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## 6. PROJECT DESCRIPTION

This chapter provides general information on the proposed project, the general location of the speculative seismic survey, and a description of typical seismic surveys.

### 6.1 GENERAL INFORMATION

#### 6.1.1 Applicant

CGG as the applicant for the Reconnaissance Permit and Environmental Authorisation will also be the operator for the proposed project.

#### 6.1.2 Existing Permit and Right Holders

The Reconnaissance Permit application area includes a number of licence blocks off the Southeast Coast of South Africa (see Figure 6-1). Licence block rights/permit holders within the Reconnaissance Permit application area are listed in Table 6-1.

CGG is required to consult and obtain written consent from the existing right holders within the Reconnaissance Permit application area, giving PASA permission to continue to process its application over their acreage. PASA has no legal obligation to accept or to continue to process any applications if the requisite consent letters from existing right holders are not received. CGG is currently in the process of acquiring these consents which will be submitted directly to PASA.

#### 6.1.3 Details of Reconnaissance Permit Area/Survey Area of Interest

The Reconnaissance Permit application area (also the survey area of interest) is approximately 12 750 km<sup>2</sup> in extent. The distance from the coast of the northern extent of the permit area ranges between 45 km and 120 km offshore (see Figure 6-1).

The Reconnaissance Permit area is located roughly between Gqeberha and a point approximately 120 km southeast of Plettenberg Bay offshore of the Eastern Cape Province. The distance between the northern (inshore) boundary of the Reconnaissance Permit area and the coast ranges as follows:

- From Gqeberha, it would be located approximately 50 km from the coast;
- From Gqeberha to St Francis Bay, it would range between 45 and 60 km from the coast; and
- From St Francis Bay to east of Plettenberg Bay, it would range between 45 km and 120 km from the coast.

The co-ordinates of the boundary points of the Reconnaissance Permit application area are provided in Table 6-2.

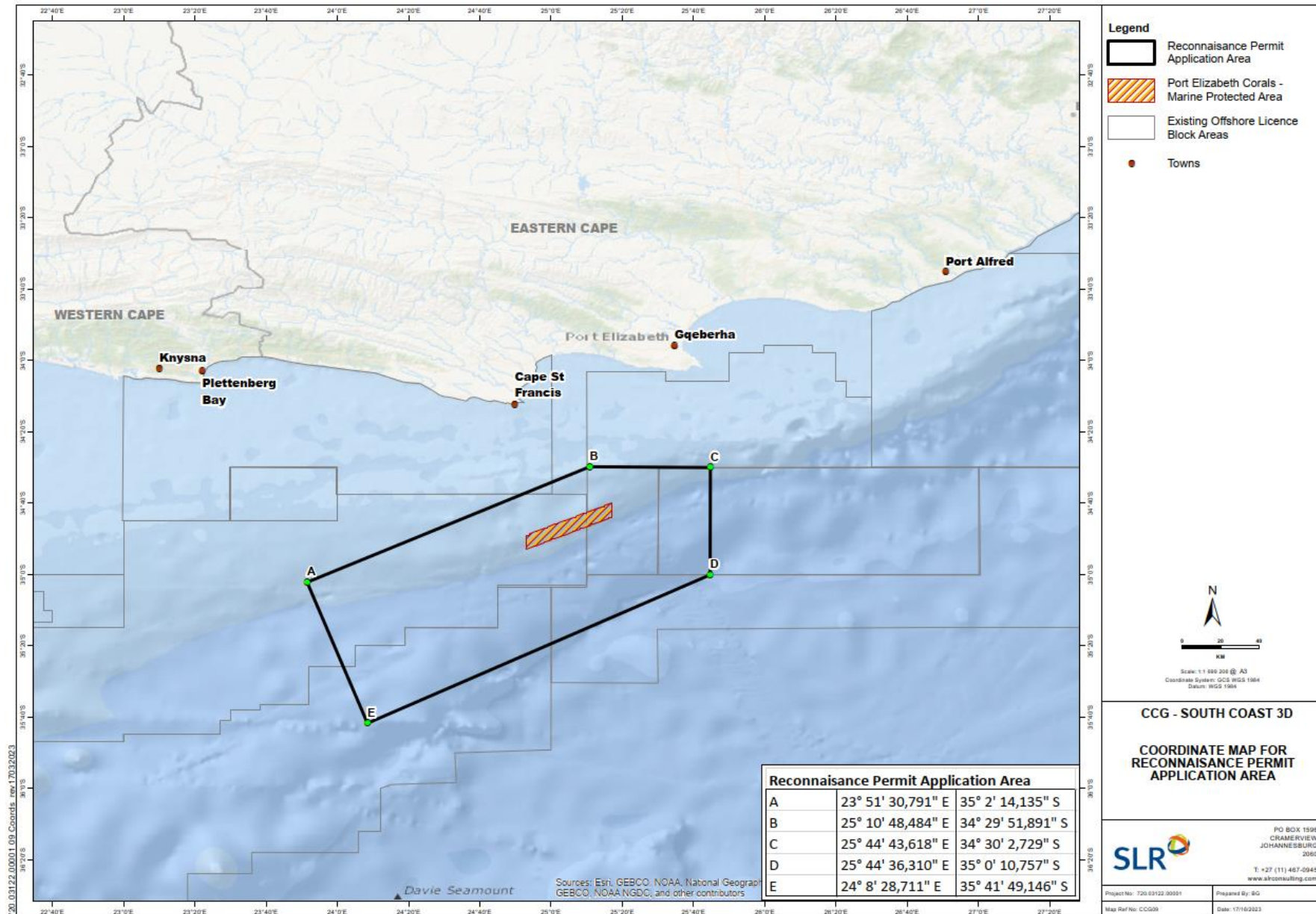


Figure 6-1: Location of the Reconnaissance Permit Application Area of Interest for the proposed 3D survey area in relation to licence blocks

**Table 6-1: List of Right Holders in the Reconnaissance Permit Application area boundary**

NO.	RIGHT HOLDER	Block
1.	New Age Algoa / RIFT Petroleum	Algoa Inshore – Exploration Right 201ER
2.	BG International / Impact Africa	Exploration Right 252ER
3.	Impact Africa / Silver Wave Energy	Area 2 – Exploration Right 276ER
4.	Total Energies	Block South Outeniqua – Exploration Right 231ER
5.	TotalEnergies / Qatar Petroleum / CNR / Main Street	Block 11B/12B – Exploration Right 067ER
6.	Sungu Sungu	Outeniqua Inshore – Exploration Right 322ER

**Table 6-2: Reconnaissance Permit Application area coordinates**

No.	Longitude	Latitude
A	23°51'39,118"E	35°2'8,869"S
B	26°29'46,029"E	33°56'17,774"S
C	26°30'7,444"E	34°39'39,715"S
D	24°8'25,63"E	35°41'24,536"S

#### 6.1.4 Project Scope and Activities

CGG is likely to acquire data in an area of approximately 9 000 km<sup>2</sup> within the Reconnaissance Permit area, with no data acquisition in MPAs or within 45 km of the coast. The proposed survey would follow an evenly spaced survey line grid.

Survey commencement would ultimately depend on permit award and the availability of a survey vessel. Subject to obtaining the Reconnaissance Permit and EA, it is anticipated that the proposed survey could potentially be undertaken within the 2023/2024 Summer survey window period (December to May inclusive), commencing in January 2024 at the earliest. The survey is anticipated to take in the order of four to five months to complete.

A seismic survey typically includes three general project phases, i.e. mobilisation, operation and demobilisation. The anticipated activities related to each of these phases are set out in Table 6-3 below.

**Table 6-3: Summary of project phases and activities**

Phase	Activity
<b>1. Mobilisation Phase</b>	Application for vessel and other permits, including seaworthiness certificates and vessel insurance
	Appointment of local service providers (e.g. supplies and refuelling)
	Transit of survey and support vessels to survey area, including routine discharges to sea
	Discharge of ballast water
<b>2. Operation Phase</b>	Seismic acquisition, including the deployment of seismic equipment (sources and streamers) and acquisition operations
	Operation of supply vessels, including routine discharges to sea
	Provision of services from local service providers (e.g. catering, refuelling and waste management)
	Berthing during crew changes
	Helicopter operations
	Bunkering at sea
<b>3. Demobilisation Phase</b>	Survey vessels leave survey area and transit to port or next destination

## 6.2 SEISMIC SURVEYS

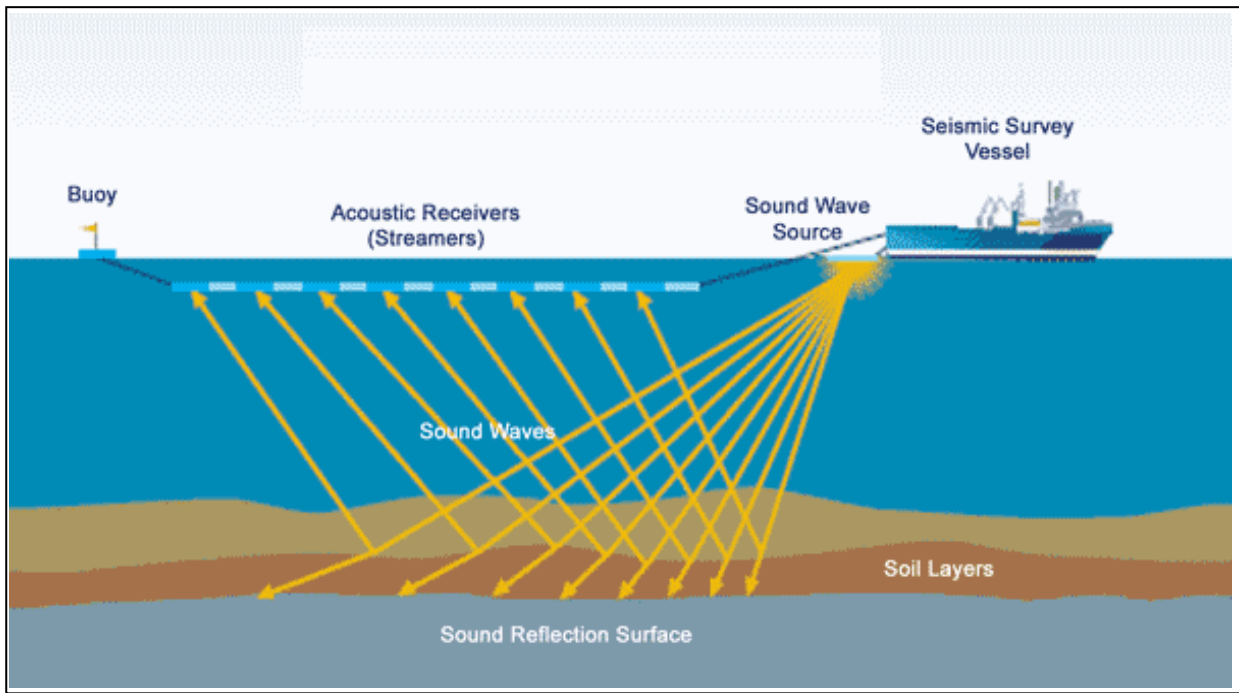
General and specific information on seismic surveys is provided below.

### 6.2.1 Principles

Marine seismic acquisition is a geophysical technique using acoustic energy and seismology to map the geological structures beneath the seafloor. This technique makes it possible to identify possible structures in the underground rocks, favourable to the possible discovery of hydrocarbons. The key principles of a seismic survey are shown in Figure 6-2.

During seismic surveys, high-level, low frequency sounds are directed towards the seabed from near-surface sound sources (see Section 6.2.2) towed by a seismic vessel. The acoustic signal, emitted by releasing high-pressure air into the water column, penetrates the seabed and is then reflected based on the characteristics of the rock formations encountered. The reflected signals are recorded by multiple receivers (or hydrophones) towed in a single or multiple streamer configuration (see Section 6.2.3). Analyses of the returned signals allow for interpretation of subsea geological formations.

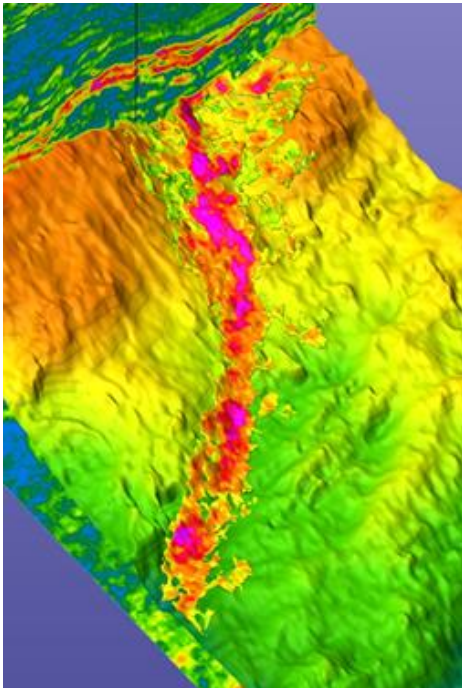
Seismic surveys are usually conducted using a purpose-built seismic vessel. The seismic vessel travels along specific pre-plotted survey lines covering a prescribed grid within the survey area that have, wherever possible, been carefully chosen to cross any known or suspected geological structure with a potential for hydrocarbons. During surveying, the seismic vessel would travel on specific line headings at a speed of between four and five knots (i.e. 2 to 3 metres per second). With equipment deployed the vessel would have limited manoeuvrability (see Section 6.2.5.2).



**Figure 6-2: Principles of offshore seismic acquisition surveys**

Source: <https://www.tes.com/>

3D seismic surveys are typically acquired to confirm structures identified from 2D data and obtain more details on potential fault, distribution of sand bodies, to estimate oil and gas volumes in place and to define the location of potential future areas for exploration drilling. The 3D seismic acquisition technique requires at least two seismic sources (airgun arrays) and several hydrophone streamers, placed in parallel and separated from each other by several tens of meters. 3D seismic acquisition aims to provide a three-dimensional image of the geology of the seabed (see Figure 6-3 ).



**Figure 6-3: Example of a 3D image**

Source: CGG MCNV

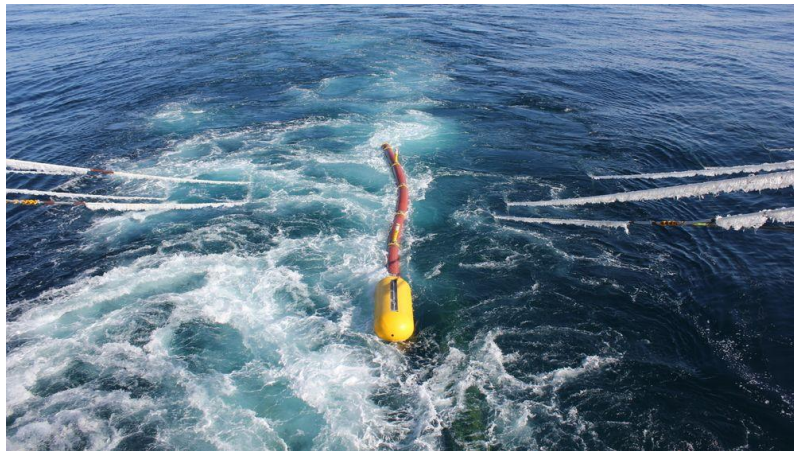
## 6.2.2 Sound Source and Sound Pressure Emission Levels

Airguns are the most common sound source used in modern seismic surveys (see Figure 6-4). The airgun is an underwater pneumatic device from which high-pressure air is released suddenly into the surrounding water. Airguns are normally used in arrays, usually consisting of between 18 and 48 airguns arranged in a rectangular configuration parallel to the sea surface, which enables the combined energy of the individual elements to be directed primarily downward (Gisiner, 2016) (see Figure 6-5).



**Figure 6-4:** A typical seismic source / airgun array

Source: Sercel (CGG)



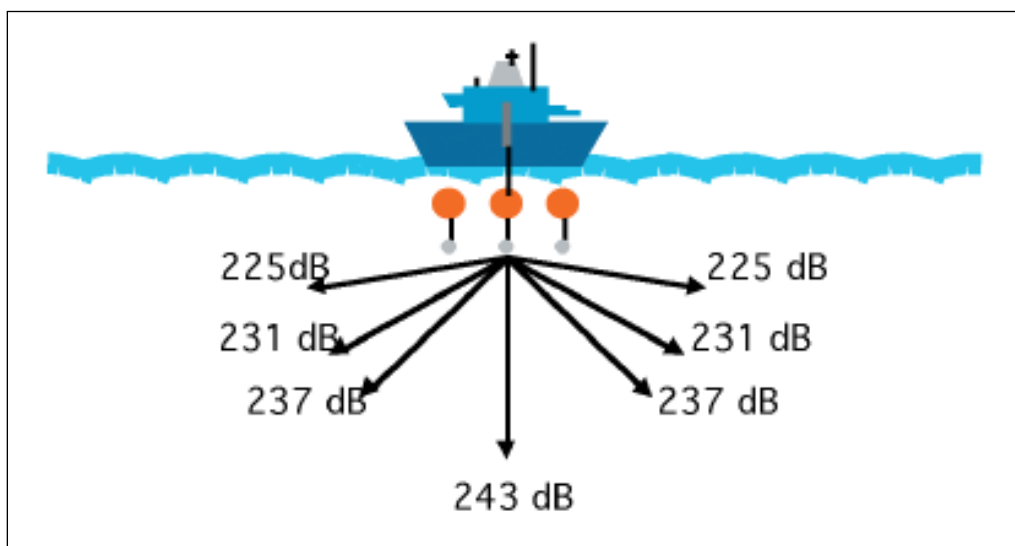
**Figure 6-5:** A seismic source (airgun array) deployed at sea

Source: Shearwater

The sound produced by a compressed air source is a function of the volume, size and shape of the ports by which the air escapes and the air pressure. An air pressure of 2 000 psi (13 789.5 kPa) is most commonly used, but can range from 1 500 to 3 000 psi (Gisiner, 2016). 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.

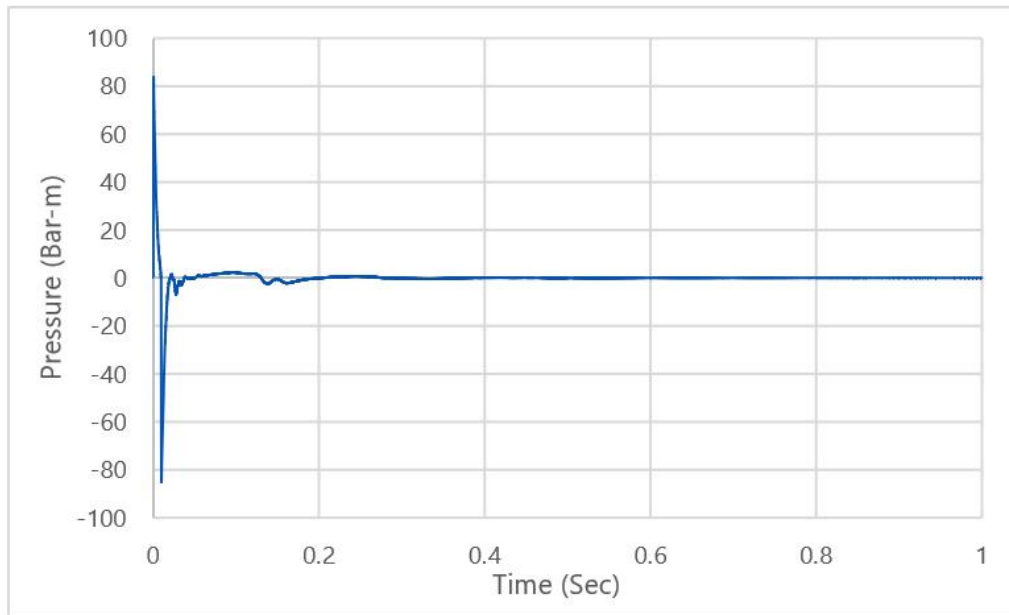
The primary output of an airgun source typically has most of the energy in the frequency bandwidth between 4 and 200 Hz, which is the frequency bandwidth of most interest in seismic surveying (OGP, 2011). The output characteristics of typical seismic source arrays are commonly presented in terms of a “nominal” peak source level or sound pressure level (SPL) in dB re 1  $\mu\text{Pa}$  @ 1 m (OGP, 2011). It is, however, important to note that the “nominal” source level will represent the so-called ‘back calculated’. Actual measurable levels around the array are typically 10-20 dB sound pressure level (SPL), which is the pressure level that would be achieved if all the elements in the source were concentrated into a single point (i.e. point source equivalent dimension) (Caldwell and Dragoset, 2000). For example, a nominal source level of 260 dB peak SPL re 1  $\mu\text{Pa}$  @ 1 m would produce measurable received sound levels between 225 and 243 dB (see Figure 6-6) (Gisiner, 2016).

One of the required characteristics of a seismic shot is that it is of short duration (the main pulse is usually between 5 and 30 milliseconds in duration). The main pulse is followed by a negative pressure reflection from the sea surface of several lower magnitude bubble pulses (see Figure 6-7: A Typica). An important reason for using different size seismic sources in an array is the cancellation of sound from oscillating bubbles after the initial formation. Any sound after the initial pulse clutters the return signal. Thus, by using multiple sources of different volumes, the bubbles oscillate at different rates, interfere with each other, and produce a “cleaner” pulse, as seen in the white composite waveform in Figure 6-7: A Typica.



**Figure 6-6: Pattern of measurable received sound levels around a schematic representation of an array, assuming a nominal point source level of 260 dB peak sound pressure level (SPL<sub>peak</sub>) re 1  $\mu\text{Pa}$**

Source: Caldwell and Dragoset, 2000 in Gisiner, 2016



**Figure 6-7: A typical pressure signature produced on firing of an airgun**

Source: CGG

### 6.2.3 Recording Equipment and Tail Buoy

Signals reflected from geological discontinuities below the seafloor are recorded by hydrophones mounted inside the streamer cable (see Figure 6-8), which can be up to 12 000 m long. Hydrophones are typically made from piezoelectric material encased in a rubber plastic hose. This hose containing the hydrophones is called a streamer. The reflected acoustic signals are recorded and transmitted to the seismic vessel for electronic processing. Analyses of the returned signals allow for interpretation of subsea geological formations. Between 8 and 12 streamers are typically used for a 3D survey.

The streamer is towed at a depth of between 6 m and 30 m and is not visible, except for the tail-buoy at the far end of the cable (see Figure 6-9 and Figure 6-10).



**Figure 6-8: Example of a hydrophone streamer**

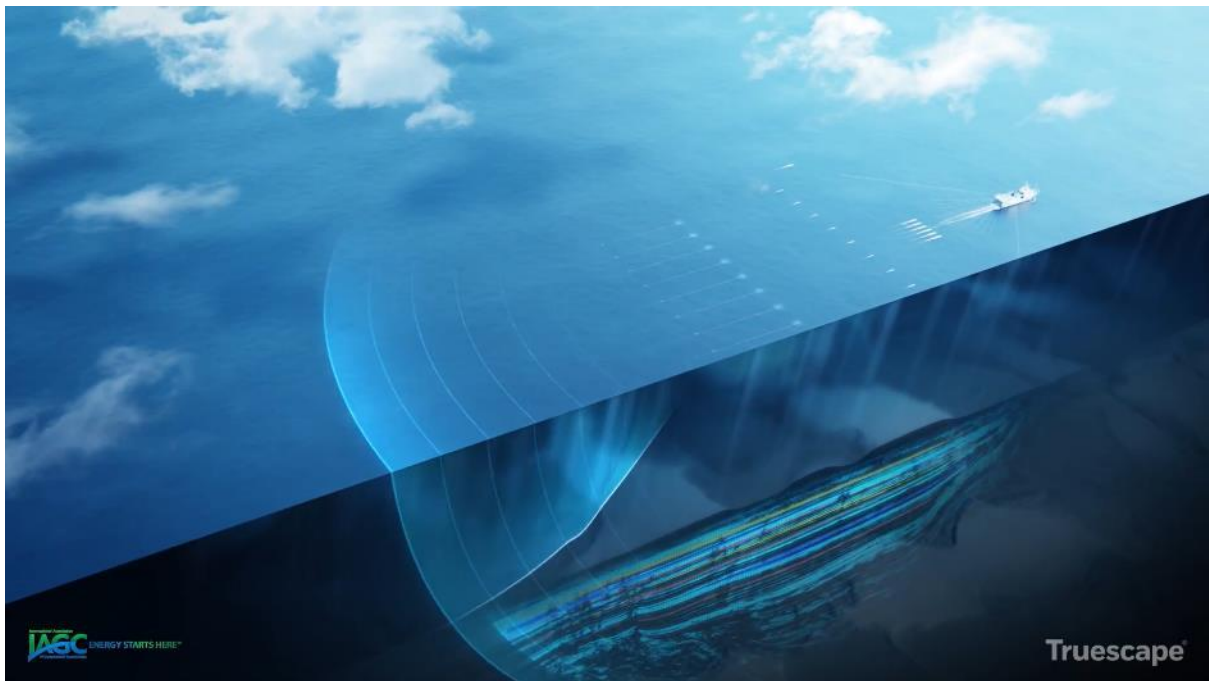
Source: <https://commons.wikimedia.org/>





**Figure 6-9: Example of a tail buoy**

Source: <https://www.shutterstock.com/>



**Figure 6-10: Graphic of a seismic vessel towing gear and a cross section of the resulting data image**

Source: <https://energeoalliance.org/>

### 6.2.4 Technical Characteristics of the Seismic Acquisition

The main technical characteristics of the proposed seismic survey are summarised in Table 6-4: below.

**Table 6-4: Characteristics of seismic acquisition operations (indicative)**

Airgun	
Type of Energy Source	Pressurized air
No. of airgun arrays	3
No. of active airguns	Approximately 36 per array
Spacings between airgun arrays	50 m to 100 m

Airgun	
Towing depth of the airgun	Approximately 7 m
Source volume	Max 3 000 cubic inches each
Operational pressure	2 000 psi
Shot interval	Max every 5 seconds, 18.75 m interval between consecutive shot-points
Hydrophone Streamer	
Types of streamers	Solid
Number of streamers	8
Length of streamer	6 000 m
Depth of streamer	10 to 20 m

### 6.2.5 Main Project Components for Seismic Surveying

This section describes the main project components, these include the following:

- Seismic survey vessel;
- Support and escort vessel;
- Possible helicopter support; and
- Onshore supply base.

#### 6.2.5.1 Seismic Survey Vessel

The survey would be undertaken by a high-capacity modern 3D seismic vessel as part of a longstanding service agreement with Shearwater. This section, however, only presents generic specifications of the survey vessel, as a specific vessel as not yet been confirmed. Specific details of the survey vessel and its certificates of fitness would be provided to PASA ahead of an actual survey.

Depending on the selected contractor, the generic specifications of the survey vessel may vary slightly, but will be of the same order of magnitude as the Shear Water *Amazon Conqueror* (see Figure 6-11:). Specifications of the likely survey vessel type to be used are provided in Table 6-5:.

During the acquisition operations, the survey vessel will receive supplies at sea from the supply vessel. The 3D survey vessel is greatly limited in its ability to manoeuvre by the length and spread of the streamers deployed in the water, which must remain in place parallel to each other.



**Figure 6-11: Amazon Conqueror**

Source: Shearwatergeo.com

**Table 6-5: Generic specifications of a seismic vessel**

Length	126 m
Width	32 m
Gross tonnage	21 195 Tons
Fuel capacity	4 800 m <sup>3</sup>
Cruising speed	17 knots
Acquisition speed	4-5 knots
Combustible to be used	Marine Gasoil (MGO)
Sewage treatment onboard (yes/no)	Yes
Incinerator onboard (yes/no)	Yes

### 6.2.5.2 Survey Vessel Exclusion Zone

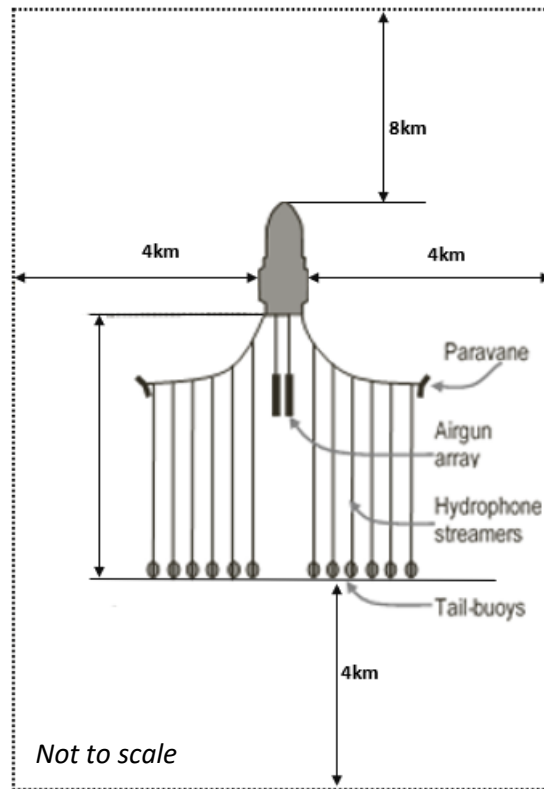
The acquisition of high-quality seismic data requires that the position of the survey vessel and the array be accurately known. Seismic surveys consequently require accurate navigation of the sound source over pre-determined survey transects. This, and the fact that the array and the hydrophone streamers need to be towed in a set configuration behind the survey vessel, means that the survey operation has little manoeuvrability while operating.

Under the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS, 1972, Part B, Section II, Rule 18), a seismic survey that is engaged in surveying is defined as a “vessel restricted in its ability to manoeuvre”, which requires that power-driven and sailing vessels give way to a vessel restricted in her ability to manoeuvre. Vessels engaged in fishing are required to, so far as possible, keep out of the way of the seismic operation.

Furthermore, under the Marine Traffic Act, 1981 (No. 2 of 1981), a seismic survey vessel and its array of airguns and hydrophones fall under the definition of an “offshore installation” and as such it is protected by a 500 m exclusion zone. Unauthorised vessels may not enter the exclusion zone. The temporary 500 m

exclusion zone around the survey vessel will always be enforced during operation. The exclusion zone will be described in a Notice to Mariners as a navigational warning.

In addition to a statutory 500 m exclusion zone, a seismic contractor will typically request a safe operational limit (that is greater than the 500 m exclusion zone) that it would like other vessels to stay beyond. Typical safe operational limits for 3D surveys are illustrated in Figure 6-12:.



**Figure 6-12: Typical configuration and safe operational limits for 3D seismic survey operations**

### 6.2.5.3 Support and Escort ('chase') Vessels

A 3D survey vessel is normally accompanied by two vessels for each survey, one support and one escort vessel.

The support vessel would be required to perform logistics support (including crew changes, supply of equipment, fuel, food and water) to the survey vessel (see Figure 6-13). It is currently anticipated that crew changes and re-provisioning would be undertaken by the support vessel in port or via helicopter. Generic specifications of a typical support vessel are provided in Table 6-6.

The escort (or 'chase') vessel will be equipped with appropriate radar and communications to patrol the area during the seismic survey to ensure that other vessels adhere to the safe operational limits. This vessel would assist in alerting other vessels (e.g. fishing, transport, etc.) about the survey and the lack of manoeuvrability of the survey vessel. At a minimum, one Fisheries Liaison Officer (FLO) able to speak both English and Afrikaans will be on board the escort vessel to facilitate communication with fishing vessels in the local language.



**Figure 6-13: Example of a typical seismic escort vessel (M/V Thor Freyja)**

Source: MarineTraffic.com

**Table 6-6: Generic specifications of a seismic support vessel**

Length	60 m
Width	15 m
Gross tonnage	2 100 Tons
Deadweight	600 Tons
Capacity (accommodation)	60 people
Fuel capacity	1 540 m <sup>3</sup>
Cruising speed	13.7 knots
Combustible to be used	Heavy Fuel Oil (HFO) + Marine Gasoil (MGO)

#### 6.2.5.4 Helicopter

Although unlikely, crew changes could potentially be undertaken via helicopter. Helicopters may also be used to transfer personnel to and from the survey vessel in the event of a medical emergency. Helicopters would operate from Gqeberha.

#### 6.2.5.5 Staffing and Logistics

The main port of call for the collection of supplies during the survey is likely to be Gqeberha. The service infrastructure required to provide the necessary onshore support is already in place at Gqeberha. No additional onshore infrastructure should be necessary for this project.

The survey vessel would accommodate up to 80 people working on 12-hour rotations. In addition, the support and escort vessels would include a crew of approximately 6 to 10 people each. It is currently

anticipated that the support vessel will be used for staff rotations, with helicopter transfers only required in emergency situations.

The support vessel would call into port every 14 to 30 days during the survey for supplies (equipment, fuel, food and water) and crew changes as dictated by need. The supply vessel would occupy the quay for about 24 hours per trip, depending on the quantity of material to be loaded / unloaded.

The methods of refuelling would depend on the contractor and the vessels selected. It is, however, anticipated that the survey vessel would be refuelled at sea ('bunkering') by the support vessel, except in the event of extreme weather conditions which would force refuelling at port. Such bunkering will be undertaken in a safe zone, taking current strength in the area into consideration, under the supervision of and with approval from SAMSA.

## 6.2.6 Emissions, Discharges and Wastes

### 6.2.6.1 Introduction

This section presents the main sources of emissions to air, discharges to water and waste generated that will result from survey operations (including mobilisation and demobilisation).

All vessels will have equipment, systems and protocols in place for prevention of pollution by oil, sewage and garbage in accordance with South African legislation, the MARPOL convention, CGG standards, national and international standards, and good international practices. A specific Waste Management Plan (covering all wastes generated offshore and onshore) will be developed in accordance with MARPOL requirements, South African legislation and international standards. Licenced waste disposal sites and waste management facilities will be identified, verified and approved prior to commencement of survey operations.

### 6.2.6.2 Atmospheric Emissions

The principal sources of emissions to air from the proposed survey will be from vessel engines. The vessels will be supplied with marine gas oil (MGO) or heavy fuel oil (HFO) with less than 0.5% sulphur (mass), which will lead to emissions of sulphur oxides (SO<sub>x</sub>), nitrogen oxides (NO<sub>x</sub>), carbon dioxide (CO<sub>2</sub>) and carbon monoxide (CO). These emissions are released during the normal operation of any marine vessel and have the potential to result in a short-term localised increase in pollutant concentrations. They also contribute to regional and global atmospheric pollution.

The fuel consumption by the survey vessel is estimated at 61.1 Tons/day, the support vessel at 9.4 Tons/day and the escort vessel at 2.8 Tons/day. Fuel consumption estimates are presented in Table 6-7: and related estimate of total air emissions is presented in Table 6-8: (as per the South African requirements for the reporting of greenhouse gas emissions, the IPCC guidelines were used for the estimation of greenhouse gas emissions).

Incineration of certain wastes onboard and compressors associated with energy sources will also produce limited occasional emissions. As with any combustion engine powered by fossil fuels, very limited emissions of unburned hydrocarbons, volatile organic compounds and particles are also likely to be generated by the propulsion system of the vessels.

**Table 6-7: Estimated fuel consumption**

Source	Value*	Units	Estimated No. units	Estimated Consumption of marine fuel (Tons)
Seismic	45	Tons / day	150 days	6 750
Support	9.4	Tons / day	150 days	1 410
Escort	2.8	Tons / day	150 days	420
<b>Total</b>				<b>8 580</b>

\* Indicative values, based on previous survey campaigns.

**Table 6-8: Estimated total atmospheric emissions**

Gas	IPCC Emission factor	Global Warming Potential**	Emitted GHG (tCO <sub>2</sub> e)
CO <sub>2</sub>	77 400	1	26 829
N <sub>2</sub> O	2	296	205
CH <sub>4</sub>	7	23	56
<b>Total</b>			<b>27 570</b>

\* Greenhouse gas (GHG) expressed as CO<sub>2</sub> equivalent (either sum of CO<sub>2</sub> + 265 N<sub>2</sub>O + 28 CH<sub>4</sub>)

\*\* Global warming potentials provided in Third Assessment Report (IPCC, 2001)

### 6.2.6.3 Liquid Discharges

The following main effluents will be discharged into the marine environment:

- Treated grey water<sup>2</sup>;
- Treated sewage (black water);
- Treated bilge water<sup>3</sup> used to clean engine rooms and other potentially polluted sources; and
- Engine cooling water.

The survey vessel and support vessels will be equipped with a water treatment system. Different types of effluents will be treated according to the following prescriptions:

- The disposal into the sea of food waste is permitted, in terms of MARPOL Annex V, when it has been comminuted or ground to particle sizes smaller than 25 mm and the vessel is *en route* and located more than 3 nautical miles (approximately 5.5 km) from land. Disposal overboard without macerating can occur greater than 12 nautical miles (approximately 22 km) from the coast when the vessel is sailing. The volumes of sewage wastes released from the seismic and support vessel would be small and comparable to volumes produced by vessels of similar crew compliment (up to 100 people in total on the three vessels). Sewage would not be discharged instantaneously but at a moderate rate when the vessel is *en route* and travelling at no less than 4 knots.

<sup>2</sup> Grey water: water from the kitchen, washing and laundry activities and non-oily water used for cleaning.

<sup>3</sup> Bilge water: water collected in the lower sections of the vessel. One of the main contributors to bilge water is the cleaning of the engine rooms of the vessel. These waters can, therefore, be contaminated by hydrocarbons and other substances, some of which are likely to be toxic if discharged directly into the marine environment.

- Bilge water will be treated by a hydrocarbon separator certified in accordance with MARPOL. In accordance with MARPOL Annex I, bilge water will be retained on board until it can be discharged to an approved reception facility, unless it is treated by an approved oily water separator to <15 ppm oil content and monitored before discharge. The residue from the onboard oil/water separator will be treated / disposed of via the vessels' waste incinerator (depending on specifications) or onshore at an approved hazardous landfill site.
- Grey water and sewage will be discharged intermittently throughout the survey and will vary according to the number of persons on board. All sewage discharges will be in compliance with MARPOL Annex IV.
  - a biological oxygen demand (BOD) of <25 mg l<sup>-1</sup> (if the treatment plant was installed after 1/1/2010) or <50 mg l<sup>-1</sup> (if installed before this date);
  - minimal residual chlorine concentration of 0.5 mg/l; and
  - no visible floating solids or oil and grease.
- Deck drainage consists of liquid waste resulting from rainfall, deck and equipment washing (using water and an approved detergent). Deck drainage will be variable depending on the vessel characteristics, deck activities and rainfall amounts. In areas where oil contamination of rainwater is more likely, drainage is routed to an oil/water separator for treatment before discharge in accordance with MARPOL Annex I (i.e. 15 ppm oil and grease maximum). There will be no discharge of free oil that could cause either a film, sheen or discolouration of the surface water or a sludge or emulsion to be deposited below the water's surface. Only non-oily water (i.e. <15 ppm oil and grease, maximum instantaneous oil discharge monitor reading) will be discharged overboard. If separation facilities are not available (due to overload or maintenance) the drainage water will be retained on board until it can be discharged to an approved reception facility. The oily residue from the onboard oil/water separator will be treated / disposed of via the vessel's waste incinerator (depending on specifications) or onshore at an approved hazardous landfill site.
- The cooling water and surplus freshwater are likely to contain a residual concentration of chlorine (generally less than 0.5 mg/l for freshwater supply systems); and
- The treated sanitary effluents discharged into the sea are estimated at around 14 000 litres per day for the duration of the seismic study based on 140 -150 litres per 100 persons.

#### 6.2.6.4 Solid Waste

Several other types of wastes generated during the survey will not be discharged at sea, but – depending on the incinerator specification - can be incinerated (e.g. paper waste, food waste, wood, oily residues and plastics) or transported to shore for ultimate disposal (e.g. glass, metal and ash from incinerators). All onboard waste will be segregated, duly identified and transported to shore for disposal at a licenced waste management facility approved by the Operator. The disposal of all waste onshore will be fully traceable.

General and hazardous waste landfill sites are located at Gqeberha. The services of a waste contractor will be used to collect and transport all operational waste for safe disposal or recycling.

A summary of the typical wastes expected to be generated and their management options are detailed in Table 6-9:. It is estimated that approximately 14 m<sup>3</sup> of solid waste per month will be generated during the seismic survey.



**Table 6-9: Summary of potential solid waste streams**

Waste stream	Main sources	Main possible constituents	Comment
Garbage	Various	Packaging materials, paper, cans, etc.	The vessel will be equipped with an incinerator. The metals will be stored on the vessel, all other fuels will be incinerated (depending on incinerator specifications).  Some waste will be transported ashore (including metallic waste, and other waste such as glass and incinerator ash) for recycling or disposal to landfill.
Medical waste	Dressings, clinical and cleaning materials	Pathogenic organisms, plastic, glass, drugs, needles	A syringe box will be made available onboard to collect medical equipment which will be disposed of by incineration (depending on incinerator specifications) or at an approved facility ashore.
Potentially hazardous waste	Batteries, paint cans, lubricating oils, etc.	Hydrocarbons, metals, acids, etc.	Transferred to land for disposal by an approved facility. There will be no discharge of hazardous waste at sea.

### 6.2.6.5 Noise Emissions

The key sources generating underwater noise are vessel propellers, with a contribution from the hull (e.g. noise originating from within the hull and on-deck machinery), and from airgun operations (see Section 6.2.4). If a helicopter will be used its can also form a source of noise, which can affect marine fauna both in terms of underwater noise beneath the helicopter and airborne noise.

The extent of project-related noise above the background noise level may vary considerably depending on the specific vessels used, the number of supply vessels operating and the airgun array. It will also depend on the variation in the background noise level with weather and with the proximity of other vessel traffic (not associated with the project). The Sound Transmission Loss Modelling study (see Appendix 5) determines transmission loss with distance from the survey area and relative zones of impact by considering the bathymetry of the survey area, sound speed profile within the water column and geo-acoustic properties related to seafloor sediments.

### 6.2.6.6 Light Emissions

Operational lighting will be required on the survey vessels for safe operations and navigation purposes during the hours of darkness. Where feasible, operational lights will be shielded in such a way as to minimise their spill out to sea.

## 6.3 FINANCIAL PROVISION AND INSURANCES

As per the Government Regulations pertaining to Financial Provision (GN No. R1147 of 2015, as amended), an operator is responsible for the management and rehabilitation of guaranteed impacts of an exploration activity. Sufficient financial provision would need to be made to ensure that rehabilitation is undertaken

after completion of exploration activities. Such provision does not, however, include the management of unplanned events such as vessel collisions or lost equipment.

As seismic surveys do not have any specific guaranteed impacts that would need to be rehabilitated, no financial guarantees are required in terms of the Financial Provision Regulations. CGG and its appointed contractors would, however, need to have the necessary vessel insurances in place in order to manage the consequences of any unplanned event. Proof of such insurances would be submitted to PASA and SAMSA before activities would be allowed to commence.

## 6.4 CONSIDERATION OF ALTERNATIVES

“Alternatives” to a proposed activity are defined as “a different means of meeting the general purpose and requirements of the activity, which may include alternatives to the:

- Property on which or location where the activity is proposed to be undertaken;
- Type of activity to be undertaken;
- Design or layout of the activity;
- Technology to be in the activity; or
- Operational aspects of the activity.”

A summary of the project alternatives considered during the project design, which have been considered in the Basic Assessment process are summarised in Table 6-10 below. These are presented in alignment with the mitigation hierarchy which prioritises the need for avoidance over minimisation. Avoidance measures are typically the most important way of minimising project impacts primarily through site selection or timing of activities. The need to assess alternatives is specifically required where significant impacts of the proposed project activity are predicted to arise.

A comparative assessment of the project alternatives is provided in Section 10.3.

**Table 6-10: Summary of Project Alternatives**

MH	No.	Alternatives	Description	Comment on Status
Avoidance	<b>1. Site / location alternatives</b>			
	1.1	Survey area location	The location of the exact survey lines within the Reconnaissance Permit application area has not been finalised. CGG has, however, confirmed that data acquisition would be undertaken within a 9 000 km <sup>2</sup> area of interest within the Reconnaissance Permit area and that all seismic survey operational activities would be limited to the boundaries of the Reconnaissance Permit area. Although there is overlap with the Port Elizabeth Corals Marine Protected Area (MPA), no data acquisition would be undertaken within the MPA or within a 2 km buffer around the MPA. There is overlap with the Kingklip Corals Ecologically or Biologically Significant Area (EBSA) in the inshore area of the Reconnaissance Permit area (see Figure 7-46). There is also an approximately 13.4% overlap with Critical Biodiversity Area 1 (CBA1) and CBA2 areas and a 6.5% overlap with Ecological Support Areas (ESA), including the buffer around the Port Elizabeth Corals MPA (see Figure 7-47).	<p>CGG would limit survey activities to 9 000 km<sup>2</sup> within the 12 750 km<sup>2</sup> Reconnaissance Permit area. This Basic Assessment considers that the proposed 3D survey could be undertaken anywhere within the Reconnaissance Permit area, apart from the Port Elizabeth Corals MPA and related buffer zone.</p> <p>A larger area of interest was originally considered by CGG as part of a previous Reconnaissance Permit application process. Having reconsidered the data acquisition requirements, the location of the key fishing areas and proximity to seabird breeding islands, the Reconnaissance Permit area was reduced from the previous application to avoid overlap with squid fishing grounds and minimise overlap with key trawl fishing grounds.</p> <p>The smaller Reconnaissance Permit area was considered in the Marine Ecology and Fisheries Impact Assessments to confirm potential impacts on nearby sensitive areas (CBAs / EBSAs / MPAs) and fishing grounds, respectively. Based on the noise modelling results and survey area location, specialists have recommended various mitigation measures to avoid / minimise potential impacts (e.g., a 60-minute pre-watch survey and 800 m noise mitigation zone).</p>
	1.2	Onshore base locations	Due to the location of the proposed survey, the onshore supply base would be located at the Port of Gqeberha as the closest port of sufficient size to service the supply vessels.	The Basic Assessment considers the option of sourcing supplies from the Port of Gqeberha. Due to the temporary nature of the survey and limited supply requirements, there would be no difference in impact significance between Gqeberha and another South African port, e.g. Cape Town.
	<b>2. Timing / Scheduling Alternatives</b>			
	2.1	Timing of seismic survey	Seismic activities may impact on marine fauna, such as plankton (including fish eggs and larvae), whales, dolphins, turtles and seabirds that have seasonal occurrences in the survey area of interest.	The Basic Assessment considers the implications of surveying within the 2023/2024 summer survey window period from December to May (inclusive), with the earliest commencement date in January 2024. The proposed survey period would avoid the key whale migration period (June to November) as well as key squid and kingklip spawning periods. If any other periods were to be considered, it would encroach into sensitive spawning and migration periods.
	<b>3. No-Go alternative</b>			
3.1	No-Go option	The No-Go alternative represents the option not to proceed with the proposed survey and represents maintaining the status quo, except for variations from natural causes or other human activities. This leaves the project area of influence (see Section 7.2) in its current state and precludes the opportunity of identifying further potential oil and gas resources as part of Government’s aim to include natural gas in the country’s energy mix.	The implications of the No-Go alternative are considered in Section 8.9.	

MH	No.	Alternatives	Description	Comment on Status
Minimisation	<b>4. Technology Alternatives</b>			
	4.1	Seismic technology	The proposal is to undertake a 3D seismic survey using seismic airguns as sound source.	A viable data acquisition alternative to seismic surveys is not currently available on a commercial scale and for the survey requirements in the proposed Reconnaissance Permit area. The Basic Assessment, however, assumes that CGG will define and enforce the use of the lowest practicable seismic source volume of production. It has been suggested in the public domain that alternative technology, Marine Vibroseis, should be considered as an alternative to seismic airguns. This technology is, however, still very much in its infancy and there is not yet a test option to use the technology on a largescale project. The technology also has a very limited bandwidth application, constrained to the low end of the frequency spectrum. The operational use of the system is therefore extremely limited to low frequency sampling and not feasible for use in the proposed survey area, even if a viable commercial system was available.
	4.2	Helicopter flight paths	Helicopter flights between the shore base and the drilling unit may impact on seabirds or seals on coastal rocky shores or islands during specific breeding seasons.	The Basic Assessment assesses the risk of helicopter flights on seabirds or seals to confirm whether helicopter flight paths need to be rerouted to avoid certain sensitive areas. Recommendations are made to avoid such areas and maintain a specified altitude.