# 3. PROJECT DESCRIPTION

This chapter describes the need and desirability for the proposed project, provides general project information, an overview of the proposed exploration drilling programme and a description of the project alternatives.

## 3.1 NEED AND DESIRABILITY

Fossil fuels (including gas) play a central role in the socio-economic development of South Africa, while simultaneously providing the necessary infrastructural economic base for the country to become an attractive host for foreign investments in the energy sector (Ministerial foreword of the White Paper on the Energy Policy 1998). The White Paper on the Energy Policy (1998) is the overarching policy document which guides future policy and planning in the energy sector. It states that the government will, *inter alia*, "promote the development of South Africa's oil and gas resources…" and "ensure private sector investment and expertise in the exploitation and development of the country's oil and gas resources". The successful exploitation of these natural resources would contribute to the growth of the economy and relieve pressure on the balance of payments.

The National Development Plan (NDP) (2012) provides the context for all development in South Africa, with the overarching aim of eradicating poverty and inequality between people in South Africa. The NDP identifies the need to diversify the current energy mix and to reduce carbon emissions. There is a clear intention for gas to play a more significant role in the energy mix and the exploration of gas as an alternative to coal for energy production has been recognised as a planning priority.

The position of the NDP is reiterated in the Draft Integrated Energy Plan (IEP) (2013), which seeks to determine how current and future energy needs can be addressed efficiently. Key objectives outlined in the plan include security of supply, increased access to energy, diversity in supply sources and primary sources of energy and minimising emissions. The plan indicates that projected demand for natural gas between 2010 and 2050 would be second only to petroleum products, primarily due to increased growth in the industrial sector. It also identifies significant potential for natural gas in terms of power generation and direct thermal uses.

An increase in domestic natural gas reserves would also contribute to security of supply in the gas-to-liquids industry, which relies on feedstock from coal, oil and gas reserves. The Draft IEP points out the vulnerability of the liquid fuels industry and its economy to fluctuations in the global oil market, given that South Africa is a net importer of oil. Furthermore, existing gas stocks in the domestic offshore are declining, and new sources of feedstock are required to support and increase production in the gas-to-liquids industry (NDP, 2012).

As such, exploration for additional domestic hydrocarbon reserves is considered important and any discoveries would be well received by the local market. The Department of Energy's Integrated Resource Plan (2010-2030) supports this view, stating that regional and domestic gas options should be pursued. In essence, the government's official position is that exploration and development of oil and gas fields should be encouraged.

In July 2014 the South African Government launched Operation Phakisa[1], which is an innovative, pioneering and inspiring approach that will enable South Africa to implement its policies and programmes better, faster and more effectively. Operation Phakisa aims to, *inter alia*, unlock the economic potential of South Africa's

[1] Address by President Jacob Zuma at the launch of Operation Phakisa, 19 July 2014; http://www.thepresidency.gov.za/pebble.asp?relid=17739)

oceans. In this regard four priority sectors have been selected as new growth areas in the ocean economy, including:

(a) Marine transport and manufacturing activities, such as coastal shipping, trans-shipment, boat building, repair and refurbishment;
(b) Offshore oil and gas exploration;
(c) Aquaculture; and
(d) Marine protection services and ocean governance.

In terms of offshore oil and gas exploration the goal is to further enhance the enabling environment for exploration of oil and gas while simultaneously maximising the value captured for South Africa. The proposal by Rhino provides an opportunity to meet one of the aims of Operation Phakisa.

The identification of potential geological structures or "prospects" within the proposed exploration licence area for future exploration and possible well-drilling provides an opportunity to develop a South African oil and gas industry resulting in long-term benefits consisting of access to new energy sources, improved security of supply, major in-country investments in a development project and reduced dependence on the importation of hydrocarbons. There is also potential in the long-term for local economic stimulation through direct employment, future business opportunities, royalties and tax revenues.

In summary, exploration success would result in long-term benefits for South Africa consisting of access to new energy sources, improved security of supply, major in-country investments in a development project and reduced dependence on the importation of hydrocarbons.

## 3.2 GENERAL PROJECT INFORMATION

### 3.2.1 EXPLORATION RIGHT HOLDER

Rhino as the applicant for an Exploration Right will also be the operator for the proposed project.

| | |
|---|---|
| Address: | Rhino Oil and Gas Exploration South Africa (Pty) Ltd<br>Icon Building, Suite 300<br>Corner of Long Street & Hans Strijdom Avenue<br>CAPE TOWN<br>8000 |
| Vice President & COO: | Phillip Steyn |
| Cell: | +27 797 161 030 |
| E-mail: | psteyn@rhinoresourcesltd.com |

### 3.2.2 LICENCE AREA DETAILS

Licence Blocks 3617 and 3717 are located off the South-West Coast of South Africa and cover an area of approximately 13 279 km$^2$. The eastern border of the proposed exploration licence area is located between approximately 190 km and 385 km off the South-West Coast of South Africa in water depths greater than 3 500 m (see Figure 1.1). The co-ordinates of the proposed exploration licence area are provided Table 3.1.

**Table 3.1: Co-ordinates of License Blocks 3617 and 3717.**

| Point | Latitude (S) | | | Longitude (E) | | |
|---|---|---|---|---|---|---|
| 1 | 37° | 48' | 15.3236" | 18° | 00’ | 00.0000” |
| 2 | 36° | 00’ | 00.0000” | 18° | 00’ | 00.0000” |
| 3 | 36° | 00’ | 00.0000” | 17° | 00’ | 00.0000” |
| 4 | 37° | 27’ | 53.2011” | 17° | 00’ | 00.0000” |

Co-ordinate system: WGS 84

### 3.2.3 FINANCIAL PROVISION

In terms of Section 24P of NEMA, an applicant for Environmental Authorisation relating to exploration must, before the Minister of Mineral Resources issues the Environmental Authorisation, comply with the prescribed financial provision for the rehabilitation, closure and ongoing post decommissioning management of negative environmental impacts.

Rhino would ensure appropriate insurance cover is in place prior to any work being undertaken in the exploration licence area. Rhino would discuss and conclude the nature and quantum of the financial provision required for the management and remediation of environmental damage with PASA prior to any exploration activities being undertaken. The proposed nature and quantum of the financial provision will be presented in the EIR.

## 3.3 PROPOSED EXPLORATION PROGRAMME

The proposed exploration programme in Licence Blocks 3617 and 3717 would commence with acquisition and collation of existing data. Thereafter multi-beam bathymetry and 2D/3D seismic surveys would be conducted to identify potential target areas for future exploration. The proposed activities associated with the exploration programme are described further below.

### 3.3.1 MULTI-BEAM BATHYMETRY

#### 3.3.1.1 Introduction

There are a number of different sonar surveying tools for investigating the structure of the ocean bed sediment layers (including depth sounders, side scan sonar, bottom profilers and multi-beam echo/depth sounders). The operator proposes to undertake a multi-beam bathymetry survey to produce a digital terrain model of the seafloor (see Figure 3.1).

#### 3.3.1.2 Methodology

The survey vessel would be equipped with a multi-beam echo sounder to obtain swath bathymetry and a sub-bottom profiler to image the seabed and the near surface geology within the proposed exploration licence area. The multi-beam system provides depth sounding information on either side of the vessel’s track across a swath width of approximately two times the water depth.

The multi-beam echo sounder emits a fan of acoustic beams from a transducer at frequencies ranging from 10 kHz to 200 kHz and typically produces sound levels in the order of 207 db re 1µPa at 1m. The sub-bottom profiler emits an acoustic pulse from a transducer at frequencies ranging from 3 kHz to 40 kHz and typically produces sound levels in the order of 206 db re 1µPa at 1m.

#### 3.3.1.3 Extent and duration

The multi-beam bathymetry survey would be undertaken over the majority of the proposed exploration licence area. It is anticipated that data acquisition would take in the order of 15 to 20 productive days to complete at a vessel speed of 4 knots.

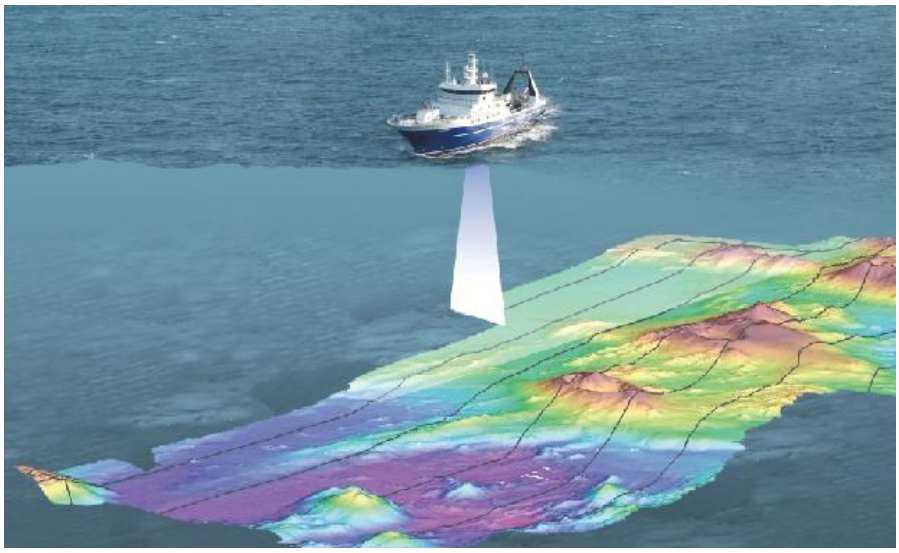

**Figure 3.1: Illustration of a vessel using multi-beam depth/echo sounders (http://www.gns.cri.nz/).**

### 3.3.2 SEISMIC SURVEYS

#### 3.3.2.1 Introduction

Seismic surveys are carried out during oil and gas exploration activities in order to investigate subsea geological formations. During seismic surveys, high-level, low frequency acoustics are directed towards the seabed 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 (see Figure 3.2). Analyses of the returned signals allow for interpretation of subsea geological formations.

Seismic surveys are undertaken to collect either 2D or 3D data. 2D surveys are typically applied to obtain regional data from widely spaced survey grids (tens of kilometres) and infill surveys on closer grids (down to a 1 km spacing) are applied to provide more detail over specific areas of interest such as potentially drillable petroleum prospects. A 2D survey provides a vertical slice through the earth's crust along the survey track-line. The vertical scales on displays of such profiles are generally in two-way sonic time, which can be converted to depth displays by using sound velocity data.

3D surveys are typically applied to promising petroleum prospects to assist in fault interpretation, distribution of sand bodies, estimates of oil and gas in place and the location of exploration wells. A 3D survey operation requires multiple traverses of the survey area over the region of interest. Typically the surface sail line tracks of the vessel are separated by half the streamer array width.

For this investigation Rhino is proposing to undertake acquisition of a 2D seismic survey. However, if it is determined by subsequent analysis of existing data, that acquisition of a seismic dataset utilising 3D seismic techniques might be a more advantageous approach for data collection, then a 3D seismic survey might be substituted for the 2D survey or may be done in addition to the 2D seismic survey.

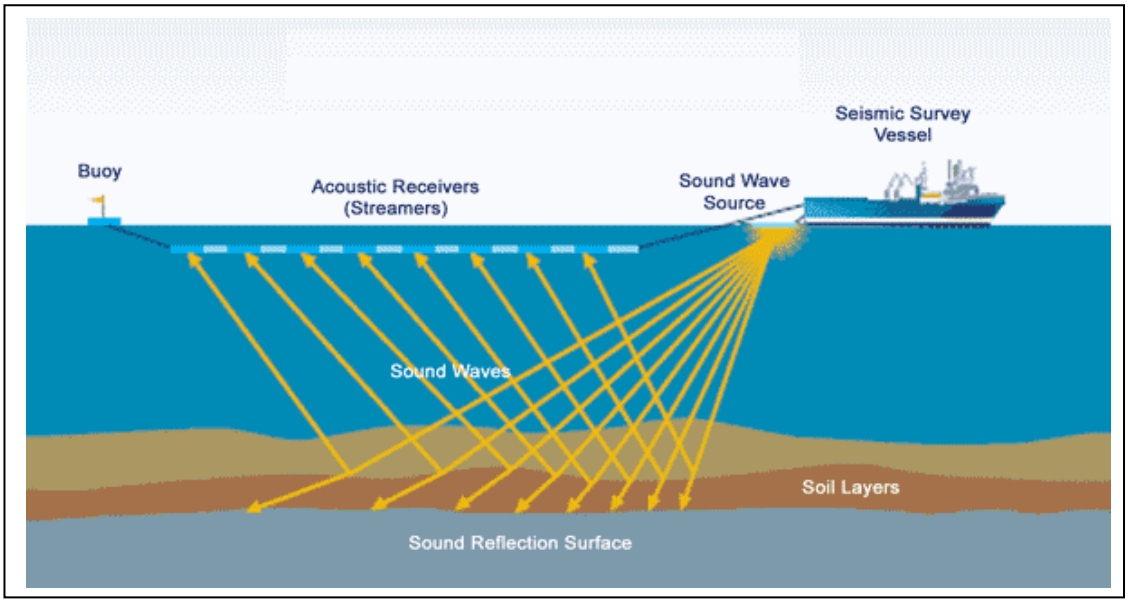


**Figure 3.2: Principles of offshore seismic acquisition surveys (from fishsafe.eu).**

#### 3.3.2.2 Survey methodology and airgun array

The seismic survey would be conducted using a purpose-built seismic vessel. The seismic vessel would travel along transects of a prescribed grid within the survey area that have been carefully chosen to cross any known or suspected geological structure. During surveying, the seismic vessel would travel at a speed of between four and six knots (i.e. 2 to 3 metres per second).

The seismic survey would involve a towed airgun array, which provides the seismic source energy for the profiling process, and a seismic wave detector system, usually known as a hydrophone streamer. The anticipated airgun and hydrophone array would be dependent on whether a 2D or 3D seismic survey is undertaken. The sound source or airgun array (one for 2D and two for 3D) would be situated some 80 m to 150 m behind the vessel at a depth of 5 m to 25 m below the surface. A 2D survey typically involves a single streamer, whereas 3D surveys use multiple streamers (up to 12 streamers spaced 100 m apart). The array can be up to 12 000 m long. The streamer/s would be towed at a depth of between 6 m and 30 m and would not be visible, except for the tail-buoy at the far end of the cable. A typical 3D seismic survey configuration and safe operational limits are illustrated in Figure 3.3.

Airguns, which are the most common sound source used in modern seismic surveys, would be used for the proposed survey. The 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. Airguns are used on an individual basis (usually for shallow water surveys) or in arrays. Arrays of airguns are made up of towed parallel strings, usually comprised of between 12 and 70 airguns in total. The airguns are commonly towed some 100 m to 200 m behind the vessel at a depth of 5 to 25 m below the surface. The airgun would be fired at approximately 10 to 20 second intervals.

The sound waves are reflected by boundaries between sediments of different densities and returned signals are recorded by hydrophones mounted inside streamer cables and transmitted to the seismic vessel for electronic processing. Analyses of the returned signals allow for interpretation of subsea geological formations.

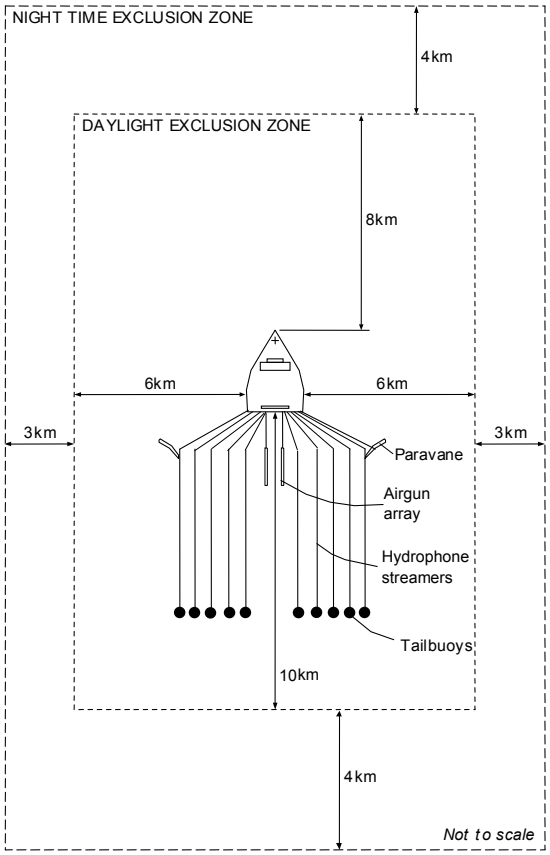


**Figure 3.3: Typical configuration for a 3D seismic survey operation. Safe operational limits applicable to both 2D and 3D surveys are also shown.**

#### 3.3.2.3 Sound pressure emission levels

A single airgun could typically produce sound levels in the order of 220-230 dB re 1 mPa @ 1m, while arrays produce sounds typically in the region of 250 dB re 1 mPa @ 1m. The majority of energy produced is in the 0 to 120 Hz bandwidth, although energy at much higher frequencies is also recorded. High-resolution surveys and shallow penetration surveys require relatively high frequencies of 100-1000 Hz, while the optimum wavelength for deep seismic work is in the 10-80 Hz range.

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). The main pulse is followed by a negative pressure reflection from the sea surface of several lower magnitude bubble pulses (see Figure 3.4). Although the peak levels during the shot may be high, the overall energy is limited by the duration of the shot.

#### 3.3.2.4 Extent, duration and timing

It is anticipated that the proposed 2D seismic survey would be at a minimum 200 km in total length comprising a number of low density spaced survey lines covering the majority of the proposed exploration licence area (see Figure 3.5).

Although survey commencement would ultimately depend on a permit award date, availability of seismic contractors and other factors, it is anticipated that the survey would be undertaken during the summer of 2016/2017 and would take in the order of 15 to 20 productive days to complete. The summer period has specifically been selected in order to avoid the main cetacean migration / breeding period from June to December, as well as ensuring optimal sea state and weather conditions.

Once the initial 2D survey has been undertaken (or replaced by an initial 3D survey) the data will be analysed. After data analysis further possible target areas may be identified for further 3D surveying.

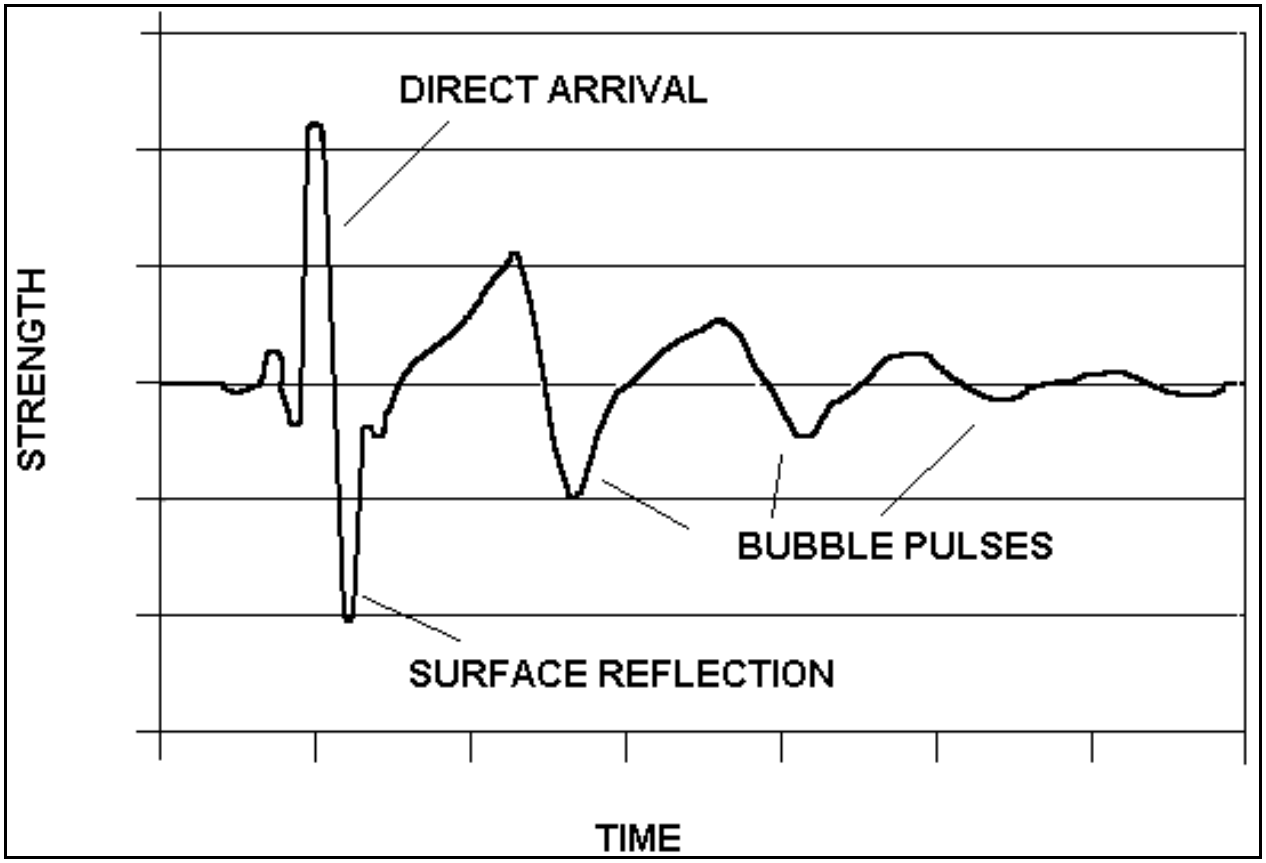


**Figure 3.4: A typical pressure signature produced on firing of an airgun.**

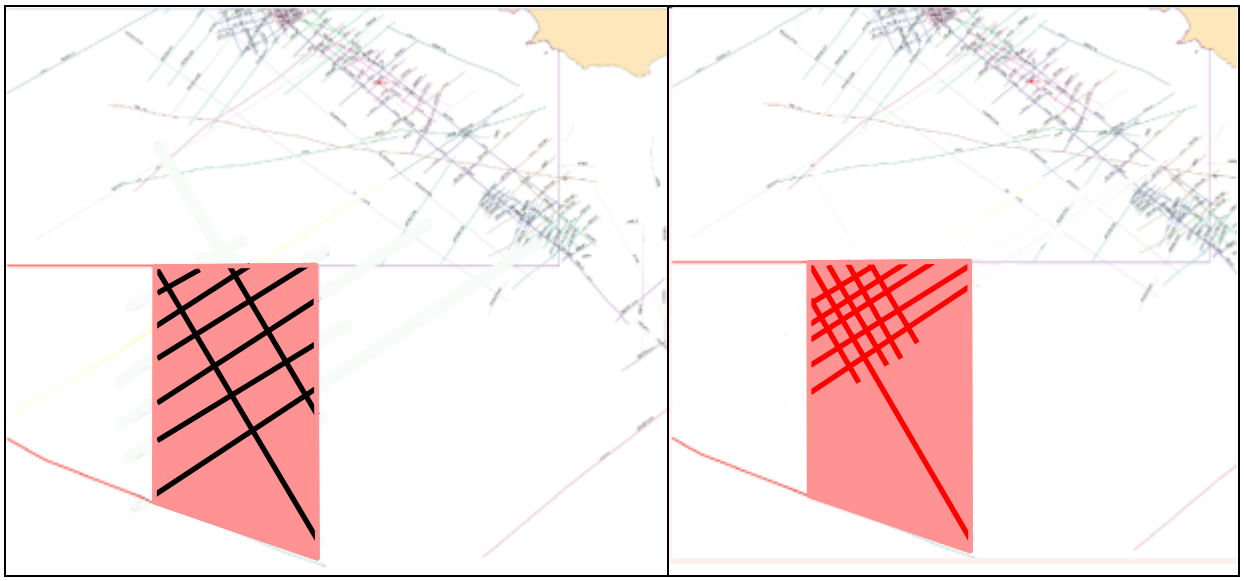

**Figure 3.5: Indicative alternatives for the multi-beam bathymetry and seismic survey lines in the offshore exploration licence area.**

### 3.3.3 EXCLUSION ZONES

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 tow-ship, 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, Rule 18), survey vessels that are engaged in surveying or towing operations are defined as "vessel restricted in its ability to manoeuvre[2]" which requires that power-driven and sailing vessels give way to a vessel restricted in its ability to manoeuvre. Vessels engaged in fishing shall, so far as possible, keep out of the way of the seismic survey operation. Furthermore, under the Marine Traffic Act, 1981 (No. 2 of 1981), a vessel (including array of airguns and hydrophones) used for the purpose of exploiting the seabed falls under the definition of an "offshore installation" and as such it is protected by a 500 m safety zone. It is an offence for an unauthorised vessel to enter the safety zone. In addition to a statutory 500 m safety zone, a seismic contractor would typically request a safe operational limit (that is greater than the 500 m safety zone) that it would like other vessels to stay beyond. Typical safe operational limits for a 2D and 3D survey are illustrated in Figure 3.3.

At least a 500 m exclusion zone would need to be enforced around all survey vessels (including its array of airguns and hydrophones) at all times. A chase boat with appropriate radar and communications would be used during the seismic survey to warn vessels that are in danger of breaching the exclusion zone.

The 500 m safety zone and proposed safe operational limits would be communicated to key stakeholders well in advance of the proposed exploration programme. Notices to Mariners will also be communicated through the proper channels.

### 3.3.4 SUPPORT SERVICES

A support vessel may be required to perform logistics support to the seismic vessel.

Bunkering of the survey vessels is expected to be undertaken at port of operation (Cape Town or Saldanha) or at sea during the survey. Standard operating procedures for refuelling would be adhered to at all times.

### 3.3.5 ENVIRONMENTAL NOTIFICATION

At this stage no vessels have been contracted for the various exploration activities. Thus specific detail would only be available when the operator has appointed a contractor/s and contracted vessel/s. The specific details of the contractor/s and vessel/s would be compiled into an Environmental Notification that would be

[2] Definition: The term "vessel restricted in her ability to manoeuvre" means a vessel which from the nature of her work is restricted in her ability to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel. The term "vessels restricted in their ability to manoeuvre" shall include but not be limited to:

- (i) a vessel engaged in laying, servicing, or picking up a navigation mark, submarine cable or pipeline;
- (ii) a vessel engaged in dredging, surveying or underwater operations;
- (iii) a vessel engaged in replenishment or transferring persons, provisions or cargo while underway;
- (iv) a vessel engaged in the launching or recovery of aircraft;
- (v) a vessel engaged in mine clearance operations; and
- (vi) a vessel engaged in a towing operation such as severely restricts the towing vessel and her tow in their ability to deviate from their course.

prepared per exploration activity and submitted to PASA for information purposes prior to the commencement thereof. The Environmental Notification may include, depending on the activity, the following:

- Survey lines / target area;
- Survey timing and duration;
- Contractor details;
- Vessel specifications (including relevant certification and insurance);
- Emergency Response Plan and Shipboard Oil Pollution Emergency Plan (SOPEP); and
- Details of Marine Mammal Observer, Passive Acoustic Operator and Fisheries Liaison Officer, where applicable.

## 3.4 PROJECT ALTERNATIVES

NEMA prescribes that every application for Environmental Authorisation must include, *inter alia*, an investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity (i.e. No-Go Alternative).

"Alternatives", in relation to a proposed activity, are different ways of meeting the general purposes and requirements of the proposed activity, which may include alternatives to:

- the location where it is proposed to undertake the activity;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity; and
- the option of not implementing the activity.

A summary of the project alternatives that have been considered during the scoping process is provided in Table 3.2 below.

**Table 3.2: Summary of project alternatives.**

| No. | Alternatives | Description |
|---|---|---|
| **1. Site / location alternatives** | | |
| 1.1 | Exploration Right area | The location of the proposed exploration activities are ultimately determined by Rhino's application for an Exploration Right in Licence Blocks 3617 and 3717. Thus the proposed exploration activities would be limited to these blocks and no further site alternatives can be considered.<br><br>The S&EIA will assess the potential impacts of the proposed exploration activities over the entire extent of the proposed exploration licence area. |
| **2. Activity alternatives** | | |
| 2.1 | Bathymetry and Seismic Surveys | Rhino has assessed the petroleum potential of the proposed exploration licence area using existing data available from PASA and public sources (seismic surveys and data from existing exploration wells). This assessment has indicated there may be a possibility to find oil or gas reservoirs within the area.<br><br>In order to better understand the potential of finding oil or gas within the Exploration Right area, Rhino are proposing to undertake multi-beam bathymetry and 2D / 3D seismic surveys. No other activity alternatives are being considered in the S&EIA process. |

| No. | Alternatives | Description |
|---|---|---|
| **3. Design or layout alternatives** | | |
| 3.1 | Survey Lines | Rhino is considering two alternative bathymetry and seismic programme plans for the multi-beam bathymetry and seismic survey lines in the proposed exploration licence area (see Figure 3.5).<br><br>In order to cater for any potential deviations to the proposed alternative bathymetry and seismic programme plans, the S&EIA will assess the potential impacts of the proposed exploration activities over the entire extent of the proposed exploration licence area. |
| 3.2 | Scheduling | Although Rhino is proposing to commence the seismic surveys in a fair weather period in 2016 / 2017 (see Section 3.3.2.4), the S&EIA will assess the potential impacts of the proposed exploration activities during both the summer and winter. |
| **4. Technology alternatives** | | |
| 4.1 | Sonar survey technologies | In order to further investigate the structure of the ocean bed sediment layers, there are several possible alternative technologies available, including:<br>• Depth sounders;<br>• Side scan sonar;<br>• Bottom profilers; and<br>• Multi-beam bathymetry.<br><br>Rhino is proposing to undertake multi-beam bathymetry surveys. No other sonar survey technology alternatives are being considered in the S&EIA process. |
| 4.2 | Seismic survey technologies | The main seismic survey parameters such as line position, line length, line spacing and streamer length are determined in advance by geophysicists bearing in mind the objectives of the survey. Parameters such as airgun array and streamer tow depths may be adjusted at the start of the survey to optimise data quality. Gun types, array configurations, and streamer type are limited to what equipment is available on the contacted vessel and, therefore, cannot be easily changed.<br><br>For this investigation Rhino is proposing to undertake acquisition of a 2D seismic survey. However, if it is determined by subsequent analysis of existing data, that acquisition of a seismic dataset utilising 3D seismic techniques might be a more advantageous approach for data collection, then a 3D seismic survey might be substituted for the 2D survey or may be done in addition to the 2D seismic survey.<br><br>The S&EIA will assess the potential impacts of undertaking both 2D and 3D seismic surveys. |

### 3.4.1 NO-GO ALTERNATIVE

The No-Go alternative is the non-occurrence of the proposed exploration activities. Thus there would be no acquisition of bathymetry and seismic data for the proposed exploration licence area as proposed. The negative implications of not going ahead with the proposed exploration are as follows:

- South Africa would lose the opportunity to further establish the extent of indigenous oil or gas reserves off the South-West Coast;
- Lost economic opportunities related to sunken costs (i.e. costs already incurred) of initial desktop investigations in the proposed exploration licence area; and
- If economic oil and gas reserves do exist and are not developed, South Africa / Rhino would lose the opportunity to maximise the use of its own indigenous oil and gas reserves.

The No-Go alternative will be assessed in the EIA phase.