 500m exclusion zone.
- ❖ Marine Animal Monitoring and Mitigation Plan aboard the Survey Vessel.
- ❖ The use of Turtle friendly tail buoys, and.
- ❖ Compliance to all MARPOL (Marine Pollution) Regulations and Waste Disposal Procedures.

1.4.6 Public and Stakeholder Consultation Process

The overall objectives of conducting public and stakeholder consultation process were to inform all the Interested and Affected Parties (I&APs) about the proposed project activities, disclose the Terms of Reference, the assessment and management reports.

Public and stakeholder consultation activities were undertaken during the months of October and November 2023. The key consultation approaches focused on the following activities:

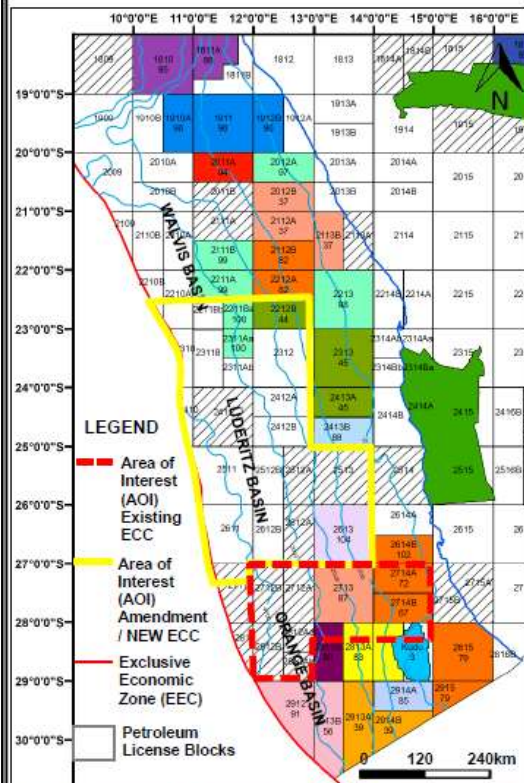
1. Preparation of the appropriate materials such public notice, BID, posters, presentation, and leaflets.
2. Directly contacting and engaging with the key stakeholders such as fishing companies and other affected parties.
3. Use of newspaper publications notices / adverts for the and placement of public notices at strategic places in Lüderitz (Figs. 1.8 and 1.9), and.
4. Organised a public meeting in Lüderitz on Tuesday 7th November 2023, held at the Benguela Community Hall, From 09hrs00-12hrs00.

In accordance with provisions of the national regulations and corporate requirements of the Proponent, the identification and assessment of stakeholders and issues of importance to them, were key steps that were undertaken as part of the EIA process for the proposed activities.

The assessment of the key stakeholders in terms of their likely interest and role to the EIA Process with respect to the proposed activities have been continuously evaluated and updated as the EIA process progressed.

PUBLIC NOTICE FOR APPLICATION FOR ENVIRONMENTAL CLEARANCE CERTIFICATE (ECC)

PGS Exploration (UK) Limited (Proponent) Proposed Multiclient/Proprietary 2D / 3D Area of Interest (AOI), Orange, Lüderitz and Walvis Basins, Offshore Namibia

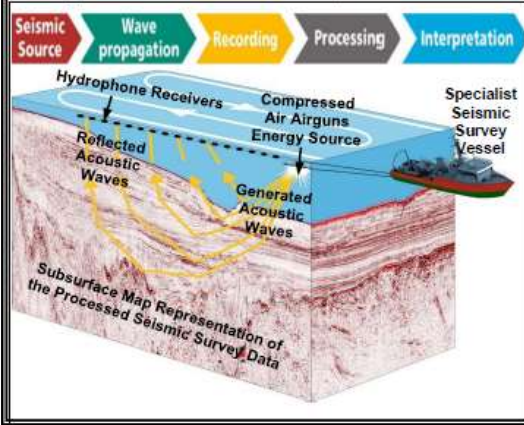


PGS EXPLORATION (UK) LIMITED (PROPONENT) intends to apply for an Amended and New Environmental Clearance Certificates (ECCs) over the outlined Area of Interest (AOI) with respect to the proposed potential Multiclient/Proprietary 2D / 3D seismic survey location specific projects that may be originated within the outlined AOI. The outlined AOI covers Blocks 2511, 2611, 2512B, 2512A, 2513, 2612B, 2612A, 2613, 2412B, 2411, 2410, 2310, 2311B, 2311Aa, 2311Ab, 2312, 2212B, 2211Ba, 2211Bb, 2210A and 2210B, falling in the Orange, Lüderitz and Walvis Basins, offshore deep-water, south-central Namibia. The Proposed AOI falls in water depths ranging from ca-200m to more than ca-4000m, from east to west, respectively. Although the outlined AOI represents a large area coverage, the actual likely location specific Multiclient/Proprietary 2D/3D seismic survey projects to be originated within the outlined AOI will be limited to the specific Petroleum Exploration Licenses (PELs) with potential high prospectivity opportunities. The likelihood of implementing specific projects within the proposed AOI will largely depend on the expression of interests by the PELs holders or the Government through NAMCOR wanting to acquire Multiclient/Proprietary 2D/3D seismic data sets for their respective AOIs.

The overall aim of undertaken Multiclient/Proprietary 2D/3D seismic survey seismic surveys is to map the subsurface of the key potential targeted areas within the outlined AOI. Although offshore seismic surveys operations in Namibia began as far back as 1968, a lot more still need to be done to have a full understanding of the subsurface geology, and petroleum systems of the deep-water offshore Namibia. The datasets from the potential Multiclient/Proprietary 2D/3D seismic surveys will provide critical insight into the regional and local subsurface geological evolution, deep-water offshore basin architecture, depositional, structural history and delineate potential drill-ready subsurface potential reservoirs likely to be situated kilometres below the seafloor. Seismic survey data sets generated can also be utilised in the search for natural suitable Carbon Capture and Storage (CCS) banking terrains as one of the possible options for Climate Change long-term global mitigation strategies. In oil and gas exploration, seismic survey data sets reduce the risk of drilling multiple dry wells, improve the chances for commercial discovery and reduces the environmental impacts of drilling more wells in the search for oil and gas resources.

The marine seismic survey is conducted using a specialist survey vessel towing an energy source in form of a compressed air source and hydrophone receivers. During the survey, compressed air is released to generate seismic acoustic signals/waves at regular intervals. The generated acoustic waves travel deep into the subsurface of the earth and get reflected by various rock formations of the subsurface at different depths below the seafloor. The returned signals get recorded and measured by receiving devices called hydrophones. Geophysicists, geologists, and petroleum engineers use sophisticated software to create subsurface images /maps showing potential subsurface geological structures called reservoirs that may contain potential commercial hydrocarbons resources. This is achieved by analysing the two-way travel times of the seismic waves through the various subsurface rock layers and the surface. 2D seismic survey is a regional mapping / imaging methodology aimed at de-risking an exploration project by establishing a validated Sedimentary Basin Scale Model of an exploration AOI. 3D seismic survey on the other hand, is a detailed local mapping / imaging methodology aimed at de-risking an exploration project by establishing a local validated Prospect/s or Lead/s Scale Models of an exploration AOI. 3D and 2D seismic surveys data sets are acquired on local to subregional dense and regional widely spaced survey grids / spacings, respectively.

The potential Multiclient/Proprietary 2D / 3D seismic survey location specific projects to be undertaken within the AOI, will be conducted using a MARPOL / Namibian Maritimes Laws compliant vessels and will adopt the well-established international best practices such as seasonality and survey implementation timing, establishment of buffer zones, use of Marine Mammal Observers (MMOs) & Fisheries Liaison Officers (FLOs), use of Passive Acoustic Monitoring (PAM) technology, soft starts' and 'pre-firing' observations, termination of firing in the 500m exclusion zone and use of turtle friendly tail buoys. The potential seismic survey activities within the proposed AOI cannot be undertaken without an Environmental Clearance Certificate (ECC) as provided for in the Environmental Management Act, 2007, (Act No. 7 of 2007) and the Environmental Impact Assessment (EIA) Regulations 30 of 2012. The Proponent is required to have undertaken environmental assessment process and the preparation of the EIA and Environmental Management Plan (EMP) Reports to support the application for ECC. In fulfilment of these environmental requirements, the Proponent has appointed Risk-Based Solutions (RBS) CC as the Environmental Consultant, led by Dr Sindila Mwiya and supported by Ms Emerita Ashipala as the Environmental Assessment Practitioners (EAPs) to prepare the EIA and EMP Reports. All Interested and Affected Parties (I&APs) are hereby invited to register and submit written comments / objections / inputs with respect to the potential Multiclient/Proprietary 2D / 3D seismic survey to be undertaken within the proposed outlined AOI in Orange, Lüderitz and Walvis Basins, offshore Namibia. A Background Information Document (BID) and Project Reports are available for comments upon registration as a stakeholder / Interested and / Affected Party (I&AP). NOTE: In terms of the provisions of the EIA Regulation 23 (1), an I&AP is required to disclose, on registration any direct business, financial, personal, or other interest which that party may have in the approval or refusal of the ECC application.



REGISTER BY EMAIL WITH: Ms Emerita Ashipala (EAP/ Risk-Based Solutions (RBS) Independent Senior Technical Consultant),
Email: emerita.ashipala@gmail.com. For more technical clarifications on marine /offshore subsurface mapping using seismic survey operations, the receiving environment and oil and gas exploration and production, please contact Dr Sindila Mwiya EAP/Technical Permitting Advisor/ International Resources Consultant, **Email:** frontdesk@rbs.com.na

A PUBLIC MEETINGS HAS BEEN ORGANISED IN LÜDERITZ AS FOLLOWS:
LÜDERITZ: Tuesday 7th NOVEMBER 2023, PLACE: Benguela Community Hall, Lüderitz Town, TIME: From 09hrs00-12hrs00

REGISTRATION AND WRITTEN SUBMISSIONS DEADLINE IS: FRIDAY, 17th NOVEMBER 2023

Risk-Based Solutions (RBS) CC (URL: www.rbs.com.na)
 Your Technical Specialist Consultants, Permitting & De-Risking Advisors in Natural Resources covering Petroleum Exploration & Production/ Minerals Exploration & Mining / Energy / Water / Environmental Assessments & Management (ESG, SEA, EIA, EMP, EMS)
 Find Us @ 10 Schützen Street, Erf No. 7382, Sivieda House-Home of RBS, Tel: +264-61-306058 / 224780 / 236598

Figure 1.8: Copy of the Public Notice published in multiple local Newspapers for two (2) consecutive weeks starting the 27th October 2023 as part of the EIA process to support the application for a new ECC over the proposed AOI.

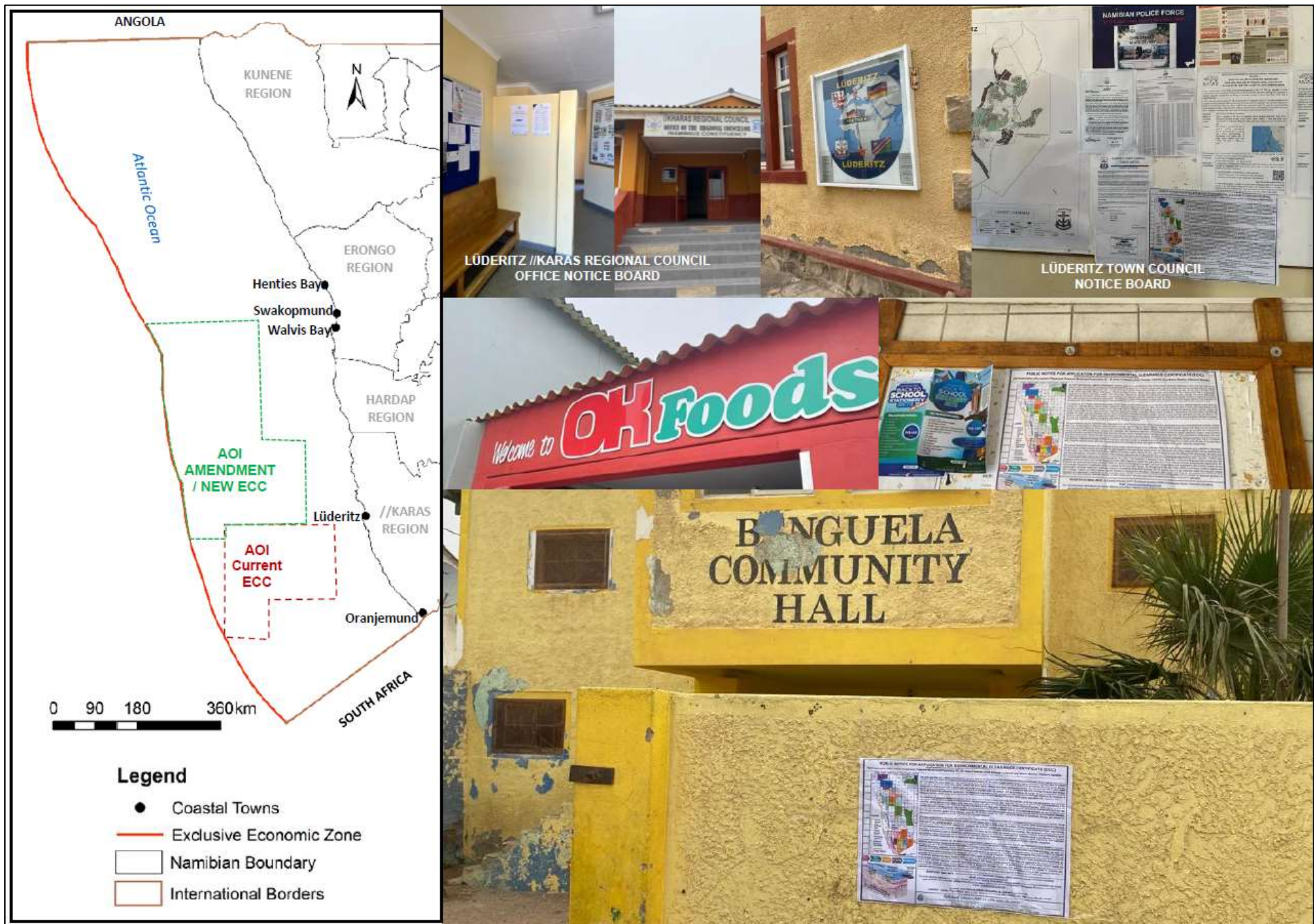


Figure 1.9: Public notices placed at multiple strategic places in Lüderitz in October and November 2023 as part of the EIA process to support the application for the new ECC over the proposed AOI.

2. PROJECT SUMMARY AND REGULATORY REGISTER

2.1 General Description of Marine Seismic Survey Operation

Seismic survey is a key tool that resources companies exploring for hydrocarbons (oil and natural gas) use to map the subsurface and kilometres below the ground either on land (onshore) or in the sea (offshore) (Figs. 2.1 and 2.2). The basic principle of seismic survey method is the application of controlled generation of sound / acoustic waves by a seismic source to obtain an image of the subsurface. The generated acoustic wave that travels deep into the earth, is reflected by the various rock formations of the earth and returns to the surface where it is recorded and measured by receiving devices called hydrophones (Figs. 2.1-2.3).

Airguns are the most common sound source used in modern offshore seismic surveys (Figs. 2.1-2.3). An airgun is an underwater pneumatic device from which high-pressure air is released suddenly into the surrounding water. On release of pressure the resulting bubble pulsates rapidly producing an acoustic signal that is proportional to the rate of change of the volume of the bubble. The frequency of the signal depends on the energy of the compressed air prior to discharge. Arrays of airguns are made up of towed parallel strings (Figs. 2.1-2.3).

A single airgun could typically produce sound levels of the order of 220 - 230 dB re 1 mPa @ 1 m, while arrays produce sounds typically in the region of 250 dB re 1 mPa @ 1 m. Most of the energy produced is in the range of between 0 - 120 Hz bandwidth, although energy at much higher frequencies is also produced and recorded. High-resolution surveys and shallow penetration surveys require relatively high frequencies of between 100 – 1, 000 Hz, while the optimum wavelength for deep seismic work is in the 10 - 80 Hz range.

During the survey operation, the seismic vessel records the data from all the hydrophones, including accurate coordinates of the vessel and its hydrophones. As shown in Figs. 2.1-2.3, the proposed Multiclient / Proprietary 2D/3D seismic survey will employ numerous streamers and many hydrophones, providing enough data to give a detailed subsurface profile of the rock layers as illustrated in Figs. 2.1-2.3. The depths of the reflecting layers are calculated from the time taken for the sound to reach the hydrophones via the reflector. This is known as the two-way travel time.

The pulse of sound from the guns radiates out as a hemispherical wave front, a portion is reflected towards the hydrophones from rock interfaces. The path of the minute portion of the reflected wave-front intercepted by a hydrophone group is called a ray path. Hydrophone groups spaced along the streamer pick out ray paths that can be related to specific points on the reflector surface.

Graphs of the intensity of the recorded sound plotted against the two-way time are displayed as wiggle traces. Seismic recording at sea always uses the Common Depth Point (CDP) method. A sequence of regularly spaced seismic shots is made as the survey vessel accurately navigates its course. Shots are usually timed to occur at distances equal to the separation of the hydrophone groups. In this way up to 120 recordings of the echoes from any one of 240 reflecting points can be collected. Each represents sound, which has followed a slightly different ray path, but has all been reflected from the same common depth point. By analysing the time, it takes for the seismic waves to travel between the rock formations and the surface, geophysicists, geologists, and petroleum engineers use sophisticated software to create subsurface images /maps showing potential drill-ready subsurface geological structures called reservoirs that may contain hydrocarbons (Figs. 2.1-2.3).

2.2 Envisaged Logistical Arrangements Support

The vessel/s, helicopter and all other supporting equipment will to be used for the proposed Multiclient / Proprietary 2D/3D seismic survey will be in full compliance with all the requirements of the international convention on the prevention of pollution from ship (MARPOL) policies and practices as well as all the national marine related regulations administered by the Department of Maritime Affairs in the Ministry of Works and Transport (MWT) and Ministry of Fisheries and Marine resources (Figs. 2.4 and 2.5 and Plate 2.2). The Ports of Lüderitz and Walvis Bay will serve as the operations base as may be required for the supply of materials, consumables, port requirements and services where needed.

Step 5:

FIELD MANAGEMENT

Use GeoStreamer PURE as a 4D baseline.

Step 4:

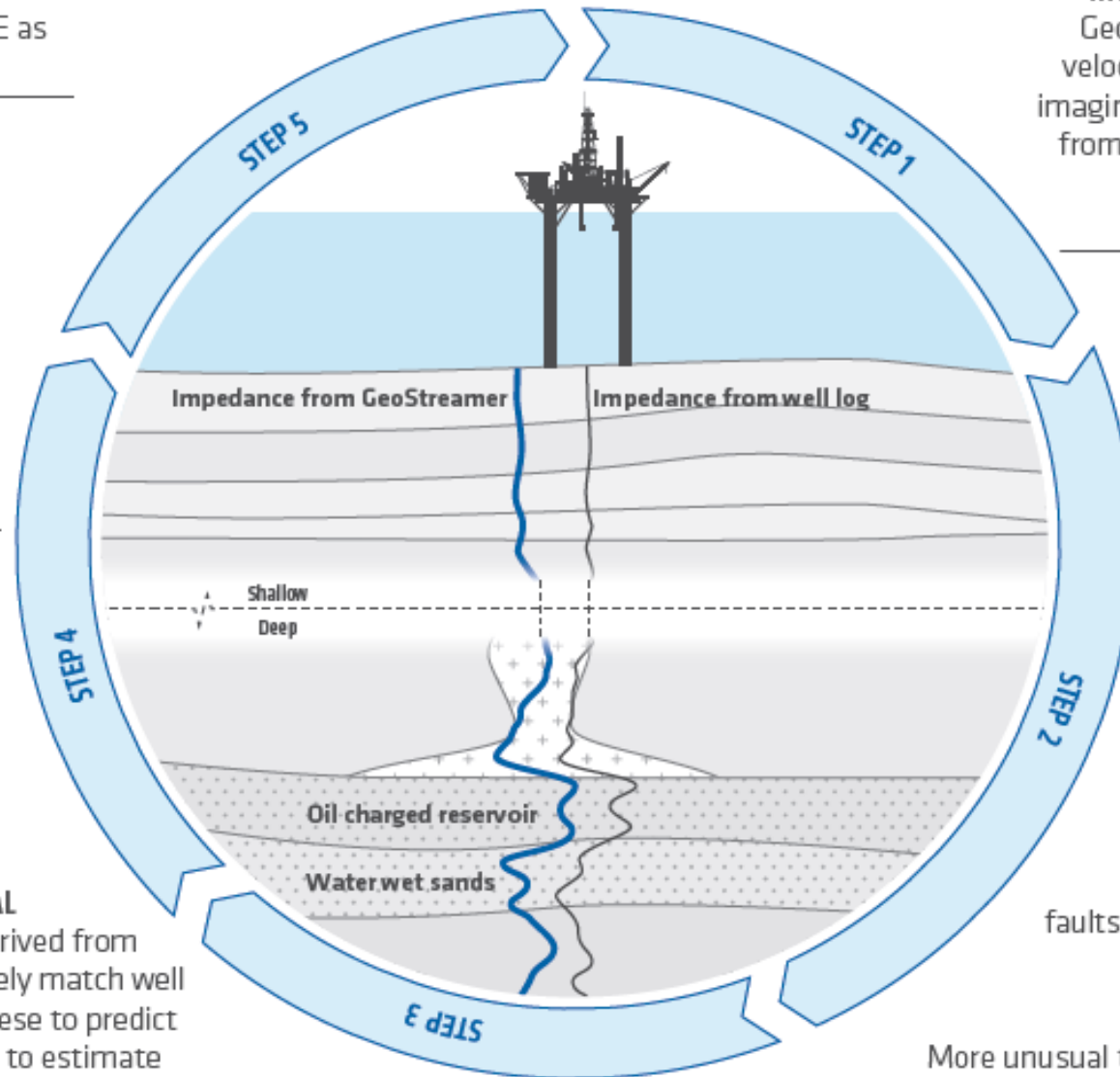
ASSESS ECONOMICS WITH CONFIDENCE

Present prospect economics based on reliable data. Assess shallow hazard risk with high resolution near-surface data

Step 3:

CHARACTERIZE RESERVOIR AND NEAR-FIELD POTENTIAL

Reservoir properties derived from GeoStreamer data closely match well measurements. Use these to predict lithology and fluid, and to estimate size and volume.



Step 1:

INVESTIGATE REGIONAL GEOLOGY

GeoStreamer depth data and velocity models allow accurate imaging of faults and structures from the shallows to the deep, to facilitate large-scale interpretation work.

Step 2:

Understand the petroleum system to identify leads

LOCATE THE RESERVOIRS

Each dataset has reliable attributes and accurate well ties

IDENTIFY SOURCES

Find sources and model their history

CONFIRM MIGRATION

Examine carrier beds and faults to estimate timing of trap formation and migration

SPOT TRAPS

More unusual traps are easier to identify with detailed GeoStreamer data

Figure 2.1: Seismic survey data support to an exploration journey (Extract from PGS Infographic, supporting your exploration journey: www.pgs.com/publications/infographics).

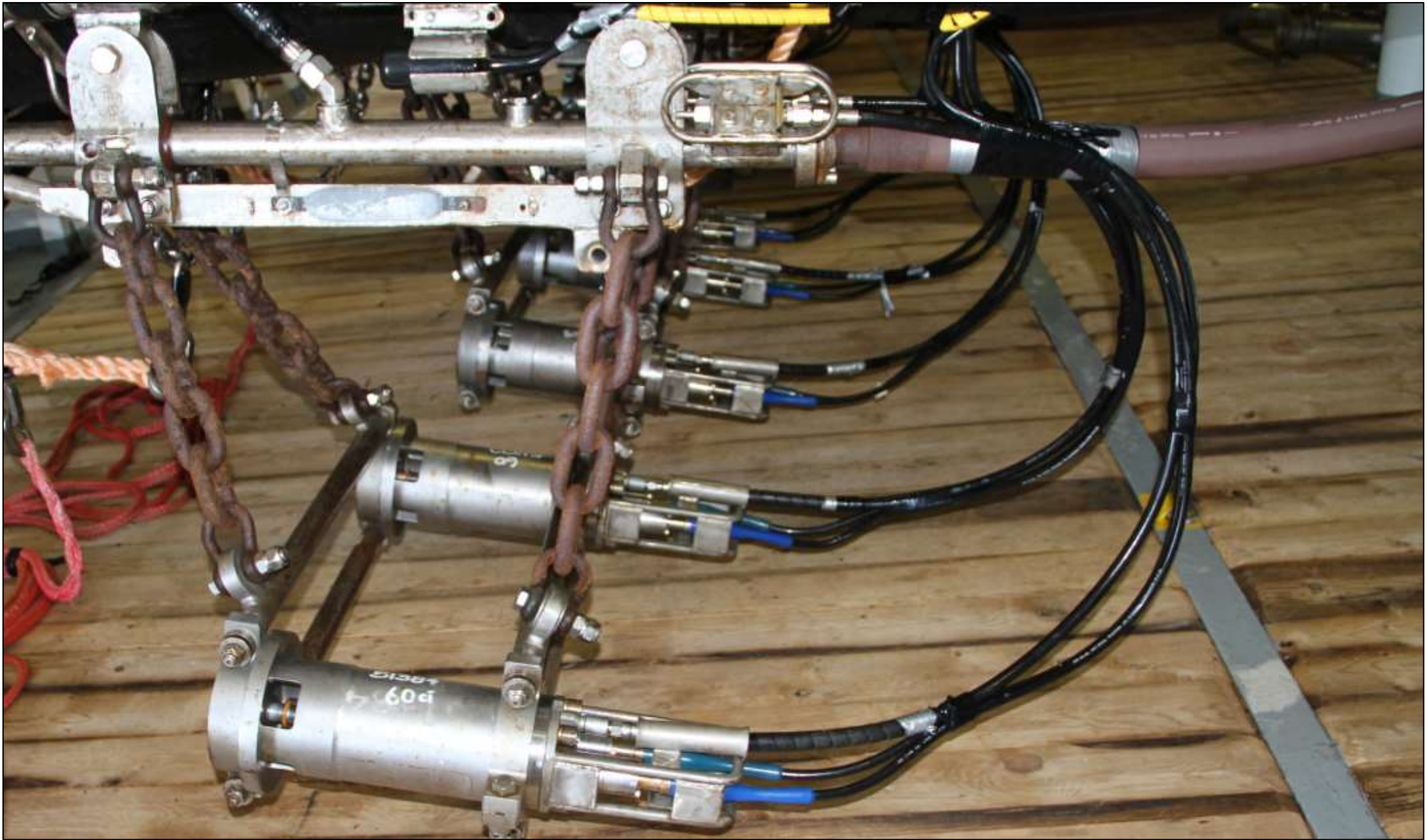
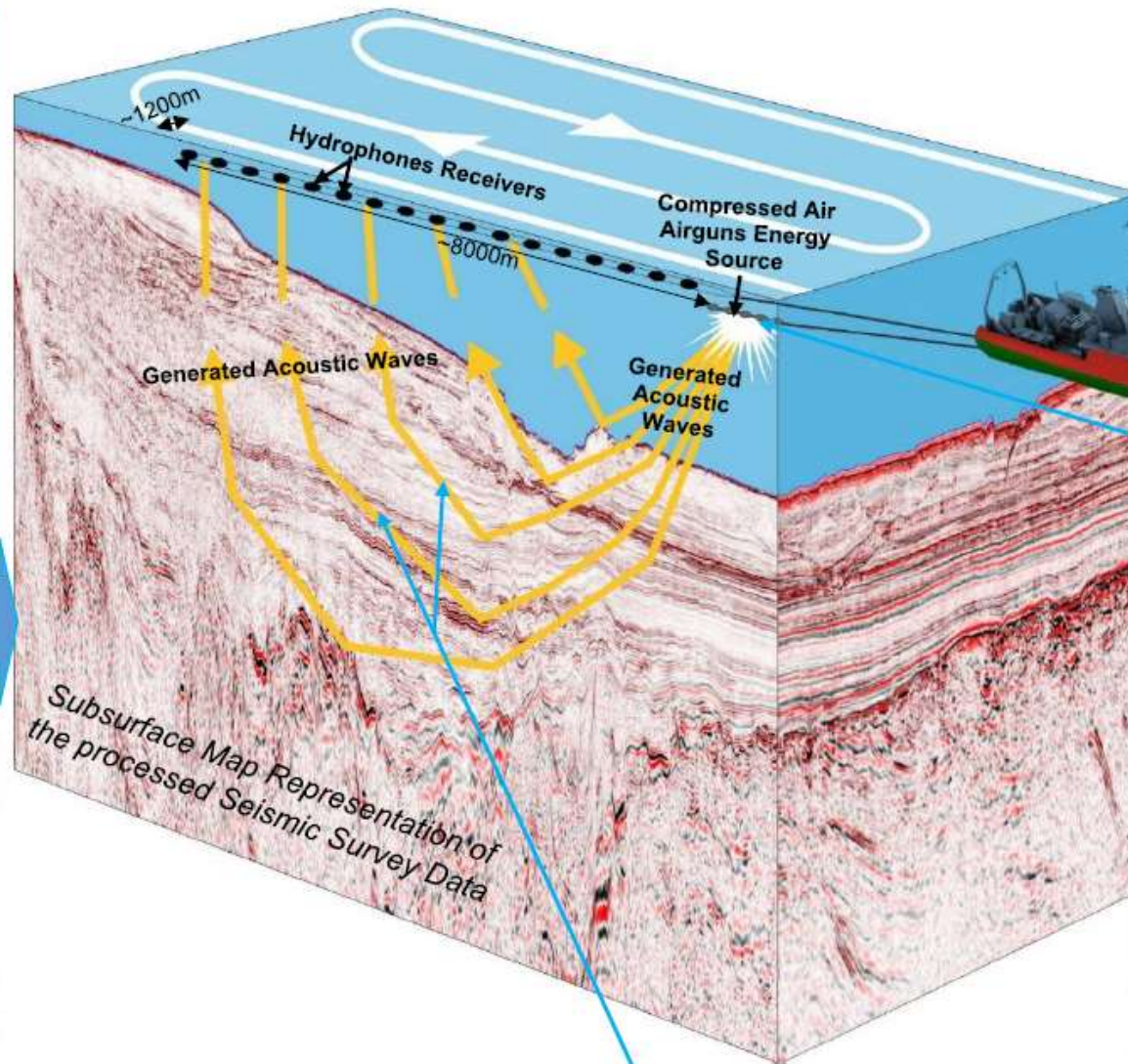


Plate 2.1: Example of the air guns used in marine seismic survey operations.

4.

Seismic survey data sets are recorded as broadband multiple signals that contains the widest possible multiple ranges of frequencies. The interpretation of seismic surveys data sets from allows geophysicists to get a picture of the subsurface rock formations, structures and layers. The data processing and interpretation process uses migration and other advanced data processing algorithms to identify key reflection points and remove all the noises in order to see the targeted details of the subsurface, geological, layers formations, and structures as well as delineation of drill-ready targets.



1.

A Marine Multiclient or Proprietary 2D / 3D seismic survey operation is an advanced deep subsurface mapping technique which involves the sending of acoustic energy into the subsurface and using multiple acoustic energy wave-generating devices called airguns which are towed by a specialist seismic survey vessel.



2.

The acoustic energy is created by the release of compressed air from an array of airguns towed behind a seismic vessel (specialised ship), firing at varying time interval in seconds.

3.

The waves bounce off the subsurface layers of rocks below the seafloor, and the timing of these echoes are recorded by the hydrophones (towed microphones) receivers. Each receiver records a trace, which represents the amplitude of seismic signal and noise received during the recording time. Multiple traces representing seismic records are produced which is a collection of data with distance or geographic location along the horizontal axis, or axes, and recording time along the vertical axis. Time, rather than depth, is plotted along the vertical axis. The recorded time comprises a two-way travel time (TWT) because the signal must travel from the surface to the reflector and back up to the receiver on the surface.

Figure 2.2: Illustration of the of the principles of marine / offshore seismic survey method.

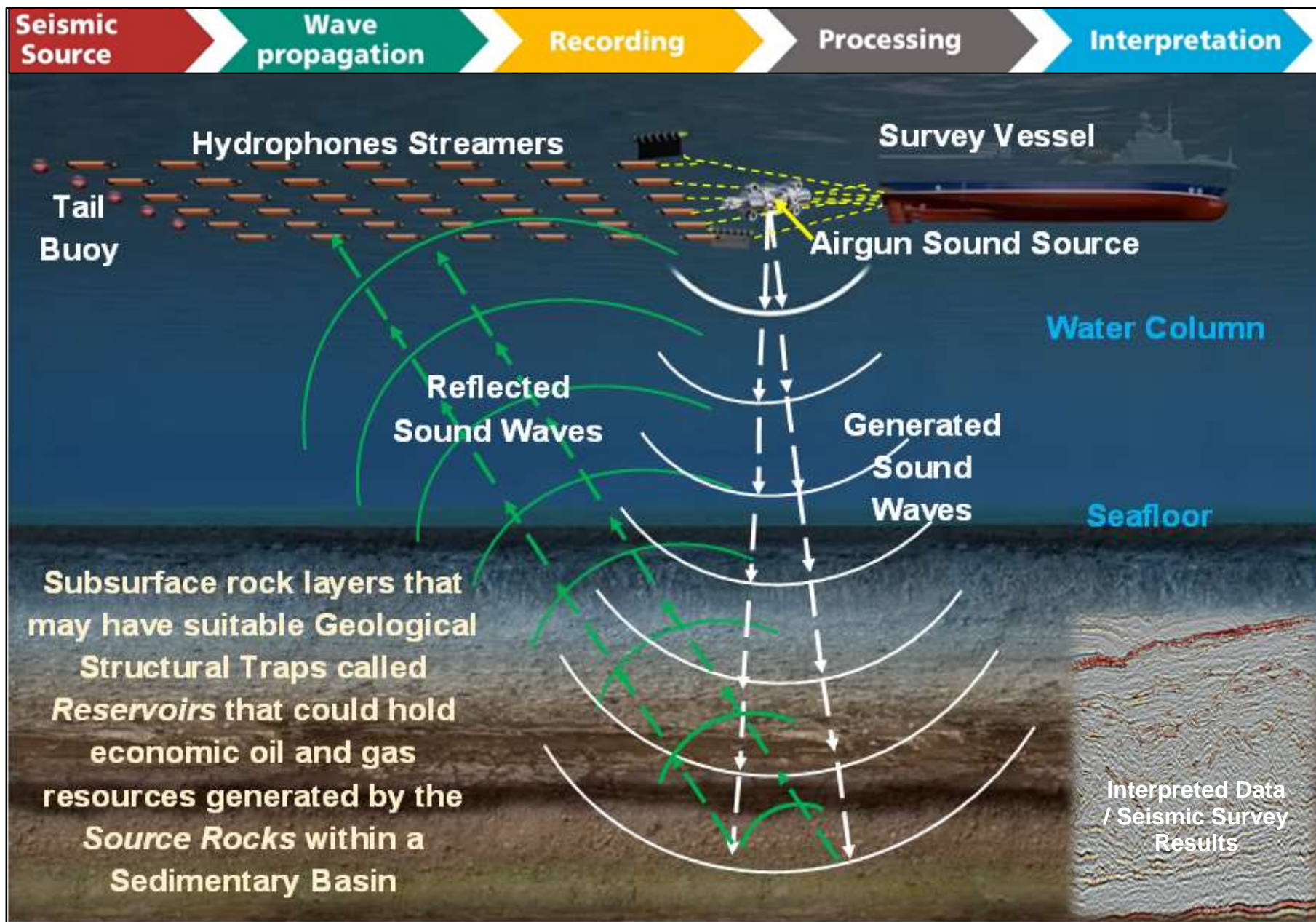
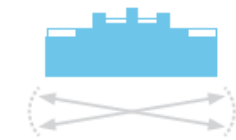


Figure 2.3: Illustration of the application of marine seismic survey method involving data collection and analyses of the times for seismic waves to travel between the various subsurface rock formations. Geophysicists, geologists, and petroleum engineers use sophisticated software to create subsurface images /maps showing potential drill-ready subsurface geological structures called reservoirs that may contain commercial hydrocarbons (Image Source: www.youtube.com/watch?v=FN8IAb0rG9A).

RAMFORM Titan-Class

Engineered for Geoscience



Stability

The Titan design ensures better performance and room for growth. The ultra-broad delta shaped hull provides fantastic seakeeping capabilities and also means a smooth ride.



Endurance

120 days without re-fueling.
Dry docking interval 7.5 years.
Maintenance at sea lowers operating costs.



Redundancy

3 propellers, each with 2 motors - fully operational with 2 propellers.
2 engine rooms, each with 3 generators - fully operational with 1 engine room.



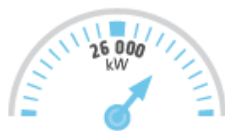
Fuel Capacity

Providing flexibility and endurance.



All Weather

Widening the weather window and extending the seasons in northern and southern hemispheres without compromising HSEQ.



Power

Additional power enables more in-sea and onboard equipment.

Wire Pull @ 4.5 kts

This measures towing force through the water and is a more realistic representation of towing capability than bollard pull (300 tons).

Space = Flexibility

Three times larger than modern conventional vessels, the Titans offer a highly efficient work environment with ample space for equipment, maintenance and accommodation.



Towing & Handling

24 reel and streamer capacity and back deck automation provides flexibility, rapid deployment and safe retrieval.

HSEQ

Layout supports One Culture operations improving all aspects of HSEQ.



Health

Social zones, gym, stability - rested crews perform better.



Safety

Stable platform minimizes risk of fatigue, trips and falls. Space to work, redundancy in power and propulsion, 2 stern-launched workboats, back-deck automation.



Environment

Larger spreads and faster turnaround mean fewer days on each job and leaves a smaller environmental footprint. DMV GL Clean Design - max SO_x content of <2.5%. Reactive catalysts reduce NO_x emissions by 90%.

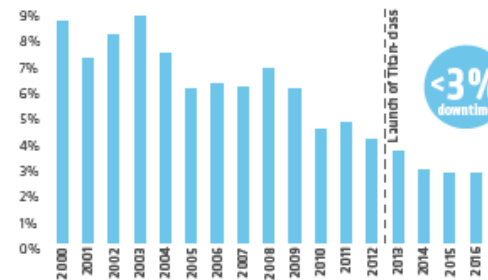


Quality

Superior platform to deploy the best dual-sensor technology - 100% GeoStreamer. Equipped with streamer and source steering.

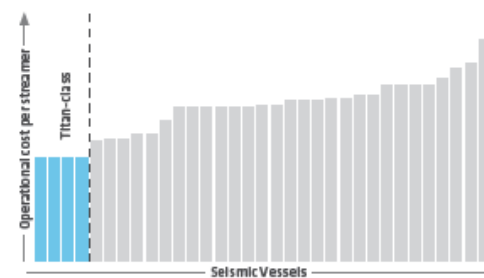
Performance Results

Downtime



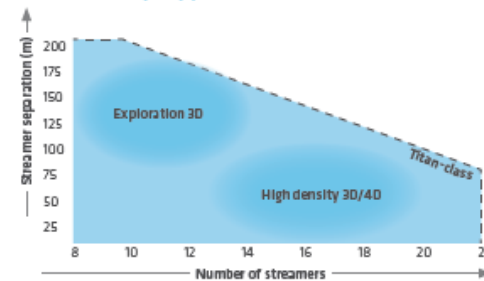
Ramform Titan - Zero maritime downtime and only 2.7% seismic downtime to date. Total sq.km acquired by Titan-class vessels is 140 052 sq. km.

Cost/Streamer



Ultra high capacity seismic vessels are more cost effective.

All Survey Types



Titan-class vessels cover all the bases from highly efficient reconnaissance exploration surveys to the detailed resolution required for 4D production seismic.

Records



Rapid Deployment

16 streamers (each 8.1 km) safely deployed in just 73 hours.

Large Spread

13.75 sq. km fan spread with 18 streamers (each 7.05 km) x 100 m separation (130 m at tail end).

Fast Acquisition

Highest production 175 sq.km in a day (average for this survey = 139 sq. km/day).

Future Proof

25 years Lifespan

Setting the benchmark for this generation of seismic vessels and the next.

Size
POWER
flexibility



MAR 11 2017

Figure 2.4: Specifications of the ultra-high-capacity Ramforms, both Titan-class and S-class (Source: www.pgs.com).



Plate 2.2: Ramform Titan one of the seismic survey vessels used by PGS (Source: www.pgs.com).

Environmental Commitment

Safe, Responsible, Productive

Planning

Planning and preparation begin months before the survey starts



Permitting

Following the rules for each location is a requirement.



Risk assessment

Operational, environmental and commercial aspects of the survey are covered.



Sound modeling

Output and propagation of sound is documented for the survey location.



Assess impact for time and place

Our assessments are based on desk research and face-to-face consultations.



Consultations

We listen and talk to local stakeholders to minimize impact and interference with fisheries and others.



Learning

Comparing project logs with the risks and mitigations flagged in the survey plan, we assess what can be improved next time.



Learning loop for future operations

Operating

Safe, reliable seismic operations minimize impact on sea life, climate and other ocean activities



Reliable partner

PGS' safe, modern seismic ships permit fast and accurate surveys, with minimal impact on the environment.



Planning for reality

We mitigate any risks highlighted in the survey plan, and continue to monitor activities in the area to adjust for reality.



Survey soft start

We give advance warning to marine life by increasing signal strength from low to full volume over at least 20 minutes.

Projection and direction

Carefully tuned seismic sources direct sound energy downward into the earth.



Watch, listen & report

Trained marine mammal observers enforce the safety zone with visual and acoustic monitoring.



Safety first

Our risk management system helps us identify hazards, assess risk and introduce appropriate safety measures.



Escort vessels

Our support vessels scout the area, coordinating activity and communicating with fishing boats in the vicinity.



Shut down

The survey stops if marine mammals are spotted within the safety zone (normally 500 m).



Sound Exposure Level

Sound travels but fades out with distance.

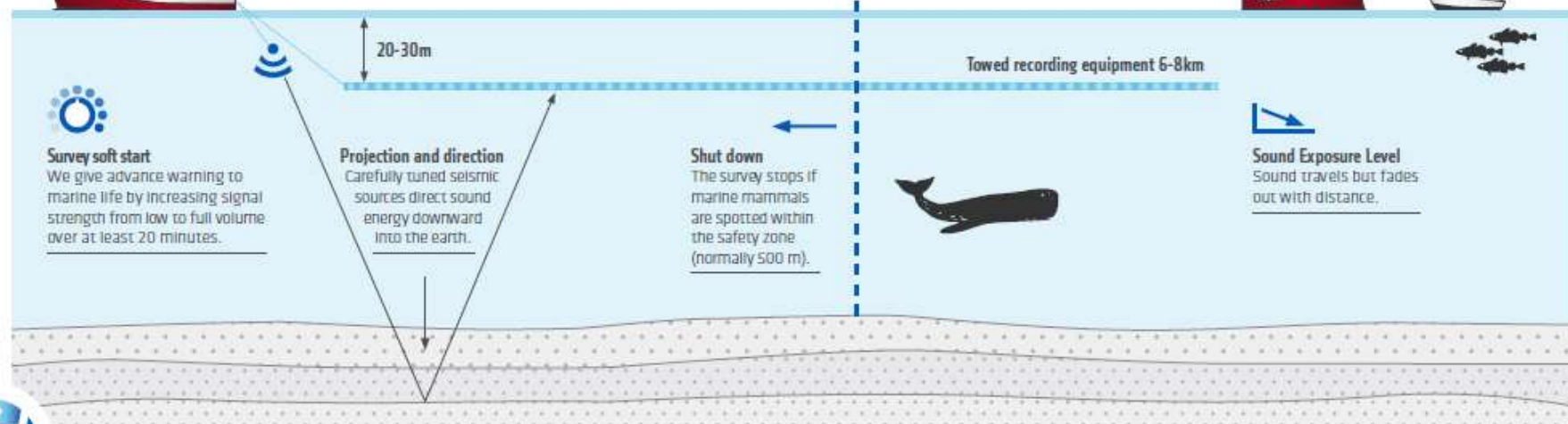
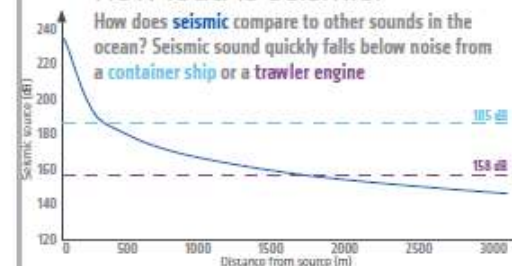
What is seismic?

Like medical ultrasound, seismic surveys use sound to image structures deep in the earth



How loud is seismic?

How does seismic compare to other sounds in the ocean? Seismic sound quickly falls below noise from a container ship or a trawler engine



Supporting ocean research
PGS shares water temperature, salinity, currents and weather data with ocean researchers.

Careful preparation and good survey planning result in minimal impact on the environment and other activities in the area.



Figure 2.5: PGS Environmental Commitments to environmental management and international best practices (Source: www.namcor.com.na).

2.3 Summary of Proposed Project Regulatory Register

The following is the summary of the regulatory register for all applicable legislations with respect to the proposed Multiclient/Proprietary 2D/3D Seismic Survey:

1. Namibian Constitution Articles 91(c) and 95.
2. Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007) and Environmental Impact Assessment (EIA) Regulations No. 30 of 2012.
3. Petroleum Products and Energy Act 13 of 1990 (as amended by the Petroleum Products and Energy Amendment Act 29 of 2004, Act 3 of 2000 and Act 16 of 2003).
4. Namibian Ports Authority Act 2 of 1994 (as amended in 2000 and the accompanying 2001 Port Regulations).
5. Health Act (No. 21 of 1988) and Public and Environmental Health Act, 2015 (Act No. 1 of 2015).
6. Foreign Investment Act 27 of 1990.
7. Merchant Shipping Act 57 of 1951.
8. Sea Shore Ordinance 37 of 1958.
9. Aviation Act 74 of 1962 (as last amended by the Aviation Amendment Act 10 of 1991 and the Aviation Amendment Act 27 of 1998) (and the Namibian Civil Aviation Regulations 2001).
10. National Monuments Act 28 of 1969 (as amended by the National Monuments Amendment Acts 22 of 1970 and 30 of 1971, the Expropriation Act 63 of 1975, and the National Monuments Amendment Act 35 of 1979).
11. Hazardous Substance Ordinance 14 of 1974.
12. Atmospheric Pollution Prevention Ordinance 11 of 1976.
13. Dumping at Sea Control Act 73 of 1980.
14. Marine Traffic Act 2 of 1981 (as amended by the Marine Traffic Amendment Act 5 of 1983, the Marine Traffic Amendment Act 15 of 1991, and the Namibia Ports Authority Act 2 of 1994).
15. Prevention and Combating of Pollution of the Sea by Oil Act 6 of 1981 (as amended by the Prevention and Combating of Pollution of the Sea by Oil Amendment Act 59 of 1985, Act 63 of 1987, and Act 24 of 1991, and the Namibian Ports Authority Act 2 of 1994).
16. Territorial Sea and Exclusive Economic Zone of Namibia Act 3 of 1990 (and the Territorial Sea and Exclusive Economic Zone of Namibia Amendment Act 30 of 1991).
17. Nature Conservation Amendment Act 5 of 1996.
18. The Marine Resources Act 27 of 2000 (and the Regulations relating to the Exploitation of Marine Resources 2001).
19. Wreck and Salvage Act 5 of 2004.
20. National Heritage Act 27 of 2004 (and the Regulations/Appointments/Declarations made under the National Monuments Act 28 of 1969 and the Regulations 2005).
21. Atomic Energy and Radiation Protection Act 5 of 2005 (and the Radiation Protection and Waste Disposal Regulations 2011).

22. Labour Act 11 of 2007 (and the Labour Amendment Act 2 of 2012).
23. Tobacco Products Control Act 1 of 2010 (and the Regulations).
24. Disaster Risk Management Act 10 of 2012.
25. International Conventions and Protocols:
 - a) International Plant Protection Convention (IPPC) 1951 (as last amended in 1997).
 - b) Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (The Ramsar Convention on Wetlands) 1971.
 - c) Declaration of the United Nations Conference on the Human Environment 1972.
 - d) Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) 1972 (as amended).
 - e) Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (and amendments)
 - f) International Convention for the Prevention of Pollution from Ships (MARPOL) 1973 (as modified by the Protocol of 1978.
 - g) International Convention for the Safety of Life at Sea (SOLAS) 1974 (as amended).
 - h) United Nations Convention on the Law of the Sea (UNCLOS) 1982.
 - i) Vienna Convention for the Protection of the Ozone Layer 1985 and Montreal Protocol on Substances that Deplete the Ozone Layer 1987.
 - j) Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal 1989.
 - k) International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) 1990.
 - l) United Nations (UN) Framework Convention on Climate Change 1992 and Kyoto Protocol to the UN Framework Convention on Climate Change 1997.
 - m) Convention on Biological Diversity (CBD), Rio de Janeiro, 1992.
 - n) Stockholm Convention on Persistent Organic Pollutants (POPs) 2001 (as amended in 2009 and 2011).
 - o) United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention on the Protection of the Underwater Cultural Heritage 2001.
 - p) Convention for the Safeguarding of the Intangible Cultural Heritage 2003.
 - q) Convention on the Protection and Promotion of the Diversity of Cultural Expressions 2005.
 - r) Revision of International Standards for Phytosanitary Measures No. 15 Regulation of Wood Packaging.
 - s) Regional Agreements: Southern African Development Community (SADC) Protocol on Mining 1997 and on Energy 1998.

3. SUMMARY OF THE EIA RESULTS AND MITIGATIONS MEASURES

3.1 Introduction

The potential positive and negative impacts likely to be associated with the proposed 2D/3D seismic survey have been identified, described, and assessed in the EIA Report. Mitigation measures are described in this EMP Report.

3.2 Summary Assessment of Positive Impacts

The following is summary of the key positive impacts that the proposed 2D/3D seismic survey activities will have on socioeconomic landscape of Namibia:

- ❖ Increased earnings by the State through rights' rentals and payment of direct and indirect taxes.
- ❖ Increased understanding and knowledge of the deep-water petroleum systems of Namibia that could finally led to the discovery of economic oil or gas resources that will change the economic landscape of Namibia for benefits of its people.
- ❖ Contributions to the national geosciences' skills development and knowledge transfer through on job training and short-term job attachments of Namibians.
- ❖ Contributions to the short and long-term strategies of attracting investments in the petroleum exploration sector in Namibia through new data acquisition, research, monitoring and management.
- ❖ Contribution to the long-term strategy that will promote the coexistence of petroleum operations with other marine users in Namibia.
- ❖ Direct contributions to the training of young Namibians through increased contributions to the national PetroFund which is currently offering several scholarships to Namibians to be able to study at foreign universities.
- ❖ Contributions to economic growth through ongoing exploration investments and potential future oil and gas discovery.
- ❖ Creation of employment opportunities through short and long-term contracts, and.
- ❖ Contribution to the development of local infrastructures and new businesses to support the ongoing oil and gas exploration opportunities particularly around the Ports of Walvis Bay and Lüderitz.

3.3 Summary Assessment of Negative Impacts

3.3.1 Sound Modelling Conclusions and Recommendations

Based on the results of acoustic modelling specialist assessment and without any mitigation measures in place, the following are summary of conclusions.

1. There is potential for significant disturbance to marine mammals within up to 2.9 km of the source array and mild disturbance within 9.4 km.
2. Before mitigation measures are applied, there is potential for injury to low frequency cetaceans within a radius of 280 m, 30 m for high frequency cetaceans and 833 m for very-high frequency cetaceans.
3. These injury zones will reduce to 57 m for low frequency cetaceans and 266 m for very-high frequency cetaceans once mitigation measures are applied, with high frequency cetacean injury thresholds no longer being exceeded.

4. These injury zones can effectively be monitored using MMOs. Based on the acoustic modelling results, a mitigation zone of 500 m is considered sufficient to effectively eliminate the risk of injury to marine mammals.
5. It is therefore concluded that it is unlikely that marine mammals will be injured as a result of the survey.
6. Recoverable injury could occur in some fish at a range of up to 369 m from the source array (for fish with swim bladders and eggs and larvae).
7. For fish without swim bladders, the potential range of effect reduces to a maximum of 201 m from the source array.
8. Temporary Threshold Shift (TTS) could occur to fish within 340 m of the source array, and.
9. Some sea turtles could be injured at ranges of up to 369 m from the source array.

3.3.2 Impact Assessment Summary on Marine Mammals, Birds, Fish and Fisheries

3.3.2.1 Summary of the Overall Impacts

Table 3.7 summarises the potential impacts discussed in detail in the specialist reports on marine mammals, birds, fish and fisheries and the acoustic underwater sound modelling report. The assessment of the impacts in Table 3.1 are given without mitigation measures applicable. The impacts are considered at different levels, (such as physiological, perceptual and behavioural), but the overall impact is presented. The source of impact (noise, seismic vessel, support craft, pollution) and duration of the impact (short/long term) are also considered, as well as whether the impact is to an individual or at population level. In the end, population and long-term impacts are the defining criteria. Table 3.2 summarises the potential impacts if the suggested mitigation measures are applied.

3.3.2.2 Assessment of Potential Impacts on Cape Fur Seals

Noise from the seismic survey is expected to have no impact on seal populations. Noise disturbance from support aircraft, such as helicopters, can cause startle response and panic behaviour. The impact would be high in the immediate short term, however, in the long term, impact on marine mammals from the noise of low-flying aircraft related to the survey operations is considered negligible in comparison to other aircraft noise sources in the region. Individual seals may be impacted by discarded waste and gear lost overboard, but this will be equal to any similar threat posed by fishing or other vessels.

3.3.2.3 Assessment of Potential Impacts on Marine Mammals

Seismic source noise is only expected to impact low-frequency cetaceans within close range of the operating source. As there are no known resident low-frequency cetaceans, the impact will be on migrating mammals. The number of mammals migrating through the Namibian waters is relatively low and wide-spread. If mitigation measures such as soft-starts, visual observation and exclusion limits are applied, the impacts of seismic noise can be lessened to acceptable levels. Overall, the expected impacts at population level are considered low in the long-term.

Noise from support vessels will have an insignificant impact, because whales and dolphins are likely to display avoidance reactions at a distance of about 1 km. The communication and navigation sounds emitted by whales and dolphins should not be masked by noise emitted by supply vessels and therefore, it is considered to be of insignificant impact.

The impact of prey displacement as a result of seismic activities is considered to be of very low significance overall, as marine mammals have an adaptable diet and prey on more than one fish

species. In addition, these creatures are highly mobile and able to follow prey in different directions. The impact of the seismic survey on feeding would be of very low significance.

3.3.2.4 Assessment of Potential Impacts on Sea Turtles

Although the occurrence of sea turtles in the region has increased in recent years, they are, by and large, still only occasional visitors. The likelihood of encountering turtles during the survey operations is moderate to low. None-the-less, should a turtle be in very close range of the seismic array, the potential impact on turtle physiology, behaviour and feeding is considered to be of high intensity in the short-term, but of low probability.

The impact on turtle mortality due to entanglement or garbage consumption can be high, but if turtle exclusion tail buoys are fitted to the hydrophone array and MARPOL 73/78 solid waste disposal procedures are followed this impact will be lessened to low significance. The impact of seismic noise on turtle migration is considered to be insignificant, since turtles make use of magnetic cues rather than acoustics for navigation.

3.3.2.5 Assessment of Potential Impacts on Sea Birds

Only a few sea bird species frequent deep, offshore waters and the likelihood of encountering significant numbers of endangered species is slim. The potential physiological impact of seismic pulses on non-diving birds is considered to be insignificant as birds would be expected to stay away from the noise source and the buoys of the seismic array.

The potential of pathological impact is considered to be of low-moderate significance on diving sea birds without mitigation and of very low significance with mitigation such as warning ramp-up procedures and if marine mammal observers are employed. In comparison to the impact of long-line fishing on pelagic birds, the potential impact of noise from this seismic survey on bird populations in the long term, is considered insignificant.

Avoidance behaviour would be limited to the immediate vicinity of the source array and only for the duration of the actual firing and vessel passage. The impact on behaviour is thus considered to be of MEDIUM intensity and of short duration, but overall, of very low significance in the long term. The impact of the seismic noise on non-diving bird behaviour is considered to be insignificant.

The impact of prey displacement as a result of the survey on the foraging of diving and non-diving birds is considered to be of moderate intensity in the medium term in the immediate vicinity of the shooting operations, and of very low significance overall. Research has shown that shoaling fish disturbed by seismic firing return to the area within a relatively short time period. In addition, the extent of prey species and wide ranges over which sea birds feed indicate that the impact of the seismic survey on feeding would be of very low significance.

Birds are generally only drawn to vessels to scavenge on discarded waste, or by lights at night. As long as the vessels comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) regulations, general waste should not pose a threat to and have zero impact on marine bird populations.

There is the possibility of a sea bird becoming entangled in, or colliding with lines and structures, particularly at night when shipboard lighting may cause disorientation and temporarily lowered visual ability. However, if lighting is reduced to minimal onboard safety requirements, then such incidents are likely to be scarce and the significance level and impact is considered low.

Noise disturbance from aircraft can cause startle responses and avoidance behaviour. The impact can be high in the immediate short term, however, if aircraft avoid known breeding colonies the aircraft noise directly related to the survey operations is considered negligible in comparison to other aircraft noise sources.

Sea birds are most likely to be severely impacted by the seismic vessel in the event of an oil spill or other major water-borne pollution. Such an event could be of high intensity in a localised area for a

short term. The fact that the survey activities are generally offshore and away from any large or sensitive breeding colonies, and that foraging birds will likely to be able to avoid any such spills, will lessen the impact. The chances of such an incident are equal to any other vessel operating within the Benguela Current Large Marine Ecosystem Programme. Thus, the overall impact of the survey on sea birds is regarded as low.

3.3.2.6 Assessment of Potential Impacts on Fish

The impact on larvae close to the surface in the vicinity of the source will be of high intensity in the short term, but in overall comparison with natural mortality, the impact of the seismic survey is considered to be of very low significance to larval stages, particularly if timing and spatial mitigating measures are employed.

Seismic noise disturbance may impact the spawning activities of certain fish species. However, most of the commercially important species spawn inshore and north of the proposed survey area, and in view of the relatively short duration of the disruption to species and the wide distribution of fish, the impacts of the survey on fish recruitment at the population level are considered to be of low significance.

The potential impact of physiological damage to pelagic species in close proximity to the noise source would be of high intensity. The potential impact would be limited to the short-term period of surveying activities in the population locale.

The overall impact of physiological damage to pelagic fish species is considered to be of low to very low significance dependant on the mitigation measures employed. However, the potential impact on demersal species and on species in shallow and inshore water would be insignificant as they are expected to be well out of the range of damage. Also, certain species of commercial importance (herring, mackerel, gobi, sharks) have under-developed or no swim bladders and there is little risk of injury from seismic noise. The physiological impact on large pelagic species is considered to be negligible.

The fish of the are generally highly mobile and exhibit large migration patterns and ranges, so while the potential impact on fish behaviour could be of high intensity, this would be limited to shallow waters and /or close proximity to the source, and restricted to the short-term duration of the survey operating in the area., but limited to the survey area. The impact of fish behaviour is, thus, considered to be of low significance both with and without mitigation measures.

3.3.2.7 Assessment of Potential Impacts on Fisheries

The fishing industry in Namibia is arguably the most socio-economically sensitive of all the marine activities currently being undertaken in Namibian waters. The Namibian commercial fishing industry plays an important role in the general economy of the country and the numerous companies are a great source of employment.

Commercially exploited demersal species include both shallow- and deep-water Cape Hake, Monkfish and Kingklip. These species are fished on the continental shelf, between -200 m and -400 m, where the distribution varies seasonally. Data indicates that there is no long-term reduction in catch per unit effort for species such as hake and cod as a result of seismic surveys.

The proposed seismic survey may affect fish behaviour and distribution in the short-medium term; however, research shows that catch rates should be resumed to normal within 24 hours for long-liners and from 12 hours up to a maximum of 5 days for demersal trawling. Although there may be some disruption to fishing operations, it is expected that the fish populations and distribution will return to normal within a relatively short time period after cessation of seismic activities.

The expected impact of the seismic activity on commercial catch and effort is considered to be of LOW significance. The seismic survey vessel locations and timetable should be communicated to this fishery well in advance of the onset of proposed operations.

The most commercially valuable mid-water fish are adult Cape Horse mackerel and juvenile Hake. The Cape horse mackerel are exploited by two sectors of the fishing industry: juveniles are caught by purse seiners and adults by midwater-trawler. These fisheries operate inshore of the proposed AOI and so the proposed seismic operations should have no impact on this fishery.

The pelagic purse seine fishery targets small pelagic fish such as anchovy, pilchard, juvenile Cape horse mackerel and pelagic goby. The purse seine fishing grounds are inshore and north of the AOI, so will receive NO IMPACT from surveys within the AOI.

The AOI lies mostly north of the tuna fishery. While the seismic survey will not impact the species as a whole, seismic noise may cause the fish to alter their migration route and avoid the areas of seismic operations. This can have a direct impact on the fishing industry, which targets tuna species in known locations.

The pole-and-line fishery, in particular, is a very small and seasonal fishery, operating only a couple of months in the year. The effort is variable and dependent on fish availability. The fishery operates on windows of opportunity. When a shoal is located, many vessels will congregate at one location for a number of days. Albacore tuna movement between South Africa and Namibia is poorly understood and there is no clear pattern.

Due consideration must be given to this fishery and negotiations regarding the timing of the seismic survey could lessen any negative associated impacts. Flexibility is paramount in limiting impacts on this fishery, which could be medium to high if no mitigation or consultation is undertaken, but low depending on the timing of the survey and fish stock availability.

Any proposed seismic survey could impact commercial fishing due to the safety zones required around the operational seismic vessel (commonly 500 m exclusion zone). Good communication and pre-notification practices will limit unnecessary disruption and delays to both parties. Due consideration should be given to the presence of all fishing vessels while running survey lines and communication channels should be kept open to avoid close encounters.

Additionally, support vessels moving to/from Lüderitz and Walvis Bay may encounter commercial fishing vessels and potentially cause short-term disruption. Adherence to prescribed maritime communication procedures will limit any likely encounters.

Precautionary action needs to be initiated to avoid entanglement with fishing equipment, such as long-lines or purse seine nets. Damage and associated delays can be costly to both sectors. The overall potential impact of entanglement of seismic gear with fishing gear is considered negligible if the vessel operators are aware of the presence of other vessels, although any such incidents would be of high intensity, but limited to the immediate timing of the event.

In the interests of amicable co-use of the Benguela Current Large Marine Ecosystem (BCLME) resources, and also for marine safety, the following procedures should mitigate any negative interactions with fisheries:

- ❖ The surveyor must formally notify the Commissioner for Petroleum Affairs (MME) of the survey, stating the proposed location of the survey lines, the commencement date and the anticipated duration.
- ❖ This information should also be relayed to all affected parties (Directorate of Maritime Affairs, Namibian Ports Authority, South African HydroSAN and the MFMR Monitoring, Control and Surveillance Unit - Walvis Bay).
- ❖ In the interest of good relations, direct communication and facilitation with any vessels in the area at the time of the survey is important. Openness to the possibilities of adjusting survey lines, and trawling location to cause minimum disruption of operations to both parties.
- ❖ Good communications through MFMR to the fisheries (i.e., Association of Namibian Fishing Industries and the Namibian Large Pelagic and Hake Longlining Association) with pre-

notification of survey activities and vessel paths (navigational co-ordinates of the survey area, timing and duration of proposed activities).

- ❖ Notices to Mariners should be distributed timeously to fishing companies and directly to fishing vessels, stating:
 - a) the co-ordinates of the proposed survey lines.
 - b) the proposed survey timeframes and day-to-day location of the seismic vessel.
 - c) the proposed safe operational limits of the survey vessel, and.
 - d) movements of support vessels.
- ❖ Radio Navigation Warnings and Notices to Mariners should be distributed via Navigational Telex (Navtext), and local Lüderitz and Walvis Bay Radio for the duration of the survey.
- ❖ It is recommended that updates of the scheduled weekly survey plan be circulated to the operators of affected fishing vessels on a daily basis and notify trawlers when the survey may move into trawling areas.
- ❖ Establish communications with the known long-line fishers if drifting buoys (with radar responders) are sighted, and.
- ❖ An experienced Fisheries Liaison Officer (FLO) should be deployed on board the survey vessel to initiate and facilitate radio communications with maritime vessels in the vicinity of the survey area. The FLO should report daily on vessel activity, ramp up procedures, environmental matters, fauna sightings, and respond and advise on action to be taken in the event of encountering fishing gear.

3.3.2.8 Overall Impact Assessment

Fishing areas, marine mammals (Cetacean migratory routes), and sensitive coastal environments with respect to the proposed are all shown in Fig. 3.1. Known commercial fishing grounds and MFMR stock assessment survey areas relative to the proposed 2D / 3D seismic survey area are shown in Fig. 3.2. Table 3.1 summarises the potential impacts detailed in the EIA Report, marine mammals, birds, fish and fisheries and underwater acoustic modelling specialist reports.

The assessment of the impacts is given without mitigation measures are shown in Table 3.1. The impacts have been considered at different levels, (such as physiological, perceptual and behavioural), with the overall impact also presented. The source of impact (noise, seismic vessel, support craft, pollution) and duration of the impact are also considered, as well as whether the impact is to an individual or at population level. In the end, population and long-term impacts are the defining criteria.

Table 3.8 summaries the potential impacts with mitigation measures applied. The overall impact of this proposed survey is regarded as being of moderate significance in the short-term and low significance in the long-term, assuming mitigation measures are applied (Table 3.2).

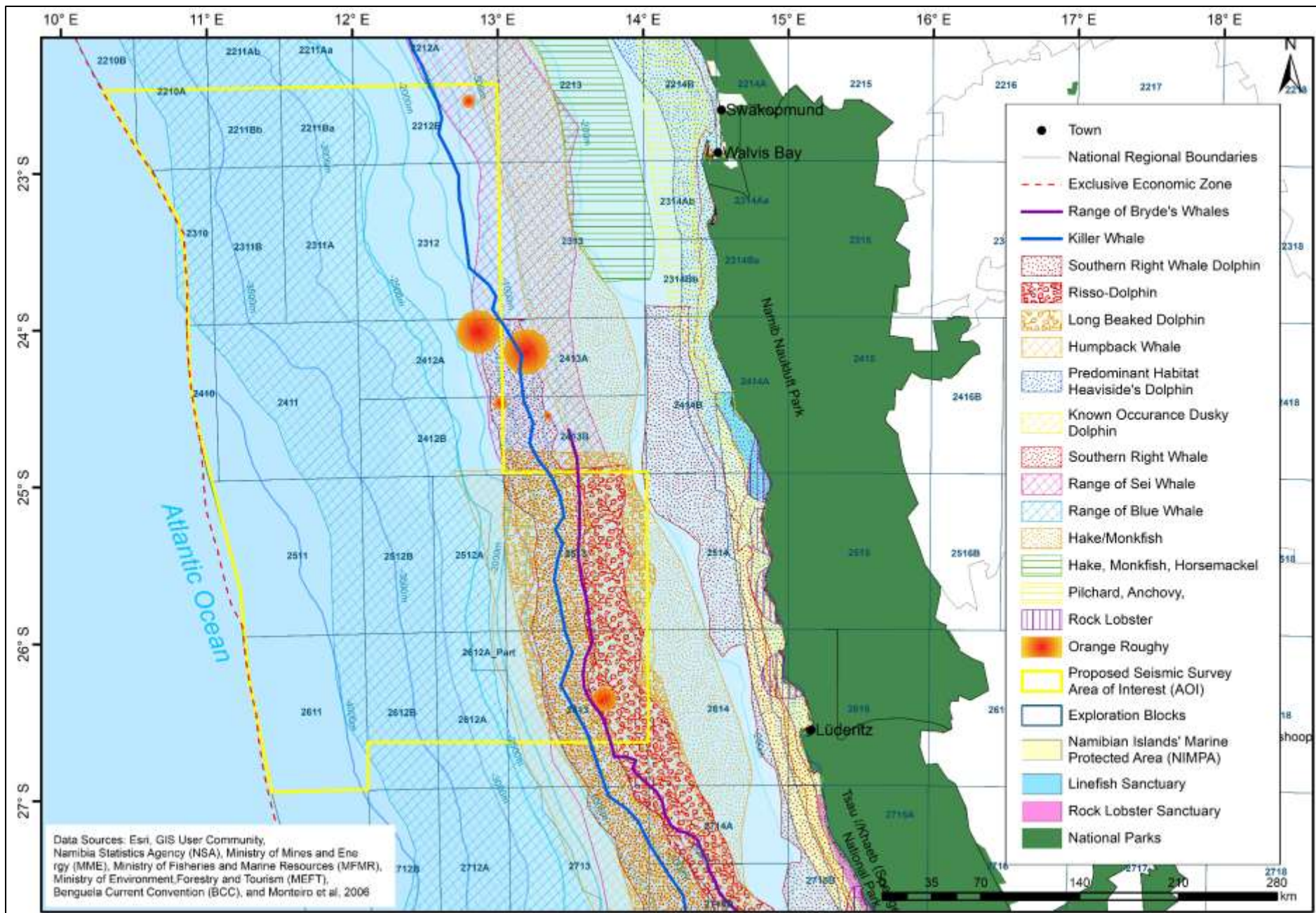


Figure 3.1: Fishing areas, marine mammals (Cetacean migratory routes), and sensitive coastal environments with respect to the proposed Multiclient or Proprietary 2D/3D Seismic Survey over the Area of Interest (AOI) (Data Source: Geological Survey of Namibia and National Marine Information and Research Centre, 2003).

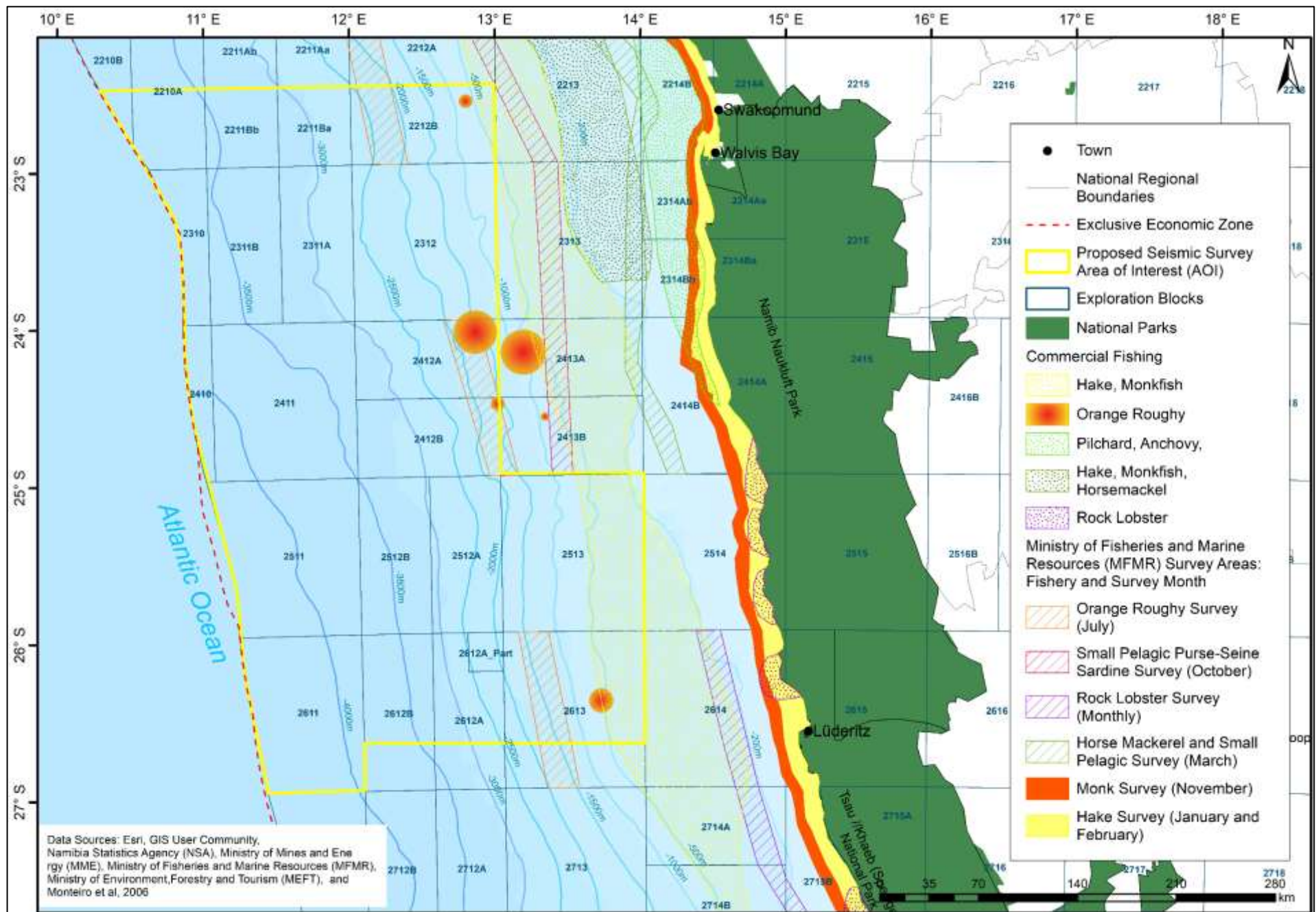


Figure 3.2: Known commercial fishing grounds and MFMR stock assessment survey areas with respect to the proposed Multiclient or Proprietary 2D/3D Seismic Survey over the Area of Interest (AOI).

Table 3.1: Summaries of the potential impacts without mitigation measures are applied with respect to the proposed Multiclient or Proprietary 2D/3D Seismic Survey over the Area of Interest (AOI).

Potential Impacting Factors	Impacted Sectors – WITHOUT mitigation measures applied – Survey Activities									
	Air quality	Water quality	Cape Fur Seal	Cetaceans	Sea Turtles	Sea Birds	Shore Birds	Fish	Fisheries	Tuna Fishery
Seismic Noise – short term	No impact	No impact	Insignificant impact	Moderate impact	Low-Moderate impact	Low-Moderate impact	No impact	Low-Moderate impact	Low-Moderate impact	Moderate - High impact
Seismic Noise – long term	No impact	No impact	Insignificant impact	Low impact	Insignificant impact	Insignificant impact	No impact	Low impact	Low impact	Low-Moderate impact
Light disturbance	No impact	No impact	No impact	No impact	No impact	Low-Moderate impact	No impact	No impact	No impact	No impact
Aircraft Noise –short term	No impact	No impact	Moderate - High impact	Low impact	No impact	Low impact	Moderate - High impact	No impact	No impact	No impact
Aircraft Noise –long term	No impact	No impact	Low impact	No impact	No impact	No impact	Low impact	No impact	No impact	No impact
Vessel exclusion zone – short term	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Moderate impact	Moderate impact
Vessel exclusion zone – long term	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Low impact	Low impact
Waste generation	No impact	Moderate impact	Moderate impact	Low impact	Moderate - High impact	Moderate impact	Low-Moderate impact	Low-Moderate impact	Low impact	Low impact
Air Emissions	Moderate impact	No impact	No impact	No impact	No impact	Insignificant impact	Insignificant impact	No impact	No impact	No impact
Major accidental spill of diesel/oil	Insignificant impact	High impact	Moderate impact	Moderate impact	Moderate impact	Low-Moderate impact	High impact	Moderate impact	Moderate - High impact	Moderate - High impact
Small accidental spills	No impact	Low impact	Insignificant impact	Insignificant impact	Insignificant impact	No impact	Insignificant impact	Insignificant impact	No impact	No impact
Ballast water	No impact	Moderate - High impact	No impact	No impact	No impact	No impact	No impact	Low-Moderate impact	Low impact	No impact

Table 3.2: Summaries of the potential impacts with mitigation measures are applied for the proposed Multiclient or Proprietary 2D/3D Seismic Survey over the Area of Interest (AOI).

Potential Impacting Factors	Impacted Sectors – WITH mitigation measures applied – Survey Activities									
	Air quality	Water quality	Cape Fur Seals	Cetaceans	Sea Turtles	Sea Birds	Shore Birds	Fish	Fisheries	Tuna Fishery
Seismic Noise – short term	No impact	No impact	Insignificant impact	Low impact	Low impact	Low impact	No impact	Low impact	Low-Moderate impact	Low impact
Seismic Noise – long term	No impact	No impact	Insignificant impact	Insignificant impact	No impact	Insignificant impact	No impact	Insignificant impact	Low impact	Low impact
Light disturbance	No impact	No impact	No impact	No impact	No impact	Low impact	No impact	No impact	No impact	No impact
Aircraft Noise – short term	No impact	No impact	Moderate impact	Insignificant impact	No impact	Insignificant impact	Moderate impact	No impact	No impact	No impact
Aircraft Noise – long term	No impact	No impact	Insignificant impact	No impact	No impact	No impact	Low impact	No impact	No impact	No impact
Vessel exclusion zone – short term	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Moderate impact	Low impact
Vessel exclusion zone – long term	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Insignificant impact	Low impact
Waste generation MARPOL	No impact	Low impact	Insignificant impact	Insignificant impact	Low impact	Insignificant impact	Insignificant impact	No impact	No impact	No impact
Air Emissions MARPOL	Low-Moderate impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact
Major accidental spill of diesel/oil	Insignificant impact	Moderate - High impact	Low-Moderate impact	Low-Moderate impact	Low-Moderate impact	Low impact	Moderate - High impact	Low impact	Moderate impact	Moderate impact
Small accidental spills	No impact	Insignificant impact	Insignificant impact	Insignificant impact	Insignificant impact	No impact	Insignificant impact	Insignificant impact	No impact	No impact
Ballast water Control	No impact	Insignificant impact	No impact	No impact	No impact	No impact	No impact	Insignificant impact	No impact	No impact

3.3.1 Overall EIA Negative Impact Assessment Framework

The overall impact assessment framework adopted for this project used the Leopold matrix which is one of the best known internationally matrix methodology available for predicting the impact of a project on the environment. The Leopold matrix is a two-dimensional matrix cross-referencing the following:

- ❖ The activities linked to the project stages covering mobilisation and pre-survey preparations, actual survey operations, post survey operations, and non-routine or accidental events that are likely to have an impact on the receiving environment, and.
- ❖ The existing environments (physical, biological, and socioeconomic) that could possibly be affected by the project.

The activities linked to the proposed 2D/3D seismic survey operations are listed on one axis, while the receiving environments (physical, biological and socioeconomic) are listed on the other axis, and divided in following three (3) major groups:

- ❖ Physical conditions: marine and coastal air quality, change climate, seawater quality, seabed topography and sediment quality.
- ❖ Biological conditions: marine and coastal benthic ecology, fishes, turtles, seabirds, seals and cetaceans, and.
- ❖ Socioeconomic conditions and other users: marine and coastal fishing industry, tourism and recreation, minerals exploration and mining, other petroleum exploration licence.

The proposed 2D/3D seismic survey activities have the potential to affect the receiving environments in many ways. The first step in impact identification has been to identify the various types of activities associated with the mobilisation and pre-survey preparations, actual survey operations, post survey operations stages of the proposed survey, together with their associated emissions and discharges where appropriate.

At a high level, the main sources of impact of the proposed survey operations are:

- ❖ Planned or routine events: where an aspect (i.e., impact producing factor) is a result of routine Project activities. For example, the generation of atmospheric emissions from the survey and support vessels can be considered a planned event, and.
- ❖ Unplanned or non-routine (accidental) events: where an aspect is a result of mishaps or failures, including failure of equipment, procedures not being followed, human error, unforeseen events, or process equipment not performing as per design parameters. Typical examples are spills, leaks, emergency emissions, collisions, and explosions.

Overall, the following is the summary of the project related activities linked to planned/ routine and unplanned / accidental events of the mobilisation and pre-survey preparations, actual survey operations, post survey operations stages of the proposed survey:

1. Port of Walvis Bay or Lüderitz including onshore support operations and waste management.
2. Physical presence of survey and support vessels.
3. Physical disturbance of the survey operations.
4. Sound generation from 2D/3D seismic survey sources including sound of the survey and support vessels.
5. Increased light levels from routine vessels operations.
6. Atmospheric emissions from routine operations of the survey and support vessels.

7. Planned marine discharges.
8. Unplanned marine discharges (e.g., minor spillages of fuel, lubricants / maintenance oils.
9. Accidental event: Loss of vessel, equipment or material.
10. Accidental event: Collision with marine wildlife during vessel operations.
11. Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or another major event.

Accidental events can potentially lead to significant impacts, for example in the event of an oil spill. However, they are clearly not a part of the intended activity and their potential occurrence has a low probability of occurrence associated with it.

The activities / sources of potential impact due to the project and the receiving environment that could potentially be affected has been assessed in the EIA report and presented in form of a two-dimensional cross-referencing Leopold matrix covering the following:

- ❖ Sensitivity of receptors (Table 3.3).
- ❖ Impact magnitude (Table 3.4).
- ❖ Duration of exposure (Table 3.5).
- ❖ Geographical extent (Table 3.6).
- ❖ Probability, likelihood of occurrence (Table 3.7), and.
- ❖ Overall significant impacts (Table 3.8).

Table 3.3: Sensitivity of receptors (Physical, biological and socioeconomic receiving environment).

RECEIVING ENVIRONMENT SENSITIVITY			RECEPTORS / TARGETS THAT MAY BE IMPACTED (MARINE AND COASTAL RESOURCES)																	
SENSITIVITY RATING		CRITERIA	PHYSICAL ENVIRONMENT					BIOLOGICAL ENVIRONMENT					SOCIOECONOMIC ENVIRONMENT							
1	Negligible	The receptor or resource is resistant to change or is of little environmental value.	Air Quality	Change Climate	Seawater Quality	Seabed Topography	Sediment Quality	Benthic Ecology	Fishes	Turtles	Seabirds	Seals	Cetaceans	Fishing Industry	Tourism and Recreation	Minerals Exploration and Mining	Other Petroleum Exploration Licence Holders	International Shipping Line	International Communication Lines / Cables	
2	Low	The receptor or resource is tolerant of change without detriment to its character, is of low environmental or social value, or is of local importance.																		
3	Medium	The receptor or resource has low capacity to absorb change without fundamentally altering its present character, is of high environmental or social value, or is of national importance																		
4	High	The receptor or resource has moderate capacity to absorb change without significantly altering its present character, has some environmental or social value, or is of district/regional importance.																		
5	Very High	The receptor or resource has little or no capacity to absorb change without fundamentally altering its present character, is of very high environmental or social value, or is of international importance.																		
SOURCES OF POTENTIAL IMPACT	ROUTINE AND PHYSICAL PRESENCE OPERATIONAL ACTIVITIES	ONSHORE / COASTAL																		
		1.	Port of Walvis Bay including Onshore support operations and waste management	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		OFFSHORE																		
		2.	Physical presence of survey and support vessels	1	1	2	1	1	1	2	4	2	2	4	4	1	1	1	1	1
		3.	Physical disturbance of the survey operations	1	1	1	1	1	1	2	4	2	2	4	4	1	1	1	1	1
		4.	Sound generation from the proposed 2D/3D seismic survey sources including sound of the survey and support vessels	1	1	1	1	1	1	4	4	4	2	4	4	1	1	1	1	1
		5.	Increased light levels from routine vessels operations	1	1	1	1	1	1	2	2	4	2	4	2	1	1	1	1	1
	6.	Atmospheric emissions from routine operations of the survey and support vessels	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	7.	Planned marine discharges	1	1	2	1	1	1	2	2	2	2	3	2	1	1	1	1	1	
	ACCIDENTAL	8.	Unplanned marine discharges (e.g., minor spillages of fuel, lubricants / maintenance oils	1	1	2	1	1	1	2	2	2	2	3	2	1	1	1	1	1
		9.	Accidental event: Loss of vessel, equipment or material	1	1	1	1	1	1	2	2	2	2	3	2	1	1	1	1	1
10.		Accidental event: Collision with marine wildlife during vessel operations	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	
11.		Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or other major event.	1	1	4	1	1	1	4	4	4	4	4	4	1	1	1	1	1	

Table 3.4: Likely impact magnitude.

MAGNITUDE		RECEPTORS / TARGETS THAT MAY BE IMPACTED (MARINE AND COASTAL RESOURCES)																		
		PHYSICAL ENVIRONMENT					BIOLOGICAL ENVIRONMENT					SOCIOECONOMIC ENVIRONMENT								
		SCALE	DESCRIPTION	Air Quality	Climate Change	Seawater Quality	Seabed Topography	Sediment Quality	Benthic Ecology	Fishes	Turtles	Seabirds	Seals	Cetaceans	Fishing Industry	Tourism and Recreation	Minerals Exploration and Mining	Other Petroleum Exploration Licence Holders	International Shipping Line	International Communication Lines / Cables
0	no observable effect																			
1	low effect																			
2	tolerable effect																			
3	medium high effect																			
4	high effect																			
5	very high effect (devastation)																			
SOURCES OF POTENTIAL IMPACT	ROUTINE AND PHYSICAL PRESENCE OPERATIONAL ACTIVITIES	ONSHORE / COASTAL																		
		1.	Port of Walvis Bay including Onshore support operations and waste management	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		OFFSHORE																		
		2.	Physical presence of survey and support vessels	0	0	3	0	0	0	3	3	3	3	3	2	1	0	1	1	0
		3.	Physical disturbance of the survey operations	0	0	0	0	0	0	3	3	3	3	3	2	1	0	1	1	0
		4.	Sound generation from the proposed 2D/3D seismic survey sources including sound of the survey and support vessels	0	0	0	0	0	0	3	1	1	1	3	2	1	0	1	1	0
		5.	Increased light levels from routine vessels operations	0	0	0	0	0	0	1	1	3	1	3	0	1	0	1	1	0
	6.	Atmospheric emissions from routine operations of the survey and support vessels	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	7.	Planned marine discharges	0	0	3	0	0	0	1	3	3	3	3	0	1	0	1	1	0	
	ACCIDENTAL	8.	Unplanned marine discharges (e.g. minor spillages of fuel, lubricants / maintenance oils)	0	0	1	0	0	0	3	3	3	3	3	4	1	0	1	1	0
		9.	Accidental event: Loss of vessel, equipment or material	0	0	1	0	0	0	1	1	1	1	3	3	1	0	1	1	0
10.		Accidental event: Collision with marine wildlife during vessel operations.	0	0	0	0	0	0	0	0	0	0	3	0	1	0	1	1	0	
11.		Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or other major event.	0	0	1	0	0	0	4	4	4	4	4	4	1	0	1	1	0	

Table 3.5: Likely impact duration / time period of exposure.

DURATION OF IMPACT EXPOSURE		RECEPTORS / TARGETS THAT MAY BE IMPACTED (MARINE AND COASTAL RESOURCES)																		
		PHYSICAL ENVIRONMENT					BIOLOGICAL ENVIRONMENT					SOCIOECONOMIC ENVIRONMENT								
SCALE	DESCRIPTION	Air Quality	Climate Change	Seawater Quality	Seabed Topography	Sediment Quality	Benthic Ecology	Fishes	Turtles	Seabirds	Seals	Cetaceans	Fishing Industry	Tourism and Recreation	Minerals Exploration and Mining	Other Petroleum Exploration Licence Holders	International Shipping Line	International Communication Lines / Cables		
T	Temporary																			
P	Permanent																			
SOURCES OF POTENTIAL IMPACT	ROUTINE AND PHYSICAL PRESENCE OPERATIONAL ACTIVITIES	ONSHORE / COASTAL																		
		1.	Port of Walvis Bay including Onshore support operations and waste management	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		OFFSHORE																		
		2.	Physical presence of survey and support vessels	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		3.	Physical disturbance of the survey operations	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		4.	Sound generation from the proposed 2D/3D seismic survey sources including sound of the survey and support vessels	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		5.	Increased light levels from routine vessels operations	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	6.	Atmospheric emissions from routine operations of the survey and support vessels	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	7.	Planned marine discharges	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	ACCIDENTAL	8.	Unplanned marine discharges (e.g., minor spillages of fuel, lubricants / maintenance oils	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
		9.	Accidental event: Loss of vessel, equipment or material	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
10.		Accidental event: Collision with marine wildlife during vessel operations.	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T		
11.		Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or another major event.	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T		

Table 3.6: Likely impact geographical coverage / extent.

GEOGRAPHICAL COVERAGE		RECEPTORS / TARGETS THAT MAY BE IMPACTED (MARINE AND COASTAL RESOURCES)																		
		PHYSICAL ENVIRONMENT					BIOLOGICAL ENVIRONMENT					SOCIOECONOMIC ENVIRONMENT								
		Air Quality	Climate Change	Seawater Quality	Seabed Topography	Sediment Quality	Benthic Ecology	Fishes	Turtles	Seabirds	Seals	Cetaceans	Fishing Industry	Tourism and Recreation	Minerals Exploration and Mining	Other Petroleum Exploration Licence Holders	International Shipping Line	International Communication Lines / Cables		
SCALE	DESCRIPTION																			
L	limited impact on location																			
O	impact of importance for municipality;																			
R	impact of regional character																			
N	impact of national character																			
M	impact of cross-border character																			
SOURCES OF POTENTIAL IMPACT	ROUTINE AND PHYSICAL PRESENCE OPERATIONAL ACTIVITIES	ONSHORE / COASTAL																		
		1.	Port of Walvis Bay including Onshore support operations and waste management	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
		OFFSHORE																		
		2.	Physical presence of survey and support vessels	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
		3.	Physical disturbance of the survey operations	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
		4.	Sound generation from the proposed 2D/3D seismic survey sources including sound of the survey and support vessels	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
		5.	Increased light levels from routine vessels operations	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	6.	Atmospheric emissions from routine operations of the survey and support vessels	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	
	7.	Planned marine discharges	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	
	ACCIDENTAL	8.	Unplanned marine discharges (e.g., minor spillages of fuel, lubricants / maintenance oils	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
		9.	Accidental event: Loss of vessel, equipment or material	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
10.		Accidental event: Collision with marine wildlife during vessel operations.	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	
11.		Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or another major event.	L	L	O	L	L	L	O	O	O	O	O	O	L	L	L	L	L	

Table 3.7: Likely impact probability, likelihood of occurrence.

PROBABILITY, LIKELIHOOD		RECEPTORS / TARGETS THAT MAY BE IMPACTED (MARINE AND COASTAL RESOURCES)																		
		PHYSICAL ENVIRONMENT					BIOLOGICAL ENVIRONMENT					SOCIOECONOMIC ENVIRONMENT								
		Air Quality	Climate Change	Seawater Quality	Seabed Topography	Sediment Quality	Benthic Ecology	Fishes	Turtles	Seabirds	Seals	Cetaceans	Fishing Industry	Tourism and Recreation	Minerals Exploration and Mining	Other Petroleum Exploration Licence Holders	International Shipping Line	International Communication Lines / Cables		
SCALE	DESCRIPTION																			
A	Extremely unlikely (e.g. never heard of in the industry)																			
B	Unlikely (e.g. heard of in the industry but considered unlikely)																			
C	Low likelihood (egg such incidents/impacts have occurred but are uncommon)																			
D	Medium likelihood (e.g. such incidents/impacts occur several times per year within the industry)																			
E	High likelihood (e.g. such incidents/impacts occurs several times per year at each location where such works are undertaken)																			
SOURCES OF POTENTIAL IMPACT		ONSHORE / COASTAL																		
		1.	Port of Walvis Bay including Onshore support operations and waste management	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
		OFFSHORE																		
		2.	Physical presence of survey and support vessels	A	A	C	A	A	A	C	C	C	C	C	C	A	A	A	A	A
		3.	Physical disturbance of the survey operations	A	A	A	A	A	A	C	C	C	C	C	C	A	A	A	A	A
		4.	Sound generation from the proposed 2D/3D seismic survey sources including sound of the survey and support vessels	A	A	A	A	A	A	C	C	C	C	C	C	A	A	A	A	A
		5.	Increased light levels from routine vessels operations	A	A	A	A	A	A	A	A	C	A	A	A	A	A	A	A	A
		6.	Atmospheric emissions from routine operations of the survey and support vessels	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
		7.	Planned marine discharges	A	A	B	A	A	A	B	B	B	A	A	A	A	A	A	A	A
		8.	Unplanned marine discharges (e.g., minor spillages of fuel, lubricants / maintenance oils)	A	A	B	A	A	A	B	B	B	B	B	B	B	A	A	A	A
		ACCIDENTAL		9.	Accidental event: Loss of vessel, equipment or material	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A
10.	Accidental event: Collision with marine wildlife during vessel operations.			A	A	B	A	A	A	B	B	B	B	B	B	A	A	A	A	A
11.	Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or other major event.			A	A	B	A	A	A	B	B	B	B	B	B	A	A	A	A	A

Table 3.8: Likely impact significant of impacts.

SIGNIFICANCE						RECEPTORS / TARGETS THAT MAY BE IMPACTED (MARINE AND COASTAL RESOURCES)																			
						PHYSICAL ENVIRONMENT					BIOLOGICAL ENVIRONMENT					SOCIOECONOMIC ENVIRONMENT									
IMPACT SEVERITY [Magnitude, Duration, Extent, Probability]	RECEPTOR CHARACTERISTICS (SENSITIVITY)					Air Quality	Climate Change	Seawater Quality	Seabed Topography	Sediment Quality	Benthic Ecology	Fishes	Turtles	Seabirds	Seals	Cetaceans	Fishing Industry	Tourism and Recreation	Minerals Exploration and Mining	Other Petroleum Exploration Licence Holders	International Shipping Line	International Communication Lines / Cables			
	Very High (5)	High(4)	Medium (3)	Low (2)	Negligible (1)																				
Very High (5)	Major [5/5]	Major [4/5]	Moderate [3/5]	Moderate [2 /5]	Minor 1/5																				
High (4)	Major [5/4]	Major [4/4]	Moderate [3/4]	Moderate [2/4]	Minor[1/4]																				
Medium (3)	Major [5/3]	Moderate[4/3]	Moderate[3/3]	Minor[2/3]	None[1/3]																				
Low (2)	Moderate [5/2]	Moderate[4/2]	Minor[3/2]	None[2/2]	None[1/2]																				
Negligible (1)	Minor [5/1]	Minor [4/1]	None [3/1]	None [2/1]	None [1/1]																				
SOURCES OF POTENTIAL IMPACT		ROUTINE AND PHYSICAL PRESENCE OPERATIONAL ACTIVITIES	ONSHORE / COASTAL																						
			1.	Port of Walvis Bay including Onshore support operations and waste management	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	
			OFFSHORE																						
			2.	Physical presence of survey and support vessels	2/1	1/1	2/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	2/1	2/1	2/1	4/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
			3.	Physical disturbance of the survey operations	2/1	2/1	2/1	2/1	2/1	2/1	4/1	3/2	3/2	3/2	3/2	4/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
			4.	Sound generation from the proposed 2D/3D seismic survey sources including sound of the survey and support vessels	1/1	1/1	1/1	1/1	1/1	1/1	4/2	4/2	2/1	2/1	4/2	4/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
			5.	Increased light levels from routine vessels operations	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	4/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		6.	Atmospheric emissions from routine operations of the survey and support vessels	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	
		7.	Planned marine discharges	1/1	1/1	3/2	1/1	1/1	1/1	3/2	3/2	3/2	3/2	3/2	2/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	
		ACCIDENTAL	8.	Unplanned marine discharges (e.g. minor spillages of fuel, lubricants / maintenance oils	1/1	1/1	3/2	1/1	1/1	1/1	3/2	3/2	3/2	3/2	3/2	3/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	
			9.	Accidental event: Loss of vessel, equipment or material	1/1	1/1	1/1	1/1	1/1	1/1	1/1	3/2	3/2	3/2	3/2	4/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	
10.	Accidental event: Collision with marine wildlife during vessel operations.		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	4/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1			
11.	Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or other major event.		1/1	1/1	4/1	1/1	1/1	1/1	3/2	3/2	3/2	3/2	3/2	3/2	3/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1			

4. EMP IMPLEMENTATION AND MITIGATION MEASURES

4.1 Aims and Objectives of the EMP

This EMP Report has the following specific objectives:

1. Ensure that the key environmental impacts identified and assessed in the EIA Report are addressed.
2. Ensure compliance with all applicable national regulations and MARPOL (marine pollution) regulations and waste disposal procedure and all legal frameworks and other requirements that must be adhered to.
3. Promote environmental management and communicate the aims and goals of the project EMP to all stakeholders, contractor, subcontractor and all key employees of the Proponent who will be involved in the proposed 2D/3D seismic survey activities operations.
4. Incorporate environmental management principles into project design and operational procedures.
5. Ensure all workers, contractors, sub-contractors and all those who are involved in the project are meeting all requirements with respect to environmental management.
6. Address issues and concerns raised in the EIA process.
7. Serve as an action plan for environmental management.
8. Provide a framework for implementing commitments to address all the key impacts identified in the EIA Report.
9. Provided a framework for preparing and maintaining records of project environmental performance (i.e., monitoring, audits and compliance tracking), and.
10. Provide an environmental monitoring plan whose aim is to ensure that the mitigation measures during the project mobilisation and pre-survey preparations, actual survey operations, post survey operations, and non-routine or accidental events are effectively implemented, and the positive impacts are enhanced, and.
11. Provide a basis for preparing the “close out” report to be submitted to the Government (Ministry of Mines and Energy, (MME), Ministry of Environment, Forestry, and Tourism (MEFT), Ministry of Fisheries and Marine Recourse (MFMR) and the Ministry of Work and Transport (MWT), Department of Maritimes Affairs) once the proposed 2D/3D seismic survey activities operations have been completed.

4.2 Principles of Environmental Management

The following principles of environmental management, as stated in Part II, Section 3 of the Environmental Management Act, 2007, Act No. 7 of 2007 have been considered in the preparation of this EMP for proposed 2D/3D seismic survey activities in the Walvis, Lüderitz and Orange Basins, offshore Namibia:

1. Use renewable resources on a sustainable basis for the benefit of present and future generations.
2. Involve the community in natural resources management and promote and facilitate the sharing of benefits from the use of resources.
3. Promote public participation in decisions affecting the environment and ensure that their interests, needs and values are considered.

4. Promote equitable access to all environmental resources and consider the functional integrity of ecological systems so that the sustainability of systems is ensured and that harmful effects are prevented.
5. Undertake environmental assessments for all projects that may adversely impact on the environment, or the use of natural resources.
6. Promote sustainable development in all aspects relating to the environment.
7. Protect and respect Namibia's cultural and natural heritage, including its biological diversity, for the benefit of present and future generations.
8. Reduce the generation of waste and polluting substances at source by adopting the option that provides the most benefit or causes the least environmental damage, at costs acceptable by society, in the short- and long term.
9. Promote the reduction, re-use and recycling of waste.
10. Adopt the "polluter pays" principle.
11. In cases where there is enough evidence to conclude that there are threats of serious or irreversible damage to the environment, the lack of full scientific certainty may not be used as an excuse for postponing cost-effective measures to prevent environmental degradation, and.
12. Prevent damage to the environment. if this is not possible, reduce, limit, or control activities that may cause damage to the environment.

4.3 The EMP Framework

The following is the summary of the EMP Framework based on the precautionary principles and principles of environmental management as detailed in the Environmental Management Act, 2007, Act No. 7 of 2007 for the proposed offshore 2D/3D seismic survey activities:

- ❖ The proposed 2D/3D seismic survey activities can only be implemented once the MEFT has issued an Environmental Clearance Certificate.
- ❖ All interested and affected parties (I&APs), particularly other users of the marine environment, must be notified prior to the survey start.
- ❖ Attempts must be made to reduce the likelihood of possible cumulative impacts through co-ordination of activities with other operators / users of the marine environment.
- ❖ All communications and public consultation should be channelled through a single interface, usually the Proponent's Representative (PR) / Operations Manager (OM).
- ❖ Conditions and provisions as detailed in this EMP shall be adhered to for conservation and preservation of the natural environment.
- ❖ The Proponent's Representative (PR) / Operations Manager (OM) is responsible for the implementation of the remediation of any environmental damage in accordance with the recommended methodology and/or the best available procedures / practices.
- ❖ Vessel crew should be trained in good environmental practices and onboard supervision shall always be applied.
- ❖ A Marine Mammal Observer (MMO/ Fisheries Liaison Officer (FLO) and /or Independent Marine Observer (IMO) who is familiar with fisheries sectors in the area and experienced in seabird and marine mammal identification and observation techniques must be appointed to be onboard thought the survey period, and.

- ❖ In the absence of any specific mitigation measures being provide in this EMP, the Proponent shall always adopt the precautionary approach.

4.4 Hierarchy of Mitigation Measures Implementation

A hierarchy of methods for mitigating significant adverse effects has been adopted in order of preference and as follows:

- (i) Enhancement, e.g., protection of habitats through operational approaches.
- (ii) Avoidance, e.g., flexible implementation timing to avoid effects on ecological receptors.
- (iii) Reduction, e.g., limitation of effects on receptors through design or operational changes, and.
- (iv) Compensation, e.g., community benefits.

4.5 Roles and Responsibilities

4.5.1 Overview

Management and monitoring of the environmental elements that may be affected by the different activities of the 2D/3D seismic survey through the allocation of resources, roles and responsibilities is an important element of the mitigatory process. This EMP provides for the human resources roles and responsibilities necessary for the implementation and monitoring of the key components of the mitigation measures.

4.5.2 Proponent's Representative (PR) / Operations Manager (OM)

The proponent shall appoint a **Proponent's Representative (PR) / Operations Manager (OM)** with responsibilities not limited to the following with respect to the EMP implementation:

- ❖ Act as the PR and implementing agent on behalf of the proponent.
- ❖ Ensure that the proponent's responsibilities are executed in compliance with the relevant national and international regulations and best practices.
- ❖ Ensure that all the necessary environmental authorisations and permits have been obtained before the implementation of the proposed activities.
- ❖ Assist any contractor / subcontractor and monitoring specialists in finding environmentally responsible solutions to challenges that may arise during the survey.
- ❖ Should the operations manager believe a serious threat to, or impact on the receiving environment may be caused by the seismic survey activities, he/she may stop work and the proponent must be informed of the reasons for the stoppage as soon as possible.
- ❖ The OM has the authority to issue fines for transgressions of basic conduct rules and/or contravention of the EMP.
- ❖ Should any contractor / subcontractor and monitoring specialists or his/her employees fail to show adequate consideration for the environmental aspects related to the EMP, the operations manager can have person(s) and/or equipment removed from the vessel or work suspended until the matter is remedied.

- ❖ Maintain an open and direct lines of communication between the stakeholders and proponent, as well as any other identified Interested and Affected Parties (I&APs) with regards to environmental matters, and.
- ❖ Attend regular meetings / daily briefings and inspections as may be required.

4.5.3 Safety, Health and Environment (SHE) Officer / Environmental Coordinator

The proponent shall appoint a Safety, Health and Environment (SHE) Officer / Environmental Coordinator with responsibilities not limited to the following with respect to the EMP implementation:

- ❖ Assist the OM in ensuring that the necessary environmental authorisations and permits have been obtained and any subsequent fillings are prepared and lodged accordingly.
- ❖ Assist the OM and Contractor in finding environmentally responsible solutions to challenges that may arise.
- ❖ Conduct daily safety and environmental management briefings as per EMP requirements or as may be required.
- ❖ Carry out regular site inspections (on average once per week) with regards to compliance with the EMP. report any non-compliance(s) to the OM as soon as possible.
- ❖ Continuously review the EMP and recommend additions and/or changes to the EMP document as may be required and in consultations with the OM and monitoring specialists.
- ❖ Monitor the Contractor's environmental awareness training for all new personnel joining the operations.
- ❖ Keep records of all activities related to environmental control and monitoring. the latter to include a photographic record of all the major incidents / incidences, and.
- ❖ Attend regular meetings.

4.5.4 Other Contractors and Subcontractors

The responsibilities of the **Contractors and Subcontractors** that may be appointed by the proponent to undertake certain activities of the proposed include but not limited to the following with respect to the EMP implementation:

- ❖ Comply with the EMP provisions of relevant national and international regulations and best practices.
- ❖ Preparation and submission to the proponent through the Project HSE of the following Management Plans:
 - Environmental Awareness Training and Inductions.
 - Emergency Preparedness and Response.
 - Waste Management, and.
 - Health and Safety.
- ❖ Ensure adequate environmental awareness training for senior site personnel.
- ❖ Environmental awareness presentations (inductions) to be given to all personnel prior to work commencement. the Project HSE shall provide the content and topics that should be covered the awareness materials and should not be limited to the following guidance:

- The importance of complying with the EMP provisions.
- Roles and responsibilities, including emergency preparedness.
- Basic rules of conduct (Do's and Don'ts).
- EMP: aspects, impacts and mitigation.
- Fines for failure to adhere to the EMP, and.
- Health and safety requirements.
- ❖ Record keeping of all environmental awareness training and induction presentations, and.
- ❖ Attend regular meetings and environmental reviews /inspections of the operations.

4.5.5 Environmental Monitoring Specialist (MMO and FLO)

The proponent shall appoint a Marine Mammal Observation (MMO) and Fishery Liaison Officers (FLO) with responsibilities not limited to the following with respect to the EMP implementation:

- (i) MMO:
 - ❖ Record a written physical description of a marine mammal.
 - ❖ Log which direction it is travelling in.
 - ❖ Describe its behaviour.
 - ❖ Log the time.
 - ❖ Inform the contractor's seismic observers that they need to stop firing until further notice (which will be when the marine mammal has exited the exclusion zone).
 - ❖ Track the marine mammal and keep the seismic observers informed.
 - ❖ Attend regular meetings and environmental reviews /inspections of the operations, and.
 - ❖ Prepare daily, weekly, monthly / final closure monitoring report as may be applicable.
- (ii) FLO:
 - ❖ Act as the link between fishing vessels in the seismic survey area and seismic vessel.
 - ❖ Work closely with the OM and the fishing industry to minimise any potential impact of the project upon local fishing. The objective is to facilitate as far as possible, an arrangement based on coexistence.
 - ❖ Keeps local fishing vessels informed of ongoing work on major projects within that area. This allows local fishermen to understand the potential hazards and to plan their fishing activities accordingly. It also enables the seismic survey project to proceed unhindered by fishing vessels, saving significant time and money for the client or seismic contractor.
 - ❖ Attend regular meetings and environmental reviews /inspections of the operations, and.
 - ❖ Prepare daily, weekly, monthly / final closure monitoring report as may be applicable.

4.6 Specific Mitigation Measures

4.6.1 Specific Mitigation Measures Implementation

Based on the findings of the impact assessment as detailed in the EIA Report and summarised in Table 3.1-3.6 in this report, Table 4.1-4.3 provides the detailed specific mitigations measures to be implemented by the proponent with respect to the proposed 2D/3D seismic survey operations. The following is the summary of the key project stages linked to the migration measures:

(i) **Mobilisation and Pre-Survey Preparations (Table 4.1):**

- ❖ Pre-survey planning.
- ❖ Emergency and Contingency planning.
- ❖ EIA submission and approval.
- ❖ Environmental mitigation.
- ❖ Compliance with EIA and EMP.
- ❖ Notification of and coordination with relevant parties., and.
- ❖ Appointment of MMO and FLO.

(ii) **Actual Survey Operations (Table 4.2):**

- ❖ Adherence to EMP.
- ❖ monitoring of effects and performance assessment.
- ❖ Pollution control and waste management.
- ❖ Equipment management.
- ❖ Seismic source operation.
- ❖ Communication and notification to other vessels.
- ❖ Exclusion of other vessels.
- ❖ Prevention of emergencies, and.
- ❖ Emergency management procedures including oil spills.

(iii) **Post Survey Operations (Table 4.3):**

- ❖ Survey vessels to leave.
- ❖ Inform relevant parties of survey completion.
- ❖ Final waste disposal.
- ❖ Final observation reports, and.
- ❖ Close-out reports.

Table 4.1: Mobilisation and Pre-Survey Preparations.

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Pre-survey Planning	Allocate provisions for Environmental monitoring and Liaison with fishing, mining, petroleum industries and other users of the sea.	<ol style="list-style-type: none"> 1) Make provision for including Marine Mammal Observation (MMO) and Fishery Liaison Officers (FLO) as crew on board the seismic vessel. 2) Notify relevant government departments Ministry of Mines and Energy (MME), Ministry of Environment, Forestry, and Tourism (MEFT), Ministry of Fisheries and Marine Recourse (MFMR) and the Ministry of Work and Transport (MWT) Department of Maritimes Affairs Search and Rescue, Namibian Ports Authority and port captains 3) Determine the extent of local fishing, petroleum and mining activities within the survey area. 4) Notify other marine users, fishing industry (Namibian and foreign), marine petroleum, mineral prospecting and mining licence holders. <ul style="list-style-type: none"> - Notification must include <ul style="list-style-type: none"> ➢ navigational co-ordinates of the survey area ➢ timing and duration of proposed activities ➢ designated safety zone around the seismic vessel (500 m) 5) Finalise negotiations and resolve any conflict over the allocation of user rights prior to the commencement of operation. 6) Charter a local vessel to act as chase boat 	PGS, Operations Manager Seismic Contractor Environmental Coordinator		Prior to commencing survey operations	Minutes of meetings Copies of all correspondence MMO / FLO /SHE reports
Emergency and Contingency Planning	Preparation for any emergency that could result in an environmental impact	<ol style="list-style-type: none"> 1) Company (or representative) Emergency Response Plan. 2) Seismic & support vessel Contractor Emergency Response Plan (including. MEDIVAC) 3) Helicopter Operator Emergency Response Plan. 4) Oil Pollution Emergency Plan should refer to the National Marine Pollution Contingency Plan (NMPCP) 5) Ensure there is adequate protection and indemnity insurance cover for oil pollution 6) Produce vessel's seaworthiness certificate and/or classification stamp 	Seismic Contractor SHE Officer	Copies of all correspondence		Confirm compliance and justify any omissions
EIA submission and Approval / Environmental Clearance	Compliance with legislative requirements – Namibian EA Policy	Submit EIA and EMP to Ministry of Environment, Forestry, and Tourism for approval and issuing of Environmental Clearance Certificate (ECC)	PGS / Subcontractor		Prior to commencing survey operations	Final EIA and EMP Reports with ECC issued
Environmental Mitigation	Minimise impact on cetaceans and turtles	<ol style="list-style-type: none"> 1) Employ an MMO 2) Use visual monitoring during daytime 3) Use passive acoustic monitoring system for detections. 4) Initiate soft-start procedure. 5) Use 'turtle-friendly' tail buoys. Alternatively, the existing tail buoys should be fitted with either exclusion or deflector 'turtle guards'. 	PGS, Seismic Contractor Environmental Coordinator		Prior to commencing survey / appointment contractors	None

Table 4.1: Cont.

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Compliance with EIA and EMP	PGS and contractor to fulfil requirements set by MEFT, MME and MARPOL and Commit to adherence to EMP	<ol style="list-style-type: none"> 1) Ensure copies of ECC, EIA and EMP Reports are onboard throughout survey period 2) Ensure that a copy of the EIA report is provided to the Seismic contractor. 3) Elucidate all personnel of the EMP requirements and motivation. Assign duties appropriately. 4) Ensure availability of relevant personnel and suitable equipment to meet EMP requirements. 5) Notify other marine users and promote cooperation to minimise cumulative impacts. 	Seismic Contractor Operations Manager, Environmental Coordinator, Equipment Quartermaster, SHE Officer	Minutes of meetings Copies of all environmental awareness training manuals and schedules Self-audit	Prior to commencing survey operations	<p>Minutes of meetings</p> <p>Signed acknowledgment of receipt of EIA by Contractor</p> <p>Confirm compliance and justify any omissions</p>
Notification of and coordination of activities with relevant parties	Ensure that other users are aware of the seismic survey. Promote cooperation and coexistence with other users to minimise cumulative environmental impacts	<ol style="list-style-type: none"> 1) Notify relevant government ministries and departments – MFMR, MEFT, MME and MWT / Maritimes Affairs (SAR) 2) Notify other marine users, fishing industry (Namibian and foreign), marine petroleum, mineral prospecting and mining licence holders. <ul style="list-style-type: none"> - Notification must include <ul style="list-style-type: none"> ➢ Navigational co-ordinates of the survey area ➢ Timing and duration of proposed activities ➢ Designated safety zone around the seismic vessel (500m). 3) Notify fishing operators through recognised fishing associations, MFMR, fishing companies, agents or through MME <ul style="list-style-type: none"> ➢ Notify operational fishing vessels directly where required or encountered 4) Transmit Daily Radio Navigation Warnings and Notices to Mariners the survey vessel's position and operation progress 	Seismic Contractor Operations Manager, Environmental Coordinator	Copies of all correspondence Copies of notices sent	Notice to Mariners at least 24 hours before start of survey Daily positional updates throughout survey	Copies of notices and list of recipients/ addressees
Appointment of FLO / MMO	Ensure compliance with EMP Minimise impacts	Appoint trained FLO who are familiar with fisheries operational in the area and MMO must have experience in seabird, turtle, seal and marine mammal identification and observation techniques.	Seismic Contractor	FLO / MMO contract and reports	Prior to commencing survey	Monitoring reports

Table 4.2: Actual survey operations.

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Adherence to EMP and Industry Best Practices	Operate in an environmentally responsible manner	1) Comply fully with the EMP (compliance means all activities are undertaken successfully and details recorded). 2) Abide by terms of internationally recognised Environmental Management Policy <ul style="list-style-type: none"> ➢ Include environmental awareness training, waste management, environmental monitoring, procedure and data recording. 3) Comply with the Joint Nature Conservation Committee (JNCC) "guidelines for minimising the risk of injury and disturbance to marine mammals from seismic survey" 4) Comply with " <i>Environmental Guidelines for Worldwide Geophysical Operations</i> " as issued by the Energeo Alliance's, formerly known as the International Association of Geophysical Contractors (IAGC)	Operations Manager and Seismic Contractor, FLO and MMO	Self-audits	During the survey period	Copies of self-audit reports FLO and MMO reports
Helicopters Crew changes, Services or in an event of an Emergency as may be required	Minimise noise impact to coastal fauna	1) Instruct helicopter operator and pilots not to overfly Ramsar sites, islands, coastal reserves, bird and seal breeding colonies. If not possible <ul style="list-style-type: none"> ➢ Minimum altitudes of 600 m over nature conservation/breeding areas ➢ No-fly zone 3km seaward and 1km landward of sensitive area ➢ Avoid seabird colonies on the numerous offshore islands 2) Brief all pilots on the ecological risks associated with flying over seabird and seal colonies and at a low level parallel to the coast. 3) Avoid prolonged coast-parallel flights within 1 nautical mile of the shore) 4) Maintain reasonable altitude over sea (600 m) if cetaceans are spotted. 5) Report any deviations from pre-set flight paths.	Operations Manager Environmental coordinator Helicopter operator	Report deviation from prescribed flight path	Ad Hoc As required	Log of flight paths
Equipment management	Minimise equipment loss overboard and minimise hazards on seafloor or floating	1) Keep a record of all items lost overboard including time and location 2) Inform relevant authorities (MEFT, MFMR, MME), and other users in the area (mining houses, fishing companies). 3) When any items that constitute a seafloor or navigation hazard are lost a standard form must be completed including: <ul style="list-style-type: none"> ➢ Date and cause of loss ➢ Details of equipment (Type, Size) ➢ Vessel ➢ Location ➢ Sea state and weather ➢ Nature of the Seafloor 	Seismic Contractor Operations Manager Equipment quartermaster Environmental officer	Incident records	During the operation	List of lost equipment Copy of record sheet

Table 4.2: Cont.

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Pollution control and Waste Management	Minimise marine pollution Maximise recycling Adherence to MARPOL 73/78	1) Minimise pollution and maximise recycling by implementing and maintaining a company waste management policy. 2) Comply with legal requirements for waste management and pollution control (for air and water quality levels at sea) by educating crew, adhering to MARPOL policies and monitoring practices. 3) Ensure all crew is trained in spill management. 4) Ensure that a waste disposal contractor disposes of waste returned to port at a licensed landfill site. 5) Ensure waste disposal is carried out in accordance with appropriate laws. 5) Supply vessels must comply with internationally agreed MARPOL standards MARPOL Procedures and Guidelines <ul style="list-style-type: none"> • <i>General waste:</i> Minimise waste generation -No disposal overboard. • <i>Galley waste:</i> Reduce to < 25 mm prior to disposal overboard if < 12 NM from shore - No disposal within 3 NM of the coast. • Disposal without macerating – vessel must be >12 nautical miles from shore. • <i>Medical waste:</i> Seal in aseptic containers for disposal onshore. • <i>Deck drainage:</i> Use biodegradable, non-toxic cleaning agents • Ensure that weather decks are kept free of spillage. Mop any spill immediately. Collect in oily water separator systems. • <i>Machinery space drainage:</i> Collect used oil and oily water • Filter oily water and release water of < 5ppm oil in water • Dispose of sludge in appropriate facility at port. • Return waste oil to shore for processing • <i>Solid waste:</i> Incinerate onboard or store and transport to port for disposal on land. • <i>Hazardous waste:</i> record volume and type brought onboard • Store in dedicated waste containers • Dispose of in the designated site at port. • <i>Sewage:</i> use approved treatment plants set to MARPOL standards. Discharge only where the high wind and wave energy is expected to result in rapid dispersal. Discharge treated sewage between 4 and 12 NM from the coast. No sewage discharge within 4 NM of the coast. No treatment needed if beyond 12 NM from coast, However, vessel must be moving at ≥4 knots before discharging at a moderate rate. • <i>Metal:</i> Send to shore for recycling or disposal. • <i>Minor oil spill:</i> Use oil absorbent. • <i>Atmospheric emissions:</i> Maintain and tune all hydraulic hoses, engines, motors, generators to minimise soot and unburned diesel. 	Seismic Contractor Operations Manager Environmental coordinator	Self-audit Registers Record books Daily reports	Throughout survey operations	Summary of waste record book Waste disposal schedule Receipts from disposal agents/sites Record destination of waste for on land disposal Report occurrence of minor oil spills

Table 4.2: Cont.

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Communication and notification to other vessels, Coordination with other users	Minimise disruption to other users. Promote cooperation Promote safe navigation Minimise cumulative impacts	1) Notify relevant government ministries and departments – MFMR, MEFT, MME, Namibian Ports Authority. Port Captains and Commissioner for Petroleum Affairs 2) Notify other marine users, fishing industry (Namibian and foreign), marine petroleum, mineral prospecting and mining licence holders. - Notification must include <ul style="list-style-type: none"> ➢ Navigational Coordinates of the Survey Area ➢ Timing and Duration of Proposed Activities ➢ Designated safety zone around the seismic vessel (500 m). 3) Notify fishing operators through recognised fishing associations, MFMR, fishing companies, agents. <ul style="list-style-type: none"> ➢ Notify operational fishing vessels directly 4) Transmit Daily Radio Navigation Warnings and Notices to Mariners re the survey vessel's position and operation progress 5) Co-operate with other users to minimise disruption of their activities. 6) Co-operate with other legitimate users of the sea to minimise cumulative impacts on marine life.	Seismic Contractor Operations Manager Environmental Coordinator FLO	Copies of written notices and correspondence	Notice to Mariners at least 24 hours before start of survey Daily positional updates throughout survey During survey operations as required	Copies of notices and list of recipients/ addressees/ FLO Reports / notes/ minutes
Exclusion of other vessels	Minimise probability of collision or contact incidents	1) Use communication channels (radio and email) to inform all other potential users about the survey locations, timing, priority of passage, safety exclusion zones. 2) Keep constant watch for approaching vessels during operations. 3) Warn by radio and chase boat if required. 4) Communicate any delays or equipment loss. 5) Record any unusual incidents	Survey Contractor Environmental Coordinator Operations Manager FLO Officer of the watch Chase boat skipper	Daily Reports Copies of written communication Incident Report	During the survey operations	Copies of written communication Incident Reports/FLO Reports / notes/ minutes
Prevention of emergencies	Minimise potential emergency Minimise environmental damage Minimise extraneous costs	1) Prevent collisions by ensuring good communications with relevant parties. 2) Ensure seismic and support vessels display correct signals by day and lights by night (including twilight) 3) Set watches – visual, radar and standby vessel. 4) Identify any long-line activity in survey area and communicate with fishers as to location of gear. 5) Service equipment regularly 6) Conduct weekly emergency drills. 7) Establish lines of communication with emergency response: <ul style="list-style-type: none"> ➢ MEFT, MFMR, MWTC, Sea Rescue Institute of Namibia, Ports Captains. 	Survey Contractor Environmental Coordinator Operations manager FLO Officer of the watch Chase boat skipper	Daily Reports Copies of written communication Incident Report	Throughout survey operations	Copies of written communication Incident Reports/ FLO Reports / notes/ minutes

Table 4.2: Cont.

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Emergency management procedures (include. Oil Spills)	Minimise environmental damage Minimise distress and tragedy	<p>1) Adhere to code of conduct and Law of the Sea obligations regarding other vessels in distress.</p> <p>2) In the event of an onboard crisis implement health and safety procedures in accordance with emergency plans.</p> <p>3) In the event of an oil spill immediately notify NAMPORT and the Commissioner for Petroleum Affairs. Information required when reporting a spill includes:</p> <ul style="list-style-type: none"> ➤ The type and circumstances of incident ➤ Ship name, type, port of registry ➤ Nearest agent representing the ships company ➤ Location (lat, long), distance offshore and extent of oil spill ➤ Prevailing weather conditions and sea state ➤ Persons and authorities already informed of the spill. <p>Where diesel, which evaporates relatively quickly, has been spilled, the water should be agitated or mixed using a propeller boat to aid dispersal and evaporation.</p> <p>Dispersants are most effective:</p> <ul style="list-style-type: none"> ➤ On fresh crude oils. under turbulent sea conditions (dispersants require mixing). ➤ When applied within 12 hours or at a maximum of 24 hours after the spill. <p>The volume of dispersant application should not exceed 20-30% of the oil volume.</p> <p>Dispersants should not be used without authorisation by MFMR.</p> <p>Dispersants should not be used:</p> <ul style="list-style-type: none"> ➤ On diesel or light fuel oil or on heavy fuel oil. ➤ On slicks > 0.5 cm thick. ➤ On any oil spills within 5 nautical miles offshore ➤ In water depths < 30 m ➤ When spill is so far offshore there is little chance of oil reaching the shore. 	Survey Contractor Environmental Coordinator Operations manager/ SHE Officer of the watch	Daily Reports Copies communication Incident Report	Throughout survey operations	Copies of communication Incident Reports

Table 4.2: Cont.

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Seismic source Operation	Minimise impact of seismic noise on marine fauna	<p>1) Maintain continuous watch for marine life within 500 m of vessel and energy source. PAM should be used at night and in periods of poor visibility.</p> <p>2) Use of the lowest practicable source volume as defined by the operator.</p> <p>3) Implement the following procedures before and during shooting:</p> <ul style="list-style-type: none"> No seismic activity if birds and/or animals are observed within 500 m of the vessel or the source array. Commence "soft-start" procedures if no animals or diving birds have been sighted within the safe zone (500 m) for at least 30 minutes. If after 30 minutes, small cetaceans (dolphins) and seals are still in area, normal "soft start" procedures may commence Re-initiate "soft starts" after a cessation in firing of 20 minutes or longer. Ramp-up proportionally if break was shorter than 20 minutes. Activate low level warning shots during turns and repositioning, unless using PAM. <p>Temporarily terminate seismic shooting when:</p> <ul style="list-style-type: none"> Negative behaviour indicating distress directly related to the source is observed Animals and/or birds are observed within 500 m of the operating source or the vessel (except dolphins and seals) Animals and/or birds approach the source (except dolphins and seals) Injury occurs as a direct result of the survey. Natural avoidance behaviour is over-ridden by feeding response near the seismic array (e.g., Due to the presence of stunned fish) There is mass mortality or evidence of mass disorientation or injury of fish and/or invertebrates. <p>At night:</p> <ul style="list-style-type: none"> PAM will be used. Lighting on board survey vessels should be reduced to the minimum safety levels to minimise the potential stranding of pelagic seabirds Any stranded seabirds must be retrieved and released according to appropriate guidelines <p>4) Record sightings of any injured or dead protected species, regardless of whether the injury or death was caused by the seismic vessel itself. If the injury or death was caused by a collision with the seismic vessel, the date and location (lat, long) of the strike and the species and a description of the animal and/or bird should be recorded.</p>	<p>Survey Contractor</p> <p>Environmental Coordinator</p> <p>Officer of the watch</p> <p>MMO</p>	<p>Self-audit</p> <p>Daily Reports</p> <p>Shut-down logs</p> <p>IMO/MMO reports</p> <p>Incident Report</p> <p>Records of marine fauna observations and "Soft-start" procedures</p>	<p>Prior to and throughout survey operations</p>	<p>IMO/MMO reports</p> <p>Copies of completed marine fauna observation forms and seismic activity log showing "Soft-start" Initiation.</p> <p>Log of shutdowns, including all decisions and discussions relevant to the termination.</p>

Table 4.2: Cont.

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Ongoing monitoring of effects	Ongoing monitoring programmes (in conjunction with government if required)	1) Initiate monitoring programmes as per specific indication by authorities, 2) Monitor performance against objectives and targets 3) Document all activities and findings for internal and external audits 4) Undertake daily monitoring and recording of the following: <ul style="list-style-type: none"> ➤ Marine mammals and sea birds sighted ➤ Record species and numbers in relation to survey activities ➤ Responses of animals and birds to seismic activity ➤ Fish or invertebrate mortality associated with source firing ➤ Record sound levels and "soft start procedures" ➤ Record changes in behaviour (swimming motion, feeding, diving patterns, change in swimming direction and speed, startle responses) ➤ Record vessel interaction, particularly if chase boat was used to maintain safe operational zone ➤ Details of unattended fishing gear ➤ Document communication with other vessels 	Seismic Contractor Environmental Coordinator MO	Daily Reports	During survey operations	Daily reports MMO reports
Performance assessment	Ongoing monitoring programme and EMP Performance Assessments	1) Implement the ongoing monitoring programmes and EMP Performance Assessment as determined by MME 2) Submit Environmental Performance Assessment reports to MME and MEFT 3) Performance assessment based on successful implementation of EMP Data recorded should include: <ul style="list-style-type: none"> ➤ Species and numbers ➤ Location (lat, long) ➤ Relation to vessels (distance, approaching/retreating) ➤ Swimming direction and speed ➤ Change in swimming direction/speed as a result of survey activities ➤ Stunning or mortality as a result of survey activities Take note of: <ul style="list-style-type: none"> • Seismic source activities, including sound levels, "soft-start" procedures, shut-down and pre-firing regimes, night-time survey, relocation • Meteorological conditions and sea state • Compliance with (MARPOL 73/78 regulations) 4) Submit reports to ministries weekly and to research institutes such as the National Marine Information and Research Centre (NatMirc) in the MFMR for analyses of survey impacts in local waters.	Seismic Contractor SHE FLO and MMO	Daily reports MMO reports	During survey operations and after completion of survey Required regularity of performance assessment to be determined by MEFT and MME	Monitoring reports Provide all recorded information

Table 4.3: Post survey operations.

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Survey vessels to leave area	Leave area in state that it was prior to survey operations	Ensure that all deployed equipment is retrieved.	Seismic Contractor Operations Manager SHE Equipment Quartermaster	Self-Audit Equipment records	On completion of survey operations	SHE / Environmental Coordinator Report
Inform relevant parties of survey completion	Ensure all relevant parties are aware of completion of survey operations	1) Inform MEFT, MME and MFMR of completion of survey operations 2) Inform other users of completion of survey operations (Fishing Industry Mining Companies) <ul style="list-style-type: none"> Inform fishing companies and vessels through recognised fishing associations. 	Seismic Contractor Operations manager SHE Environmental Officer	Records of communication	Within a fortnight of survey completion	Copies of communication and notification documents
Final waste disposal	Minimise pollution, maximise recycling Ensure correct disposal of all waste brought to port	1) Dispose of all waste retained onboard at a licensed waste site through a licensed waste disposal contractor.	Seismic Contractor operations manager SHE Environmental Officer	Receipts from waste disposal contractor	In port	Receipts from waste disposal contractor and sites
Final observation reports	Share information with interest groups	1) Share faunal observation reports with relevant parties/associations and MFMR, MEFT.	MMO and FLO	Reports	After completion of survey	FLO and MMO monitoring reports
Close-out report	Ensure corrective action and EMP compliance	1) Compile a seismic survey "close-out" report on completion of the survey. 2) Base "close-out" report on the monitoring requirements and the EMP. 3) Provide information / records asked for in "close-out" report column of EMP 4) Submit copies to MEFT and MME	PGS / External Consultant such as Risk-Based Solutions (RBS) CC		Three (3) months after survey close	Above information, records and reports

5. MONITORING AND REPORTING

5.1 OVERVIEW

The current Namibian environmental assessment and management procedure requires the submission of biannual Environmental Monitoring Reports (EMRs) or as the Environmental Clearance Certificate (ECC) additional conditions that may be stipulate.

It recommended that the EMRs as submitted when due even if no activities did take place. The EMRs are used to support the renewal of the ECC once it expires after three (3) years.

The EMRs shall comprise the summary description of the activities undertaken for the period under review, the EMP implementation and the submission of the monitoring datasets collected. The regular submission of EMRs and collation of data may facilitate recognition of effects and impacts not previously foreseen and allow for the implementation of precautionary measures and mitigation before the impacts become significant.

The monitoring programme acts as a quality assurance check list on all environmental procedures and environmental performances with respect to the implementation on the EMP. The following is the summary of the key general component of the EMP monitoring framework that shall be monitored and documented in addition to the specific reporting by the SHE / Environmental Coordinators, FLO and MMO activities:

- 1) I&AP consultation and communication records:
 - a. Pre-survey meetings.
 - b. Communication with I&APs, and.
 - c. Notice to Mariners.
- 2) Port calls.
- 3) Vessel operations:
 - a. Fuel consumption.
 - b. Oil consumption, and.
 - c. Water consumption.
- 4) Weather and Climate:
 - a. Atmospheric weather conditions, and.
 - b. Sea state.
- 5) Marine Fauna sightings and interactions
 - a. Invertebrates (sightings / reaction to survey).
 - b. Turtles (sightings / reaction to survey).
 - c. Sea Birds (sightings / reaction to survey /landing on vessel).
 - d. Seals (sightings / reaction to survey).

- e. Baleen whales (sightings / reaction to survey).
 - f. Toothed whales and dolphins (sightings /reaction to survey).
 - g. Cetaceans (sightings /reaction to survey), and.
 - h. Fish / fishing vessel/s (sightings / reaction to survey).
- 6) Incidents involving other marine users:
- a. Daily updates (survey position and progress).
 - b. Fishing industry interaction (incident record – vessels / gear), and.
 - c. Other Vessels (incident record).
- 7) Onboard environmental awareness:
- a. Environmental training.
 - b. Waste management:
 - i. Discharge to atmosphere (volume).
 - ii. Discharge to sea:
 - o Sewage (volume), and.
 - o Galley waste (tonnage).
 - iii. Disposal at port:
 - o Solid waste (tonnage/ disposal site).
 - o Hazardous Waste (volume/ disposal site), and.
 - o Other waste (volume/ disposal site)
- 8) Emergencies:
- a. Service record.
 - b. Major Oil/ Chemical spills.
 - c. Emergency Drills / Training, and.
 - d. Health and Safety Briefings.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 EMP Conclusions

This EMP report has been prepared based on the findings and recommendations of the EIA Report to mitigate the significant potential negative impacts that the proposed Multiclient / Proprietary 2D/3D seismic survey activities may have on the receiving marine environments covering physical, biological, and socioeconomic components). If the mitigation measures are implemented and monitored, any likely negative impacts that the proposed Multiclient / Proprietary 2D/3D seismic survey activities may have on the receiving environment are likely to be reduced significantly, thereby promoting the coexistence of petroleum exploration activities with natural marine environment and other marine users such as fisheries. The mitigation measures presented in this EMP merged the Proponent's international best practices mitigations measures with local species events such as the whale migration corridors and timings, key fish spawning areas and timing, key fishing seasons, breeding and feeding areas as well as several unique marine ecosystems of the Walvis, Orange and Lüderitz Basins, offshore Namibia.

The overall EMP framework and mitigation measures presented in this report are tailored-made to Namibia's southern offshore environment and considered the peak primary and secondary Whales migration periods in Namibia are May-July and October–November, respectively, as well as the probability of encountering whales outside these peak migration periods.

Offshore seismic survey, especially 3D survey, can only be undertaken in the Namibian waters during calm weather window months between November-March. Temporary, operational and other key avoidance mitigatory measures have been considered in this EMP to mitigate for the likely overlaps with marine mammals migratory periods and other marine users with the suitable weather window for undertaking seismic survey in the Namibian marine environment. In addition to the company's strict compliance with all the relevant national regulations and standards, the Proponent shall always consider international standards of protection developed through the Joint Nature Conservation Committee (JNCC) "guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys", and the Energeo Alliance's, formerly known as the International Association of Geophysical Contractors (IAGC)'s "recommended mitigation measures for cetaceans during geophysical operations". These international best industry practices have proved to be effective in several different countries like Canada, Australia, Norway, and the United States. These guidelines have been developed based on noise attenuation modelling, international experiences during seismic acquisition and a cautious approach to the disturbance of marine mammals from seismic surveys.

6.2 EMP Framework Recommendations

It is hereby recommended that the proposed Multiclient / Proprietary 2D/3D seismic survey activities covering the Walvis, Orange and Lüderitz Basins, offshore Namibia, shall go-ahead and be granted with an ECC. The proposed Multiclient / Proprietary 2D/3D seismic survey can coexist with other proposed and ongoing marine related activities in the AOI and precautionary principles and actions shall be exercised by the Proponent at all times.

Based on the findings of the EIA Report and the mitigation measures provided in this EMP, the first annual survey event for the proposed Multiclient / Proprietary 2D/3D seismic survey activities is recommended to start from December where possible, if the ECC is granted by the Environmental Commissioner (Table 5.1). However, if the survey has to start before December, due to the limited favourable weather window for conducting seismic survey in the Namibian waters which is from November-March, the Proponent shall implement the precautional principles, and mitigation measures linked to international best practices as recommended by the JNCC of the IAGC for protecting cetaceans during geophysical operations in addition to the other key mitigation measures as detailed in the EMP Report.

Notifications to marinas shall be issued before the start of the proposed 2D/3D seismic survey to be supported by continuous communications and monitoring during the actual survey operations. Seismic survey operations within the proposed AOI should not coincide with the MFMR stock assessment survey as shown in Table 5.1.

Table 5.1: RBS developed coexistence Knowledge-Based System Model Methodology (KBSMM) log framework fully validated and populated during the EIA process in identifying suitable window/s of opportunities for undertaking the proposed Multiclient/Proprietary 2D/3D seismic survey activities with respect to the receiving environment in the Walvis, Lüderitz and Orange Basins, offshore Namibia..

MONTH	KEY FISHING SEASON (KEY SPECIES)	MAIN SPAWNING ACTIVITIES (KEY SPECIES)	MINISTRY OF FISHERIES AND MARINE RESOURCES STOCK SURVEYS	KEY CETACEOUS PRESENCES / MIGRATORY TIMES	OTHER KEY USERS	WEATHER WINDOW	COMMENTS ON OFFSHORE SEISMIC SURVEY OPPORTUNITY WINDOW
January	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster		Hake Stock Survey			Good	Impact – Hake Stock Survey (less than-1000m), Tuna migrating (Trip Seamount) SURVEY PLANNED TO START 2024
February	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster						Impact – Hake Stock Survey (less than-1000m), Tuna migrating (Trip Seamount)
March	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster				❖ Marine Diamond Exploration and Mining in shallow water less than -200m.	Moderate Mixed	Impact – Tuna migrating (Trip Seamount)
April	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster						Impact – Tuna migrating (Trip Seamount)
May	Hake Trawl, Monk			Whales Migration Primary Peak Period	❖ The Survey area covers an area which is a busy international shipping lane	Very Poor	No Impacts but unfavorable weather
June	Snoek, Hake Trawl, Monk	Snoek, and Orange Roughy					
July	Hake Trawl, Monk					Poor	Impact – Orange Roughy spawning (shallow waters), Snoek migrating in deepwater
August	Hake Trawl, Monk				Impact – Orange Roughy aggregated spawning, Snoek migrating in deepwater		
September	Surface Longline, Hake Trawl, Monk			Whales Migration Secondary Peak Period		Moderate Mixed	Impact – Snoek migrating in deepwater
October	Pole and line Tuna, Surface Longline, Monk	Rock Lobster	Rock Lobster Stock Survey				Impact – Shallow water rock Lobster Stock Survey, Tuna migrating (Trip Seamount)
November	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster		Monk Stock Survey			Good	Impact – Monk Stock Survey (less than-1000m), Tuna migrating (Trip Seamount)
December	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster				Impact – Tuna migrating (Trip Seamount)		

6.3 EMP Recommendations

The following is the summary of the EMP recommendations to be implemented and monitored by the Proponent with respect to the proposed Multiclient / Proprietary 2D/3D seismic survey activities over the Walvis, Lüderitz and Orange Basins, offshore Namibia:

9. Procedure for Commencement of Operations:

- (i) Exclusion zone:
 - 500 m horizontal radius from centre of source array.
- (ii) Visually monitor the exclusion zone:
 - In water depths of greater than 150m, for at least 30 minutes prior to activating seismic sources, observer(s) should visually survey the 500 m exclusion zone for cetaceans.
 - Observer(s) assigned to visual observations during commencement of operations:
 - Observer(s) should be trained to an acceptable standard.
 - Observer(s) may be crew members, other employees, or third-party contractors, and.
 - All visual observations and operations should be electronically documented and made available for evaluation and study.
 - If cetaceans are present within the 500m exclusion zone, delay the start of soft-start procedure until at least 20 minutes after the last sighting of a cetacean, and.
 - If there are no cetaceans present, initiate soft-start procedure.
- (iii) Soft Start Procedure:
 - To achieve the soft start principle of commencing with the smallest volume element in the array and progressing to the full operating volume of the source over a specified period, the following key elements will be implemented:
 - The first stage of soft start will involve activating the smallest volume element in the array.
 - Subsequent stages will involve doubling the number of active elements at the commencement of each stage.
 - All stages should ideally be of approximately equal length.
 - The total duration of the soft start should be at least 20 minutes.
 - As there will generally be one stage in which doubling the number of elements is not possible (due to the number of elements in the full array not being, for example, 8, 16 or 32) it is preferable to make this stage the last one of the soft start sequences (as opposed to adjusting the increments of other stages or placing a lower increment early in the soft start sequence).
 - To minimise additional noise in the marine environment, a soft-start (from commencement of soft-start to commencement of the line) should not be significantly longer than 20 minutes (for example, soft-starts greater than 40 minutes are considered to be excessive, and an explanation should be provided within the MMO report), and.
 - Operators should avoid unnecessary firing at full power before commencement of the line.

(iv) Periods of poor visibility and darkness:

- Initiate soft-start procedure as above, and.
- Use passive acoustic monitoring system for detections.

10. Procedure for Ongoing Operations:

- (i) If seismic sources are silent for 5 minutes or more, use soft-start procedure.
- (ii) Report immediately to MMO or FLO if there is any animal in distress, animal carcasses, etc.
- (iii) The vessels involved in the project must not move towards cetaceans whenever it is possible. Wherever possible the vessels must avoid and distance themselves from these animals.
- (iv) Whenever possible the speed of the project vessels must be limited to a maximum of 13 knots.
- (v) Whenever protected marine mammals are observed within the exclusion zone, **the shots must be interrupted** and thereafter a slow-start procedure followed, and.
- (vi) If marine mammals are detected within 500 metres of the centre of the source array whilst the sources are firing, either during the soft-start procedure or whilst at full power, **there is no requirement to stop emitting the sources.**

11. Procedure for Testing Source Elements:

- (i) If a source test is necessary whereby each source element must be activated individually.
- (ii) Visually monitor the exclusion zone before any instances of seismic source testing.
 - At least 30 minutes prior to activating seismic sources, observer(s) should visually survey the 500m exclusion zone for cetaceans.
 - Observer(s) assigned to visual observations during commencement of operations
 - Observer(s) should be trained to an acceptable standard.
 - Observer(s) may be crew members, other employees, or third-party contractors.
 - All visual observations and operations should be electronically documented and made available for evaluation and study.
 - If cetaceans are present within the 500m exclusion zone, delay the start of soft-start procedure until at least 20 minutes after the last sighting of a cetacean.
 - If cetaceans are absent from the 500m zone, initiate the seismic source, starting with the smallest volume source element and working up to the larger volumes, and.
 - If the intention is to test a single source on low power, then a soft start is not required.

12. General Practices:

- (i) Environmental awareness programmes must be organised for all crew members to explain the conservation status of the cetaceans and turtles and to highlight the importance of the mitigation measures.

- (ii) Ensure that the support vessel(s) are in watch of the safety zone established around the seismic vessel (5.5km ahead and abeam and 13 km as clearance from the vessel) this measure will allow the reduction of potential safety risks associated with the seismic operations especially with the fishing vessels while working in the shallow waters.
- (iii) High intensity unnecessary noise must be avoided where possible.
- (iv) Any occurrence of large marine mammals should be brought to the attention of MMO or FLO.
- (v) MMO and FLO observations shall always be made when the vessel is moving (not only during seismic acquisition).
- (vi) Regular maintenance must be performed on the project vessels and the maintenance team must pay special attention to the noise produced by the vessels.
- (vii) Whenever possible, ensure that the towed exploration materials (buoys, air cannons, etc.) do not have gaps (or these must be covered or reduced) in which the animals (e.g. turtles) can get stuck.
- (viii) All crew members must be forbidden from killing or causing injuries to marine fauna. Any crew member that deliberately kills or causes any damage to marine fauna must be immediately dismissed, reported to the relevant authorities and sent to shore.
- (ix) There must be someone in the support vessels who is responsible for watching out for the possible occurrence of these animals in the vicinity of ships.
- (x) In the event of entanglement, all activities must stop and the rescue actions to rescue the animal must be put into practice.
- (xi) Through the Petroleum Commissioner in the Ministry of Mines and Energy or directly, request from the Namibian Maritime Search and Rescue (SAR), Department of Maritimes Affairs in the Ministry of Works and Transport in their capacity as the national maritime authority, for instructions on the rules and procedures that shall be adhered to, prior-to and during the seismic operations in Namibian territorial (jurisdictional) waters, and.
- (xii) It shall be ensured that the "Navigation Warnings" are issued and disseminated through the Petroleum Commissioner in the Ministry of Mines and Energy or directly through Namibian Maritime Search and Rescue (SAR), Department of Maritimes Affairs in the Ministry of Works and Transport maritime communications network, as well as through other means of dissemination as may be available while at sea.

13. Pollution Prevention and Management:

- (i) The procedures for deposition applied must comply with national legislation (e.g., Regulation for the Prevention of Pollution and Marine and Coastal Environmental Protection, Decree No. 45/2006 of 30 November) and international best practices (eg. International Convention for the Prevention of Pollution by Ships – Marpol 73/78).
- (ii) The treatment of sewage must be done before it is discharged into the sea, according to the recommendations by Marpol 73/78.
- (iii) The ships must perform the treatment of the bilge waters onboard or do the transshipment offshore, in compliance with the recommendations by Marpol 73/78.
- (iv) Implement a Pollution Control Programme, including the treatment, adequate disposal and minimizing waste, according to the recommendations by Marpol 73/78.

- (v) The frequent monitoring of the disposed waters, as a means of ensuring that the levels of pollutants are within the recommended standards.
- (vi) The seismic vessel shall possess a manual of procedures to deal with domestic garbage that if correctly applied, prevent and minimize the potential negative effects of this impact.
- (vii) The Proponent shall ensure that the seismic vessel possesses a Plan for Domestic Residues Management that is in conformity with Annex V of the MARPOL Convention: Prevention of Pollution by Garbage from Ships.
- (viii) All atmospheric pollution emissions shall comply with the Mozambican Laws and International Guidelines.
- (ix) According to Annex VI of the MARPOL 73/78 Convention, the content of the oils sulphuric shall have a maximum value of 4.5% m/m except in cases that the seismic vessel is equipped with an approved cleaning system for the treatment of exhaustion gases or any other technical method that is verifiable and that reduces the SO₂ emissions to a maximum of 6.0 g/kWh¹, and.
- (x) The incineration of packaged contaminated materials on board the seismic vessel and Polychlorinated Biphenyls (PCBs) is prohibited. Furthermore, the deliberate emission of substances that are prejudicial to the Ozone Layer, including halon and the chlorofluorcarbonates (CFCs) is also prohibited.

14. Spills Prevention and Management:

- (i) All equipment and machinery that could potentially leak or spill fuel must be regularly maintained, inspected and tested.
- (ii) An Emergency Response Plan for Oil Spills must be prepared and must include, at least, the requirements specified by the World Bank related to Health, Safety and the Environment during Offshore Petrol and Gas operations (World Bank Group, 2015).
- (iii) In the event of fuel spills or other chemicals, an Emergency Response Plan for Oil Spills must be put into action /implemented. The capacity to implement that plan must be proven before the start of any activities.
- (iv) The Emergency Response Plan for Oil Spills must consider the best measure and the state-of-the-art methods for containing spills or loss of fuels, oil and chemical products, in all the vessels involved in the Project.
- (v) Regular adequate training must be provided for all Project workers, related to the prevention, containment and response to spills.
- (vi) All equipment involved in the response to spills must be frequently maintained, inspected and tested.

15. Overall Compliances:

- (i) Compliance to all relevant national, regional and international (MARPOL) marine pollution prevention regulations, standards, guidelines and procedures, and.

16. Adoption of the Precautionary Principles:

- (i) In the absence of any specific mitigation measures being provide in this EMP Report, the Proponent and / or Contractor shall always adopt the precautionary principles / approaches.