PROPOSED SPECULATIVE 2D AND 3D SEISMIC SURVEYS OFF THE SOUTH AND WEST COAST OF SOUTH AFRICA: ENVIRONMENTAL MANAGEMENT PROGRAMME

Prepared for: Petroleum Geo-Services
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<table>
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<tr>
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<tbody>
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<td>EMP issued for I&amp;AP review</td>
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EXECUTIVE SUMMARY

1. INTRODUCTION

1.1 BACKGROUND

In October 2018, Petroleum Geo-Services (PGS) submitted an application for a Reconnaissance Permit to the Petroleum Agency SA (PASA) in order to apply to undertake a multi-client speculative two-dimensional (2D) and three-dimensional (3D) seismic surveys in a number of petroleum licence blocks off the South and West Coast of South Africa (see Figure A). The application was made in terms of Section 74 of the Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA).

Actual survey commencement would ultimately depend on a permit award date and the availability of a survey vessel. Furthermore, the duration of the surveys would be dependent on whether the 2D and 3D surveys are run concurrently or at a different times. It is, however, anticipated that the surveys would take in the order of five months to complete. Should the permit be awarded, it is anticipated that the proposed surveys could commence within Q1 or Q2 2019, with the balance of the survey resuming at the end of December 2019.

PASA has requested that in order for PGS to obtain a Reconnaissance Permit, it must prepare a ‘plan for managing potential environmental impacts that may result from the proposed operation and notify consult with affected parties’ and submit it to them for consideration by the Minister of Mineral Resources. For this application, the plan is referred to as an Environmental Management Programme (EMP)\(^1\).

PGS has appointed SLR Consulting (South Africa) (Pty) Ltd (SLR) to compile this EMP and undertake the required public participation process for the proposed speculative seismic surveys.

1.2 OPPORTUNITY TO COMMENT

This report has been distributed for public review and comment from 15 November to 15 December 2018 in order to provide Interested and Affected Parties (I&APs) and authorities with an opportunity to comment on any aspect of the proposed project. Copies of the full report have been made available on the SLR website (at http://slrconsulting.com/za/slr-documents/).

All I&APs registered on the project database have been informed of the release of the report and where the full report can be reviewed. In order to be included in the final EMP, any comments on the EMP should be forwarded directly to SLR at the address, telephone/fax numbers or e-mail address shown below by no later than 15 December 2018.

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\(^1\) There is currently no legislated environmental process prescribed for a Reconnaissance Permit application. A legislated Environmental Impact Assessment process in terms of the National Environmental Management Act, 1998 (No. 107 of 1998) is thus not required.
FIGURE A: LOCALITY OF THE PROPOSED RECONNAISSANCE PERMIT AREA (BLUE OUTLINE).
2. EMP PROCESS

2.1 OBJECTIVES

The objectives of the EMP process are:

- To provide a reasonable opportunity for I&APs to be consulted on the proposed project;
- To ensure that potential key environmental issues and impacts that could result from the proposed project are identified;
- To assess potential impacts related to the proposed project;
- To present appropriate mitigation or optimisation measures to minimise potential impacts or enhance potential benefits; and
- Through the above, to ensure informed, transparent and accountable decision-making by the relevant authorities.

2.2 PUBLIC PARTICIPATION PROCESS

The public participation tasks as part of the EMP process include the following:

1. A preliminary I&AP database has been compiled of authorities and organs of state (local and regional), Non-Governmental Organisations, Community-based Organisations and other key stakeholders (including the fishing industry, overlapping and neighbouring users with delineated boundaries in the oil/gas and mining industries). This database was compiled using databases of previous studies in the area. A total of 134 I&APs have been included on the project database to date (refer to Appendix 1.1).
2. Advertisements announcing the proposed project and the availability of the Draft EMP for public review and comment were placed in four regional newspapers (Namakwalander, Plattelander, The Cape Times, and Die Burger Western Cape);
3. I&APs were notified of the availability of the Draft EMP for a review and comment period between 15 November to 15 December 2018. A copy of the Executive Summary was included with the notification letter; and
4. PGS will also directly notify all existing exploration right and technical cooperation permit holders and applicants in the proposed Reconnaissance Permit area.

2.3 SPECIALIST STUDIES AND REPORT COMPILATION

Two specialist studies were undertaken to address the key issues that required further investigation, namely the impact on fishing and marine fauna. The specialist studies involved the gathering of data relevant to identifying and assessing environmental impacts that may occur as a result of the proposed project. These impacts were then assessed according to pre-defined rating scales.

The specialist studies and other relevant information were then integrated into this EMP. Many of the issues associated with seismic surveys are generic in nature and have been assessed based on previous seismic survey programmes off the coast of South Africa and the Generic EMPr prepared for seismic surveys in South Africa. Recommendations proposed are based on specialist input and are in line with the Generic EMPr and the general principles of the Joint Nature Conservation Committee (JNCC) seismic guidelines. Information was incorporated into the EMP in order to ensure compliance with Section 39 and Regulation 52 of the MPRDA.

The EMP aims to present all information in a clear and understandable format and suitable for easy interpretation by authorities, I&APs and other key stakeholders (e.g. operator and contractors).
2.4 WAY FORWARD

After closure of the comment period, all written comments received from I&APs will be collated and submitted, together with the EMP, to PASA for consideration and for acceptance by the Minister of Mineral Resources in terms of the MPRDA.

3. PROJECT DESCRIPTION

This chapter provides general information on the proposed project, the general location of the proposed multi-client 2D and 3D speculative seismic surveys, and a description of typical seismic surveys.

3.1 GENERAL INFORMATION

3.1.1 Reconnaissance Permit Application

PGS as the applicant for the Reconnaissance Permit will also be the operator for the proposed project.

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3.1.2 Existing Permit and Right Holders (and Applicants)

The proposed Reconnaissance Permit area includes a number of licence blocks off the South and West Coasts of South Africa (see Figure A). As mentioned in Section 2.2, PGS is required to obtain written consent from the existing exploration right and technical cooperation permit holders and applicants within the proposed Reconnaissance Permit area in order to apply for this permit.

3.2 SEISMIC SURVEY

Seismic surveys are carried out during marine oil and gas exploration in order to investigate subsea geological formations. During seismic surveys high-level, low frequency sounds are directed towards the seafloor from near-surface sound sources towed by a seismic vessel. Signals reflected from geological interfaces below the seafloor are recorded by multiple receivers (or hydrophones) towed in a single or multiple streamer. Analyses of the returned signals allow for interpretation of subsea geological formations.

For this investigation, PGS is proposing to undertake a multi-client speculative 2D and 3D seismic surveys. The Reconnaissance Permit area is approximately 290 299 km².
The proposed 2D survey would cover a single target area located roughly between Lamberts Bay in the north and Cape Agulhas in the south. The distance between the eastern boundary of the 2D survey area and the coast decreases from approximately 150 km offshore of Lamberts Bay to 65 km offshore of Cape Columbine and then reaches its closest point of more than 40 km offshore of the Cape Peninsula. From Cape Point the distance starts to increase again, ultimately reaching a distance of more than 120 km offshore of Cape Agulhas. The western extent of the survey area is located more than 350 km away from the coast. The total length of the survey would be between 2 000 and 8 000 km.

The proposed 3D surveys would cover two target areas:

- A northern 3D survey area located to the north of the proposed 2D survey area and situated approximately 200 km offshore of Klienzee to the north and Strandfontein to the south. At its closest point to the West Coast, the eastern boundary of this 3D survey area would be located approximately 150 km offshore, with the furthest western boundary located approximately 390 km offshore; and
- A southern 3D survey area which overlaps with the north-eastern portion of the proposed 2D survey area. This 3D survey area is located approximately 170 km offshore of Lambert’s Bay to the north and more than 60 km offshore of the Cape Peninsula to the south. The furthest western boundary of this 3D survey area is located approximately 200 km offshore.

The total extent of the 3D survey data acquisition within both areas would be between 3 000 and 10 000 km².

Actual survey commencement would ultimately depend on a permit award date and the availability of a survey vessel. Furthermore, the duration of the surveys would be dependent on whether the 2D and 3D surveys are run concurrently or at different times. It is, however, anticipated that the surveys would take in the order of five months to complete. Should the permit be awarded, it is anticipated that the proposed surveys could commence within Q1 or Q2 2019, with the balance of the survey then resuming at the end of December 2019.

PGS proposes to use a vessel similar to the M/V Ramform Sovereign (Plate 3.1) to acquire the seismic data for the proposed surveys. A support vessel would be commissioned as a "chase" boat. This vessel would be equipped with appropriate radar and communications to patrol the area during the seismic surveys to ensure that other vessels adhere to the safe operational limits. The chase boat would assist in alerting other vessels (e.g. fishing, transport, etc.) about the proposed survey and the lack of manoeuvrability of the survey vessel. The chase boat would also be required to perform logistics support to the survey vessel. Some of the basic specifications of the survey vessel are provided in the Table 3-1 below.

**TABLE 3-1: VESSEL SPECIFICATIONS OF M/V RAMFORM SOVEREIGN.**

<table>
<thead>
<tr>
<th>Specification</th>
<th>M/V Ramform Sovereign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call sign</td>
<td>C6CR8</td>
</tr>
<tr>
<td>Length</td>
<td>102.2</td>
</tr>
<tr>
<td>Draft</td>
<td>7.4m</td>
</tr>
<tr>
<td>Gross tonnage</td>
<td>13688</td>
</tr>
<tr>
<td>Max speed</td>
<td>18 knots in transit</td>
</tr>
</tbody>
</table>
The airgun and hydrophone array specifications are summarised in Table 3-2. In summary, a typical survey array would consist of 24 active guns with operating pressures of 2 000 pound-force per square inch (psi). The airgun sound source would be situated approximately 50 m behind the vessel at approximately 7 to 8 m below the surface. The single hydrophone steamer would be up to 12 km long. The streamer would be towed at a variable depth of 20 to 25 m and would not be visible, except for the tail-buoy at the far end of the streamer.

### TABLE 3-2: AIRGUN AND HYDROPHONE ARRAY SPECIFICATIONS.

<table>
<thead>
<tr>
<th>Airgun and hydrophone array specifications</th>
<th>M/V Ramform Sovereign</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of active air guns</td>
<td>24</td>
</tr>
<tr>
<td>Nominal source pressure (typical)</td>
<td>2000 psi</td>
</tr>
<tr>
<td>Depth of airgun</td>
<td>7/8 m</td>
</tr>
<tr>
<td>Distance of airgun behind vessel</td>
<td>50 m</td>
</tr>
<tr>
<td>Streamers (max)</td>
<td>12</td>
</tr>
<tr>
<td>No. of hydrophones</td>
<td>7</td>
</tr>
<tr>
<td>Streamer depth</td>
<td>20-25m</td>
</tr>
</tbody>
</table>

4. **DESCRIPTION OF THE AFFECTED ENVIRONMENT**

4.1 **PHYSICAL OCEANOGRAPHY**

The proposed survey areas lie within the southern zone of the Benguela Current region and is characterised by the cool Benguela upwelling system. The dominant southerly and south-easterly winds in summer drive the massive offshore movement of surface water, resulting in strong upwelling of nutrient-rich bottom waters. Nutrient-rich upwelled water enhances primary production, and the West Coast region consequently supports substantial pelagic fisheries. The South Atlantic Seamounts lie on and adjacent to the southern boundary of the Reconnaissance Permit Area. Seasonal association with Child’s Bank (off Namaqualand) and Tripp Seamount (off southern Namibia and approximately 100 km north of the northern 3D survey area) occurs between October and June, with commercial catches often peaking in March and April.

4.2 **BIOLOGICAL OCEANOGRAPHY**

The Reconnaissance Permit Application area primarily falls into the Atlantic Offshore Bioregion, with the inshore portions overlapping with the South-western Cape and Namaqua Bioregions. Communities within marine habitats are largely ubiquitous throughout the southern African West Coast region, being particular only to substrate type or depth zone. These biological communities consist of many hundreds of species, often displaying considerable temporal and spatial variability (even at small scales). The threat status of the benthic habitats within the survey areas are mapped by SANBI as Least Threatened.

The proposed survey areas lie within the influence of the Namaqua upwelling cell, and seasonally high phytoplankton abundance can be expected, providing favourable feeding conditions for micro-, meso- and macrozooplankton, and for ichthyoplankton.
The fish species likely to be encountered comprise primarily the large pelagic species (e.g. tunas, billfish and pelagic sharks), which migrate throughout the southern oceans, between surface and deep waters (>300 m). Most seabirds in the region reach highest densities offshore of the shelf break (200 to 500 m depth). The breeding areas are distributed around the coast with islands being especially important. The closest breeding islands are the Saldanha Bay islands, Dassen Island off Yzerfontein, Robben Island in Table Bay and Dyer Island off Danger Point, approximately 75 km east of the eastern border of the proposed 2D survey area. There is a further Cape Gannet breeding colony on Bird Island at Lambert’s Bay, approximately 175 km east of the northern point of the 2D survey area. African Penguins nesting sites are at Dassen Island, Robben Island, Boulders beach in False Bay, Betty’s Bay and Dyer Island.

In terms of large migratory cetaceans, the humpback and southern right whale are likely to be encountered year-round, with numbers in the Cape Columbine area highest between September and February, and not during winter as is common on the South Coast breeding grounds. Several other large whale species are also most abundant on the West Coast during winter: fin whales peak in May-July and October-November; sei whale numbers peak in May-June and again in August-October and offshore Bryde’s whale numbers are likely to be highest in January-February.

There are a number of Cape fur seal colonies within the broader area including, amongst others Cliff Point, Bucchu Twins, Kleinzee (incorporating Robeiland), Strandfontein Point (south of Hondeklipbaai), Bird Island at Lamberts Bay and McDougall’s Bay islands and Wedge Point.

4.3 HUMAN UTILISATION

Eight commercial fishing sectors could potentially be affected by the proposed survey operations. These include: demersal trawl, mid-water trawl, demersal long-line, small pelagic purse seine, large pelagic long-line, tuna pole, traditional line-fish, and South Coast rock lobster fishery.

A large number of vessels navigate along the South and West Coasts on their way around the southern African subcontinent. The majority of shipping traffic is located on the outer edge of the continental shelf. Thus, a high degree of shipping traffic is expected to occur in, and pass through, the proposed 2D and 3D survey areas.

Exploration for oil and gas is currently undertaken in a number of licence blocks off the West Coast. There is no current development or production from the South African West Coast offshore. A number of proposed prospecting areas for glauconite and phosphorite / phosphate are located off the West and South Coasts. The proposed survey areas overlap with a number of these. However, there is a limited degree of overlap with marine diamond mining concession areas.

5. IMPACT ASSESSMENT CONCLUSIONS

A summary of the assessment of potential environmental impacts associated with the proposed 2D and 3D seismic surveys is provided in Table 5-1.
In summary, the majority of the impacts associated with the proposed 2D and 3D seismic surveys would be of short-term duration and limited to the immediate survey area. As a result, the majority of the impacts are considered to be of **INSIGNIFICANT** to **MEDIUM** significance after mitigation.

The three key issues identified in this study relate to:

- The potential impact on marine mammals (physiological injury and behavioural avoidance) as a result of seismic noise;
- The potential impact on the fishing industry (vessel interaction, disruption to fishing operations and reduced catch) due to the presence of the survey vessel with its associated safety zone, potential fish avoidance of the survey area and changes in feeding behaviour; and
- The potential impact on fisheries research (vessel interaction and disruption to the research surveys) due to the presence of the survey vessel with its associated safety zone and fish distribution and behavioural patterns which could negatively affect the findings of these surveys.

Although most of the impacts on cetaceans are assessed to have **VERY LOW to LOW** significance with mitigation, the impact could be of much higher significance due to the limited understanding of how short-term effects of seismic surveys relate to longer term impacts. For example, if a sound source displaces a species from an important breeding area for a prolonged period, impacts at the population level could be more significant. In order to mitigate the potential impact on cetaceans it is recommended that the proposed seismic survey programme be planned to avoid their key cetacean migration and breeding period which is from the beginning of June to the end of November. In addition, to avoid encountering humpback whales that may still be moving through the area on their return migrations in December, and the fact that several of the large whale species are also abundant on the West Coast between September and February, it is recommended that the inshore portions of the seismic operations be scheduled in the late summer and early winter period (February - May). Various other measures are recommended to further mitigate the potential impact on cetaceans, including a 60-minute pre-watch period (visually and using PAM technology), 20-minute “soft-start” procedure, temporary termination of survey, etc.

With regards to cumulative and confounding long-term effects on cetaceans from continuous seismic surveys, it must be noted that despite the density of seismic survey coverage over the last 17 years, the Southern Right whale population along the South African coast is reported to be increasing by 6.5% per year and the Humpback whale population by at least 5% per annum. These increases have taken place over a time period when seismic surveying frequency has increased, suggesting that, for these two populations at least, there is no evidence of long-term negative change to population size as a direct result of seismic survey activities.

The potential impact on the fishing industry relates to the temporary exclusion of fishing vessels from important fishing grounds and the potential reduction in catch rates. With regards to temporary exclusion, the potential impact ranges from **VERY LOW** (small pelagic purse-seine and south Coast rock lobster) to **LOW** (midwater trawl) and **MEDIUM** (demersal trawl, hake demersal long-line, large pelagic long-line and tuna pole) significance with mitigation. The proposed survey area does not overlap with the inshore West Coast rock lobster and netfish fishing grounds, thus, there would be **NO IMPACT** on these fishing sectors.

The potential impact of reduced catch rates across all fishing sectors active within the proposed survey areas has been rated as of **VERY LOW** significance after mitigation. If fish, however, avoid the survey area and / or
change their feeding behaviour it could have a more significant impact on the fishing industry. Research has, however, shown that behavioural effects are generally short-term with duration of the effect being less than or equal to the duration of exposure, although these vary between species and individuals, and are dependent on the properties of the received sound. Similarly, if there was any interaction between the seismic survey vessel and a fishery the significance of the impact could be higher. Thus it is important that PGS engage timeously with the fishing industry prior to and during the surveys. Regular communication with fishing vessels in the vicinity during surveying would minimise the potential disruption to fishing operations and risk of gear entanglements.

The potential impacts on the demersal trawl and the small pelagic acoustic surveys within the proposed survey area has been rated as of VERY LOW significance after mitigation. While the behavioural effects on fish are generally short-term (as noted above), should there be a spatial and temporal overlap between the proposed seismic surveys and the fisheries research surveys, the significance of the impact could be higher. Thus it is recommended that survey operations should, if possible, commence in the western portions of the proposed survey areas to avoid disruption of the planned demersal research trawl survey in January to mid-February 2019. It is further recommended that the portions of the survey areas inshore of the 1 000 depth contour should be surveyed from mid-February to May to avoid disruption of the planned small pelagic acoustic research surveys.

### TABLE 5-1: SUMMARY OF THE SIGNIFICANCE OF POTENTIAL IMPACTS OF THE PROPOSED SPECULATIVE 2D AND 3D SEISMIC SURVEYS OFF THE WEST AND SOUTH COASTS OF SOUTH AFRICA.

<table>
<thead>
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<th>Potential impact</th>
<th>Significance</th>
<th>Without mitigation</th>
<th>With mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normal seismic / support vessels and helicopter operation:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge/disposal to the sea</td>
<td>VL</td>
<td>VL</td>
<td></td>
</tr>
<tr>
<td>Accidental oil spill during bunkering / refuelling</td>
<td>In Port</td>
<td>Insignificant</td>
<td>INsignificant</td>
</tr>
<tr>
<td></td>
<td>Offshore</td>
<td>VL</td>
<td>VL</td>
</tr>
<tr>
<td>Noise from seismic and support vessel operations</td>
<td>VL</td>
<td>VL</td>
<td></td>
</tr>
<tr>
<td>Noise from helicopter operation</td>
<td>Insignificant to VL</td>
<td>INsignificant</td>
<td></td>
</tr>
<tr>
<td><strong>Impact of seismic noise on marine fauna:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plankton</td>
<td>VL</td>
<td>VL</td>
<td></td>
</tr>
<tr>
<td>Invertebrates</td>
<td>Physiological injury</td>
<td>VL</td>
<td>VL</td>
</tr>
<tr>
<td></td>
<td>Behavioural avoidance</td>
<td>Insignificant(benthic invertebrates) - VL (squid)</td>
<td>INsignificant</td>
</tr>
<tr>
<td>Fish</td>
<td>Physiological injury</td>
<td>L</td>
<td>VL</td>
</tr>
<tr>
<td></td>
<td>Behavioural avoidance</td>
<td>L</td>
<td>VL</td>
</tr>
<tr>
<td></td>
<td>Spawning and reproductive success</td>
<td>VL</td>
<td>VL</td>
</tr>
<tr>
<td></td>
<td>Masking sound and communication</td>
<td>Insignificant</td>
<td>INsignificant</td>
</tr>
<tr>
<td></td>
<td>Indirect impacts</td>
<td>VL</td>
<td>VL</td>
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<tr>
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<td>INsignificant</td>
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<tr>
<td></td>
<td>Behavioural avoidance</td>
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<td>INsignificant</td>
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<tr>
<td>Diving seabirds</td>
<td>Physiological injury</td>
<td>L</td>
<td>VL</td>
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<td></td>
<td>Behavioural avoidance</td>
<td>L</td>
<td>VL</td>
</tr>
<tr>
<td></td>
<td>Indirect impacts</td>
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<td>INsignificant</td>
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## Potential impact

<table>
<thead>
<tr>
<th>Potential impact</th>
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<tbody>
<tr>
<td><strong>Turtles</strong></td>
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<td>Behavioural avoidance</td>
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<td>VL</td>
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<td>Reproductive success</td>
<td>L</td>
<td>VL</td>
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<tr>
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<td>INSIGNIFICANT</td>
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<tr>
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<tr>
<td><strong>Seals</strong></td>
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<td>VL</td>
<td>VL</td>
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<td>VL</td>
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<tr>
<td>Masking sound and communication</td>
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<td><strong>Mysticete Cetaceans</strong></td>
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<td>Physiological injury</td>
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<td>VL</td>
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<td>Masking sound and communication</td>
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<td>VL</td>
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<td>INSIGNIFICANT</td>
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<tr>
<td><strong>Odontocete Cetaceans</strong></td>
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<td>VL</td>
</tr>
<tr>
<td>Behavioural avoidance</td>
<td>VL-L</td>
<td>VL</td>
</tr>
<tr>
<td>Masking sound and communication</td>
<td>L</td>
<td>VL</td>
</tr>
<tr>
<td>Indirect impacts</td>
<td>VL</td>
<td>VL</td>
</tr>
</tbody>
</table>

## Impact on other users of the sea:

<table>
<thead>
<tr>
<th>Fishing industry</th>
<th>Without mitigation</th>
<th>With mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demersal trawl</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Mid-water trawl</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Demersal long-line</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Small pelagic purse-seine</td>
<td>VL</td>
<td>VL</td>
</tr>
<tr>
<td>Large pelagic long-line</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Tune pole</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Traditional line-fish</td>
<td>Insignificant</td>
<td>INSIGNIFICANT</td>
</tr>
<tr>
<td>South Coast rock lobster</td>
<td>VL</td>
<td>VL</td>
</tr>
<tr>
<td>West Coast rock lobster and netfish</td>
<td>NO IMPACT</td>
<td></td>
</tr>
<tr>
<td><strong>- Reduced catch rates</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All fishing sectors</td>
<td>L</td>
<td>VL</td>
</tr>
<tr>
<td>Fisheries research</td>
<td>L</td>
<td>VL</td>
</tr>
<tr>
<td><strong>Marine transport routes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td><strong>Marine prospecting, mining, exploration and production</strong></td>
<td>VL</td>
<td>VL</td>
</tr>
<tr>
<td>Prospecting and mining</td>
<td>VL</td>
<td>VL</td>
</tr>
<tr>
<td>Exploration and production</td>
<td>VL</td>
<td>VL</td>
</tr>
<tr>
<td><strong>Job creation and business opportunities</strong></td>
<td>VL (positive)</td>
<td>VL (POSITIVE)</td>
</tr>
</tbody>
</table>

**H=High**  **M=Medium**  **L=Low**  **VL=Very low**  **All impacts are negative, unless stated otherwise**

SLR is of the opinion that based on the findings of the EMP, (potential impacts generally of VERY LOW to MEDIUM significance after mitigation) and the transient nature of the proposed seismic surveys, a positive decision should be made by DMR (or delegated authority) in this regard.
5.1 RECOMMENDATIONS FOR MITIGATION

5.1.1 Compliance with EMP and Marpol Standards

- All phases of the proposed project (including pre-establishment phase, establishment phase, operational phase, and decommissioning and closure phase) must comply with the actions listed in the Environmental Management Programme presented in Chapter 7. In addition, the seismic and support vessels must ensure compliance with the MARPOL 73/78 standards.

5.1.2 Permit/Exemption Requirements

- In terms of the Marine Living Resources Act, 1998 (No. 18 of 1998) it is illegal for any vessel to approach or remain within 300 m of whales within South African waters without a permit or exemption. Thus, if the operator or seismic contractor are not able to comply with this restriction, an application should be made to DEA for a permit or exemption.

5.1.3 Communication with Key Stakeholders

- Prior to survey commencement, PGS should consult with the managers² of the DAFF research survey programmes to discuss their respective survey and survey programmes and the possibility of altering the exploration programme in order to minimise or avoid disruptions to both parties;
- Prior to survey commencement the following key stakeholders should be consulted and informed of the proposed survey activity (including navigational co-ordinates of the survey area, timing and duration of proposed activities) and the likely implications thereof:
  > Fishing industry / associations: SA Tuna Association, SA Deep-Sea Trawling Industry Association (SADSTIA), Fresh Tuna Exporters Association, SA Hake Longline Association (SAHALLA), South African Tuna Long-Line Association (SATLA), South African Pelagic Fishing Industry Association (SAPFIA), SA Commercial Linefish Association and South African Tuna Long-Line Association (SATLA), South African Pelagic Fishing Industry Association (SAPFIA), SA Commercial Linefish Association and South Coast Rock Lobster Association; and
  > Other key stakeholders: DAFF, Port Captains, South African Maritime Safety Authority (SAMSA) and South African Navy Hydrographic office, Control and Surveillance Unit in Cape Town (Vessel Monitoring System Unit) and other prospecting / exploration right holders.

These stakeholders should again be notified at the completion of surveying when the survey vessel and support vessels are off location.

- The operator must request, in writing, the South African Navy Hydrographic office to release Radio Navigation Warnings and Notices to Marinerst throughout the seismic survey period. The Notice to Mariners should give notice of (1) the co-ordinates of the proposed survey areas, (2) an indication of the proposed survey timeframes and day-to-day location of the survey vessel, and (3) an indication of the 500 m safety zones and the proposed safe operational limits of the survey vessel. These notices should be distributed timeously to fishing companies and directly onto vessels where possible;
- An independent onboard FLO that is familiar with fisheries operational in the area must be appointed for the duration of the survey. The FLO should provide a fisheries facilitation role to identify and

---

² Deon Durholtz (DeonD@nda.agric.za) and Janet Coetzee (JanetC@nda.agric.za).
communicate with fishing vessels in the area to reduce the risk of gear interaction between fishing and survey activities. The FLO should:
> report on vessel activity daily;
> advise on actions to be taken in the event of encountering fishing gear;
> provide back-up on-board facilitation with the fishing industry and other users of the sea; and
> set up a daily electronic reporting routine to keep key stakeholders informed of survey activity and progress and fisheries, environmental issues.

In addition to the above, the FLO should assist in the identification of current fishing target areas to, where possible, allow for the adjustment of the survey plan to accommodate fishing.

- Any fishing vessels target a radar range of 12 nm from the survey vessel should be called via radio and informed of the navigational safety requirements around the survey vessel;
- Ongoing notification is to be undertaken throughout the duration of survey with the submission of daily reports (via email) indicating the vessel’s location to key stakeholders, as appropriate;
- Any dispute arising with other right holders should be referred to DMR or PASA for resolution; and
- Marine mammal incidence data and seismic source output data arising from the survey should be made available, if requested, to the Marine Mammal Institute, DEA, DAFF and PASA for analyses of survey impacts in local waters.

5.1.4 Vessel Safety

- The survey vessels must be certified for seaworthiness through an appropriate internationally recognised marine certification programme (e.g. Lloyds Register, Det Norske Veritas). The certification, as well as existing safety standards, requires that safety precautions would be taken to minimise the possibility of an offshore accident;
- Collision prevention equipment should include radar, multi-frequency radio, foghorns, etc. Additional precautions include:
  > A support / chase vessel with FLO familiar with the fisheries expected in the area;
  > The existence of an internationally agreed 500 m safety zone around the survey vessels;
  > Cautionary notices to mariners; and
  > Access to current weather service information.
- The vessels are required to fly standard flags, lights (three all-round lights in a vertical line, with the highest and lowest lights being red and the middle light being white) or shapes (three shapes in a vertical line, with the highest and lowest lights being balls and the middle light being a diamond) to indicate that they are engaged in towing surveys and are restricted in manoeuvrability, and must be fully illuminated during twilight and night; and
- Report any emergency situation to SAMSA.

5.1.5 Emissions, Discharges, into the Sea and Solid Waste

- Ensure adequate maintenance of diesel motors and generators to minimise emissions to the atmosphere;
- Route deck and machinery space drainage to a separate drainage system (oily water catchment system) for treatment to ensure compliance with MARPOL (15 ppm);
- Ensure all process areas are bunded to ensure drainage water flows into the closed drainage system;
• Use drip trays to collect run-off from equipment that is not contained within a bunded area and route contents to the closed drainage system;
• Use low toxicity, biodegradable detergents during deck cleaning to further minimise the potential impact of deck drainage on the marine environment;
• Ensure adequate maintenance of all hydraulic systems and frequent inspection of hydraulic hoses;
• Undertake spill management training and awareness of crew members of the need for thorough clean-up of any spillages immediately after they occur, as this would minimise the volume of contaminants washing off decks;
• Initiate an on-board waste minimisation system;
• Ensure on-board solid waste storage is secure;
• Ensure that waste (solid and hazardous) disposal onshore is carried out in accordance with the appropriate laws and ordinances; and
• Prepare a project specific Emergency Response Plan and Shipboard Oil Pollution Emergency Plan for the proposed seismic survey, which defines the organisational structure and protocols that would be implemented to respond to any incident (including accidental oil / fuel spills) in a safe, rapid, effective and efficient manner.

5.1.6 Offshore Bunkering

• Offshore bunkering should not be undertaken in the following circumstances:
  > Within 50 nm of the coast;
  > Wind force and sea state conditions of 6 or above on the Beaufort Wind Scale;
  > During any workboat or mobilisation boat operations;
  > During helicopter operations;
  > During the transfer of in-sea equipment; and
  > At night or times of low visibility.
• Support vessels must have the necessary spill response capability to deal with accidental spills in a safe, rapid, effective and efficient manner; and
• Crew must be trained in spill management.

5.1.7 Job Creation and the Generation of Direct Revenues

• The use of local companies for support services should be promoted as far as possible.

5.1.8 Vessel Lighting

• Lighting on board survey vessels should be reduced to the minimum safety levels to minimise stranding of pelagic seabirds on the survey vessels at night. All stranded seabirds must be retrieved and released during daylight hours.
5.2 MITIGATION RECOMMENDATIONS SPECIFIC TO SEISMIC SURVEYS

5.2.1 Survey Timing and Scheduling

- The seismic survey should be undertaken outside of the key cetacean migration and breeding period which extends from the beginning of June to the end of November.
- As no seasonal patterns of abundance are known for odontocetes occupying the proposed study area, a precautionary approach to avoiding impacts throughout the year is recommended;
- Survey operations can occur between January to end of May (subject to permit award date and vessel availability);
- For the inshore portions of the proposed survey areas, the following is recommended:
  - As several of the large whale species would be abundant on the West Coast between September and February, the inshore portions between Cape Point (approximately 34° 21’S) and Strandfontein (approximately 31° 45’S) of the seismic operations should be planned to be undertaken in late summer and early winter (February - May).
  - Survey operations should, if possible, commence in the western portions of the proposed survey areas to avoid disruption of the planned demersal research trawl survey in January to mid-February 2019. For the portions of the of the survey areas inshore of the 1 000 m depth contour, there must be simultaneous operational planning in place to avoid disruption of the planned small pelagic acoustic research surveys.

5.2.2 Equipment

- ‘Turtle-friendly’ tail buoys should be used by the survey contractor or existing tail buoys should be fitted with either exclusion or deflector ‘turtle guards’.

5.2.3 Seismic Survey Procedures

- PAM technology
  - The survey vessel must be fitted with PAM technology, which detects animals through their vocalisations. As the survey is taking place in waters deeper than 1 000 m depth where sperm whales and other deep-diving odontocetes are likely to be encountered, the use of PAM 24-hours a day is highly recommended. As a minimum, PAM technology must be used during the 30-minute pre-watch period and when surveying at night or during adverse weather conditions and thick fog.
  - The PAM hydrophone streamer should ideally be towed behind the airgun array to minimise the interference of vessel noise, and should be fitted with two hydrophones to allow directional detection of cetaceans.
  - In order to avoid unnecessary delays to the survey programme, it is recommended that a spare PAM cable and sensor are kept onboard should there be any technical problems with the system. However, if there is a technical problem with PAM during surveying, visual watches must be maintained by the MMO during the day and night-vision/infra-red binoculars must be used at night while PAM is being repaired.
• “Soft-start” procedure, pre-watch period and airgun firing
  > A “soft-start” procedure of a minimum of 20 minutes’ duration must be implemented when initiating airgun tests (a single or a number of airguns at full power) and / or seismic surveying. This requires that the sound source be ramped from low to full power rather than initiated at full power, thus allowing a flight response by marine fauna to outside the zone of injury or avoidance.
  > “Soft-starts” should be delayed until such time as the area is clear of seabirds (diving), turtles, seals or cetaceans. In the case of turtles and cetaceans the “soft-start” procedure should not begin until after the animals depart the 500 m exclusion zone or 30 minutes after they are last seen. In the case of small cetaceans (<3 m in overall length) and seals, which are often attracted to survey vessels, the normal “soft-start” procedures should be allowed to commence, if after a period of 30 minutes small cetaceans or seals are still within 500 m of the airguns for at least a 20-minutes duration. The MMO should monitor small cetacean behaviour during “soft-starts” to determine if the animals display any obvious negative responses to the air-guns and gear or if there are any signs of injury or mortality as a direct result of seismic shooting operations.
  > All breaks in airgun firing of longer than 20 minutes must be followed by a 60-minute pre-shoot watch and a “soft-start” procedure of at least 20 minutes prior to the survey operation continuing. In order to facilitate a more effective timing of proposed operations when surveying in deeper waters, the 60-minute pre-shoot watch can commence before the end of the survey line (whilst the airguns are still firing). Breaks of shorter than 20 minutes should be followed by a visual assessment for marine mammals and turtles within the 500 m mitigation zone (not a 60-minute pre-shoot watch) and a “soft-start” of similar duration.
  > The use of the lowest practicable airgun volume, as defined by the operator, should be defined and enforced.
  > During surveying, airgun firing should be terminated when:
    - obvious negative changes to turtle, seal and cetacean behaviour is observed;
    - turtles or cetaceans are observed within 500 m of the operating airgun and appear to be approaching the firing airgun; or
    - there is mass mortality of fish or mortality / injuries to seabirds, turtles, seals or cetaceans as a direct result of the survey.
  > The survey should remain terminated until such time the time MMO / PAM operator confirms that:
    - turtles or cetaceans have moved to a point that is more than 500 m from the source;
    - despite continuous observation, 30 minutes has elapsed since the last sighting of the turtles or cetaceans within 500 m of the source; and
    - risks to seabirds, turtles, seals or cetaceans have been significantly reduced.
  > A log of all termination decisions must be kept (for inclusion in both daily and “close-out” reports).
• MMO and PAM operator
  > An independent on-board MMO and a PAM operator must be appointed for the duration of the seismic survey. The MMO and PAM operator must have experience in seabird, turtle and marine mammal identification and observation techniques.
  > The duties of the MMO would be to:

3 Note: If the intention is to test a single airgun on low power then a “soft-start” is not required.
Marine fauna:
- Confirm that there is no marine faunal activity within 500 m of the seismic source array prior to commencing with the “soft-start” procedures;
- Record pre-shoot observation regime;
- Record survey activities, including sound levels, “soft-start” procedures and survey periods (duration);
- Monitor marine faunal activity during daytime surveying. Observe and record responses of marine fauna to the seismic survey, including seabird, turtle, seal and cetacean incidence and behaviour and any mortality or injuries of marine fauna as a result of the seismic survey. Data captured should include species identification, position (latitude/longitude), distance from the vessel, swimming speed and direction (if applicable) and any obvious changes in behaviour (e.g. startle responses or changes in surfacing/diving frequencies, breathing patterns) as a result of the survey activities; and
- Request the temporary termination of the seismic survey, as appropriate. It is important that the MMOs’ decisions to terminate firing are made confidently and expeditiously;

Other:
- Record meteorological conditions;
- Monitor compliance with international marine pollution regulations (MARPOL 73/78 standards); and
- Prepare daily reports of all observations. These reports should be forwarded to the key stakeholders, as appropriate.

> The duties of the PAM operator would be to:
- Ensure that hydrophone streamers are optimally placed within the towed array;
- Confirm that there is no cetaceans activity within 500 m of the vessel prior to commencing with the “soft-start” procedures;
- Record survey activities, including sound levels, “soft-start” procedures and survey periods (duration);
- Record pre-shoot observation regime;
- Monitor cetacean activity during daytime and night time surveying. Record species identification, position (latitude/longitude) and distance from the vessel, where possible; and
- Request the temporary termination of the seismic survey, as appropriate.

> All data recorded by the MMO and PAM operator should form part of the survey “close-out” report.
5.3 MITIGATION RECOMMENDATIONS SPECIFIC TO HELICOPTER OPERATIONS (WHERE REQUIRED)

Mitigation relating to helicopter operations includes:

- Flight paths must be pre-planned to ensure that no flying occurs over MPAs (Marcus Island, Malgas Island, Jutten Island, Langebaan Lagoon, Sixteen Mile Beach, Table Mountain National Park, Helderberg, and Betty’s Bay), seal (Kleinzee, Robberg Bucchu Twins, Strandfontein Point, Bird Island, Paternoster Point, Duikerklip, Robbesteen, Seal Island and Geyser Rock) and seabird colonies (Saldanha Bay islands, Dassen Island, Robben Island, Dyer Island, Bird Island, Boulders beach, and Betty’s Bay);
- Extensive coastal flights (parallel to the coast within 1 nautical mile of the shore) should be avoided. There is a restriction of coastal flights (parallel to the coast within 1 nautical mile of the shore) on the South Coast between the months of June and November to avoid Southern Right whale breeding areas;
- Aircraft may not approach to within 300 m of whales without a permit in terms of the Marine Living Resources Act, 1998;
- The operator must comply with the Seabirds and Seals Protection Act, 1973, which prohibits the wilful disturbance of seals on the coast or on offshore islands;
- The contractor should comply fully with aviation and authority guidelines and rules; and
- All pilots must be briefed on ecological risks associated with flying at a low level parallel to the coast.
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## ACRONYMS AND ABBREVIATIONS

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<tr>
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<tr>
<td>CEAPSA</td>
<td>Certified Environmental Practitioner of South Africa</td>
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<tr>
<td>CITES</td>
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<tr>
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<td>CMS</td>
<td>Convention on Migratory Species</td>
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<tr>
<td>CO</td>
<td>Carbon monoxide</td>
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