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ENVIRONMENTAL IMPACT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME FOR AN EXPLORATION RIGHT APPLICATION FOR PETROLEUM PRODUCTS ON VARIOUS FARMS IN THE MAGISTERIAL DISTRICTS OF MATATIELE AND MT FLETCHER, EASTERN CAPE (12/3/295 ER)

August 2016

SUBMITTED FOR ENVIRONMENTAL AUTHORISATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (NO. 107 OF 1998) (AS AMENDED) IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY AN APPLICATION IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (NO. 28 OF 2002) (AS AMENDED)

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PASA REFERENCE NUMBER: 12/3/295 ER

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EXECUTIVE SUMMARY

1. Introduction and Background

This Environmental Impact Report ("EIR") and Environmental Management Programme ("EMPr") have been compiled and distributed for review and comment as part of the Scoping and Environmental Impact Assessment (hereafter collectively referred to as "EIA") process that is being undertaken for the application by Rhino Oil & Gas Exploration South Africa (Pty) Ltd (hereafter referred to as "Rhino Oil and Gas") for an Exploration Right ("ER') for petroleum products on various farms in the magisterial districts of Matatiele and Mount Fletcher, Eastern Cape, South Africa (12/3/295 ER).

This EIR summarises the EIA process followed to date and provides an overview of the proposed project and the affected environment. It provides an assessment of the impacts of the proposed project and sets out the recommend management measures. Interested and Affected Parties ("I&APs") are asked to comment on the EIA and EMPr before it is submitted to the Petroleum Agency of South Africa ("PASA") for decision-making.

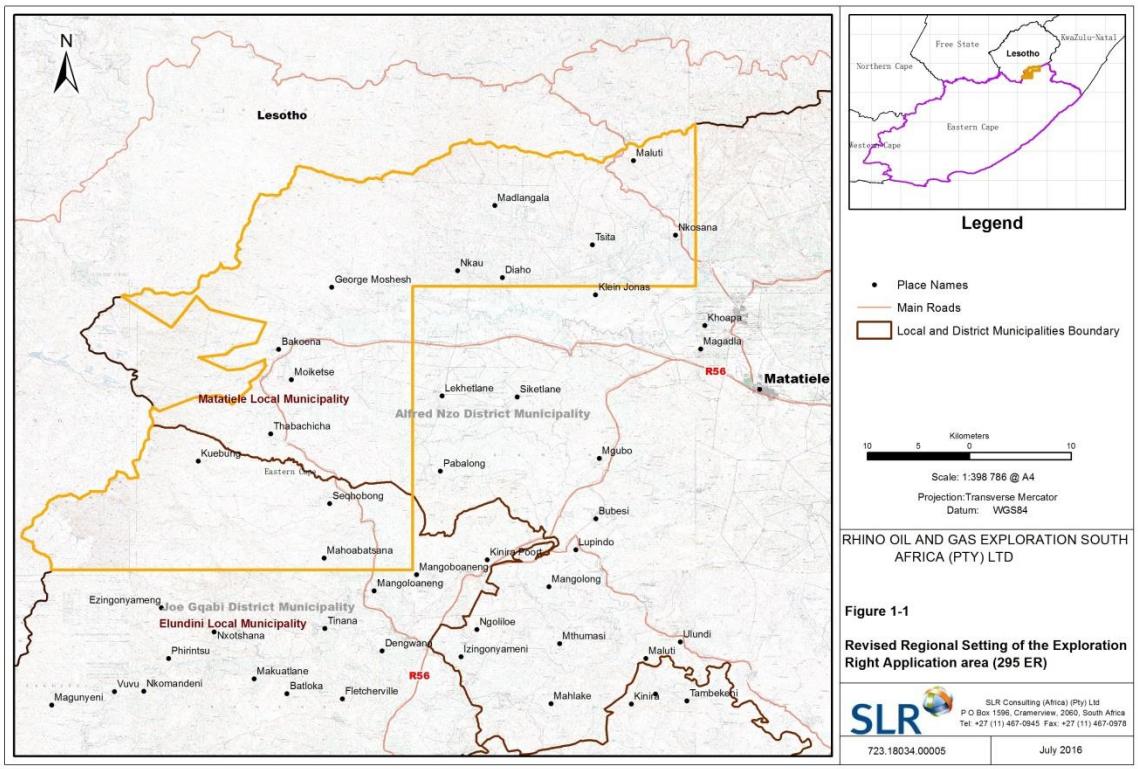
In early 2015 Rhino Oil and Gas lodged an application for an ER to explore for petroleum products (including oil, gas, condensate, coal bed methane, helium and biogenic gas) with PASA in terms of Section 79 of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA), as amended. PASA accepted the ER application on 22 May 2015 (Ref: 12/3/295 ER).

The purpose of exploration is to identify the existence of any commercially viable reserves of oil and / or gas. Exploration is a technically complex and iterative process consisting of a number of stages typically termed i) early-phase exploration, ii) appraisal and iii) well drilling. Data from each stage improves the knowledge and understanding of the resource, and informs the following stage, which is only undertaken if results are positive. Exploration can require a period of up to 10 years to inform a decision on a production right application. Rhino Oil and Gas is proposing to undertake 'early-phase exploration' activities.

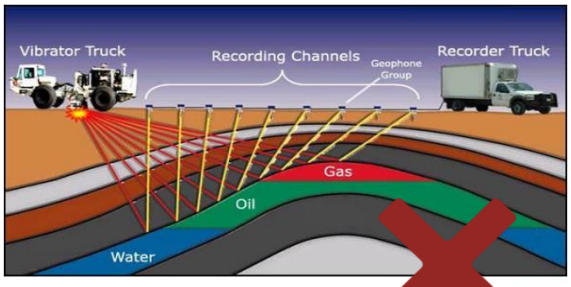
The initial ER application area was approximately 120 000 ha in extent and covered approximately 200 properties (farms and portions) (see Figure 1-1 for the regional setting of the project). The proposed 'early-phase exploration' activities as included in the initial ER application were:

- various non-invasive and remote exploration techniques (including analysis of existing data and full tensor gradiometry gravity survey);
- the drilling of up to 10 core boreholes; and

- 125 km of seismic survey acquisition.



Subsequent to the acceptance of the Scoping Report, Rhino Oil and Gas reduced the extent of the ER application area through the exclusion of the Malekgalonyane (Ongeluksnek) Nature Reserve to an area of 110 572 ha. In addition, Rhino Oil and Gas has **excluded the ground-based core hole drilling and seismic surveys** from proposed 'early-phase exploration' work for which they are seeking environmental authorisation. Thus the current focus of the application and the related environmental assessment work is now only related to the proposed remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey).



Exploration activities proposed for this application

If the application is approved, Rhino Oil and Gas would be in a position to conduct the remote exploration and to develop a more detailed understanding of the potential oil and gas resources in the ER area. Thereafter, should Rhino Oil and Gas propose to conduct ground-based exploration activities this would need to be informed by a further application to PASA and a separate environmental assessment and authorisation process. A benefit of this revised approach is that any future application for ground-based exploration activities will be focussed on specified sites, thereby enabling I&APs to know where Rhino Oil and Gas proposes to access land and conduct ground-based exploration activities.

The approval being sought as part of this application does not include any activities relating to the appraisal or well drilling phases that comprise a commercial viability assessment of a possible resource, nor any aspect of production. Thus no wells, permeability testing, pressure testing or hydraulic fracturing (commonly referred to as "fracking") is proposed as part of the initial three-year exploration programme.

1.1 Opportunity to Comment

This EIR has been distributed for a 30-day comment period from **12 August to 13 September 2016.** Copies of the report have been made available for download from the SLR website (go to: http://www.ccaenvironmental.co.za/sub-oil-gas-minerals/) and are available in hard copy at the locations described below. An electronic copy of the EIR can be emailed or provided on CD on request. The reports' Executive Summary has also been translated into Sesotho and isiXhosa and is available for download from the SLR website or can be emailed on request.

Location name	Physical Address
Matatiele Public Library	102 Main Street, Matatiele, 4730
Maluti Magistrate Offices	101 Main Street, Matatiele, 4730
Mount Fletcher Public Library	Enkululekweni Location, Mount Fletcher
Elundini Local Municipality (Mount Fletcher Offices)	272 Back Street, Mount Fletcher
Maclear Public Library	Van Riebeeck Street, Maclear, 5480
Bakoena Traditional Council	Chief Moshoeshoe's Office, Queen's Mercy
Ramohlakoana Traditional Council	Queen Sibi's Office, Hebron
Bakoena Traditional Council	Chief Lebenya's Office, Seqhobong
Amahlubi Traditional Council	Chief Zibi's Office, Ezingonyameni, Kwa Dzingwa

Any comments on the EIR should be forwarded to SLR by **no later than 13 September 2016**.

2. Legislative requirements

An application for an exploration right requires statutory approval in terms of both the MPRDA and the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA), as amended.

The MPRDA provides that mineral and petroleum resources are the common heritage of all South Africans and that the State, as custodian thereof, is entitled to issue rights to ensure the sustainable development of South Africa's mineral and petroleum resources within a framework of national environmental policy, while promoting economic and social development.

Any right granted under the MPRDA is a limited real right in respect of the mineral or petroleum and the land to which such right relates. The holder of a right is entitled to the rights referred to in Section 5 of the MPRDA and such other rights as may be granted to, acquired by or conferred upon such holder under the MPRDA or any other law. Mineral and petroleum rights are however also specific and have limitations in terms of the target resources, included land, the work programme and a timeframe. Any change to the scope of a right (i.e. further exploration or future production activities) would need to be subject to additional authorisation / approval in terms of the MPRDA and NEMA.

In terms of section 79 of the MPRDA an exploration right is required from the Minister of Mineral Resources (or delegated authority) prior to the commencement of any exploration activities. A requirement for obtaining an ER is that an applicant must comply with Chapter 5 of NEMA with regards to consultation and reporting (see below). The Minister (or delegated authority) may only grant the ER if an Environmental Authorisation is issued.

Section 2 of NEMA sets the environmental principles to be applied by all organs of State when taking decisions that significantly affect the environment. Included amongst the key principles is that all development must be socially, economically and environmentally sustainable and that environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably. NEMA also provides for the participation of I&APs and stipulates that decisions must take into account the interests, needs and values of all I&APs.

Chapter 5 of NEMA outlines the general objectives and implementation of Integrated Environmental Management (IEM), which provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and developments. Section 24 provides a framework for granting of Environmental Authorisations. In order to give effect to the general objectives of IEM, the potential impacts of listed activities must be considered, investigated, assessed and reported on to the competent authority. The proposed exploration right application triggers Activity 18 of Listing Notice 2 (GN R984) and a Scoping and EIA process must be undertaken to inform a decision from PASA on an environmental authorisation. Rhino Oil and Gas appointed SLR Consulting (South Africa) (Pty) Ltd (hereafter referred to as "SLR") as the independent environmental assessment practitioner ("EAP") responsible for undertaking the EIA process.

The scope of the current EIA process is aligned specifically to the early-phase exploration work programme (i.e. aerial full tensor gradiometry gravity survey). The environmental assessment of further ground based exploration including core hole drilling, seismic surveys, appraisal or well drilling activities for exploration or future production falls outside of the scope of this EIA process. If such work were to be proposed by Rhino Oil and Gas then it would be required to seek further approval from PASA in terms of the MPRDA and NEMA. Any further approval would be subject to an additional environmental assessment process with further public consultation as is required by NEMA.

In accordance with the EIA Regulations 2014, all other legislation and guidelines that were considered in the preparation of the EIR are documented. Review of the proposed exploration work programme in terms of the relevant legislation has not identified other requirements for authorisation.

3. Study Methodology

3.1 Scoping

A Scoping process was undertaken between October 2015 and April 2016 and concluded with a Scoping Report being submitted to PASA. The Scoping Report included copies of all supporting documents and inputs received during the public participation conducted during the Scoping phase. The Scoping Report was accepted by PASA on 10 June 2016, granting permission for the EIA to continue in terms of the Plan of Study described in the Scoping Report and the conditions included in the acceptance.

3.2 Key Issues Considered

The key issues and concerns identified by the project team, with I&AP input, during the Scoping Phase are detailed below.

Key issues identified by the project team, with I&APs input	Manner in which the issues were incorporated, or the reasons for not including them
1. Procedural issues	
There is strong opposition to the proposed exploration right application. The major themes of the public opposition are the following: • Concern, even fear, of the future risks that might arise from production should a resource be found; • Concern that given the money involved, if any hydrocarbon resource is found, it will not be possible to stop production regardless of what the future EIA processes may indicate in terms of risk. Thus the only way to avoid such risks is to not open the door to such projects; • Hydrocarbon based energy is a flawed concept and countries are moving away from new hydrocarbons in favour of a renewable energy system; • A deep mistrust of government institutions and the true motives and people behind such an application; • Significant doubt over government's ability to enforce compliance to the legislation; • South Africa does not understand unconventional hydrocarbon	The level of public opposition to the project has been documented in the Scoping and EIA Reports. Where people have registered their opposition to the project, this has been recorded. All objections received have been recorded. The EIA report has attempted to present accurate project information and a realistic assessment of impacts in order that I&APs can make an informed judgement. It is evident that much of the opposition is not directly against the merits of exploration activities as proposed, but rather against the anticipated outcome and risks that, if successful, could result from exploration. No attempt has been made to address issues and objections that are based on concerns that relating to further exploration or future production activities NEMA does not specifically provide a mechanism to

extraction risks and the necessary legislative framework to protect the environment is not in place; and • Lack of understanding of how an exploration programme is undertaken and what is actually being authorised. Numerous objections have been made to the project and EIA process.	address objections raised in the EIA process. Under the MPRDA unresolved objections would be tabled before the Regional Mining Development and Environmental Committee.
The EIA should assess the potential future exploration and production related impacts (including fracking)	The scope of the EIA is aligned with the early-phase exploration as proposed by Rhino Oil and Gas. Should Rhino Oil and Gas propose to conduct exploration activities outside of this scope, this would need to be informed by a further application to PASA and a separate environmental assessment and authorisation process.
The Strategic Environmental Assessment (SEA) for Shale Gas Development in the Karoo should be extended to cover this area/application or at least inform current EIA process. Or the findings of the SEA applied to this EIA	The scope and terms of the SEA were finalized by the DEA and is limited to Shale Gas Development in the geographic Karoo. Refer to section 2.5.5.
Time available for I&AP consultation and participation is insufficient;	An extension of time for public consultation in the Scoping phase was secured.
The adequacy of the public participation process / methodology was challenged, particularly with regards informing rural communities.	Additional efforts were undertaken in order to address this. Refer to section 5.2 of the Scoping Report as well as Box 4 in the EIA. EIA feedback meetings will be held with each of the four Traditional Authorities in the area.
Protected area or other areas incompatible with exploration should be excluded. Cognisance should be given to restrictions imposed by legislation and regulation, particularly the Petroleum Regulations	The extent of the proposed ER has been adjusted to exclude protected areas. The scope of the EIA is aligned with the early-phase exploration as proposed by Rhino Oil and Gas. Restrictions relating to future exploration or production activities have not been detailed in this EIA.
Provide a detailed baseline description of the affected environment, desktop assessment is not adequate.	Refer to Section 5 of the EIR. The large size of the application area, information constraints of the exploration process and the nature of the early-phase exploration did not allow for, nor warrant, detailed baseline assessments of the whole application area. However, it is noted that the databases that were utilized generally have good coverage, providing adequately accurate representation of the field conditions.
Confirm the location of the exploration sites and assess impacts at these sites.	The nature of exploration is such that the applicant cannot confirm the location of core hole drilling sites or seismic survey routes until the initial exploration has provided results. Rhino Oil and Gas excluded the core hole drilling and seismic surveying from the proposed 'early-phase exploration' work for which they are seeking environmental authorisation. The current focus of the application for environmental authorisation and this EIA is now only on remote exploration techniques (including analysis of existing data and

	an aerial full tensor gradiometry gravity survey). Refer to section 4.5.1
2. Potential impacts of the proposed exploration	
Impact on ecology > Loss of or disturbance to vegetation and faunal habitats > Disturbance to and mortality of fauna > Enabling the establishment of alien and invasive species in disturbed areas	The potential impacts of core hole drilling and seismic surveys have not been assessed in this EIA as they no longer form part of the proposed 'early-phase exploration' work for which Rhino Oil and Gas are seeking environmental authorisation. See Section 4.5.1. The aerial FTG surveys (see Section 4.5.5) included as part of the proposed 'early-phase exploration' would result in almost no interaction with the ground over which the survey is undertaken. Thus impacts on the majority environmental aspects could not occur. For this reason the issues were not considered further in this EIA. Should Rhino Oil and Gas propose to conduct ground-based exploration activities in the future, this would need to be informed by a further application to PASA and a separate environmental assessment and authorisation process.
Impact to Groundwater > Altered hydrogeological regime and groundwater availability > Contamination of groundwater resources > Water consumption	
Impacts on surface water > Altered surface water hydrological regime > Contamination of surface water resources > Water consumption	
Impacts on geology > Destabilisation of certain geologies > Risk to underground caverns or mine workings	
Impact on soils > Physical impact on soils (increased erosion / compaction) > Potential contamination of soils	
Impact on heritage resources	
Impact on land tenure and access to private property	
Impact on current land uses	
Structural damage to infrastructure > Structural damage to infrastructure due to shock waves, air overpressure and ground vibration > Degradation or damage due to exploration vehicles and equipment	
Impact on ambient air quality > Dust and vehicle emissions > Escape or release of gas from exploration boreholes	
Safety and security > Public safety due to inter alia, increased traffic volumes, heavy machinery, explosives, hazardous materials, release of gas, etc. > Fires > Landowner security	
Contribution or effect on the local economy	
Compensation	
Rehabilitation and liability	
Impact on ambient noise levels	Refer to Section 6.1

3.3 EIA Method

In accordance with Appendix 3 of GN No. R982, the objectives of the EIA are to:

- identify the relevant policies and legislation relevant to the activity;
- present the need and desirability of the proposed activity and its preferred location;
- identify feasible alternatives related to the project proposal;
- ensure that all potential key environmental issues and impacts that would result from the proposed project are identified;
- provide a reasonable opportunity for I&APs to be involved in the EIA process;
- assess potential impacts of the proposed project alternatives during the different phases of project development;
- present appropriate mitigation or optimisation measures to minimise potential impacts or enhance potential benefits, respectively; and
- Through the above, to ensure informed, transparent and accountable decision-making by the relevant authorities.

As per the Plan of Study for EIA presented in the Scoping Report, the approach was to commission a number of specialist studies to inform this EIA. However, with the exclusion of core hole drilling and seismic survey activities from the scope of the EIA these studies are no longer applicable.

The identification and assessment of environmental impacts is a multi-faceted process, using a combination of quantitative and qualitative descriptions and evaluations. It involves applying scientific measurements and professional judgement to determine the significance of environmental impacts associated with the proposed project. The process involves consideration of, inter alia: the purpose and need for the project; views and concerns of I&APs; social and political norms, and general public interest. SLR used an assessment methodology which considered: the intensity, extent, duration of impacts, the probability of the impact occurring, the reversibility and the degree to which the impacts can be mitigated.

The significance of environmental impacts was rated before and after the implementation of mitigation measures. The method applied to the assessment of environmental impacts was:

- Consequence is a function of intensity, spatial extent and duration;
- Significance is a result of the consequence and probability.

4. Project Description

4.1 Introduction

Rhino Oil and Gas Exploration South Africa (Pty) Ltd is a South African registered subsidiary of Rhino Resources Ltd., an independent oil and gas exploration and development company focused on Africa. Rhino Resources is building a portfolio of both onshore and offshore oil and gas assets with a primary focus on West Africa, East Africa and Southern Africa. Rhino Oil and Gas's BBBEE status has been provisionally agreed upon with another party and will comply with the Charter on empowering Historically Disadvantaged South Africans in the Petroleum and Liquid Fuels Industry. More information is available on http://www.rhinoresourcesltd.com.

4.2 Overview of exploration

The conditions necessary for petroleum reserves to have accumulated are complex and largely dependent on past geological history and present geological formations and structures. Discovering petroleum/gas reservoirs and estimating the likelihood of them containing oil and / or gas is a technically complex process consisting of a number of different stages, requiring a range of techniques. Exploration begins with the identification of target regions based on a general geological understanding. These areas are subjected to **early-phase exploration** that is focused on large-scale regional analysis. Exploration in areas identified as prospective would progress to the **appraisal stage**. This work is aimed at identifying and defining the extent of target areas with high potential for reserves of oil and / or gas. In order to fully define the commercial viability of an oil and / or gas resource a **well drilling stage** is generally undertaken. The type of wells and tests would depend entirely on the nature of the resource that has been identified. Exploration typically requires **early-phase exploration, appraisal** and **well drilling** stages**,** undertaken over a period of up to 10 years, to inform a decision on a production right application.

Rhino Oil and Gas is at the beginning of an oil and gas exploration process and at this stage is only seeking authorisation to undertake a portion of activities necessary to inform an early-phase exploration stage.

4.2 Need and Desirability

This section in the report aims to provide an overview of the need and desirability for the proposed project by firstly, highlighting the applications for the use of natural gas (particularly with reference to the electricity generation sector) and, secondly, indicating how these applications are aligned within the strategic context of national policy and energy planning, broader societal needs and regional planning, as appropriate.

Use of Natural Gas

Natural gas is a fossil fuel, used globally as a source of energy for heating, cooking, and electricity generation, amongst others. The fastest growing use of natural gas is for the generation of electric power.

Of the three fossil fuels used for electric power generation (coal, oil and natural gas), natural gas emits the least carbon dioxide per unit of energy produced. Burning natural gas also releases lower amounts of nitrogen oxides, sulphur dioxide, particulates and mercury when compared to coal and oil (Union of Concerned Scientists, n.d.).

As economic growth is dependent on the availability of electricity, ensuring a sustainable and reliable supply of electricity with sufficient capacity is a key aspect to growing the economy of South Africa. The electricity shortages experienced in South Africa over the past decade were a contributing factor to the significant slowdown in economic growth rate. In the context of the above, the use of natural gas for electricity generation is considered to have substantial benefits and is identified in national policy, together with renewable energy technologies, toward diversifying the domestic energy supply away from coal. The economic feasibility of using natural gas for domestic power generation is dependent on the availability of domestic reserves of natural gas, as well as the financial cost of importing natural gas.

At present, domestic resources are limited to offshore gas fields close to Mossel Bay (F-A field), which are understood to be in decline. The F-O offshore field (Project Ikhwezi) is envisioned to complement this supply in the short- to medium-term. Other proven offshore reserves include the Ibhubesi Gas Field off the West Coast of South Africa. The development of this field to supply gas to the existing Ankerlig Power Station is currently being considered. Neighbouring countries (Mozambique and Namibia) and regional African nations (Angola and Tanzania) have substantial gas reserves.

Although limited, gas infrastructure and consumption do exist in South Africa. Presently, gas is imported to South Africa through the Republic of Mozambique Pipeline Company (ROMPCO) pipeline from Mozambique. This gas is mostly used in Sasol's coal-to-liquid (CTL) process in Secunda (Bischof-Niemz, et al., 2016). In Johannesburg, Egoli Gas supplies industry and households in some suburbs with reticulated natural gas that is sourced from Sasol. In 2013, the total natural gas supply in South Africa (domestic production and import) equated to approximately 2.5% of total primary energy supply for the country (Bischof-Niemz, et al., 2016). Thus, an increase in domestic natural gas reserves would enable South Africa to take steps to secure the countries' energy supply (through diversification), assist in reducing the emissions of greenhouse gases (by reducing the country's reliance on coal for electricity generation) and reduce the need for the importation of gas. As such, exploration for additional domestic hydrocarbon reserves is considered important and supported by national policy, and any discoveries would be well received by the local market.

National Policy and Planning Context

An overview of the national policy and planning context relating to the promotion of economic development in general within South Africa, development of the energy sector (with specific reference to natural gas and renewable energy) and response to climate change is provided. The following documents were considered:

- White Paper on the Energy Policy of the Republic of South Africa (1998)
- White Paper on the Renewable Energy Policy (2003)
- National Gas Infrastructure Plan (2005)
- New Growth Path (2011)
- National Development Plan (2012)
- Integrated Resource Plan for Electricity (2010 and updated in 2013)
- Draft Integrated Energy Plan (2013)
- Gas Utilisation Master Plan (GUMP)
- Paris Agreement, United Nations Framework Convention on Climate Change
- National Climate Change Response White Paper

Consideration was also given to regional policy and planning context relating to development within the Eastern Cape in general.

4.3 Exploration Work Programme

Rhino Oil and Gas proposes to undertake early-phase exploration for oil and gas resources which may be located within suitable geological strata. A three-year exploration work programme has been proposed.

The initial ER application area included ~ 200 properties over an area of ~ 120 000 ha. The applicant has reduced the extent of the ER application area through the exclusion of the Malekgalonyane (Ongeluksnek) Nature Reserve to an area of 110 572 ha. The ER application area excludes all land as identified in Section 48 (1) of the MPRDA.

As indicated previously, Rhino Oil and Gas has now excluded the core hole drilling and seismic surveying from the proposed 'early-phase exploration' work for which they are seeking environmental authorisation. The current focus of the application for environmental authorisation and this EIA is now only on remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey). If the revised application is approved, Rhino Oil and Gas would only be in a position to conduct remote exploration techniques and to develop a more detailed understanding of the potential oil and gas resources in the application area. Thereafter, should Rhino Oil and Gas propose to conduct ground based exploration activities this would need to be informed by a further application to PASA and a separate environmental assessment and authorisation process.

The initial exploration work would be desktop based and include the evaluation of geological data and the assessment of source-rock geochemistry. Full tensor gravity gradiometry ("FTG") surveys may be undertaken to provide information that would lead to the identification of target sites for core hole drilling and alignment of seismic survey routes. FTG is used by oil and gas companies to measure the density of the subsurface in order to assist in the building of geological models to aid exploration. FTG uses multiple pairs of accelerometers to measure the rate of change of the gravity field in three directions and

render a detailed interpretation of subsurface geology. FTG surveys involve grid-based flights using a light fixed wing aircraft (fitted with the FTG equipment) at slow speeds (~ 130 knots) and at an altitude of between 80 and 300 m above ground. It is envisaged that up to a maximum of 4 000 km^2 could be surveyed with a spacing of between 2 and 6 km between lines. In good weather the survey would take less than 7 days to complete.

No further ground-based exploration, appraisal or well drilling and future production forms part of the current ER application. Thus no extraction of hydrocarbons or water, no stimulation of wells or hydraulic fracturing (fracking) is proposed in the initial three-year exploration work programme for which approval is sought. If the early-phase exploration were to confirm the presence of a potential resource, then Rhino Oil and Gas would need to seek further authorisation / approval from PASA for any additional exploration work required to appraise the resource. Any further approval would be subject to an additional environmental assessment (or environmental authorisation amendment) process with further public consultation and specialist input. Approvals are also likely to be required in terms of other legislation.

5. Description of the baseline environment

5.1 Biophysical Environment

Climate

The proposed ER area experiences a typical escarpment climate with warm summers and mild winter that includes periods of very cold conditions with snow. Mean annual precipitation varies between 700 mm in the east up to 1000 mm to the west, with a high proportion coming in summer through thunderstorms.

Geology

The geology of the proposed ER area comprises the Molteno, Elliot and Clarens Formations (from the Karoo Supergroup) and the Drakensberg Group.

The Molteno Formation is overlain by Elliot Formation with a maximum thickness of approximately 500 m in the south. The formation comprises an alternating sequence of greyish-red or less commonly greenish-grey mudstone and subordinate fine- to medium-coarse sandstone.

The Clarens Formation superimposes the Elliot Formation. This formation represents the final phase of Karoo sedimentation (Lurie, 2008). The Clarens Formation consists of fine- to very fine-grained sandstone and siltstone with subordinate mudstone and occasional chert and nodular limestone horizons (Johnson et al., 2006). The mudstones are generally pale-olive to pale-red in colour and the sandstones are usually very pale-orange, well sorted with sub-angular to sub-rounded grains (Karpeta and Johnson, 1979). The thickness of the Clarens Formation ranges between 200-250 m, however, the northern extent of the formation has a thickness of 100 m.

The Drakensberg Group forms the upper part of the Drakensberg Mountains. It is characterised by the dark-grey basaltic lavas with subordinate tuffs and occasional sandstones (Karpeta and Johnson, 1979). The basalts are made up of altercations of a tough and massive coarsely crystalline rock and easier-weathering vesicular varieties. The total thickness of Drakensberg Group is up to 700 m (Johnson et al., 2006). Dolerite dykes, also present in the area, are inclined sheets and sills that intruded the Karoo Sequence. Dolerite dykes are generally 3 - 10 m wide and 5 - 30 km long, although some can be followed for 80 km (Johnson et al, 2006). The inclined sheets and sills range from a few metres to 200 m or more in thickness. Quaternary deposits (<2 m in thickness) are generally limited in the study area and concentrate only along the upper Kinira River and its upper tributaries (Karpeta and Johnson, 1979).

The Southern African region is considered to be relatively stable from a seismic perspective. In general earth tremors and quakes are infrequent and generally of low magnitude. Within the ER, the Cedarville Fault is an active fault with associated recorded earthquake activity (in 1986 an earthquake of 5.15 was recorded at the town of Matatiele which is located near the fault).

Soils

The ER area consists of two main landforms including medium gradient hills and high gradient mountains. Six dominant soil classes were identified within the proposed ER area namely:

- Freely drained, structureless soils;
- Lithosols (shallow soils on hard or weathering rock);
- Undifferentiated clays;
- Undifferentiated poorly drained soils;
- Undifferentiated shallow soils; and
- Structureless and poorly drained soils.

The majority of the proposed ER area (61 633 ha) is considered to be non-arable for the purposes of crop cultivation and has moderate to low suitability as grazing land. A small section on the eastern portion of the proposed ER area (400 ha) has wilderness land capability and in terms of land capability class system should preferably only be used for wildlife and habitat conservation. The remaining areas, approximately 27 140 ha, are mapped to have a moderate potential for arable agriculture. These soils are mainly located in valley bottoms where the slope gradients are less steep and pockets of arable land makes crop farming possible (typically in close proximity to villages).

Land Cover

According the National Land Cover Data Set (2013/2014), the great majority of the ER area comprises grasslands. Some of the larger river valleys have thicket/dense bush in the upper reaches. Much of this comprises stands of alien and invasive trees rather than indigenous vegetation (pers. obs). The flatter ground in the lower elevation areas has been largely transformed, either by rural housing and

urbanisation or through various forms of cultivation (subsistence and commercial). Many of the valley bottoms contain wetland areas.

Hydrology

The proposed ER area falls within the Mzimvubu to Keiskamma Water Management Area (WMA) which has the highest mean annual runoff in South Africa, and equates to almost 15% of the total river flow in the country. At least 6 quaternary catchments occur. The source of rivers, including their associated tributaries, such as the Mosenene River, Seeta River, Mabele River, Lekhetlane River, Marulane River and the Tinana Rivers are located within the proposed ER area.

Surface water use consists of a combination of domestic, livestock use and irrigation for crop production in the low lying areas. The municipalities estimate that 50% of households rely on water from rivers, springs and dams. It is estimated that around 1 million people derive water and a livelihood within the greater catchment (pers. comm. UCPP). The uMzimvubu Catchment Partnership Programme has been established to tackle degradation of the upper uMzimvubu landscape, and protect the livelihoods dependent upon it.

Numerous wetlands are located within the proposed ER area. The upper section of the Umzimvubu catchment in the MLM hosts as much as 42 765 ha of wetland (email, UCPP). There are no major dams.

Groundwater

The exploration area is classified as a minor aquifer region. On a regional level, the hydrogeology of the proposed ER area comprises fractured and intergranular aquifers with yields in the range of 0.5 to 2 L/s. Aquifer types are related to the lithology but are typically fractured and intergranular. These aquifers are generally of ‘least’ or ‘moderate’ vulnerability, with a ‘low’ to ‘medium’ susceptibility.

Available data from the National Groundwater Archive indicates that groundwater levels range between 0.3 -108 m below ground level, with discharge rates varying between 0.01 - 9.6 L/s. Published information from the DWS indicates a mean depth to groundwater ranging between 15 - 20 mbgl and the recommended borehole drilling depth ranges between 20 – 30 m. Groundwater also surfaces at various spring sites. These sites include dykes intersecting features, contacts of dolerite sill/sheets, basal contact of fractured sandstone with an underlying less permeable mudstone horizon and on weathered basins (usually weathered dolerite sheets). The anticipated electrical conductivity concentration of groundwater within the proposed ER area is between 0 and 70 mS/m, while Total Dissolved Solids are expected to range between 200 - 449 mg/L. Calcium and magnesium are dominant constituents of groundwater within the proposed ER area, however, groundwater with high fluoride content has been reported to the south.

According to records, there are as many as 537 registered boreholes in the larger area, however only 193 of these boreholes are still in use. Registered groundwater use in the area ranges between 1 505 m^3 and

50 000 m^3 per annum and is used mainly for drinking, livestock watering and irrigation purposes (DWAF, 2008). Stakeholders within the proposed ER area note that the Cedarville Fault is an important groundwater feature with regards to groundwater development and use.

Biodiversity

The proposed ER area is located within the grassland biome within the Sub-Escarpment Grassland Bioregion and the Drakensberg Grassland Bioregion, which is structurally simple and strongly dominated by grasses which are comprised of various vegetation units. Vegetation units that are associated with the proposed ER area include the Drakensberg Foothill Moist Grassland, the East Griqualand Grassland, the Lesotho Highland Basalt Grassland, the Mabela Sandy Grassland and the Southern Drakensberg Highland Grassland (Mucina and Rutherford, 2006). The Mabela Sandy Grassland and the East Griqualand Grassland vegetation units are listed as vulnerable ecosystems in terms of Section 52 of the National Environmental Management: Biodiversity Act, 2004.

The region was historically home to numerous faunal species. The lower slopes of the Drakensberg Mountains support a greater variety of faunal species to that of the high mountains, although these areas are also subject to more significant human use. The White-tailed Rat (*Mystromys albicaudatus*) is the only mammal species of conservation concern (endangered) that may occur in the area. It is widely distributed but not much is known about it habitat needs or current status. A number of bird species of conservation concern occur including all 3 crane species (Wattled, Grey Crowned and Blue) as well as the Bearded and Cape Vultures. Rudd's Lark (*Heteromirafra ruddi*) and Black Harrier (*Circus maurus*) may also be found where suitable habitat is present. Wetland and high altitude grasslands are the most important habitat for most of these species.

The Malekgalonyane (Ongeluksnek) Nature Reserve was located within the extent of the proposed ER area. No areas declared in terms of the Biodiversity Act, 2004 (Act 10 of 2004); National Forests Act, 1998 (No. 84 of 1998) and Mountain Catchment Areas Act 1970 (No. 63 of 1970) were identified within the proposed ER area. Much of the proposed ER area overlaps with 'focus area' from the National Protected Area Expansion Strategy. The 'Development Area' of the Maloti Drakensburg Transfrontier Conservation Plan extends from KZN to the Malekgalonyane (Ongeluksnek) Nature Reserve. The Matatiele Local Municipality have identified areas for protection through the declaration of stewardship areas under the Matatiele Water Factory Project. The draft stewardship plan identifies all areas above 1750 mamsl as stewardship targets. The National Freshwater Ecosystem Priority Areas project identifies numerous NFEPA rivers and wetlands within the proposed ER area. The Eastern Cape Biodiversity Conservation Plan (ECBCP) identified and mapped critical biodiversity areas (CBAs) in the Province. A large proportion of the proposed ER area is mapped as terrestrial CBA 1, with the balance being almost entirely CBA 2. The aquatic perspective is similar with a large proportion of the proposed ER area being mapped as aquatic CBA 1 and much of the balance being CBA 2. It is therefore evident that much of the proposed ER area is considered to be ecologically sensitive. It must however be noted that a significant

amount subsistence agriculture is taking place in the lower lying area of the region. Many of the datasets do not give cognisance to this, or such use may have escalated in intensity. It is therefore likely that certain areas designated with conservation planning status may in reality be disturbed or cultivated.

Air Quality

The majority of the proposed ER area is rural in nature and is comprised mostly of small towns, isolated farmsteads, scattered communities and agricultural activities such as livestock grazing and crop cultivation. It follows that the ambient air quality is likely to be good. Air quality may be compromised at times near waste burning sites and informal brick makers and around concentrations of houses in winter when fuel burning is used as a source of warmth. Veld fires are also a major contributor to reduced air quality in winter.

5.2 Cultural Environment

The area is exceptionally rich in rock art occurrences. Numerous San and pastoralist rock art sites are located in rock shelters in the sandstone outcrops. Of the 60 heritage sites known in the area, 46 of these are rock art sites. It is highly likely that more sites are present in the area. Much of this art is unprotected and at risk from degradation of the rock-face as well as damage from humans and livestock using the shelters. The well-known Mariazelle Mission Station and the smaller Maria Linden Mission as well as the Ongeluksnek Mountain Pass are known historical features. There is very limited data on sites from the historical period, cultural landscape of living resources in the project area.

Paleontological surveys of the area are also limited. The lower elevation sections of the proposed ER area are underlain by formations of high (Clarens Formation, Stormberg Subgroup, Karoo Supergroup) and very high sensitivity (Molteno and Elliot Formations). Taking the above into consideration there is a high likelihood of fossil occurrence within the proposed ER area.

5.3 Socio-Economic Environment

The proposed ER area is located largely within the Matatiele Local Municipality (MLM) with the southern portions in the Elundini Local Municipality (ELM). These municipal areas have population in excess of 325 000 people, with a high proportion of females. Unemployment is high. The majority of people reside in a largely rural setting, with a high proportion in dwellings made of traditional materials. Basic service provision is low with as much as 50% of households relying on water from rivers, springs and dams.

There are no major towns located within the proposed ER area. Matatiele to the east is the largest town in the region. Agricultural activities are limited to the lower lying areas where the topography, water and soils are suitable for agriculture. Agricultural activities include a combination of commercial and subsistence farming. Subsistence farming is mostly associated with villages (which are numerous) which undertake both subsistence and small scale commercial farming. The grasslands around most of the villages and rural settlements is heavily grazed by mixed herds of domestic livestock.

The region is well known for its scenic beauty (particularly views of the Drakensberg) and revenue is generated from numerous eco-tourism activities. Many of these activities are widely dispersed but focus points include the Mehloding hiking trail and Malekgalonyane (Ongeluksnek) Nature Reserve.

The DMR indicated that there are no other mineral rights holders with the proposed ER area. Chief Lebenya has a pending claim on a large number of the properties within the ER application area.

6. Impact Description and Assessment

Only those potential impacts associated with remote exploration techniques have been assessed. The potential impacts of core hole drilling and seismic surveys have not been assessed in this EIA as they do not form part of the proposed 'early-phase exploration' work for which Rhino Oil and Gas are seeking environmental authorisation.

6.1 Biophysical Impacts

The flying of a light aircraft to undertake an FTG survey is not anticipated to have any impact of significance on the biophysical environment. Overpass flights of light aircraft are not uncommon over the region, even protected areas. Other than a momentary flight response, it is estimated that the impact of noise on wildlife would be **insignificant**.

6.2 Cultural/ Heritage Impacts

The flying of a light aircraft to undertake an FTG survey is not anticipated to have any impact of significance on the cultural or heritage environment. Any noise impact would be as described below.

6.3 Socio-economic impacts

Noise Impacts

The noise generated by a light aircraft flying at a low altitude (approximately 100 m) could be a nuisance to or result in the localised disturbance of a receptor. No health impacts (such as loss of hearing or increased blood pressure) are anticipated based on the proposed FTG survey.

Based on a light aircraft (e.g. Cessna) flying at a low altitude of + 80 m, it is estimated that the maximum noise level would not exceed 70 dBA outdoors and 60 dBA indoors. The latter is similar to conversational speech measured at 1 m. At any one location the duration of the overflight would be tens of seconds. Indoors the noise generated would probably not be noticed. Although the survey would cover wide areas, the extent of the impact is localised for each receptor. Where there are no receptors there would be no impact. Thus, depending on the selected flight path, an impact is possible.

Although aircraft noise would increase noise levels in what are largely quiet rural and agricultural areas, only a slight disturbance or nuisance is anticipated (i.e. **low** intensity). Based on these considerations and the fact that disturbances from light aircraft are not uncommon with a multitude of light aircraft

working in and traversing the region, the significance of this impact is considered to be **very low** before and after mitigation.

All planned survey flights should comply with local civil aviation rules. Flight paths must be pre-planned to avoid special nature reserves, national parks and world heritage sites. Where this is not possible, an altitude of 2 500 feet (762 m) should be maintained (as per Section 47(1) of NEMPRAA), unless permission is obtained from the management authority or in an emergency. Where flights are planned to occur over game farms, landowners should be notified of the survey programme prior to survey commencement.

Local limitations

As discussed in the preceding sections, the flying of a light aircraft to undertake an FTG survey would be unlikely to pose significant risk to the environment. As a result there are relatively few constraints arising from legislation, regulation, guidelines and best practice that would apply. The FTG survey would have no effect on water use or availability and could therefore be undertaken without regard for water related constraints and restrictions.

At the time of completion of the EIA report there was no indication of any change to the public or landowner position with regards the application. The majority opinion is opposed to exploration for unconventional gas or petroleum resources in the ER application area.

Granting of a Right

There is strong public opinion and I&APs refer to a significant body of evidence from around the world (not least that fracking is banned in a growing number of countries and territories), that late phase exploration and production of unconventional gas has huge risks to society and the environment. Such risks are borne by the landowners and local communities who do not participate in the economic benefits that accrue to the right holder and government. While there may be a consumer driven need for hydrocarbon extraction, the risks and costs to society and the environment far outweigh the benefits. The extraction of unconventional hydrocarbons is therefore not wanted in the Eastern Cape.

Even though early-phase exploration may have impacts of low significance, the public have raised concern that the granting of an exploration right would set in motion the development of a petroleum extraction project that would be extremely difficult to stop. Because the future process has unknown outcome and risk, this exploration right should not be approved.

The MPRDA provides that the State, as custodian of mineral and petroleum resources in South Africa, may issue mineral and petroleum rights to applicants. Such rights must enable the sustainable development of South Africa's mineral and petroleum resources within a framework of national environmental policy, while promoting economic and social development.

The granting of a right has no effect on the presence or absence of a resource, merely on whom has the entitlement to that mineral (i.e. minerals and petroleum exist regardless of the holder). A mineral and/or petroleum right is only part of the regulatory approval required by a holder and in isolation does not enable the holder to access the subject mineral. A holder must also have obtained environmental authorisation in terms of Chapter 5 of the NEMA. Furthermore, a mineral and/or petroleum right and environmental authorisation do not provide blanket approval for any conceived operation, but are both particular to the specific activities that the holder has detailed in an application. The holder is also required to negotiate access with the land owner and determine payment of compensation for loss or damages due to the specific activities. It is therefore presented that the grant of a right over a parcel of land does provide the holder carte blanche with respect to the mineral and land in question. There is thus not necessarily a direct conflict with the land owners' right to use the surface. It would in fact be the undertaking of specified activities that could result in an impact on or conflict between the land owner and the mineral and/or petroleum rights holder (if any). Such specified activities would have been subject to approval through an environmental authorisation process. In the case of this application by Rhino Oil and Gas, only remote sensing activities are included which have been shown not to have any impact on the environment.

Any further exploration (beyond what may be approved in an environmental authorisation) would have to be subject to the requisite environmental assessment and authorisation process under the NEMA and an amendment to the ER in terms of the MPRDA. Such processes assess the merits of an application in light of the principles of sustainable development as set out in Section 2 of NEMA. An environmental authorisation process would not grant approval for the undertaking of activities resulting in impacts of unacceptable significance. Each of the petroleum right approval sections in the MPRDA (80 and 84) set out that such rights may only be granted if the activity will not result in unacceptable pollution, ecological degradation or damage to the environment. Thus a decision to grant the current ER application by Rhino Oil and Gas (for remote sensing activities only) does not presuppose that future applications for further exploration or production would be approved.

It is also noted that the specified activities associated with a mineral and/or petroleum right may also be subject to approval requirements under other legislation. The need for such authorisations (e.g. water use licence, land use planning permission etc.) provide further permitting frameworks for impact assessment and management.

6.4 No-go Alternative

The positive implications of not going ahead with the proposed exploration are:

- no impacts resulting from the FTG survey within the exploration right area;
- no (reduced) chance of any risks arising from further exploration or future production; and
- allayment of the current majority opposition from the public.

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 in the Eastern Cape;
- Lost economic opportunities related to sunken costs (i.e. costs already incurred) of initial desktop investigations in the proposed exploration licence area;
- If economic oil and gas reserves do exist and are not developed, South Africa / Rhino Oil and Gas would lose the opportunity to maximise the use of its own indigenous oil and gas reserves; and
- Other sources of energy would need to be identified and developed in order to meet the growing demand in South Africa.

The great majority of I&APs that have participated in the EIA process have expressed their opposition to all forms of oil and gas exploration in the Eastern Cape and to this application in particular. Thus the "no-go" alternative would alleviate much of the anxiety and concerns related to potential future shale gas development should reserves be identified for further exploration and/or future production.

Given the wide array of unknown facts regarding the potential for economic growth and the potential for environmental impacts arising from unconventional gas production, as well as the unknown facts of the future energy mix in the absence of gas, the overall impact associated with the "no-go" alternative is considered to be of **unknown significance**.

7. Conclusions and Recommendations

SLR, as the environmental assessment practitioner appointed by Rhino Oil and Gas, has undertaken a Scoping and EIA process in terms of the EIA Regulations 2014 to inform an authority decision on the application made for environmental authorisation under the NEMA. The current ER application only includes remote exploration techniques, restricted to analysis of existing data and an aerial full tensor gradiometry gravity survey. If the application is approved Rhino Oil and Gas would be in a position to conduct the remote exploration techniques. Thereafter, should Rhino Oil and Gas propose to conduct ground based exploration activities (core boreholes and seismic surveys) this would necessitate a further application to PASA and a separate environmental assessment and authorisation process in terms of NEMA..

The key finding of the EIA is of a contrast between very low significance impacts resulting from an exploration work programme which is limited to desktop and remote sensing methods and extremely strong public opposition to all forms of exploration for onshore unconventional gas.

The assessment concluded that the impacts of proposed exploration activities would be extremely limited in extent, widely dispersed, of very short duration and very low intensity and would there have very low significance. On the simple merits of the application there is therefore no environmental reason why the

exploration activities should not be approved. All of the ER application area would be suitable for the undertaking of the remote sensing exploration methods as proposed. It is noted however that the proposed activities are likely to be the first in a series of exploration stages comprising activities that would likely increase in impact significance (if exploration was successful and the project proceeded to the following stages). The intensity and duration of such impacts would likely increase with each subsequent phase, but would likely become confined to increasingly limited target areas.

The public opposition to the exploration right application has been strongly voiced and have been received almost unanimously from all the sectors of society that have participated in the EIA. It is evident however that the majority of the opposition is not directly against the merits of exploration activities as proposed, but rather against the anticipated outcome and risks that, if exploration is successful, could result from production. The public perception is interpreted to be that issuing of an exploration right could lead to successful exploration; that would ultimately result in an application for production with the potential use of hydraulic fracturing. It is further perceived that this could lead to widespread impacts on water and land causing devastation to local livelihoods. The perception is informed by the widely publicised, purported negative effects of hydraulic fracturing and the decisions taken by many governing bodies from around the world to suspend such activities. The related concern is that once an exploration right is granted, it will be nearly impossible to stop the process later, even if the environmental risks to local receptors outweigh the benefits. This is seen to arise from a mistrust and or misunderstanding of the governance framework that is in place to regulate petroleum exploration and production; concern as to whether government can balance the needs and interests of local people against such development, and an expectation that enforcement of compliance with environmental management obligations would be poor. For these reasons the public approach is to 'close the door on exploration before it opens', thereby preventing any future risk, or potential benefit, from resulting.

It is the opinion of SLR in terms of the sustainability criteria described above and the nature and extent of the proposed early-phase exploration programme (remote sensing only), that the generally very low significance of the impacts, with the implementation of the proposed mitigation measures, should support a positive decision being made by the Minister of Mineral Resources (or delegated authority) in this regard. Since the proposed exploration activities are associated with Rhino Oil and Gas's initial three-year exploration work programme, the applicant requests that that Environmental Authorisation (should it be granted) be issued and remain valid for a period of three years or more.

The estimated cost for management and / or rehabilitation of potential negative environmental impacts that might be incurred during the proposed remote sensing exploration activities is nil.

8. Environmental Management Programme

The EMPR, once approved by the competent authority, is a legal document and Rhino Oil and Gas is overall accountable and responsible for the implementation thereof. The EMPR is set out to provide

environmental management i) objectives, ii) outcomes and iii) actions for the planning and design, undertaking of exploration; and rehabilitation and post closure phases.

ENVIRONMENTAL IMPACT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME FOR AN EXPLORATION RIGHT APPLICATION FOR PETROLEUM PRODUCTS ON VARIOUS FARMS IN THE MAGISTERIAL DISTRICTS OF MATATIELE AND MT FLETCHER, EASTERN CAPE (12/3/295 ER)

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ACRONYMS AND ABBREVIATIONS

Below is a list of acronyms and abbreviations used in this report.

Acronyms / Abbreviations	Definition
2D	Two-dimensional
3D	Three-dimensional
ANDM	Alfred Nzo District Municipality
ARI	Advanced Resources International
Bcf	Billion cubic feet
BBBEE	Broad Base Black Economic empowerment
BGIS	Biodiversity Geographic Information System
BID	Background information document
CBAs	Critical Biodiversity Areas
CBM	Coalbed Methane
CTL	Coal to liquid
CSR	Corporate Social Responsibility
DAFF	Department of Agriculture, Forestry and Fisheries
dBA	A-weighted decibel
DEA	Department of Environmental Affairs
DEDEA	Department of Economic Development and Environment Affairs
DM	District Municipality
DMR	Department of Mineral Resources
DTI	Department of Trade and Industry
DWAF	Department of Water Affairs and Forestry (former)
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECBCP	Eastern Cape Biodiversity Conservation Plan
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
ELM	Elundini Local Municipality
EMPr	Environmental Management Programme
ER	Exploration Right, as contemplated in Section 79 of the MPRDA
FEPA	Freshwater Ecosystem Priority Area
FTG	Full tensor gravity gradiometry
GA	General Authorisation, in terms of the NWA
GGI	Gravity gradient instrument
GN	Government Notice
GUMP	Gas Utilisation Master Plan
Ha	Hectares
HAPs	Hazardous air pollutants
I&AP	Interested and/or Affected Party
IBAs	Important Bird Areas
IDPs	Integrated Development Plans
IEP	Integrated Energy Plan (2013)
IES	Independent environmental scientist
IRP	Integrated Resource Plan
IUCN	International Union for Conservation of Nature
JGDM	Joe Gqabi District Municipality
Km	Kilometres
km^2	Square kilometres
L	Litres

Acronyms / Abbreviations	Definition
L/s	Litres per second
M	Meters
m^3	Cubic metres
Mamsl	Metres above mean sea level
Mbgl	Metres below ground level
Mcm	Million cubic metres
MDTFCA	Maloti Drakensburg Transfrontier Conservation and Development Area
MLM	Matatiele Local Municipality
Mm	Millimetres
MPRDA	Mineral and Petroleum Resources Development Act, 2002
MSDS	Material Safety Data Sheet
mS/m	Millisiemens/meter
NDP	National Development Plan, 2012
NEMA	National Environmental Management Act, 1998
NEMAQA	National Environmental Management Air Quality Act, 2004
NEMBA	National Environmental Management: Biodiversity Act, 2004
NEMPRAA	National Environmental Management Protected Areas Act, 2003
NEMWA	National Environmental Management: Waste Management Act, 2008
NFEPA	National Freshwater Ecosystem Priority Area
NGA	National Groundwater Archive
NHRA	National Heritage Resources Act, 1999
NPAES	National Protected Area Expansion Strategy
NWA	National Water Act, 1998
NWRS	National Water Resource Strategy
NGO	Non-governmental organisation
PASA	Petroleum Agency of South Africa
PDP	Provincial Development Plan
RC	Reverse Circulation
RE IPP	Renewable Energy Independent Power Producers
ROMPCO	Republic of Mozambique Pipeline Company
SABS	South African Bureau of Standards
SACNASP	South African Council for Natural Scientific Professionals
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resource Information System
SANBI	South African National Biodiversity Institute
SANS	South African National Standards
SDFs	Spatial Development Frameworks
SEA	Strategic Environmental Assessment
SLR	SLR Consulting (South Africa) (Pty) Ltd
SMS	Short Message Service
SOTER	Soil and Terrain Database
Tcf	Trillion Cubic Feet
TCP	Technical Co-operation Permit, as contemplated in Section 76 of the MPRDA
TDS	Total Dissolved Solids
UCPP	uMzimvubu Catchment Partnership Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USD	United States Dollar
VOC	Volatile organic compounds
WMA	Water Management Area
WR	Water Resources
WUL(A)	Water Use License (Application)

ENVIRONMENTAL IMPACT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME FOR AN EXPLORATION RIGHT APPLICATION FOR PETROLEUM PRODUCTS ON VARIOUS FARMS IN THE MAGISTERIAL DISTRICTS OF MATATIELE AND MT FLETCHER, EASTERN CAPE (12/3/295 ER)

1 INTRODUCTION

This section describes the purpose of this report, outlines the opportunity for comment, provides a brief description of the project background, summarises the legislative authorisation requirements and terms of reference, and describes the structure of the report.

1.1 PURPOSE OF THIS REPORT AND OPPORTUNITY TO COMMENT

This Environmental Impact Report ("EIR") and Environmental Management Programme ("EMPr") have been compiled and distributed for review and comment as part of the Scoping and Environmental Impact Assessment (hereafter collectively referred to as "EIA") process that is being undertaken for the proposal by Rhino Oil & Gas Exploration South Africa (Pty) Ltd (hereafter referred to as "Rhino Oil and Gas") to apply for an Exploration Right ("ER') to explore for various petroleum products on various farms in the magisterial districts of Matatiele and Mount Fletcher, Eastern Cape, South Africa (12/3/295 ER).

This EIR summarises the EIA process followed to date and provides an overview of the proposed project and the affected environment. It also provides an assessment of the impacts of the proposed project and sets out the recommend management measures. Interested and Affected Parties ("I&APs") are asked to comment on the EIA and EMPr (see Section 1.6). The document will then be updated to a final report, giving due consideration to the comments received, and be submitted to the Petroleum Agency of South Africa ("PASA"), the designated agency responsible for the administration of petroleum related minerals, for decision-making.

1.2 PROJECT BACKGROUND

In early 2015, Rhino Oil and Gas lodged an application for an ER to explore for various petroleum products (including oil, gas, condensate, coal bed methane, helium and biogenic gas) with PASA in terms of Section 79 of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA), as amended. PASA accepted the ER application on 22 May 2015 (Ref: 12/3/295 ER).

The purpose of exploration is to identify the existence of any commercially viable reserves of oil and / or gas, which may be located within suitable geological strata. The primary target of the proposed exploration programme are various forms of petroleum located in deep underground rock formations or that are associated with other hydrocarbon reservoirs such as coal beds. The conditions necessary for

petroleum reserves to have accumulated are complex and largely dependent on past geological history and present geological formations and structures. For deposits to occur, particular combinations of potential source and reservoir rocks together with migration pathways and trap structures are required. Exploration is a technically complex and iterative process consisting of a number of stages typically termed i) early-phase exploration, ii) appraisal and iii) well drilling. Data from each stage improves the knowledge and understanding of the resource, and informs the following stage, which is only undertaken if results are positive. Exploration techniques may include, *inter alia*, aero-magnetic/gravity surveys, deep and shallow geophysical (seismic) surveys, shallow drilling and coring, and appraisal and exploration drilling (DTI, 2001). Exploration can require a period of up to 10 years, in order to arrive at a point where an informed decision can be made on a production right application.

The initial ER application area was approximately 120 000 ha in extent and covered approximately 200 properties (farms and portions) (see Figure 1-1 for the regional setting of the project). The proposed 'early-phase exploration' activities as included in the initial ER application were:

- various non-invasive and remote exploration techniques (including analysis of existing data and full tensor gradiometry gravity survey);
- the drilling of up to 10 core boreholes; and
- 125 km of seismic survey acquisition.

Subsequent to the acceptance of the Scoping Report, Rhino Oil and Gas reduced the extent of the ER application area through the exclusion of the Malekgalonyane (Ongeluksnek) Nature Reserve thus reducing the number of properties included in the ER application to approximately 190 properties (farms and portions) over an area of 110 572 ha. Refer to Section 4.4 for further detail. In addition, and also subsequent to the acceptance of the Scoping Report, Rhino Oil and Gas has excluded the ground-based core hole drilling and seismic surveys from proposed 'early-phase exploration' work for which they are seeking environmental authorisation. Thus the current focus of the application and the related environmental assessment work is now only related to the proposed remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey).

If the application is approved, Rhino Oil and Gas would be in a position to conduct the remote exploration techniques and to develop a more detailed understanding of the potential oil and gas resources in the ER area. Thereafter, should Rhino Oil and Gas propose to conduct ground-based exploration activities this would need to be informed by a further application to PASA and a separate environmental assessment and authorisation process. A benefit of this revised approach is that any future application for ground-based exploration activities will be focussed on specified sites, thereby enabling I&APs to have a better understanding of where Rhino Oil and Gas proposes to access land and conduct ground-based exploration activities. This addresses some of the concerns raised by I&APs relating to where the proposed ground-based exploration activities may be located. Refer to Section 4.5.1 for further detail.

The approval being sought as part of this application does not include any activities relating to the appraisal or well drilling phases that comprise a commercial viability assessment of a possible resource. Thus no wells, permeability testing, pressure testing or hydraulic fracturing (commonly referred to as "fracking") is proposed as part of the initial three-year exploration programme. If a resource is identified for more advanced exploration, then further authorisation / approvals and associated application processes would be required before these activities could be undertaken (refer to Section 4.6 for further information in this regard).

1.3 SUMMARY OF AUTHORISATION REQUIREMENTS

An application for an exploration right requires statutory approval in terms of both the MPRDA and the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA), as amended. These two regulatory processes are summarised below and presented in more detail in Section 2. All legislation and guidelines that have been considered in the preparation of the EIR are documented in Section 2.

In terms of section 79 of the MPRDA an exploration right is required from the Minister of Mineral Resources (or delegated authority) prior to the commencement of any exploration activities. A requirement for obtaining an ER is that an applicant must comply with Chapter 5 of NEMA with regards to consultation and reporting.

In terms of the Environmental Impact Assessment Regulations 2014, promulgated in terms of Chapter 5 of NEMA, any activity which requires an exploration right under the MPRDA may not commence without Environmental Authorisation from the competent authority, the Minister of Mineral Resources (or delegated authority), to carry out the proposed exploration programme. In order for PASA, as the delegated authority, to consider an application for Environmental Authorisation and make a recommendation to the Minister of Mineral Resources (or delegated authority), a Scoping and EIA process must be undertaken.

Rhino Oil and Gas has appointed SLR Consulting (South Africa) (Pty) Ltd (hereafter referred to as "SLR") as the independent environmental assessment practitioner ("EAP") responsible for undertaking the required EIA and conducting the public participation process to meet the relevant requirements of the MPRDA, NEMA and Regulations thereto.

BOX 1: ACCEPTANCE OF SCOPING

A Scoping process, in terms of the EIA Regulations 2014, was undertaken between October 2015 and April 2016 to inform the application for environmental authorisation. A Scoping Report was prepared to document the findings of the Scoping process. The Scoping Report was accepted by PASA on 10 June 2016, with permission being granted to undertake the EIA in terms of the Plan of Study for EIA described in the Scoping Report (see Appendix 6.1) and the conditions included in the acceptance. All registered I&APs were notified that PASA accepted the Scoping Report.

Separate electronic file

FIGURE 1-1: REVISED REGIONAL SETTING OF THE EXPLORATION RIGHT APPLICATION AREA

1.4 TERMS OF REFERENCE

The terms of reference for the EIA are as follows:

- Ensure the EIA is undertaken in accordance with the requirements of NEMA and the EIA Regulations 2014 (GN No. R982, 4 December 2014);
- Ensure the EIA is undertaken in an open, participatory manner to ensure that all potential impacts are identified;
- Undertake a formal public participation process, which specifically addresses the distribution of information to I&APs and provides the opportunity for I&APs to raise any concerns/issues, as well as an opportunity to comment on all EIA documentation;
- Commission specialist studies to assess key issues and concerns identified during the scoping process,; and
- Integrate all the information, including the findings of the specialist studies and other relevant information, into an EIR to allow an informed decision to be taken on the proposed project.

BOX 2: NOTE ON THE SCOPE OF THE EIA

The scope of the current EIA process is aligned specifically to the early-phase exploration work programme as described in Section 4.5.

The reader is advised that, subsequent to the acceptance of the Scoping Report, Rhino Oil and Gas has excluded the ground based core hole drilling and seismic survey activities from the application. The current focus of the application for environmental authorisation and the related environmental assessment work is now only on remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey).

The assessment of further ground based exploration including core hole drilling, seismic surveys, appraisal or well drilling activities for exploration or future production falls outside of the scope of this EIA process. If such work were to be proposed by Rhino Oil and Gas then it would be required to seek further approval from PASA in terms of the MPRDA and NEMA. Any further approval would be subject to an additional environmental assessment process with further public consultation as is required by NEMA.

1.4.1 STRUCTURE OF THE REPORT

This EIR has been prepared in compliance with Appendix 3 of the EIA Regulations 2014 and is divided into various chapters and appendices, the contents of which are outlined below.

TABLE 1-1: STRUCTURE OF THE EIR

Section	Contents
Executive Summary	Provides a summary of the EIR.
Chapter 1	**Introduction** Describes the purpose of this report, provides a brief description of the project background, summarises the legislative authorisation requirements, presents the terms of reference of the EIA, and describes the structure of the report and the opportunity for comment.
Chapter 2	**Legislative requirements** Outlines the key legislative requirements applicable to the proposed exploration activities.
Chapter 3	**Study Method** Outlines the methodology for the assessment and consultation process undertaken in the EIA. Also includes a summary of the consultation undertaken during scoping and the results thereof.
Chapter 4	**Project overview** Describes the need and desirability for the proposed project, provides general project information, an overview of the exploration process and the proposed initial three-year exploration work programme and a description of the project alternatives.
Chapter 5	**Description of the affected environment** Describes the existing biophysical and social environment that could potentially be affected by the proposed project.
Chapter 6	**Impact description and assessment** Describes and assesses the potential impacts of the proposed project on the affected environment. It also presents mitigation or optimisation measures that could be used to reduce the significance of any negative impacts or enhance any benefits, respectively.
Chapter 7	**Conclusion and recommendations** Provides conclusions to the EIA and summarises the recommendations for the proposed project.
Chapter 8	**References** Provides a list of the references used in compiling this report.
Chapter 9	**Environmental Management Programme** Provides an Environmental Management Programme report for the proposed exploration activities.
Chapter 10	Appendix 1: Co-ordinates of the Exploration Right area Appendix 2: Properties included in the Exploration Right application area Appendix 3: EAP Undertaking Appendix 4: Proof of registrations of the practitioners Appendix 5: Curricula Vitae of the Project Team Appendix 6: Public Participation Process Appendix 6.1: Authority Correspondence since submission of the

Section	Contents
	Scoping Report Appendix 6.2: I&AP database Appendix 6.3: I&AP Submissions post completion of Scoping Report Appendix 6.4: Land Claimant information Appendix 6.5: I&AP correspondence since submission of the Scoping Report

1.5 OPPORTUNITY TO COMMENT

This EIR has been distributed for a 30-day comment period from **12 August to 13 September 2016** in order to provide I&APs with an opportunity to comment on any aspect of the proposed project and the findings of the EIA process. Copies of the full report have been made available for download from the SLR website (go to: http://www.ccaenvironmental.co.za/sub-oil-gas-minerals/) and are available at the locations described in Table 1-2.

An electronic copy of the EIR can be emailed or provided on CD on request. The EIR Executive Summary has also been translated into Sesotho and isiXhosa and is available for download from the SLR website or can be emailed on request.

TABLE 1-2: LOCATIONS WITH HARD COPIES OF THE EIR

Location name	Physical Address
Matatiele Public Library	102 Main Street, Matatiele, 4730
Maluti Magistrate Offices	101 Main Street, Matatiele, 4730
Mount Fletcher Public Library	Enkululekweni Location, Mount Fletcher
Elundini Local Municipality (Mount Fletcher Offices)	272 Back Street, Mount Fletcher
Maclear Public Library	Van Riebeeck Street, Maclear, 5480
Bakoena Traditional Council	Chief Moshoeshoe's Office, Queen's Mercy
Ramohlakoana Traditional Council	Queen Sibi's Office, Hebron
Bakoena Traditional Council	Chief Lebenya's Office, Seqhobong
Amahlubi Traditional Council	Chief Zibi's Office, Ezingonyameni, Kwa Dzingwa

Any comments on the EIR should be forwarded to SLR at the contact details shown below.

BOX 3: SUBMIT YOUR COMMENTS ON THE EIR TO:

SLR Consulting (Pty) Ltd
Attention: Matthew Hemming

PO Box 1596, CRAMERVIEW, 2060
Unit 7, Fourways Manor Office Park, Corner Roos and Macbeth Streets, Fourways, Johannesburg

Tel: (011) 467 0945
Fax: (011) 467 0978
E-mail: mhemming@slrconsulting.com OR smoeketse@slrconsulting.com

For comments to be included in the updated EIR they should reach SLR by **no later than 13 September 2016**

2 LEGISLATIVE REQUIREMENTS

This chapter outlines the key legislative requirements applicable to the proposed exploration activities.

2.1 OVERVIEW OF THE "ONE ENVIRONMENTAL SYSTEM"

The "One Environmental System" commenced on 8 December 2014 removing the environmental regulation of prospecting, mining, exploration and production and related activities from the MPRDA and transferring it to NEMA. Under the "One Environmental System", the Minister of Mineral Resources (or delegated authority) is the competent authority responsible for issuing Environmental Authorisations in terms of NEMA for mining and petroleum related activities. The Minister of Environmental Affairs, however, remains the appeal authority for these authorisations.

2.2 MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002

The MPRDA provides that the mineral and petroleum resources are the common heritage of all South Africans and the State is the custodian thereof for the benefit of all South Africans. The state is entitled to issue rights to ensure the sustainable development of South Africa's mineral and petroleum resources within a framework of national environmental policy, while promoting economic and social development.

In terms of the MPRDA, an ER must be obtained prior to the commencement of any exploration activities. A requirement for obtaining an ER is that an applicant must submit an application in terms of Section 79(1) of the MPRDA to the designated agency, and they must accept the application within 14 days if, *inter alia*, no other person holds a Technical Co-operation Permit, ER or Production Right for petroleum over any part of the proposed licence area. If the application for an ER is accepted, the designated agency must request that the applicant comply with Chapter 5 of NEMA with regards to consultation and reporting (see Section 2.1.3 below). The Minister (or delegated authority) may only grant the ER if an Environmental Authorisation is issued.

As mentioned in the introduction, Rhino lodged an application for an ER with PASA, the designated agency in terms of Section 79 of the MPRDA. PASA accepted the application on 22 May 2015 (Ref: 12/3/295 ER, see Appendix 6.1) and requested that, *inter alia*,

- an application for Environmental Authorisation be submitted to them in terms of Regulation 16 of the EIA Regulations 2014;
- a scoping report as contemplated in Regulation 21(1) of the EIA Regulations 2014 and which has been subjected to public participation be submitted;
- consultation be undertaken with landowners, lawful occupiers and any other I&APs and the results be included in the Scoping and EIR.; and
- further to submit all outstanding title deeds.

2.2.1 CONSULTATION BY AUTHORITY

Section 10 of the MPRDA requires that the designated agency (i.e. PASA), within 14 days after accepting an application for a right, and in the prescribed manner must:

- make known that an application for a right has been accepted in respect of the land in question; and
- call upon interested and affected persons to submit their comments regarding the application within 30 days from the date of the notice.

The prescribed manner for the designated agency (i.e. PASA) to give notice in terms of Section 10 of the MPRDA is set out in Regulation 3 of the MPRD Regulations (GN R 527 of April 2004). PASA has confirmed to SLR that, in respect of this application, they placed a notice on a notice board at their office and in the Magistrate's Court in the magisterial district applicable to the land in question.

2.2.2 LEGAL NATURE AND LIMITATIONS ON AN EXPLORATION RIGHT

Any right granted under the MPRDA is a limited real right in respect of the mineral or petroleum and the land to which such right relates. The holder of a right is entitled to the rights referred to in Section 5 of the MPRDA and such other rights as may be granted to, acquired by or conferred upon such holder under the MPRDA or any other law. Mineral rights are also specific and have limitations.

The ER that Rhino Oil and Gas has applied for is specific and limited to:

- The minerals being: oil, gas, condensate, coal bed methane, helium and biogenic gas;
- The proposed ER area as defined by the co-ordinates presented in Appendix 1 (revised since acceptance of the Scoping Report).
- The properties as listed in Appendix 2 (revised since acceptance of the Scoping Report);
- The proposed exploration work programme (revised since acceptance of the Scoping Report) as detailed in Section 4.5; and
- A three-year time frame from the granting of the right.

Any change to the scope of the ER, further exploration or future production activities would need to be subject to additional authorisation / approval in terms of the MPRDA and NEMA. Each of these would require a separate environmental assessment (or Environmental Authorisation amendment) process, which would include a further public participation process and an environmental assessment (potentially including specialist studies) of all project-related activities / issues. Refer to Section 4.6 for further information in this regard.

2.3 NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998

Section 2 of NEMA sets out a range of environmental principles that are to be applied by all organs of state when taking decisions that significantly affect the environment. Included amongst the key principles is that all development must be socially, economically and environmentally sustainable and that environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably. NEMA also provides for the participation of I&APs and stipulates that decisions must take into account the interests, needs and values of all I&APs.

Chapter 5 of NEMA outlines the general objectives and implementation of Integrated Environmental Management (IEM), which provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals. Section 24 provides a framework for granting of Environmental Authorisations. In order to give effect to the general objectives of IEM, the potential impacts on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority. Section 24(4) provides the minimum requirements for procedures for the investigation, assessment and communication of the potential impact of activities.

2.3.1 EIA REGULATIONS 2014

The EIA Regulations 2014 promulgated in terms of Chapter 5 of NEMA, and published in Government Notice (GN) R982, provides for the control of certain listed activities. These activities are listed in GN R983 (Listing Notice 1), R984 (Listing Notice 2) and R985 (Listing Notice 3) of 4 December 2014, and are prohibited until Environmental Authorisation has been obtained from the competent authority. Although the administration of applications for Environmental Authorisations has been delegated to PASA, the Minister of Mineral Resources (or delegated authority) remains responsible the granting of Environmental Authorisation in term of NEMA where the listed or specified activity is directly related to prospecting or exploration of a mineral or petroleum resource (refer to Section 24C(2A) of NEMA).

Environmental Authorisation, which may be granted subject to conditions, will only be considered once there has been compliance with GN R982. This notice sets out the procedures and documentation that need to be complied with when applying for Environmental Authorisation. A Basic Assessment process must be applied to an application if the authorisation applied for is in respect of an activity(ies) listed in Listing Notice 1 and / or 3 and an EIA process must be applied to an application if the authorisation applied for is in respect of an activity(ies) listed in Listing Notice 2.

The proposed exploration right application triggers Activity 18 contained in Listing Notice 2 (see Table 2-1), thus a Scoping and EIA process must be undertaken in order for PASA to consider the application in terms of NEMA and make a recommendation to the Minister of Mineral Resources. Rhino Oil and Gas

made application to PASA for environmental authorisation of the ER on 12 October 2105 and this was accepted by PASA on 19 October 2015 (see Appendix 6.1).

TABLE 2-1: LISTED ACTIVITIES APPLIED FOR AS PART OF THE PROPOSED PROJECT

ACTIVITY NO.	ACTIVITY DESCRIPTION	DESCRIPTION OF ACTIVITY IN RELATION TO THE PROPOSED PROJECT
Listing Notice 1 GN R983		
N/A	-	-
Listing Notice 2 GN R984		
18	*Any activity including the operation of that activity which requires an Exploration Right as contemplated in Section 79 of the MPRDA, including associated infrastructure, structures and earthworks.*	The proposed exploration activities require an Exploration Right and an application has been submitted to PASA. The proposed exploration activities associated with the Exploration Right application are described in Chapter 3.
Listing Notice 3 GN R985		
N/A	-	-

2.4 OTHER LEGISLATION CONSIDERED IN THE PREPARATION OF THE EIR

In accordance with the EIA Regulations 2014, all legislation and guidelines that have been considered in the preparation of the EIR must be documented. Table 2-2 below provides a summary of the applicable legislative context and policy.

TABLE 2-2: LEGAL FRAMEWORK

APPLICABLE LEGISLATION AND GUIDELINES	RELEVANCE OR REFERENCE
MPRDA and associated regulations (GN No. R 527)	Refer to Section 2.2.
Regulations on Petroleum Exploration and Production (GN R 466, July 2015)	The Regulations augment the MPRDA Regulations, so as to prescribe standards and practices to ensure the safe exploration and production of petroleum. Section 122 of the Regulations prescribes no go areas for wells and hydraulic fracturing sites in relation to water resources. The applicant has not, at this stage proposed any activities to which the Regulations apply.
Mine Health and Safety Act Regulations (GN R 93 of 1997)	Exploration must be undertaken in terms of the relevant provisions of the Regulations. The applicant has not, at this stage proposed any activities to which the Regulations apply.

APPLICABLE LEGISLATION AND GUIDELINES	RELEVANCE OR REFERENCE
NEMA	Refer to Section 2.3.
EIA Regulations 2014 (GN No. R982) and Listing Notice 2 (GN No. R984)	Refer to Section 2.3.1. The EIR and EMPr have been compiled in accordance with Appendix 3 and 4 of the EIA Regulations 2014, respectively. Exploration is an activity listed in Listing Notice 2 and therefore requires a Scoping and EIA process to inform the environmental authorisation.
Listing Notice 1 (GN No. R983), and Listing Notice 3 (GN No. R985)	No other activities are being proposed that trigger the need for an environmental authorisation.
Financial Provision Regulations, 2015 (GN R No 1147)	These regulations set the requirements for financial provision as contemplated in the Act for the costs associated with the undertaking of management, rehabilitation and remediation of environmental impacts of prospecting, exploration, mining or production operations through the lifespan of such operations and latent or residual environmental impacts that may become known in the future. See Section 7.6.
National Environmental Management Waste Act, 2008 (No. 59 of 2008) (NEMWA) and associated regulations.	NEMWA regulates all aspects of waste management and has an emphasis on waste avoidance and minimisation. NEMWA creates a system for listing and licensing waste management activities. Listed waste management activities above certain thresholds are subject to a process of impact assessment and licensing. Activities listed in Category A require a Basic Assessment process, while activities listed in Category B require an EIA process. The applicant has not, at this stage proposed any activities that trigger the need for a Waste Management Licence.
Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits,2015 (GN R 632).	The applicant has not, at this stage proposed any activities to which the Regulations apply.
National Environmental Management Air Quality Act, 2004 (No. 57 of 2003) (NEMAQA).	The NEMAQA regulates all aspects of air quality, including prevention of pollution, providing for national norms and standards and including a requirement for an Atmospheric Emissions Licence for listed activities, which result in atmospheric emissions and have or may have a significant detrimental effect on the environment. In terms of Section 22 no person may conduct a listed activity without an Atmospheric Emission Licence. The applicant has not, at this stage proposed any activities that trigger the need for an Atmospheric Emission Licence.
National Water Act, 1998 (No. 36 of 1989) (NWA)	NWA provides a legal framework for the effective and sustainable management of water resources in South Africa. It serves to protect, use, develop, conserve, manage and control water resources as a whole, promoting the integrated management of water resources with the participation of all stakeholders. This Act also provides national norms and standards, and the

APPLICABLE LEGISLATION AND GUIDELINES	RELEVANCE OR REFERENCE
	requirement for authorisation of uses listed in Section 21. The applicant has not, at this stage proposed any activities that trigger the need for a Water Use Licence.
Regulations on use of water for mining and related activities aimed at the protection of water resources (GN R704)	These Regulations, promulgated under the NWA, were made in respect of the use of water for mining and related activities, and are aimed at the protection of water resources. Regulation 4 (b) sets out that no person in charge of an activity may "carry on any underground or opencast mining, prospecting or any other operation or activity under or within the 1:50 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, whichever is the greatest. The applicant has not, at this stage proposed any activities to which the Regulations apply.
General Authorisation for taking water from a resource (GN R 399, 2004)	The General Authorisation permitted in terms of the Schedule replaces the need for a water user to apply for a licence in terms of the National Water Act for the taking or storage of water from a water resource, provided that the taking or storage is within the limits and conditions set out in this authorisation. The GA includes specific limitations for the taking of surface and groundwater per catchment per property. The applicant has not, at this stage proposed any activities to which the General Authorisation applies.

APPLICABLE LEGISLATION AND GUIDELINES	RELEVANCE OR REFERENCE
National Heritage Resources Act, 1999 (No. 25 of 1999) (NHRA)	NHRA provides for the protection of all archaeological and palaeontological sites and meteorites. Under the general protection provisions, no person may alter, demolish, destroy or remove any of these resources without a permit issued by the relevant provincial resources authority. In addition, any person who in the course of an activity discovers archaeological, palaeontological, meteorological material or burial grounds or graves, must immediately cease the activity and notify the responsible heritage resources authority. Section 38 (1) of the Act defines the categories of development for which the responsible heritage resources authority must be notified. Amongst others, under Section 38(c) *'any development or other activity which will change the character of a site*- (i) exceeding 5 000 m^2' the responsible heritage authority must be informed of a development larger than 0.5 ha. The applicant has not, at this stage proposed any activities that trigger the need for heritage permission. However an application has been submitted to the provincial heritage body in order to access the most up to date heritage datasets.
National Environmental Management: Protected Areas Act, 2003 (No. 57 of 2003) (NEMPRAA)	NEMPRAA provides for protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. Section 48 of this Act restricts certain activities (incl. exploration) within protected areas. The ER application area excludes all areas protected in terms of NEMPRAA.
National Environmental Management Biodiversity Act (NEMBA) 10 of 2004.	The objectives of NEMBA are to provide for the management and conservation of biological diversity within South Africa. NEMBA does not place any obligations on the proposed exploration. Threatened ecosystems and species of conservation concern, as listed by NEMBA, have been given consideration in the EIA.
National Forests Act (No 84 of 1998)	Provides for the sustainable management and development of forests for the benefit of all, including to provide special measures for the protection of certain forests and trees. Licensing is required for the destruction of certain indigenous trees. The applicant has not, at this stage proposed any activities to which the Act applies.
Mountain Catchment Areas Act (No 63 of 1970)	Provides for the conservation, use, management and control of land situated in mountain catchment areas. The applicant has not, at this stage proposed any activities to which the Act applies.
Spatial-Planning and Land Use Management Act (No. 16 of 2013)	Provides a framework for spatial planning and land use management. Given that no permanent infrastructure is proposed, and therefore no change in land use or the zoning thereof , there is no requirement for approval under this

APPLICABLE LEGISLATION AND GUIDELINES	RELEVANCE OR REFERENCE
	legislation. The applicant has not, at this stage proposed any activities to which the Act applies.

2.5 GUIDELINES AND POLICIES

The guidelines and policies listed below have been taken into account during the EIA.

2.5.1 NEMA PUBLIC PARTICIPATION GUIDELINE

The Department of Environmental Affairs (DEA) published a Public Participation Guideline in the EIA Process Guideline (2010) as part of the Integrated Environmental Management Guideline series. It provides guidance on the procedure and the provisions of the public participation process in terms of NEMA and the EIA Regulations, as well as other relevant legislation.

2.5.2 NEMA NEEDS AND DESIRABILITY GUIDELINE

The Department of Environmental Affairs published a Guideline on Need and Desirability in 2010 as part of the Integrated Environmental Management Guideline Series 9. The guideline has to be read together with the NEMA and the EIA Regulations.

2.5.3 PASA PUBLIC PARTICIPATION GUIDELINE

PASA prepared guidelines for consultation with I&APs (December 2011). PASA developed these guidelines as a tool to assist applicants to undertake a comprehensive consultation process as prescribed by the MPRDA.

2.5.4 MUNICIPAL IDP AND SDF

The Integrated Development Plans (IDPs) and Spatial Development Frameworks (SDFs) of the Local and District municipalities have been reviewed and relevant details are presented in Section 4.3.3.

2.5.5 STRATEGIC ENVIRONMENTAL ASSESSMENT FOR SHALE GAS DEVELOPMENT

The Department of Environmental Affairs commissioned a Strategic Environmental Assessment (SEA) for shale gas development (SGD) in South Africa to address the lack of evidence with regards to the apparent trade-off required between economic opportunity and environmental protection in potentially developing a large shale gas resource in the Karoo Basin. The SEA has been coordinated by the Council

for Scientific and Industrial Research (CSIR). To date (July 2016) the SEA has produced a draft scientific assessment that includes 18 Chapters.

While the SEA has some relevance to the application by Rhino Oil and Gas, there a number of factors that limit the direct applicability. These include:

- The geographic scope of the SEA is limited to the Central Karoo and is distinct from the Rhino Oil and Gas ER application area geologically and ecologically;
- The SEA is focussed on Shale Gas, and does not consider other conventional or unconventional forms of petroleum;
- The SEA considers impacts associated with the shale gas industry across its entire lifecycle (up to 40 years), and
- The exploration phase (scenario 1) postulated in the SEA includes the full array of techniques that may occur over the life of an exploration project (including those for the exploration, appraisal and development stages), whereas the Rhino Oil and Gas ER application is for early-phase exploration over an initial 3-year period.

The SEA does not include any consideration or assessment of aerial surveys such as FTG.

2.5.6 MINING AND BIODIVERSITY GUIDELINES

The South African National Biodiversity Institute (SANBI) and partners produced a Mining and Biodiversity Guideline (2013) to provide practical guidance to the mining sector on how to address biodiversity issues in the South African context. This guideline provides a tool to facilitate the sustainable development of South Africa's mineral resources in a way that enables regulators, industry and practitioners to minimise the impact of mining on the country's biodiversity and ecosystem services.

The Guideline distinguishes between four categories of biodiversity priority areas in relation to their importance from a biodiversity and ecosystem service point of view as well as the implications for mining in these areas. These include areas designated as: 1) Legally Protected, 2) Highest Biodiversity Importance, 3) High Biodiversity Importance, and 4) Moderate Biodiversity Importance. The 'Highest Biodiversity Importance' category is based on the mapped extent of Critically Endangered and Endangered ecosystems, Critical Biodiversity Areas (CBAs), river and wetland Freshwater Ecosystem Priority Areas (FEPAs) with a 1 km buffer and Ramsar sites.

The Guidelines indicates that if the presence of biodiversity features, leading to the categorisation as a 'Highest Biodiversity Importance' area, are confirmed then this could be a fatal flaw or pose significant limitations for new mining projects. An environmental assessment should inform whether or not mining is acceptable, including potentially limiting specific types of prospecting or mining which may be deemed not acceptable due to the impact on biodiversity and associated ecosystem services found in the priority

area. Mining in such areas may be considered out of place and authorisations may well not be granted. If granted, the authorisation may set limits on allowed activities and methods, the extent thereof and impacts.

3 STUDY METHODOLOGY

This chapter outlines the assessment methodology and I&AP consultation process followed in the EIA process.

3.1 DETAILS OF THE EIA PROJECT TEAM

The details of the EAPs that were involved in the preparation of this EIR are provided in Table 3-1.

TABLE 3-1: DETAILS OF THE EAP

GENERAL				
Organisation	SLR Consulting (South Africa) (Pty) Ltd			
Postal address	PO Box 1596, Cramerview 2060			
Tel No.	+27 11 467 0945			
Fax No.	+27 11 467 0978			
E-mail address	mhemming@slrconsulting.com			
NAME	**QUALIFICATIONS**	**PROFESSIONAL REGISTRATION**	**EXPERIENCE (YEARS)**	**TASKS AND ROLES**
Jonathan Crowther	M.Sc. (Env. Sci.). University of Cape Town	Pr.Sci.Nat., CEAPSA	27	Project Director - Report and process review
Matthew Hemming	M.Sc. (Conservation Biology), University of Cape Town	Member IAIAsa and IWMSA	10	Project Manager - Management of the EIA process, including process review, specialist study review and report compilation
Jeremy Blood	M.Sc. (Cons. Ecol.), University of Stellenbosch	Pr.Sci.Nat., CEAPSA	16	Report compilation
Stella Moeketse	M.Soc.Sc. (Environmental and Geographical Studies), University of Cape Town	N/A	7 years	Public Participation Manager - Management of the public participation process, including I&AP database, notices and communication and assimilation of comments.

SLR has no vested interest in the proposed project other than fair payment for consulting services rendered as part of the EIA process and has declared its independence as required by the EIA Regulations 2014. An undertaking by the EAP is provided in Appendix 3.

3.1.1 QUALIFICATIONS AND EXPERIENCE OF THE EAP

Jonathan Crowther is a manager at SLR, has over 27 years of relevant experience and is registered as an environmental assessment practitioner with the interim certification board and as an Environmental Scientist with the South African Council for Natural Scientific Professions (SACNASP). Matthew Hemming holds a Masters Degree in Conservation Biology, has over 10 years of relevant experience in the assessment of impacts associated with mining and exploration operations.

Both Jonathan and Matthew have been involved in multiple impact assessment for large scale mining development in Southern Africa as well as onshore and offshore oil and gas exploration and production projects. Proof of registrations of the practitioners is provided in Appendix 4 and relevant curricula vitae are attached in Appendix 5.

3.2 SCOPING PHASE

The Scoping phase complied with the requirements of NEMA and the EIA Regulations 2014, as set out in GN R982. This involved a process of notifying I&APs of the proposed project and EIA process and providing them with the opportunity to make comment in order to ensure that all potential key environmental impacts, including those requiring further investigation, were identified.

The Scoping phase included a pre-application public participation process. Although this is not a legislated requirement of the EIA Regulations 2014, it provided an opportunity to notify I&APs of the proposed project and to raise any initial issues or concerns regarding the proposed exploration activities. The steps / tasks undertaken for public participation during the pre-application and Scoping phases are summarised in Box 4.

The key issues and concerns identified by the project team, with I&AP input, during the Scoping Phase are summarised in Table 3-2. This information provided forms the basis on which the Plan of Study for EIA and terms of reference for specialist studies were determined.

The Scoping Report was accepted by PASA on 10 June 2016 (see Appendix 6.1). PASA's acceptance of the Scoping Report confirmed that the EIA phase may proceed as outlined in the Plan of Study for EIA as submitted and in accordance with Appendix 4 to the EIA Regulations 2014. Specific conditions to the acceptance prescribed by PASA include the following:

- Ensure that various State Departments be consulted and their comments incorporated in the EIR;
- Identification and consultation with all affected landowners must be carried out;
- Where desktop studies are used the data must be authenticated by physical site assessment by the EAP and specialists; and

- The potential environmental liabilities associated with the proposed activity must be quantified by a specialist and the method of provision must be indicated, in line with the Financial Provision Regulations, 2015 (GN R No 1147).

BOX 4: Tasks undertaken during the Scoping Phase

1. Pre-application public participation process

The pre-application public participation process involved the following:

- Competent authority consultation: A pre-application meeting was held with PASA on 31 July 2015. The purpose of the meeting was to discuss the legislative requirements and the approach to the EIA process to ensure agreement and compliance.
  - Landowner identification: The applicant identified all properties included as part of the exploration right application (see Appendix 2). The properties included in the application were searched against the Deeds Office records by a land surveyor to identify landowners. Further Deeds Office, CIPRO and other internet searches were undertaken to obtain contact details for land owners. At the time of distribution of this report a minimum of 93 % (42 of 45) of the land owners have been notified. This includes 32 of 35 private individuals, all 7 of the Companies / Government entities / Churches and all of the 3Trusts.
- I&AP identification: In addition to landowners, a preliminary I&AP database of authorities (including State Departments with jurisdiction in the area, municipal offices, ward councillors and traditional authorities), Organs of State, Non-Governmental Organisations, Community-based Organisations and other key stakeholders (including farmers' unions) with a potential interest in the ER application was compiled. Additional I&APs were added to the database based on responses to the advertisements and notification letter, and attendees at the Information-sharing Meetings (see bullets below). The database of registered I&APs is included in Appendix 6.2.

  It is recorded that the following State departments, as a minimum, have been notified and afforded opportunity to comment: SAHRA/Provincial Heritage Resources Authority; Provincial Environmental Department, Department of Agriculture, Forestry and Fisheries, Department of Water & Sanitation, Department of Land Affairs, district and local municipalities.
- Distribution of an initial Background Information Document (BID): All identified landowners and I&APs were notified of the application and EIA process by means of a notification letter and BID. The BID (in English and isiZulu) was compiled to provide introductory information on the project, to encourage people to register on the I&APs database and to provide an initial opportunity to comment. The BID was distributed from September 2015.
- Site notices and advertisements: Site notices (in English and IsiZulu) were placed at multiple locations in Matatiele and a number of rural localities in the ER application area. Press advertisements providing notification of the ER application and EIA process were placed in the following newspapers / websites:
  - > Daily Herald on the 18th of September 2015 in English;
  - > Pondo on the 18th of September 2015, in isiXhosa; and
  - > East Griqualand Fever in English, Sotho and IsiXhosa on 30 October 2015.
  - > A notice was placed in the Government Gazette (4 March 2016) in English and Sesotho.
- Initial information-sharing meetings: The following information-sharing meetings were held during November 2015:
  - > Local leadership (traditional leaders from Matatiele and Elundini Local Municipality) and ward councilors (Matatiele Local Municipality) on 29th of September 2015 at Nokhwezi Community Hall.
  - > Public scoping meeting was held in November 2015 at Nokhwezi Community Hall.

  At these meetings Rhino Oil and Gas and SLR provided a basic overview of the project proposal and EIA process, respectively, and provided stakeholders the opportunity to raise any issues or concerns.

BOX 4 cont.

- Public response: The response from the public was that the great majority of I&APs are strongly opposed to all forms of oil and gas exploration in the region. There was a demand for additional time within the scoping process to allow for improved public consultation given the large application area and contentious nature of the project.

2. Project registration

In October 2015, Rhino Oil and Gas submitted an application for Environmental Authorisation to PASA for the proposed exploration activities and associated listed activity. PASA accepted the application and confirmed that a Scoping and EIA process was required.

3. Pre-Scoping Report public participation process

- Competent authority consultation: A further meeting was held with PASA in November 2015 to discuss the EIA process and the key issues raised by I&APs. Based on this meeting and subsequent motivation for an extension of time, PASA granted (in December 2015) an extension for the scoping process in order to allow SLR to incorporate further public interaction and investigation to augment the Scoping process.
- Distribution of a revised BID: A revised BID (in English, Sesotho and isiXhosa) was distributed for a further comment period from January 2016. The purpose of the BID was to convey information on the proposed project, to invite I&APs to register on the project database and to provide a further opportunity to comment.
- Follow-up information-sharing meetings: Follow-up information-sharing meetings were held during January 2016. These meetings included:
  - Ward councilors of the included areas of the Elundini Local Municipality in January 2016.
  - Council meeting of the Matatiele Local Municipality in January 2016;
  - Meetings with the Amahlubi, Moshesh and Sibi Traditional Authorities in January 2016. Chief Lebenya was not available.

  As for the previous meetings, Rhino Oil and Gas and SLR provided a basic overview of the project proposal and EIA process, respectively, and provided stakeholders the opportunity to raise any issues or concerns regarding the proposed project.

4. Compilation and review of Scoping Report

A Scoping Report was prepared in compliance with Appendix 2 of the EIA Regulations 2014 and was informed by comments received during the initial public participation process. The Scoping Report was initially distributed for a 30-day review and comment period from 21 October 2015.

After the time extension a revised Scoping Report was distributed for a 30-day review and comment period from 7 March 2016. Tasks that were undertaken included:

- Scoping Report availability: Copies of the Scoping Report were made available on the SLR ftp site and at the following locations for the duration of the review and comment period:
  - Matatiele Public Library
  - Maclear Public Library
  - Elundini Municipality: Public Library
  - Maluti Magistrates Court

  Copies of the Scoping Report were sent directly to a number of key stakeholders, including the four Traditional Authority Chiefs, the UCPP and various other commenting authorities.
- I&AP notification: A notification letter was sent to all I&APs registered on the project database. The letter informed them of the release of the Scoping Report and where the report could be reviewed. To facilitate the commenting process, a copy of the Executive Summary and a Comment Form were enclosed with each letter.

BOX 4 cont.

- Radio notice: Project notifications were aired on the Alfred Nzo Community Radio Station (in both Xhosa and Sotho) during the period 8 to 10 March 2016. There were 15 airings per day at different time slots over the three day period. The notice provided introductory information on the application and EIA process; provided details of how to contact SLR for further information and informed I&APs of the Scoping Report availability.

5. Revise Scoping Report and submission to PASA for acceptance

The preparation of the final Scoping Report was informed by comments received on the draft report. All comments were collated and responded to in an updated Comments and Responses Table, which was appended to the Scoping Report. As indicated in Section 2.3.4, the Scoping Report was accepted by PASA on 10 June 2016 (see Appendix 6.1).

Note: Copies of all supporting documents and inputs received during the public participation conducted during the Scoping phase were included with the Scoping Report (up to 22 April 2016). Copies of these documents have not been provided in the EIR.

All relevant supporting documents and inputs received post submission of the Scoping Report are included in the EIR.

TABLE 3-2: KEY ISSUES IDENTIFIED DURING THE SCOPING PHASE

Key issues identified by the project team, with I&APs input	Indication of the manner in which the issues were incorporated, or the reasons for not including them
3. Procedural issues	
There is strong opposition to the proposed exploration right application. The major themes of the public opposition are the following: • Concern, even fear, of the future risks that might arise from production should a resource be found; • Concern that given the money involved, if any hydrocarbon resource is found, it will not be possible to stop production regardless of what the future EIA processes may indicate in terms of risk. Thus the only way to avoid such risks is to not open the door to such projects; • Hydrocarbon based energy is a flawed concept and countries are moving away from new hydrocarbons in favour of a renewable energy system; • A deep mistrust of government institutions and the true motives and people behind such an application; • Significant doubt over government's ability to enforce compliance to the legislation; • South Africa does not understand unconventional hydrocarbon extraction risks and the necessary legislative framework to protect the environment is not in place; and • Lack of understanding of how an exploration programme is undertaken and what is actually being authorised. Numerous objections have been made to the project and EIA process.	The level of public opposition to the project has been documented in the Scoping and EIA Reports. Where people have registered their opposition to the project, this has been recorded. All objections received have been recorded. The EIA report has attempted to present accurate project information and a realistic assessment of impacts in order that I&APs can make an informed judgement. It is evident that much of the opposition is not directly against the merits of exploration activities as proposed, but rather against the anticipated outcome and risks that, if successful, could result from exploration. No attempt has been made to address issues and objections that are based on concerns that relating to further exploration or future production activities NEMA does not specifically provide a mechanism to address objections raised in the EIA process. Under the MPRDA unresolved objections would be table before the Regional Mining Development and Environmental Committee.
The EIA should assess the potential future exploration and production related impacts (including fracking)	The scope of the EIA is aligned with the early-phase exploration as proposed by Rhino Oil and Gas. Should Rhino Oil and Gas propose to conduct exploration activities outside of this scope, this would need to be informed by a further application to PASA and a separate environmental assessment and authorisation process.
The Strategic Environmental Assessment (SEA) for Shale Gas Development in the Karoo should be extended to cover this area/application or at least inform current EIA process. Or the findings of the SEA applied to this EIA	The scope and terms of the SEA were finalized by the DEA and is limited to Shale Gas Development in the geographic Karoo. Refer to section 2.5.5.
Time available for I&AP consultation and participation is insufficient;	An extension of time for public consultation in the Scoping phase was secured.
The adequacy of the public participation process / methodology was challenged, particularly with	Additional efforts were undertaken in order to address this. Refer to section 5.2 of the

regards informing rural communities.	Scoping report as well as Box 4 in the EIA.
Protected area or other areas incompatible with exploration should be excluded. Cognisance should be given to restrictions imposed by legislation and regulation, particularly the Petroleum Regulations	The extent of the proposed ER has been adjusted to exclude protected areas. The scope of the EIA is aligned with the early-phase exploration as proposed by Rhino Oil and Gas. Restrictions relating to future exploration or production activities have not been detailed in this EIA.
Provide a detailed baseline description of the affected environment, desktop assessment is not adequate.	Refer to Section 5 of the EIR. The large size of the application area, information constraints of the exploration process and the nature of the early-phase exploration did not allow for, nor warrant, detailed baseline assessments of the whole application area. However, it is noted that the databases that were utilized generally have good coverage, providing adequately accurate representation of the field conditions.
Confirm the location of the exploration sites and assess impacts at these sites.	The nature of exploration is such that the applicant cannot confirm the location of core hole drilling sites or seismic survey routes until the initial exploration has provided results. Rhino Oil and Gas excluded the core hole drilling and seismic surveying from the proposed 'early-phase exploration' work for which they are seeking environmental authorisation. The current focus of the application for environmental authorisation and this EIA is now only on remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey). Refer to section 4.5.1
4. Potential impacts of the proposed exploration	
Impact on ecology > Loss of or disturbance to vegetation and faunal habitats > Disturbance to and mortality of fauna > Enabling the establishment of alien and invasive species in disturbed areas	The potential impacts of core hole drilling and seismic surveys have not been assessed in this EIA as they do not form part of the proposed 'early-phase exploration' work for which Rhino Oil and Gas are seeking environmental authorisation. See Section 4.5.1. The aerial FTG surveys (see Section 4.5.5) included as part of the proposed 'early-phase exploration' would result in almost no interaction with the ground over which the survey is undertaken. Thus impacts on the majority environmental aspects could not occur. For this reason the issues were not considered further.
Impact to Groundwater > Altered hydrogeological regime and groundwater availability > Contamination of groundwater resources > Water consumption	
Impacts on surface water	

> Altered surface water hydrological regime > Contamination of surface water resources > Water consumption	
Impacts on geology > Destabilisation of certain geologies > Risk to underground caverns or mine workings	
Impact on soils > Physical impact on soils (increased erosion / compaction) > Potential contamination of soils	
Impact on heritage resources	
Impact on land tenure and access to private property	
Impact on current land uses	
Structural damage to infrastructure > Structural damage to infrastructure due to shock waves, air overpressure and ground vibration > Degradation or damage due to exploration vehicles and equipment	
Impact on ambient air quality > Dust and vehicle emissions > Escape or release of gas from exploration boreholes	
Safety and security > Public safety due to inter alia, increased traffic volumes, heavy machinery, explosives, hazardous materials, release of gas, etc. > Fires > Landowner security	
Contribution or effect on the local economy	
Compensation	
Rehabilitation and liability	
Impact on ambient noise levels	Refer to Section 6.1

3.3 EIA PHASE

3.3.1 EIA OBJECTIVES

In accordance with Appendix 3 of GN. R982, the objectives of the EIA are to:

- identify the relevant policies and legislation relevant to the activity;
- present the need and desirability of the proposed activity and its preferred location;
- identify feasible alternatives related to the project proposal;
- ensure that all potential key environmental issues and impacts that would result from the proposed project are identified;
- provide a reasonable opportunity for I&APs to be involved in the EIA process;
- assess potential impacts of the proposed project alternatives during the different phases of project development;
- present appropriate mitigation or optimisation measures to minimise potential impacts or enhance potential benefits, respectively; and
- Through the above, to ensure informed, transparent and accountable decision-making by the relevant authorities.

The EIA process consists of a series of steps to ensure compliance with these objectives and the EIA Regulations 2014 as set out in GN No. R982. The process involves an open, participatory approach to ensure to ensure that all impacts are identified and that decision-making takes place in an informed, transparent and accountable manner. A flowchart indicating the legislated EIA process is presented in Figure 3-1.

This EIR has been prepared in compliance with Appendix 3 of the EIA Regulations 2014 (see Table 2-5). The report aims to present all information in a clear and understandable format, suitable for easy interpretation by I&APs and authorities, and to provide an opportunity for I&APs to comment on the proposed project and findings of the EIA process.

3.3.2 ASSUMPTIONS AND LIMITATIONS

The assumptions and limitations pertaining to this EIA are listed below:

- The assessment assumes that SLR has been provided with all relevant project information and that it was correct and valid at the time it was provided;
- The assessment is based, to some extent, on a generic description of the proposed exploration activities, as specific details would be dependent on the specific contractor employed to undertake each activity. However, it is assumed that parameters provided (or range thereof) are equivalent to the actual activity;

- There will be no significant changes to the project description or surrounding environment between the completion of the EIA process and implementation of the proposed project that could substantially influence findings, recommendations with respect to mitigation and management, etc.;
- The Public Participation Process has been undertaken in terms of Chapter 6 of the EIA Regulations 2014. Refer to Box 4;
- As a result of large number of landowners and occupiers in the application area and the availability of accurate title deed, land owner and occupier contact information, identification of and consultation with every owner of and occupier at included properties was not achieved. A minimum of 93 % of land owners have been notified. Much effort was made to make potentially affected parties aware through various other means (Refer to Box 4);
- The large size of the application area, information constraints of the exploration process and the nature of the early-phase exploration did not allow for, nor warrant, detailed baseline assessments of the whole application area. However, it is noted that the databases that were utilised generally have good coverage, providing adequately accurate representation of the field conditions.
- The exact extent of the Malekgalonyane (Ongeluksnek) Nature Reserve is uncertain as the cadastral descriptions taken from the National and Provincial databases are inconsistent.
- Although PASA required, in their conditions of acceptance of the Scoping Report, the undertaking of physical site assessments to authenticate data used in the EIA, this has not been undertaken. With the exclusion of core hole drilling and seismic survey activities from the scope of the proposed exploration activities, and thus the scope of the EIA there was no merit in undertaking such work. For any future ground-based exploration activities detailed investigations of target sites will need to be undertaken during the environmental assessment and authorisation application process.
- Negotiations with landowners with respect to agreements for access to land to conduct exploration falls outside of the scope of this EIA and will be undertaken by the applicant during the proposed exploration programme.

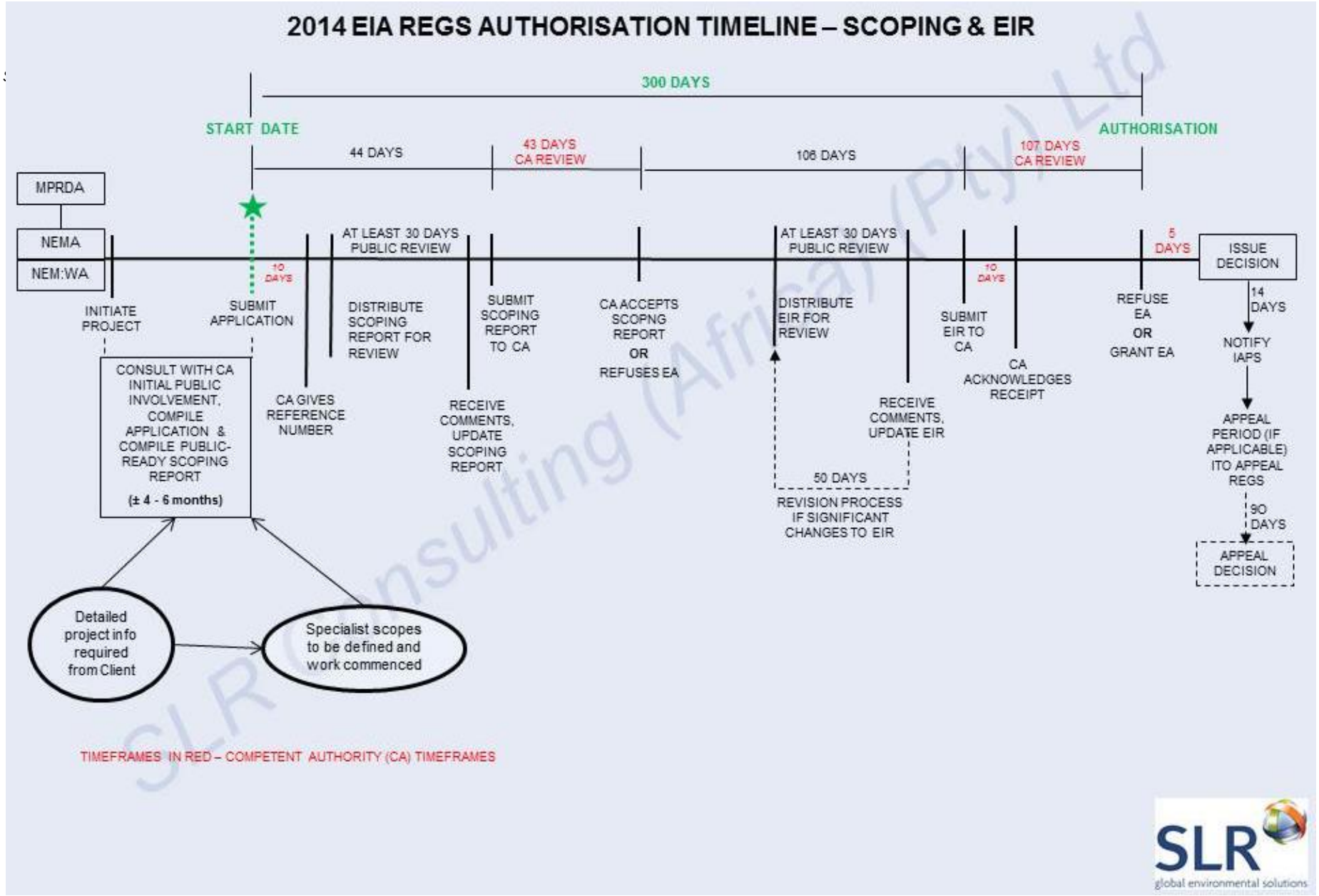

FIGURE 3-1: FLOW DIAGRAM SHOWING THE SCOPING AND EIA PROCESS (INCLUDING PRE-APPLICATION PHASE)

3.3.3 SPECIALIST STUDIES

As per the Plan of Study for EIA presented in the Scoping Report, six specialist studies were commissioned to inform this EIA. Their work was desktop based, interrogating the respective databases available for the environmental attributes, because of the large extent of the ER application area and the fact the locations for core holes and seismic surveys could not be determined at this stage in the exploration programme.

However, with the exclusion of core hole drilling and seismic survey activities from the scope of the EIA (see Section 4.5.1) these studies are no longer applicable. Detailed investigations of target sites would need to be undertaken during the environmental assessment and authorisation application process for future ground-based exploration activities.

3.3.4 COMMENTS FROM I&APS

Relatively few comments have been received from I&APs since the review period of the Scoping Report. All comments received, and the EAP responses thereto, are recorded in Appendix 6.3.

3.3.5 IMPACT ASSESSMENT METHOD

The identification and assessment of environmental impacts is a multi-faceted process, using a combination of quantitative and qualitative descriptions and evaluations. It involves applying scientific measurements and professional judgement to determine the significance of environmental impacts associated with the proposed project. The process involves consideration of, inter alia: the purpose and need for the project; views and concerns of I&APs; social and political norms, and general public interest.

Identified impacts are described in terms of the nature of the impact, compliance with legislation and accepted standards, receptor sensitivity and the significance of the predicted environmental change (before and after mitigation). The significance of environmental impacts is rated before and after the implementation of mitigation measures. These mitigation measures may be existing measures or additional measures that were identified through the impact assessment and associated specialist input. The impact rating system considers the confidence level that can be placed on the successful implementation of mitigation. The method for the assessment of environmental impacts is set out in the table below. This assessment methodology considers the following rating scales when assessing potential impacts (before and after mitigation):

- Consequence, which is a function of:
    - the intensity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources);
    - the extent of the impact;

- the duration of the impact;
- probability of the impact occurring;
- reversibility of the impact; and
- the degree to which the impact can be mitigated.

TABLE 3-3: CRITERIA FOR ASSESSING IMPACTS

Note: Part A provides the definition for determining impact consequence (combining intensity, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D.

PART A: DEFINITION AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**VL**	Very short, a few days or always less than a month.
	L	Short-term, occurs for more than a month, but less than 1 year.
	M	Medium-term, 1 to 3 years.

	H	Long term, between 3 and 10 years.
	VH	Very long, permanent, +10 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	**VL**	A portion of the site.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

PART B: DETERMINING CONSEQUENCE

INTENSITY = VL

DURATION	Very long	**VH**	Medium	Medium	Medium	High	High
	Long term	**H**	**Low**	Medium	Medium	Medium	High
	Medium term	**M**	**Low**	**Low**	Medium	Medium	Medium
	Short term	**L**	**Very low**	**Low**	**Low**	Medium	Medium
	Very short	**VL**	**Very low**	**Low**	**Low**	**Low**	Medium

INTENSITY = L

DURATION	Very long	**VH**	Medium	Medium	High	High	High
	Long term	**H**	Medium	Medium	Medium	High	High
	Medium term	**M**	**Low**	Medium	Medium	Medium	High
	Short term	**L**	**Low**	**Low**	Medium	Medium	Medium
	Very short	**VL**	**Very low**	**Low**	**Low**	Medium	Medium

INTENSITY = M

DURATION	Very long	**VH**	Medium	High	High	High	Very High
	Long term	**H**	Medium	Medium	High	High	High
	Medium term	**M**	Medium	Medium	Medium	High	High
	Short term	**L**	**Low**	Medium	Medium	Medium	High
	Very short	**VL**	**Very low**	**Low**	Medium	Medium	Medium

INTENSITY = H

DURATION	Very long	**VH**	High	High	High	Very High	Very High
	Long term	**H**	Medium	High	High	High	Very High
	Medium term	**M**	Medium	Medium	High	High	High
	Short term	**L**	Medium	Medium	Medium	High	High
	Very short	**VL**	**Low**	Medium	Medium	Medium	High

INTENSITY = VH

DURATION	Very long	**VH**	High	High	Very High	Very High	Very High
	Long term	**H**	High	High	High	Very High	Very High
	Medium term	**M**	Medium	High	High	High	Very High
	Short term	**L**	Medium	Medium	High	High	High
	Very short	**VL**	**Low**	Medium	Medium	High	High
			VL	**L**	**M**	**H**	**VH**
			A portion of the site	Whole site	Beyond the site boundary, affecting immediate neighbours	Local area, extending far beyond site boundary.	Regional/ National

			EXTENT				
PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**VH**	Medium	High	High	Very High	Very High
	Probable	**H**	Medium	Medium	High	High	Very High
	Possible/ frequent	**M**	Low	Medium	Medium	High	High
	Conceivable	**L**	Low	Low	Medium	Medium	High
	Unlikely/ improbable	**VL**	Very low	Low	Low	Medium	Medium
			VL	L	M	H	VH
			CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
Very High	Potential fatal flaw unless mitigated to lower significance.
High	It must have an influence on the decision. Substantial mitigation will be required.
Medium	It should have an influence on the decision. Mitigation will be required.
Low	Unlikely that it will have a real influence on the decision. Limited mitigation is likely to be required.
Very Low	It will not have an influence on the decision. Does not require any mitigation

***VH = very high, H = high, M= medium, L= low and VL= very low and + denotes a positive impact.**

3.3.6 WAY FORWARD IN THE EIA PROCESS

The following steps are envisaged for the remainder of the EIA process (see Figure 2-1):

- Notification to I&APs and commenting authorities of the change in scope, availability of the EIR for review and public meetings;
- Host public meeting/open day (August 24th in Matatiele);
- Key stakeholder meetings (Moshoeshoe, Sibi, Amahlubi and Lebenya Traditional Authorities);
- After closure of the EIR comment period (refer to Section 1.5), all comments received will be incorporated and responded to in a Comments and Responses Report. The EIR will then be updated into a final report, to which the Comments and Responses Report will be appended;
- The revised EIR will be submitted to PASA for consideration and decision-making by the Minister of Mineral Resources (or delegated authority);
- After the Minister of Mineral Resources (or delegated authority) has reached a decision, all I&APs on the project database will be notified of the outcome of the application and the reasons for the decision; and
- A statutory appeal period in terms of the National Appeal Regulations, 2014 (GN No. R993) will follow the issuing of the decision.

TABLE 3-4: REQUIREMENTS OF AN EIR IN TERMS OF THE EIA REGULATIONS 2014

APPENDIX 3	CONTENT OF AN EIR	COMPLETED (Y/N OR N/A)	LOCATION IN REPORT
2(a)	*(i & ii) Details and expertise of the Environmental Assessment Practitioner (EAP) who prepared the report.*	Y	3.1
(b)	*The location of the activity, including:*		Appendix 1
	(i) The 21 digit Surveyor General code of each cadastral land parcel;	Y	
	(ii) Where available, the physical address and farm name; and	Y	
	(iii) Where the required information in items (i) and (ii) is not available, the co-ordinates of the boundary of the property or properties.		
(c)	*A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is:*	N	Refer to Section 4.5.1
	(i) A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	NA	
	(ii) On land where the property has not been defined, the coordinates within which the activity is to be undertaken.	NA	
(d)	*A description of the scope of the proposed activity, including:*	Y	Section 4
	(i) All listed and specified activities triggered and being applied for;	Y	
	(ii) A description of the associated structures and infrastructure related to the development.	Y	
(e)	*A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.*	Y	Section 2
(f)	*A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location.*	Y	Section 4.3
(g)	*A motivation for the preferred development footprint within the approved site.*	NA	
(h)	*A full description of the process followed to reach the proposed development footprint within the approved site, including:*	NA	
	(i) Details of the development footprint alternatives considered;		Section 4.7
	(ii) Details of the public participation process undertaken in terms of Regulation 41 of the Regulations, including copies of the supporting documents and inputs;		Box 4
	(iii) A summary of the issues raised by I&APs, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;		Table 3-2
	(iv) The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	NA	
	(v) The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts: *(aa) can be reversed;* *(bb) may cause irreplaceable loss of resources; and* *(cc) can be avoided, managed or mitigated.*	NA	
	(vi) The methodology used in determining and ranking the nature,		Section 3.3.5

APPENDIX 3	CONTENT OF AN EIR	COMPLETED (Y/N OR N/A)	LOCATION IN REPORT
	significance, consequences, extent, duration and probability of potential environmental impacts and risks;		
	(vii) Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	NA	
	(viii) The possible mitigation measures that could be applied and level of residual risk;	NA	
	(ix) If no alternative development locations for the activity were investigated, the motivation for not considering such;	NA	Section 4.7
	(x) A concluding statement indicating the preferred alternative development location within the approved site;		
(i)	*A full description of the process undertaken to identify, assess and rank the impacts the activity and associated infrastructure will impose on the preferred location through the life of the activity, including:*	Y	3.3.5
	(i) A description of all environmental issues and risks that were identified during the EIA process; and	Y	Table 3-2
	(ii) An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.	Y	6
(i)	*An assessment of each identified significant impact and risk, including:* *(i) Cumulative impacts;* *(ii) The nature, significance and consequence of the impact and risk;* *(iii) The extent and duration of the impact and risk;* *(iv) The probability of the impact occurring;* *(v) The degree to which the impact and risk can be reversed;* *(vi) The degree to which the impact and risk may cause irreplaceable loss of resources; and* *(vii) The degree to which the impact and risk can be mitigated.*	Y	6
(k)	*Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.*	Y	7.1
(l)	*An environmental impact statement which contains:*	Y	6.2
	(i) A summary of the key findings of the EIA;	Y	7.2.1
	(ii) A map at an appropriate scale which superimposes the activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and	NA	
	(iii) A summary of the positive and negative impacts of the proposed activity and identified alternatives.	Y	7.2.2
(m)	*Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.*	Y	7.3

APPENDIX 3	CONTENT OF AN EIR	COMPLETED (Y/N OR N/A)	LOCATION IN REPORT
(n)	*The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment.*	Y	7.4
(o)	*Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.*	Y	7.5
(p)	*A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.*	Y	Section 3.3.2
(q)	*A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.*	Y	Section 7.5
(r)	*Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised.*	NA	
(s)	*An undertaking under oath or affirmation by the EAP in relation:* *(i) The correctness of the information provided in the report;* *(ii) The inclusion of comments and inputs from stakeholders and I&APs;* *(iii) The inclusion of inputs and recommendations from the specialist reports where relevant; and* *(iv) Any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by I&APs.*	Y	Appendix 3
(t)	*Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.*	Y	Section 7.6
(u)	*An indication of any deviation from the approved Scoping Report, including the plan of study, including:* *(i) Any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and* *(ii) A motivation for the deviation.*	Y	Section 7.7
(v)	*Any specific information that may be required by the competent authority.* *PASA listed information requirements in their Letter of Acceptance of the Scoping Report. Information included:*		
	1. Consultation with various State Departments	Y	Box 4
	2. Identification and consultation with all affected landowners	Y	Box 4
	3. Physical site assessment to authenticate data derived from desktop studies	Y	Section 3.3.5
	4. Financial Provision in terms of the Regulations	Y	Section 7.6
(m)	*Any other matter required in terms of section 24(4)(a) and (b) of the Act.*	NA	

4 PROJECT DESCRIPTION

This chapter provides general project information; a general overview of exploration processes; describes the need and desirability for the proposed project; presents the proposed initial three-year exploration work programme and a description of the project alternatives.

4.1 GENERAL PROJECT INFORMATION

4.1.1 APPLICANT DETAILS

Address:	Rhino Oil and Gas Exploration South Africa (Pty) Ltd Icon Building, Suite 300 Corner of Long Street & Hans Strijdom Avenue CAPE TOWN, 8000
Vice President and COO:	Phillip Steyn
Cell:	+27 (0)79 716 1030
E-mail:	psteyn@rhinoresourcesltd.com
Website:	www.rhinoresourceltd.com

4.1.2 APPLICANT BACKGROUND

Rhino Oil and Gas Exploration South Africa (Pty) Ltd is a South African registered subsidiary of Rhino Resources Ltd. Rhino Resources is an independent oil and gas exploration and development company focused on Africa. Rhino Resources is building a portfolio of both onshore and offshore oil and gas assets with a primary focus on West Africa, East Africa and Southern Africa. The company's key strategic areas include the East African Continental Rift System, the Central African Rift System, the coastal margins of East Africa, the South Atlantic margin of West Africa and the eastern Karoo formations of South Africa.

South Africa has the eighth largest shale gas reserves in the world according to a recent United States Department of Energy report with estimates ranging from 30 trillion cubic feet (Tcf) to 390 Tcf for the Karoo Basin. Rhino Resources' goal is to develop these natural resources with the benefit of enhanced prosperity for African host countries and local communities.

Rhino Oil and Gas is currently one of the largest applicants for both onshore and offshore oil and gas exploration rights in South Africa with a number of applications under consideration by PASA. Rhino Oil and Gas previously held a Technical Co-operation Permit ("TCP") for the Eastern Cape 295 ER application area. The TCP was issued by PASA in terms of Section 77 of the MPRDA. The holder of a TCP has, subject to Section 79 of the MPRDA, the exclusive right to apply for and be

granted an ER in respect of the area to which the permit relates. Through the current application Rhino Oil and Gas intends to secure an ER. Rhino Oil and Gas as the applicant for the ER will also be the operator for the proposed early-phase exploration.

The directors and owners of Rhino Oil and Gas Exploration South Africa (Pty) Ltd are Mr P Mulligan (a US citizen) and Mr P Steyn (a South African). More information is available on http://www.rhinoresourcesltd.com/management.

4.1.2.1 BBBEE

Rhino Oil and Gas's BBBEE status has been agreed upon with a BBEEE party and complies with all current requirements. Further shareholding within the party is still being finalized. Currently, the BBBEE requirement for upstream exploration is 9% according to the Charter for the South African Petroleum and Liquid Fuels Industry on empowering Historically Disadvantaged South Africans in the Petroleum and Liquid Fuels Industry.

4.1.2.2 Environmental Policy

Rhino Oil and Gas's environmental policy is provided below:

"Rhino Resources commits to corporate social responsibility in order to promote sustainable development in the countries and communities where we work. We prioritize corporate citizenship as an ethical commitment as well as a strategic advantage that enhances our ability to operate in emerging markets. To realize this vision, Rhino Resources, Ltd. and our subsidiaries, adhere to the guiding principles of our Corporate Social Responsibility (CSR) Policy:

Environmental stewardship: We strive to promote environmental stewardship in areas where we work, and will take measures to minimize environmental impacts.

Human Rights: We believe that every human life has equal value and respect and promote internationally recognized human rights in all facets of our work.

Compliance: We comply with all relevant local, national and international laws and regulations in countries where we operate, and conduct our operations with honesty and integrity.

Transparency: We recognize the Foreign Corrupt Practices Act and the Extractive Industries Transparency Initiative, and support financial transparency and good governance practices in engaging with local and national authorities.

Community development: We work to accelerate social and economic development in the communities where we are privileged to work. In addition to contributing to national authorities and local employment,

the company supports dedicated initiatives in healthcare, education, and innovation to build a positive legacy in communities. Initiatives supported by Rhino Resources are designed and implemented in partnership with local NGOs, civil society, and national authorities and tailored for each context.

Partners: We strive to select business partners that uphold our vision for CSR. Rhino Resources Ltd. is committed to work cooperatively and responsibly with local communities and our partners in our host countries, and perform our obligations in a social, environmental, and ethical manner for all stake holders over a sustained period of time to obtain real results and lasting change."

4.1.2.3 Insurance Policy

Rhino Oil and Gas abides by all government requirements. Rhino Oil and Gas would provide proof of all required guarantees and insurances to the Regulator prior to any form of exploration work being conducted.

4.2 GENERAL OVERVIEW OF THE EXPLORATION PROCESS

The purpose of exploration is to identify the existence of any commercially viable reserves of oil and / or gas. The conditions necessary for petroleum reserves to have accumulated are complex and largely dependent on past geological history and present geological formations and structures. For deposits to occur, particular combinations of potential source and reservoir rocks together with migration pathways and trap structures are required. Discovering such reservoirs and estimating the likelihood of them containing oil and / or gas is a technically complex process consisting of a number of different stages requiring the use of a range of techniques. Such techniques may include, *inter alia*, aero-magnetic/gravity surveys, deep and shallow geophysical (seismic) surveys, shallow drilling and coring, and exploration and appraisal drilling (DTI, 2001). Exploration is an iterative process with data acquired from a prior stage required to improve the knowledge and understanding of the resource, which may then be subject to a later stage of more intensive exploration.

Exploration begins with the identification of target areas. Based on a general geological understanding, often informed by publically available data, broad areas are initially identified as being prospective with the potential to contain reserves of oil and / or gas. These areas are then subjected to **early-phase exploration** that is focused on large-scale regional analysis. This is undertaken by integrating the regional surface and basin structure data derived from available legacy data. Prospective areas are further defined using a combination of surface / shallow mapping techniques and seismic surveys to aid understanding of deeper, subsurface geology. Aero-magnetic and gravity surveys, as well as core drilling, are also used to define the general geological structure such as sedimentary basins. The work in this early-phase exploration stage might identify potential areas of interest for follow up study, but do not typically enable the extent of areas with oil and gas to be defined. Through the course, or at the end, of

this stage the non-prospective areas would typically be relinquished by the applicant from the exploration right area.

Exploration in areas identified as prospective would then progress to the **appraisal stage**. Identified areas of potential interest are subjected to further seismic and lithological study, which may involve reinterpreting existing data or conducting new surveys. Such surveys would typically be conducted at higher resolution or with more accurate techniques to improve the confidence in the information. The purpose of these surveys is to delineate and evaluate the prospects of interest identified in the first phase of exploration. Exploration wells would then be planned to access the target stratigraphy for testing, which may include permeability testing, pressure testing and hydraulic fracturing. It is noted that the only reliable way to determine whether the identified formations contain hydrocarbons is to undertake exploration well drilling (DTI, 2001). This work is aimed at identifying and defining the extent of target areas with high potential for reserves of oil and / or gas, as well as whether or not the size of the resource warrants further study and drilling. At the end of this stage the non-prospective areas would typically be relinquished by the applicant from the exploration right area.

In order to fully define the commercial viability of an oil and / or gas resource a **well drilling stage** is generally undertaken. Exploration wells (in one or a variety of forms) would be drilled and subject to an array of trials and testing (possibly including permeability testing, pressure testing and hydraulic fracturing). The type of wells and tests would depend entirely on the nature of the resource that has been identified. The identified resource is then evaluated and tested. These wells would enable the geoscientists to gain the greatest level of understanding of the reservoir and its viability for production. Only once it is determined that a field is commercially viable would an operator consider moving into the production phase. At the end of this stage the non-prospective areas would typically be relinquished by the applicant from the exploration right area.

Exploration typically requires the **early-phase exploration,** the **appraisal stage** and a **well drilling stage,** undertaken over a period of up to 10 years, in order to arrive at a point where an informed decision can be made on a production right application.

Rhino Oil and Gas is at the beginning of an oil and gas exploration process and at this stage is only seeking authorisation to undertake a portion of early-phase exploration activities (see Figure 3-1). The early-phase exploration programme is the second step in determining if there is a likely oil or gas resource in the exploration right area that would warrant further investigation (the first phase having been the technical study undertaken). The proposed exploration work programme is designed to improve the understanding of the regional geology and inform the potential for the occurrence of an oil and / or gas resource.

It is not known at this stage whether there are any oil and / or gas reserves. It is also not known at this stage what form the oil and / or gas might take. This will only be known after all the data from the initial three-year exploration work programme has been analysed. At the end of the current exploration work programme it would still not be possible to define the extent of a resource nor to determine if the resource was commercially viable.

As indicated in Sections 1.2 and 4.6, if a resource is identified for more advanced exploration, further authorisation / approvals would be required before these activities could be undertaken.

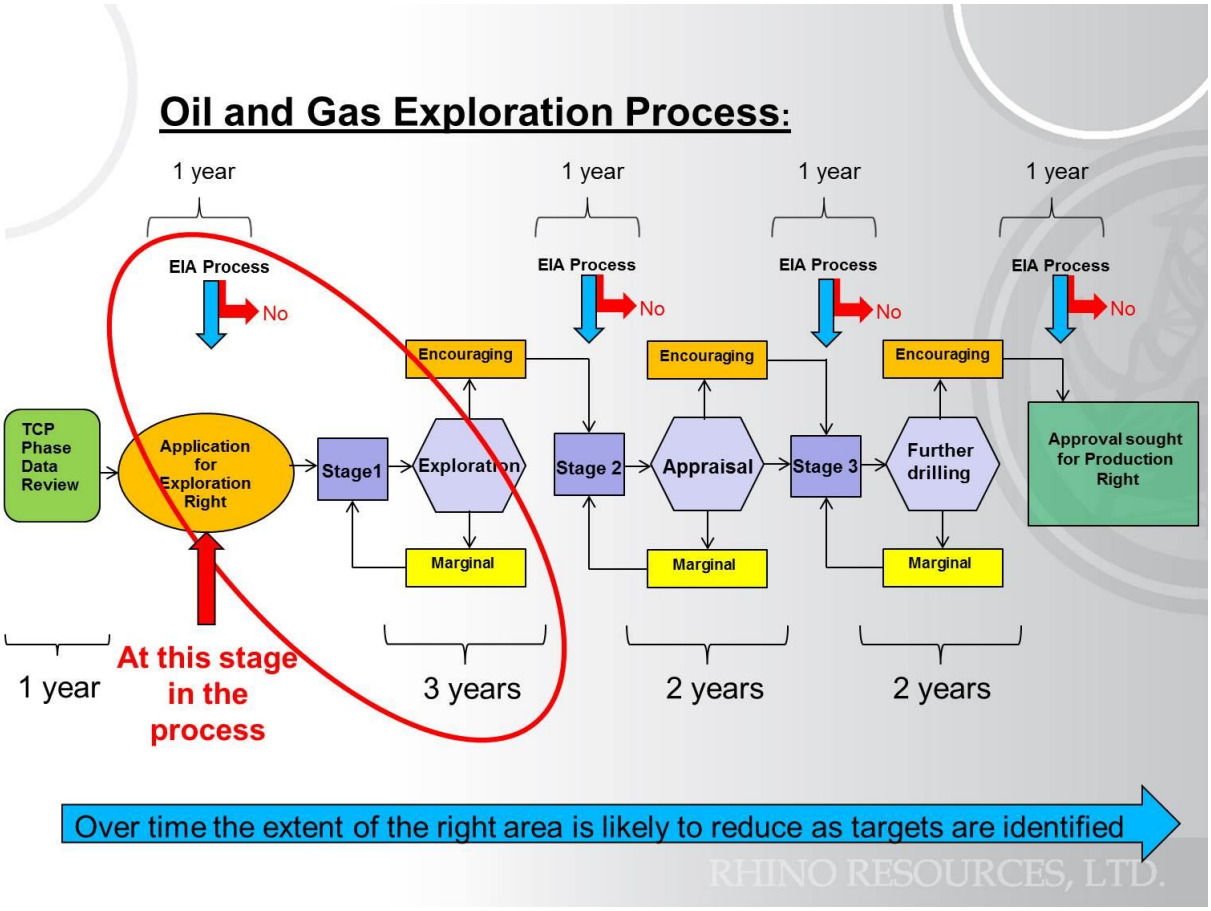

FIGURE 4-1: OVERVIEW OF THE EXPLORATION PROCESS

4.3 NEED AND DESIRABILITY OF THE PROPOSED PROJECT

The DEA guideline on need and desirability (GN R 891, 20 October 2014) notes that while addressing the growth of the national economy through the implementation of various national policies and strategies, it is also essential that these policies take cognisance of strategic concerns such as climate change, food security, as well as the sustainability in supply of natural resources and the status of our ecosystem services. Thus, the over-arching framework for considering the need and desirability of development in

general is taken at the policy level through the identification and promotion of activities/industries/developments required by civil society as a whole. The DEA guideline further notes that at a project level (as part of an EIA process), the need and desirability of the project should take into consideration the content of regional and local plans, frameworks and strategies.

In light of the above, this section aims to provide an overview of the need and desirability for the proposed project by firstly, highlighting the applications for the use of natural gas (particularly with reference to the electricity generation sector) and, secondly, how these applications are aligned within the strategic context of national policy and energy planning, broader societal needs and regional planning, as appropriate.

4.3.1 USE OF NATURAL GAS

Natural gas is a fossil fuel, which is used globally as a source of energy for heating, cooking, and electricity generation. It is also used as fuel for vehicles and in the manufacturing of plastics and other commercially important chemicals. The fastest growing sector for the use of natural gas is for the generation of electric power (Union of Concerned Scientists, n.d.).

Natural gas power plants usually generate electricity in gas turbines, directly using the hot exhaust gases from the combustion of the gas (Union of Concerned Scientists, n.d.). Of the three fossil fuels used for electric power generation (coal, oil and natural gas), natural gas emits the least carbon dioxide per unit of energy produced. When burnt, natural gas emits 30% and 45% less carbon dioxide than burning oil and coal, respectively. Burning natural gas also releases lower amounts of nitrogen oxides, sulphur dioxide, particulates and mercury when compared to coal and oil (Union of Concerned Scientists, n.d.).

As economic growth is dependent on the availability of electricity, ensuring a sustainable and reliable supply of electricity with sufficient capacity is a key aspect to growing the economy of South Africa in the future. The electricity shortages experienced in South Africa over the past decade were a contributing factor to the significant slowdown in economic growth rate. To enable economic growth within the target rate of between 6% and 8% (Accelerated and Shared Growth Initiative, 2004) to be achieved, it will be necessary for Government to continue increasing electricity generating capacity in the country.

In the context of the above, the use of natural gas for electricity generation is considered to have substantial benefits going forward and is identified in national policy, together with renewable energy technologies, as an alternative in diversifying the domestic energy supply away from its current reliance on coal. The feasibility of using natural gas for domestic power generation is considered to be dependent on the extent of available domestic reserves of natural gas, as well as the financial cost of importing natural gas should those reserves be insufficient.

At present, domestic resources are limited to offshore gas fields close to Mossel Bay (F-A field), which are understood to be in decline. The F-O offshore field (Project Ikhwezi) is envisioned to complement this supply in the short- to medium-term. Other proven offshore reserves include the Ibhubesi Gas Field off the West Coast of South Africa. The development of this field to supply gas to the existing Ankerlig Power Station is currently being considered. Neighbouring countries (Mozambique and Namibia) and regional African nations (Angola and Tanzania) have substantial gas reserves. Presently, gas is imported to South Africa through the Republic of Mozambique Pipeline Company (ROMPCO) pipeline from Mozambique. This gas is mostly used for chemical processes in Sasol's coal-to-liquid (CTL) process in Secunda (Bischof-Niemz, et al., 2016). In Johannesburg, Egoli Gas supplies industry and households in some suburbs with reticulated natural gas that is sourced from Sasol.

In 2013, the total natural gas supply in South Africa (domestic production and import) equated to approximately 2.5% of total primary energy supply for the country (Bischof-Niemz, et al., 2016). Thus, an increase in domestic natural gas reserves would enable South Africa to take steps to secure the countries energy supply (through diversification), assist in reducing the emissions of greenhouse gases (by reducing the country's reliance on coal for electricity generation) and reduce the need for the importation of gas. As such, exploration for additional domestic hydrocarbon reserves is considered important and supported by national policy, and any discoveries would be well received by the local market.

4.3.2 NATIONAL POLICY AND PLANNING CONTEXT

This section aims to provide an overview of the national policy and planning context relating to the promotion of development in general within South Africa, developing the energy sector (with specific reference to natural gas and renewable energy) and response to climate change.

4.3.2.1 White Paper on the Energy Policy of the Republic of South Africa (1998)

The White Paper on the Energy Policy (1998) is the overarching policy document which guides future policy and planning in the energy sector. The objectives of the policy included the stimulation of economic development, management of energy related environmental and health impacts and diversification of the country's energy supply to ensure energy security.

It is stated 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. Before the development of the country's oil and gas resources can take place, there is a need to undertake exploration activities to determine their extent and the feasibility of utilising these resources for production.

4.3.2.2 White Paper on the Renewable Energy Policy (2003)

The White Paper on Renewable Energy is intended to supplement the White Paper on Energy Policy (described above) and sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. The position of the paper is based on the integrated resource planning criterion of "*ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options*". The White Paper affirms Government's commitment to develop a framework within which the renewable energy industry can operate, grow, and contribute positively to the South African economy and to the global environment. The White Paper indicated that due to the limited availability of gas reserves, gas was unlikely to form any major component of primary energy supply over any extended period when compared with coal, even though natural gas is considered to a "cleaner fuel" in comparison with coal and oil.

4.3.2.1 National Gas Infrastructure Plan (2005)

The National Gas Infrastructure Plan is Government's strategy for the development of the natural gas industry in South Africa so as to meet the energy policy objectives set out in the White Paper on Energy Policy (1998). The plan sets out the outlook for gas consumption and production globally and within South Africa and aims to articulate Government's broad policy and development aims. The plan outlines four main phases of gas infrastructure development (each with sub-phases) and following the completion of these projects, it is envisaged that there will be a fully integrated network linking the major economic centres to the upstream supplies of gas.

4.3.2.1 New Growth Path (2011)

The New Growth Path (NGP) reflects the commitment of Government to prioritise Employment creation in all economic policies and sets out the key drivers and sectors for Employment which will be the focus of Government. The sectors identified for prioritisation include infrastructure, agriculture, mining, manufacturing, tourism and the green economy.

Within the green economy sector, the NGP targets 300 000 additional direct jobs by 2020, with 80 000 in manufacturing and the rest in construction, operations and maintenance of new environmentally friendly infrastructure. It is envisaged that the additional jobs will be created by expanding the existing public Employment schemes to protect the environment and the production of biofuels. The NGP notes that renewable energy provides new opportunities for investment and Employment in manufacturing new energy technologies as well as in construction.

The NGP further identifies the need to develop macroeconomic strategies and microeconomic measures to achieve sustainable expansion of work opportunities and output. As part of the identified microeconomic measures, the NGP states that South Africa should be the driving force behind the development of regional energy, transport and telecommunications infrastructure. Priorities in this regard

include strengthening the regional integration of energy by undertaking urgent improvements in electricity interconnectors, and exploring other opportunities for enhancing clean energy across central and southern Africa, including natural gas.

4.3.2.2 National Development Plan (2012)

The National Development Plan (NDP) (2012) provides the context for all growth in South Africa, with the overarching aim of eradicating poverty and inequality between people in South Africa through the promotion of development. It is also acknowledged that environmental challenges are in conflict with some of these development initiatives. As such, it is emphasised that there is also a need to:

- protect the natural environment;
- enhance the resilience of people and the economy to climate change;
- extract natural resources to facilitate the improvement of living standards, skills and infrastructure in a sustainable manner; and
- reduce greenhouse gas emissions and improve energy efficiency.

The NDP identifies the need to develop the electricity generation sector in order to support the growth of the national economy and reach the stated developmental objectives. It is further acknowledged that emissions of carbon dioxide and other greenhouse gases potentially pose a significant cost on a global scale with respect to climate change. While South Africa contributes to these emissions, it is acknowledged that it is also particularly vulnerable to the effects of climate change. Thus, in conjunction with developing the electricity generation sector further, the NDP also aims to ensure that carbon emissions are reduced.

The NDP identifies the construction of infrastructure to import liquefied natural gas, increasing exploration for domestic gas feedstock (including investigating shale and coal bed methane reserves) and procuring at least 20 000 MW of renewable electricity by 2030 as priority investments (amongst others) needed to develop the electricity generation sector further.

4.3.2.3 Integrated Resource Plan for Electricity (2010 and updated in 2013)

The Integrated Resource Plan (IRP) for Electricity (2010 – 2030), initiated by the Department of Energy (DoE), is viewed as an outline of Government's planned policy to meet the current and projected energy demands of the country for the foreseeable future. The IRP also defines a mix of generating technologies to ensure that the projected demand can be met.

The IRP was updated in 2013 to reflect changes in the electricity demand outlook from what was anticipated in 2010. The key recommendations of the updated IRP include delaying the decision on increasing the nuclear base-load, procuring a new set of fluidised bed combustion coal generators, making use of regional hydro-electric generation, continuing the Renewable Energy Independent Power

Producers (RE IPP) programme and undertaking further exploration of regional and domestic gas options.

4.3.2.4 Draft Integrated Energy Plan (2013)

The Draft Integrated Energy Plan (IEP) (2013) 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.

The Draft IEP points out that given South Africa is a net importer of oil, the liquid fuels industry and its economy is vulnerable to fluctuations in the global oil market. It is noted that the current natural gas consumption exceeds production, with the majority of demand being met through imports from Mozambique.

The plan states that the use of natural gas as an alternative electricity generator must be considered in moderation due to limited proven reserves, but that it has significant potential both for power generation, as well as direct thermal uses. The use of natural gas for power generation is considered as an option to assist South Africa to move towards a low carbon future given that natural gas has a lower carbon content than coal.

The role of renewable energy to deliver the intended policy benefits of improved energy security and reduced greenhouse gas emissions is also acknowledged in the plan. The availability of untapped renewable energy resources within the country is highlighted. It is noted that the DoE had implemented the RE IPPs procurement process to increase the share of renewable energy technologies in the energy mix. The plan also highlights that storage remains the most important challenge to the widespread use of renewable energy. Due to the intermittent nature of renewable energy systems and the variability in electricity load requirements, the storage of the electricity generated when demand is low is considered to be critical. Thus the IEP notes that there is still a need to incorporate the use fossil fuels and nuclear power to ensure that there is both sufficient base-load electricity generating power to meet the minimum needs and peak-load power to meet the needs during peak periods.

4.3.2.5 Gas Utilisation Master Plan (GUMP)

The DoE is currently in the process of compiling a Gas Utilisation Master Plan (GUMP) for South Africa. The GUMP is intended to be a long-term (30-year) plan for the development of a gas industry within South Africa. One of the key objectives of the GUMP is to enable the development of indigenous gas resources and to create the opportunity to stimulate the introduction of a portfolio of gas supply options. The GUMP will inform a Gas Independent Power Producers Programme with the intent to bring gas demand and supply on stream at the same time.

4.3.2.6 Paris Agreement - United Nations Framework Convention on Climate Change

The Paris Agreement was adopted by South Africa on 12 December 2015 at the 21st session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC CoP21).

The Paris Agreement is a comprehensive framework which aims to guide international efforts to limit greenhouse gas emissions and to meet challenges posed by climate change. The main objective of the Paris Agreement is to limit the global temperature increase to below 2 °C. Each individual country is responsible for determining their contribution (referred to as the “nationally determined contribution”) in reaching this goal. The Paris Agreement requires that these contributions should be "ambitious" and "represent a progression over time". The contributions should be reported every five years and are to be registered by the UNFCCC Secretariat. As a signatory to the Paris Agreement, South Africa will be required to adopt the agreement within its own legal systems, through ratification, acceptance, approval or accession.

“As a signatory to the Paris Agreement, South Africa would be required to investigate alternatives to existing industries which have high carbon-emissions. In this regard, it is anticipated that there will be a shift away from coal-based energy production within the energy sector and increased reliance on alternative energy sources. Given the fact that natural gas produces lower emissions and is a highly efficient source of energy when compared to coal, the increased use of natural gas can, in the short term, serve as bridge on the path to the carbon-neutral goal of the Paris Agreement” (Source: http://www.energylawexchange.com/the-paris-agreement-on-climate-change-implications-for-africa/).

The SEA for Shale Gas Development indicates that “Including more natural gas in South Africa’s energy mix would make the energy system more efficient, cheaper and more reliable. Natural gas, regardless of its source, has a desirable set of qualities that coal and oil do not possess. Gas can be used in almost all subsectors (e.g. power generation, heat, transport, manufacture of chemicals); is easily transported once gas infrastructure is in place; is supported by a growing international market; is a more consistent fuel than coal (thus more flexible and easier to handle); is less CO_2 intensive when burnt than coal (if leakage during production and transport is minimised); can be more efficiently used for power generation (more kWh per GJ); has high operational flexibility; and has an end-use cost structure that is capital- light and fuel-intensive, making it economically flexible” (Summary for Policy Makers, Page 12).

4.3.2.1 National Climate Change Response White Paper

The White Paper on the 4.3.2.1 National Climate Change Response presents the South African Government’s vision for an effective climate change response and the long-term, just transition to a climate-resilient and lower-carbon economy and society. South Africa’s response to climate change has two objectives:

- Effectively manage inevitable climate change impacts through interventions that build and sustain South Africa's social, economic and environmental resilience and emergency response capacity.
- Make a fair contribution to the global effort to stabilise greenhouse gas (GHG) concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe that enables economic, social and environmental development to proceed in a sustainable manner.

The Green Paper acknowledges that South Africa has relatively high emissions for a developing country. The energy intensity of the South African economy, largely due to the significance of mining and minerals processing in the economy and the coal-intensive energy system, means that South Africa is a significant emitter of GHGs. The majority of South Africa's energy emissions arise from electricity generation.

The Green Paper sets out South Africa's overall response strategy though strategic priorities, leading to a series of adaption, mitigation, response measures and priority flagship programmes. Policy decisions on new infrastructure investments must consider climate change impacts to avoid the lock-in of emissions-intensive technologies into the future. In the medium-term, the Green Paper indicates that a mitigation option with the biggest potential includes a shift to lower-carbon electricity generation options. The Renewable Energy Flagship Programme is identified as possible driver for the deployment of renewable energy technologies.

4.3.3 REGIONAL POLICY AND PLANNING CONTEXT

This section aims to provide an overview of the regional policy and planning context relating to development within the Eastern Cape in general.

4.3.3.1 Eastern Cape Vision 2030 Provincial Development Plan (2014)

The Eastern Cape Vision 2030 Provincial Development Plan (PDP) is based on the premise of the NDP (refer to Section 4.3.2). Like the NDP, the PDP identifies nine key challenges which include: unemployment, education, infrastructure, spatial patterns, health, public service levels, corruption, and inequality. In order to address these challenges, the PDP outlines five goals which aim to "*encourage rural development to address the spatial and structural imbalances in the Eastern Cape*." The five goals are:

- Goal 1: A growing, inclusive and equitable economy;
- Goal 2: An educated, empowered and innovative citizenry;
- Goal 3: A healthy population;
- Goal 4: Vibrant, equitably enabled communities; and
- Goal 5: Capable, conscientious and accountable institutions.

For each of the above-mentioned goals, the PDP outlines a vision and key objectives. In order to realise the goals, various strategic objectives related to each goal have also been identified. In support of the identified strategic objectives, various strategic actions are also proposed. Strategic actions relevant to the proposed exploration activities include the following:

Strategic action 1.1.6: Position the province as a key investment hub in the energy sector and ensure reliable energy supply to high-potential sectors

The PDP notes that it is the intent of the Province to position itself as an investment hub in the energy sector through the promotion of wind farms, imported liquefied natural gas, shale-gas and nuclear energy. New investment in this sector is identified as a possible catalyst for provincial economic development, particularly if the regional and local benefits are maximised, and costs (including externalities) are minimised. The identified benefits accruing from new investment in the energy sector include:

- *"Cheaper energy (fuel and electricity), leading to cheaper food and transport, and more competitive labour market;*
- *employment in the construction, operation and maintenance of new energy facilities;*
- *employment in the supply of manufactured components for the new energy facilities;*
- *Downstream linkages (for example, in the petro-chemicals industry based on shale gas); and*
- *New rental collection systems to capture a portion of the surplus from these new investments."*

Strategic action 1.5.2: Grow and develop the mining sector

The main opportunity identified for the province is the development of Karoo shale-gas. The PDP acknowledges that the sector is currently at the exploration stage and that potential reserves could be significant. However, it is stressed that the environmental impact of exploiting these resources would need to be carefully managed. Additional benefits identified by the PDP include:

- *"The development of a downstream petro-chemicals industry at Coega;*
- *Water for the fracking process could be used for irrigation;*
- *Increased construction activity; and*
- *Coal and gas could be used for electricity generation".*

Strategic action 1.5.4: Grow and develop manufacturing industry

The PDP identifies nine manufacturing industries that have potential for expansion, including renewables (based on future planned wind-farms) and petro-chemicals (based on Karoo shale-gas and offshore resources).

Strategic objective 4.3: Ensure universal access to adequate, reliable and basic infrastructure for all by 2030

The PDP envisages that by 2030, water resources in the Eastern Cape will be allocated to support economic growth and all citizens will have access to adequate water services, while ensuring the

protection and integrity of water bodies. In order to achieve this, various actions are proposed to be prioritised, including managing the quality and quantity of surface water and groundwater, and protecting habitats.

4.3.3.2 Alfred Nzo District Municipality Spatial Development Framework (2007)

The Alfred Nzo District Municipality Spatial Development Framework (SDF) is intended to guide all development activities within the district. The SDF highlights the fact that the natural environment is regard as a prime asset and resource base, and that sustainable utilisation of natural resources contributes to appropriate local economic and social development.

The SDF notes that key areas limiting growth in the district include limited and poorly developed internal accessibility and outside of urban areas there is poor access to safe water supplies and no supply of electricity. It is further stated that the severe topographic conditions create difficult preconditions for development within the district.

The suggested focus for development within the district includes: basic service provision, establishment of a functional hierarchy of nodes, improved internal and external linkage, more efficient agriculture, more structured rural and urban growth, and environmental management.

4.3.3.3 Joe Gqabi District Municipality SDF (2009)

The SDF of the Joe Gqabi District Municipality (formerly the Ukhahlamba District Municipality) identifies key spatial issues, as well as related spatial objectives and strategies to address these issues. The SDF notes that the district is made up of two varying and distinct settlement patterns associated with historical patterns of socio-economic development. The district predominately comprises privately owned, expansive tracts of land with low intensity land use, while the north-central and eastern parts of the district have scattered, fragmented and sprawling rural settlements with largely unmanaged land use.

From a natural resource perspective, the climate and soil conditions vary across the district, with conditions favourable to forestry and rain-fed agriculture being found more in the eastern sectors of the district (e.g. Elundini Municipality).

The SDF states that the economic development potential of the district appears to reside largely in the sectors of agriculture, tourism and trade, with the services sector (government) continuing to play a major role. Spatially, the development potential of these sectors is located within key urban settlements and areas of potential higher yields such as the eastern rural sectors (Elundini).

4.3.3.4 Elundini Local Municipality Integrated Development Plan 2015 -1 2016 (2015)

The Elundini Local Municipality IDP notes that eight “Priority Programmes” have been adopted to drive growth and development over the next five to ten years, namely: Agriculture, Forestry (Timber), Tourism,

Roads and Stormwater, Rural Electrification, Small Town Generation, Township Establishment and Governance.

The key development challenges identified in the IDP include a high rate of unemployment with decreasing levels of employment, low levels of skills development and literacy, limited access to basic household and community services; unsustainable developmental practices, as well as inadequate energy and water supply.

The IDP highlights the reliance of agriculture to the local economy and notes that there is a need to diversify the economy and increase its competitiveness. It is the intent of the Local Municipality to focus or target high growth markets with the objective of creating investment and export opportunities in the manufacturing sector, especially in forestry and agriculture value adding initiatives.

4.3.3.5 Matatiele Local Municipality Spatial Development Framework 2014/2015 (2014)

The primary aim of the SDF is to guide the spatial form and location of future developments within the municipality in order to achieve planning outcomes that facilitate restructuring of spatially inefficient settlements, promote sustainable use of land, channel resources to areas of greatest need and development potential and redress the inequitable historical treatment of marginalised areas.

The SDF notes that the municipality is located in an area that is characterised by relatively high level of environmental sensitivity, particularly wetland areas associated with the Umzimvubu River catchment. In addition, there are a large number of historical and heritage sites that should be considered for conservation. While local communities utilise natural resources in a manner that enables them to meet their immediate needs, this has led to several impacts. These impacts include soil erosion, loss of biodiversity, degradation of water quality and an increase in invasive species. Settlement in the region also continues to increase thus exerting more pressure on the already depleted natural resources.

It is highlighted that any future development within the municipality would need to take into account the following environmental aspects: ecosystems and resources in the target area (wetlands, perennial rivers etc); existing activities (e.g. communal grazing, conservation, tourism, industry) and associated outputs such as effluent, livestock production, jobs etc); and the presence of any threatened elements such as rare bird species or erodible soils. The SDF stipulates that if development takes place within sensitive areas, it should occur under carefully drafted environmental management guidelines or plans.

Provincial government (through Eastern Cape Parks and Tourism) and the Matatiele Local Municipality have identified areas for protection through the declaration of stewardship areas under the Matatiele Water Factory Project. The proposed declaration of stewardship areas aims to improve land management of the upper catchment landscape, enhance ecosystem services and build climate change resilience, which can generate sustainable livelihood benefits and enhance water security of the region.

The initial draft of the Matatiele stewardship process was adopted by the Matatiele Council in May 2015 (https://umzimvubu.org/projects/current-activities/).

The initial draft comprises a stewardship plan and priority maps for the entire Matatiele Local Municipality area which includes seven target protected areas (see Figure 5-10), based on the expansion of Eastern Cape protected areas along with key criteria such as freshwater and biodiversity priority areas as identified in the status quo research. The identified target areas are indicated to guide initial discussions and are considered to undergo further refinement and discussion over time (https://umzimvubu.files.wordpress.com/2014/10/matatiele-stewardship-process-outline-draft-1.pdf).

4.3.4 SUMMARY OF NATIONAL AND REGIONAL POLICY AND PLANNING

The previous sections have considered the various national and regional policies, plans, guidelines and conventions which are relevant to the proposed exploration activities. As highlighted above, there is a drive from national and provincial Government to stimulate development and grow the economy of South Africa. In order to facilitate this economic growth, there is a need to ensure that there is sufficient capacity in the country's electricity supply by diversifying the primary energy sources within South Africa. One of the proposals to meet this aim is to develop the oil and gas sector within the country.

The proposed exploration activities would allow for the determination of whether or not petroleum resources are located within the proposed ER area. By gaining a better understanding of the extent, nature and economic feasibility of extracting these potential resources, the viability of developing indigenous gas resources would be better understood.

However, it is acknowledged that the promotion of the oil and gas sector could also be considered in contradiction with some of the other plans and policies, which identify the need to reduce the reliance on fossil fuels for electricity generation. Nevertheless, the current limitations of renewable energy technologies are such, that there is still a need to include fossil fuels within the energy mix of the country.

4.3.5 CONSISTENCY WITH NEMA PRINCIPLES

The national environmental management principles contained in NEMA serve as a guide for the interpretation, administration and implementation of NEMA and the EIA Regulations. In order to demonstrate consistency with the NEMA principles, a discussion of how these principles are taken into account during the EIA process is provided below.

TABLE 4-1: CONSIDERATION OF THE NEMA PRINCIPLES IN RELATION TO THE PROPOSED PROJECT.

National Environmental Management Principles	Comment
(2) Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.	The proposed project aims to determine the presence of petroleum resources within the Exploration Right area. Confirmation of the presence of such resources would enable the country to refine its long-term planning for the development of the oil and gas sector within the country. The gas sector is known to have significant economic benefits as well as environmental risk that need to be balanced.
(3) Development must be socially, environmentally and economically sustainable.	Government has indicated that there is a need for the country to reduce its reliance on coal-based electricity. The use of natural gas is being considered to assist in reaching this goal. By determining the presence (and extent) of such resources, the sustainability of developing the petroleum sector within the country can be better considered.
(4)(a) Sustainable development requires the consideration of all relevant factors including the following:	The EIA process has considered potential social, economic, biophysical impacts that could result through the implementation of the proposed exploration activities. The EIA Report provides a list of areas which have been excluded from physical exploration (see Sections 4.4.1 and 4.4.2). By excluding these areas the disturbance of sensitive ecosystems and disturbance of cultural heritage resources is avoided as far as possible. The EIA Report also identifies measures to avoid, minimise and/or remedy an pollution and/or degradation of the environment that may occur as a result of the proposed exploration activities (see Section 9. By determining the presence and extent of any natural gas reserves, it can be determined whether the possible future use of these non-renewable resources would be sustainable.
(i) That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;	
(4)(a)(ii) that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;	
(4)(a)(iii) that the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;	
(4)(a)(iv) that waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner;	
(4)(a)(v) that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;	
(4)(a)(vi) that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised;	
(4)(a)(vii) that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions;	Assumptions, uncertainties and limitations associated with the compilation of the EIR and EMPr are discussed in Section 3.3.2.

National Environmental Management Principles	Comment
and	
(4)(a)(viii) that negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.	The EIA process has considered and assessed the identified potential social, economic, biophysical impacts of the project (refer to Section 6). The EMPr provides the recommended management measures to mitigate the significance of these identified impacts.
(4)(b) Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option.	The EIA process that has been followed recognises that all elements of the environment are linked and interrelated. PASA, as the decision-making authority, will be responsible for taking all aspects of the environment, including whether or not the potential impacts of the project would unfairly discriminate against any person, into consideration when making a decision regarding the proposed project.
(4) (c) Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons.	
(4) (d) Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination.	The proposed exploration activities are not anticipated to limit access to environmental resources that meet basic human needs. The use of any land for exploration activities would have to be through an Access Agreement negotiated between the exploration right holder and the landowner/occupier.
(4) (e) Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.	Rhino is proposing to undertake a 3-year, early-phase exploration programme. The EMPr contains measures for the management of operational activities.
(4) (f) The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured.	The public consultation process has been undertaken in accordance with the requirements of the EIA Regulations 2014. In addition to various public meetings held for the project, the Scoping and Environmental Impact Reports have also been distributed for public review and comment (see Box 3 and Section 1.5).
(4) (g) Decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognizing all forms of knowledge, including traditional and ordinary knowledge.	The EIA process has taken into the account the interests, needs and values of all interested and affected parties, through the submission of comments on the proposed project, during the Scoping and EIA phases of the project.
(4) (h) Community wellbeing and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means.	The Scoping Report and EIR prepared for the proposed project have been made available to communities for review and comment (refer to Box 3 and Section 1.5). Where necessary, the Executive Summaries have been translated into isiXhosa and Sotho.
(4) (i) The social, economic and environmental impacts of activities, including disadvantages	The EIA process has considered the identified potential social, economic, biophysical impacts of the project in an

National Environmental Management Principles	Comment
and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment.	integrated manner. The significance of these impacts has been assessed in Section 6.
(4) (j) The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected.	During the undertaking of the exploration activities, Rhino (and its appointed contractors) would be required to comply with the requirements of the Mine Health and Safety Act. The Environmental Awareness Plan also requires that staff be informed about any aspects of their work that may pose a danger to the environment.
(4) (k) Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law.	As mentioned previously, the public consultation process has been undertaken in accordance with the requirements of the EIA Regulations 2014 and have allowed for the distribution of the Scoping Report and EIR for public review and comment. This information has been provided in an open and transparent manner.
(4) (l) There must be intergovernmental co-ordination and harmonisation of policies, legislation and actions relating to the environment.	The public consultation process for the proposed project provides an opportunity for the other spheres of government to provide comment on the proposed project and address any potential conflicts between policies or other developmental proposals administered by other organs of state that may be in conflict with the proposed exploration activities before decision-making.
(4) (m) Actual or potential conflicts of interest between organs of state should be resolved through conflict resolution procedures.	
(4) (n) Global and international responsibilities relating to the environment must be discharged in the national interest.	PASA, as the decision-making authority, will be responsible for taking cognisance of international obligations that could have an influence on the project. As highlighted above, the proposed exploration activities would enable the determination of the extent the country's natural gas reserves. This will assist the country in making an informed decision of the role natural gas may play in South Africa's energy sector and commitment to reduce greenhouse gas emissions.
(4) (o) The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage.	The footprint of the proposed exploration activities is relatively small in relation to the extent of the Exploration Right area. As discussed in Section 4.4.1 and 4.4.2, various environmental features have been recognised as being sensitive features. The need to protect these features is recognised and they have been excluded from the areas of interest for exploration.
(4) (p) The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimizing further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.	As the applicant, Rhino will be responsible for the implementation of the measures included in the EMPr.
(4) (q) The vital role of women and youth in environment management and development must be recognised and their full participation therein must be promoted.	The public participation process for the proposed project has been inclusive of woman and the youth.
(4) (r) Sensitive, vulnerable, highly dynamic or	Sensitive areas have been excluded from possible target

National Environmental Management Principles	Comment
stressed ecosystems, such as coastal shores, estuaries, wetlands and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.	areas for the proposed exploration activities.

4.4 APPLICATION AREA AND REGIONAL SETTING

The initial ER application area for 295 ER was approximately 120 000 ha in extent and covered approximately 200 properties (farms and portions). As previously indicated the applicant has subsequently reduced the extent of the ER application area through the exclusion of the Malekgalonyane (Ongeluksnek) Nature Reserve. The 295 ER application area now includes approximately ~190 properties (farms and portions) over an area of 110 572 ha (see Figure 1 1). The boundary co-ordinates of the application area are provided in Appendix 1. A list of the properties (farm name, number and portion), with the 21 digit Surveyor General code, included in the exploration right application area is provided in Appendix 2.

In broad terms the exploration right application area lies in the northern region of the Eastern Cape. It is bound by the Lesotho boundary to the west, from near Qacha's Nek to approximately 20 km north of Mt. Fletcher in the south. The area lies to the west of the R56 road between Matatiele and Mt. Fletcher with the Maria-Linden Mission being just inside the boundary.

Future ground-based exploration activities would not take place across all of the ER area but would be confined to strategic or target areas. At this early stage of exploration Rhino Oil and Gas is not able to specify exactly where within the ER application area future ground-based exploration activities would be undertaken. Exploration applications are typically made over large areas and as data from the initial non-invasive stages (in years 1 and 2) becomes available it is used to refine the exploration area and determine the sites for on-site exploration activities (e.g. core hole drilling and seismic survey lines). As early-phase exploration progresses the non-prospective areas would be relinquished (i.e. would be removed from the ER area). Refer to Section 4.2 for an overview on the exploration process.

4.4.1 LEGAL EXCLUSIONS FROM THE RIGHT AREA

Section 48 (1) of the MPRDA sets out the specific cases in which properties are excluded from the extent of a right application area. These include:

- as per Section 48 of the Protected Areas Act, 2003 (No. 57 of 2003): special nature reserves, national parks, nature reserves, protected areas or protected environments (including world heritage sites, marine protected areas, specially protected forest areas, forest nature reserves and forest wilderness areas);

- land comprising a residential area;
- any public road, railway or cemetery;
- any land being used for public or government purposes or reserved in terms of any other law; or
- areas identified by the Minister by notice in the Gazette in terms of Section 49.

All of the above, as have been identified to date, are excluded from the ER application area for the proposed project. Where surveyed information was available to Rhino Oil and Gas these are reflected on the map of the application area (see Figure 1-1). Any decision by PASA would have to consider the extent of the ER application area taking cognisance of the requirements of Section 48(1) of the MPRDA.

4.4.2 SCREENING TO DEFINE FUTURE TARGET AREAS

The aerial FTG surveys included as part of the proposed 'early-phase exploration' would result in almost no interaction with the ground over which the survey is undertaken. Thus the environmental attributes of the sites where the survey takes place are of relatively little consequence and limited restriction of sites is required (See the EMPr).

Although Rhino Oil and Gas has made application for a right over all of the properties included in the ER application area, they have been made aware that there are locations with environmental features and attributes that may be incompatible with early-phase exploration activities. Rhino Oil and Gas must implement measures to ensure that their future ground-based exploration activities (core holes and seismic surveys) within the Exploration Right area are undertaken in a lawful and environmentally responsible manner. The goal of the commitments is the avoidance of potential negative impacts, which is the primary mechanism in the mitigation hierarchy prescribed by NEMA.

To achieve this it is recommended that each target site is subjected to a preliminary screening to eliminate locations that have technical, practical, environmental or ethical attributes that would make them incompatible with exploration. The locations remaining after the screening would be potentially acceptable as target site for future ground-based exploration. However, each of these target sites must then be subject to appropriate environmental assessment and authorisation processes once the target location has been identified. During the course of this process Rhino Oil and Gas would also have to negotiate the terms and conditions of access with the land owner.

Rhino Oil and Gas has also been made aware of the regulatory restrictions that may be applicable to future well drilling and production activities (see Table 2-3). Their planning for and undertaking of exploration must take cognisance of this.

4.5 PROPOSED THREE-YEAR EXPLORATION WORK PROGRAMME

This Section provides a description of the activities that have been proposed by Rhino Oil and Gas as part of the early-phase exploration work programme submitted to PASA in terms of the MPRDA.

4.5.1 REVISED EXPLORATION WORK PROGRAMME

As indicated previously, Rhino Oil and Gas has now excluded the core hole drilling and seismic surveying from the proposed 'early-phase exploration' work for which they are seeking environmental authorisation. The current focus of the application for environmental authorisation and this EIA is now only on remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey).

If the revised application is approved, Rhino Oil and Gas would only be in a position to conduct remote exploration techniques and to develop a more detailed understanding of the potential oil and gas resources in the application area.

Thereafter, should Rhino Oil and Gas propose to conduct ground-based exploration activities this would need to be informed by a further application to PASA and a separate environmental assessment and authorisation process.

A benefit of this revised approach is that any future application for ground-based exploration activities would be focussed on specified sites, thereby enabling I&APs to have a better understanding of where Rhino Oil and Gas proposes to access land and conduct ground-based exploration activities. This addresses some of the concerns raised by I&APs relating to where the proposed ground-based exploration activities may be located. The future environmental assessment process would investigate and report on the environmental attributes of the specified sites.

4.5.2 INTRODUCTION

The hydrocarbon potential of the geologically defined Karoo Basin, within which the proposed ER application area is located, has been known since the early 1900s and various exploration programmes were undertaken in the 1940s and 1960s. This work included seismic surveys and the drilling of several deep wells (targeting oil). Although some resources were discovered the reserves were not considered viable at the time. With the discovery of offshore reserves, exploration for petroleum in the onshore areas was largely abandoned. Recent developments in the technologies available to exploit unconventional gas resources, volatility in supply and prices of hydrocarbons have made prospecting for natural gas (and other petroleum resources) a more attractive financial proposition (less so with the recent decline in oil prices). Several organisations have commenced exploration efforts in the greater Karoo Basin region, targeting mostly coal bed methane or shale gas.

Rhino Oil and Gas proposes to undertake early-phase exploration for oil and gas resources which may be located within suitable subsurface geological strata. The initial, early-phase exploration is aimed at obtaining the data required to clearly define geological structures in the ER area and determining if an oil or gas resource exists that would warrant further exploration. The exploration work would thus target key geologies of the Karoo Basin. The results of the proposed early-phase exploration programme would serve as a basis for planning for possible further exploration.

The three-year exploration work programme proposed by Rhino Oil and Gas is presented in Table 4-2 below.

TABLE 4-2: THREE-YEAR EXPLORATION WORK PROGRAMME

YEAR	PROPOSED EXPLORATION ACTIVITY
Year 1	• Improved mapping of subsurface structure and stratigraphy • Detection of structural features and traps • Enhance source rock geochemistry database
Year 2	• Geochemical database compilation • Apatite fission track analysis
YEAR 2/3	• Full tensor gradiometry gravity survey (maximum total survey size of 4 000 km^2) • Define the locations or alignment for the ground-based activities • ~~Drill tests on identified structures (up to a maximum of 10 core holes)~~
Year 3	• ~~Purchase existing seismic data~~ • ~~Seismic acquisition (2D seismic acquisition of up to 125 line km).~~

Through an analysis of existing (historical) seismic and core hole information data retrieved during the TCP programme, and from studying published field data in combination with the information derived from Year 1 and 2, Rhino Oil and Gas would identify preliminary locations and/or alignment for the field (on-site) activities. It should be noted that the proposed exploration work is phased with results from the early phases informing the need and planning for the later phases. Each later phase would only be undertaken if the early phase results are considered to be positive.

4.5.3 EVALUATION OF GEOLOGICAL DATA

In the 1st and 2nd years of the exploration the work would be desktop based and aim to provide information that would lead to the identification of target sites for core hole drilling and alignment of seismic survey routes. The work listed below would be undertaken during the initial exploration period, but would continue throughout exploration as new data is acquired or generated:

- An extensive review of available information that exists over the ER application area would be undertaken. This review would include identifying:
  - > Sources of published and possibly unpublished data from the Council for Geoscience;
  - > Private companies that may have information that could be purchased; and

  - Resources such as information from annual reports of companies close to, or adjoining the properties of interest.
- Creation of geological models based on the database collated from these various sources;
- Detection of structural features and traps;
- Apatite fission track analysis;
- Remote sensing, including the analysis of existing geophysical data available from the Council for Geoscience;
- Visualisation of various target areas (target generation);
- A "pre-feasibility" analysis of the targets based on all the data gathered and analysed.

4.5.4 SOURCE ROCK GEOCHEMISTRY DATABASE

Also in the 1st and 2nd years, Rhino Oil and Gas would acquire data on source-rock geochemistry. This may include the acquisition of rock samples from surface outcrops for laboratory analysis. A database on geochemistry of the region would be compiled.

4.5.5 FULL TENSOR GRADIOMETRY GRAVITY SURVEY

In the 2nd year Rhino Oil and Gas would purchase full tensor gravity gradiometry ("FTG") survey data where available and, depending on the data acquired, may commission further surveys. FTG data is used by oil, gas and mining companies to measure the density of the subsurface in order to assist in the building of subsurface geological models to aid exploration. While a conventional gravity survey records a single component of the three-component gravitational force, usually in the vertical plane, FTG uses multiple pairs of accelerometers to measure the rate of change of the gravity field in all three directions. The end result is a more accurate representation of the gravity field being surveyed (http://www.findingpetroleum.com). From these FTG surveys, a detailed interpretation of the subsurface geology can focus future exploration objectives.

FTG surveys involve grid-based flights using a light fixed wing aircraft (fitted with the FTG equipment) at slow speeds (~ 130 knots) and at an altitude of between 80 and 300 m above ground. It is envisaged that up to a maximum of 4 000 km^2 could be surveyed with a spacing of between 2 and 6 km between lines. In good weather the survey would take less than 7 days to complete. The grid pattern is not currently known, as this would ultimately be determined based on the findings of the initial exploration activities undertaken in Year 1 and 2. The flight parameters, survey grid and timing can be adapted to some degree depending on, *inter alia*, land use and other restrictions.

The fundamental component of a gravity gradiometer is the gravity gradient instrument ("GGI'), which consists of a slowly rotating disk on which four very precise accelerometers are mounted (termed a 'complement'). The arrangement of the accelerometers together with their rotation allows a GGI to

measure gravity gradients (i.e. is the spatial rate of change of gravitational acceleration). These variations in the earth's gravitational field help image subsurface structures.

FTG surveys provide a less invasive alternative to acquiring land-based data. This is an advantage when surveying environmentally sensitive areas and when trying to acquire onshore data where extensive permitting is required. Airborne acquisition neutralises any access and terrain issues associated with difficult to access areas.

FIGURE 4-2: TYPICAL FTG EQUIPMENT AND RESULTS

4.5.6 CORE BOREHOLE DRILLING

Core borehole[1] drilling is no longer included in the proposed 'early-phase exploration' work for which Rhino Oil and Gas are seeking environmental approval.

Rhino Oil and Gas would still propose to undertake core hole drilling as part of further early-phase exploration. The location of core hole sites is currently unknown, as these would ultimately be determined based on the findings of the initial exploration activities undertaken in Year 1 and 2. Target locations would initially be determined from an assessment of geological information derived from the available data and FTG survey. Since the exact location of an exploration core hole is flexible, it can be adjusted to accommodate local features, landowner' needs and local environmental sensitivities. This process of adjusting a site's location would always involve consultation with the land owner to reach a negotiated access agreement.

[1] A "stratigraphic well or hole" means a well or hole drilled only for the purpose of obtaining information pertaining to specific geological, structural and stratigraphic information that might lead towards the discovery of petroleum with no intent to produce from such a well (GN R466, June 2015).

In proposing locations for drill sites, consideration would be given to environmental criteria. Each drill sites would be subject to the requisite environmental assessment and authorisation process.

FIGURE 4-3: TYPICAL CORE BOREHOLE EQUIPMENT
(Sources De Beers and Pinnacle Drilling)

4.5.7 SEISMIC DATA ACQUISITION

Seismic surveys are no longer included in the proposed 'early-phase exploration' work for which Rhino Oil and Gas are seeking environmental approval.

Rhino Oil and Gas would still propose to undertake seismic surveys as part of further early-phase exploration. The location of seismic lines is currently unknown, as these would ultimately be determined based on the findings of the initial exploration activities undertaken in Year 1 and 2. Target routes would initially be determined from an assessment of geological information derived from the available data, FTG surveys and core borehole drilling. Since the exact alignment of a seismic line is flexible, it can be adjusted to accommodate local features, landowner' needs and local environmental sensitivities. This process of adjusting a seismic line's route would always involve consultation with the land owner to reach a negotiated access agreement.

In proposing routes for seismic survey alignments, consideration would be given to environmental criteria. Each route would be subject to the requisite environmental assessment and authorisation process.

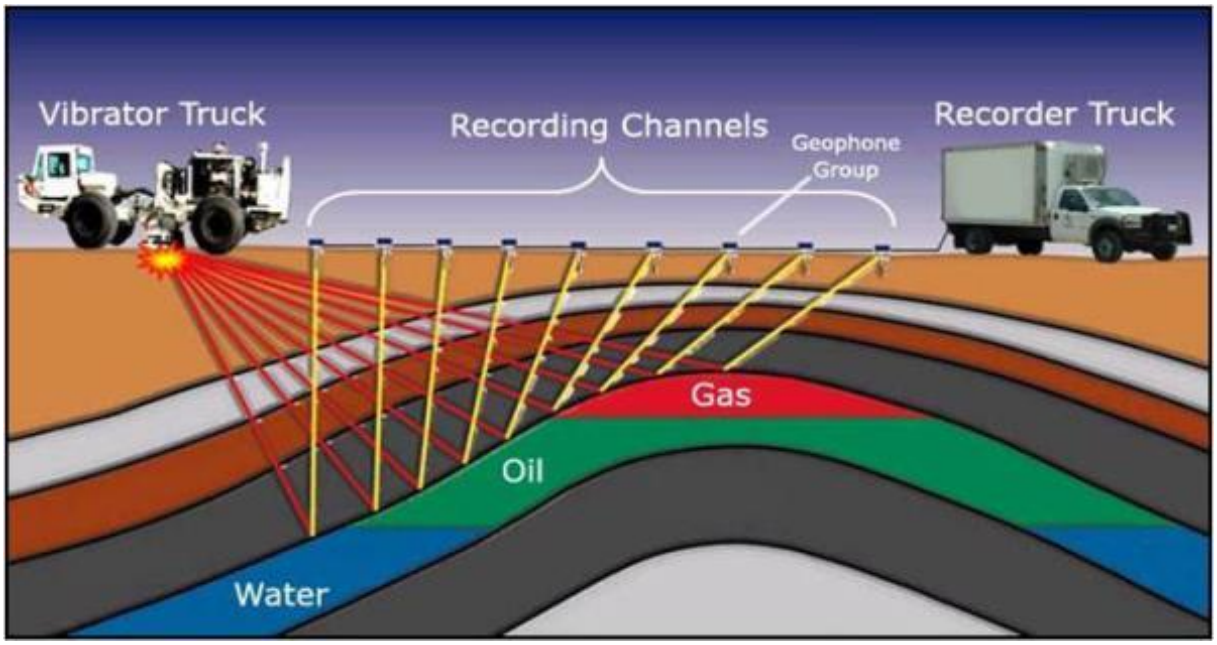

FIGURE 4-4: SCHEMATIC OF TYPICAL SEISMIC SURVEY USING A VIBRATOR TRUCK

4.5.8 SUPPORTING INFRASTRUCTURE

The desktop work and aerial FTG survey do not require the establishment of any infrastructure.

4.5.9 REHABILITATION

No rehabilitation will be required as none of the proposed exploration activities will disturb any ground.

4.6 FURTHER APPRAISAL, WELL DRILLING OR FUTURE PRODUCTION

Rhino Oil and Gas has stated that the ultimate, long-term goal for the proposed project is to extract hydrocarbons in a commercially viable manner. However, they have indicated that there is currently insufficient information to determine if there is a resource and what techniques might be required for future hydrocarbon extraction.

Until the early-phase exploration (proposed and future) is concluded Rhino Oil and Gas are, therefore, not able to provide any information on the implications regarding further appraisal or well drilling during exploration nor future extraction of hydrocarbons. The early-phase exploration (proposed and future) is the first stage of the exploration process, and a prerequisite to determining what might take place during further exploration or future production. Refer to Section 4.2 for details on the general exploration process required to develop an oil or gas resource.

No further ground-based exploration, appraisal or well drilling and future production forms part of the current ER application. Thus no extraction of hydrocarbons or water, no stimulation of wells or hydraulic fracturing (fracking) is proposed in the initial three-year exploration work programme for which approval is sought.

If the early-phase exploration were to confirm the presence of a potential resource, then Rhino Oil and Gas would need to seek further authorisation / approval from PASA for any additional exploration work required to appraise the resource. Any further approval would be subject to an additional environmental assessment (or environmental authorisation amendment) process with further public consultation and specialist input. Approvals are also likely to be required in terms of other legislation.

Similarly, if the later exploration led to the discovery of a commercial resource suitable for development, then Rhino Oil and Gas would need to apply for and secure a Production Right from PASA. An application for a Production Right would need to be subject to a separate EIA process in terms of NEMA with further public consultation and specialist input. Approvals are also likely to be required in terms of other legislation.

Any further exploration work or future production operations that may arise, if a resource is discovered, is therefore beyond the scope of the current EIA process.

4.7 DETAILS OF ALL ALTERNATIVES CONSIDERED IN THE EIA PROCESS

4.7.1 PROPERTY OR LOCALITY ALTERNATIVES

4.7.1.1 Exploration Right Application Area

The purpose of exploration is to acquire and evaluate relevant data to determine where an oil or gas resource may be located. The process is iterative with data gained in early phases being used to improve the level of knowledge and refine the anticipated (or known) extent of the resource (refer to Section 4.2 for an overview of the exploration process). The exploration process begins with the development of a regional perspective of the geology to determine where conditions that are conducive to hydrocarbon formation may exist. Given the low level of accuracy of the publicly available petroleum resource data, it is necessary to apply for a right over a large area such that with ongoing data collation and refinement a resource is identified within the boundaries of application area. The expected dispersed nature of petroleum resources is such that a reasonably large area is required initially in order to identify a resource that may be economically viable. The result is that an ER application is typically made over large areas.

It is not possible for more than one ER to be held over land for the same mineral and thus an application area must be distinct from other ERs (and applications). Refer to the Figure 4-4 and the PASA website

for the hubmap with details of all existing ERs and applications (see www.petroleumagencysa.com). The extent of Rhino Oil and Gas' 295 ER application area is such that it does not overlap with other areas.

As mentioned previously in Section 4.4.1, in terms of Section 48 of the MPRDA an ER may not be held over land comprising residential areas, any public road, railway or cemetery, any land being used for public or government purposes or reserved in terms of any other law or areas identified in terms of Section 49 of the MPRDA. Section 48 of the NEMPRAA further restricts exploration from all protected areas. An exploration right therefore cannot be granted over such properties.

Exploration right applications are only made over areas, subject to the restraints indicated above, the applicant believes are likely to be prospective for the subject resource. No alternative ER application areas have been considered.

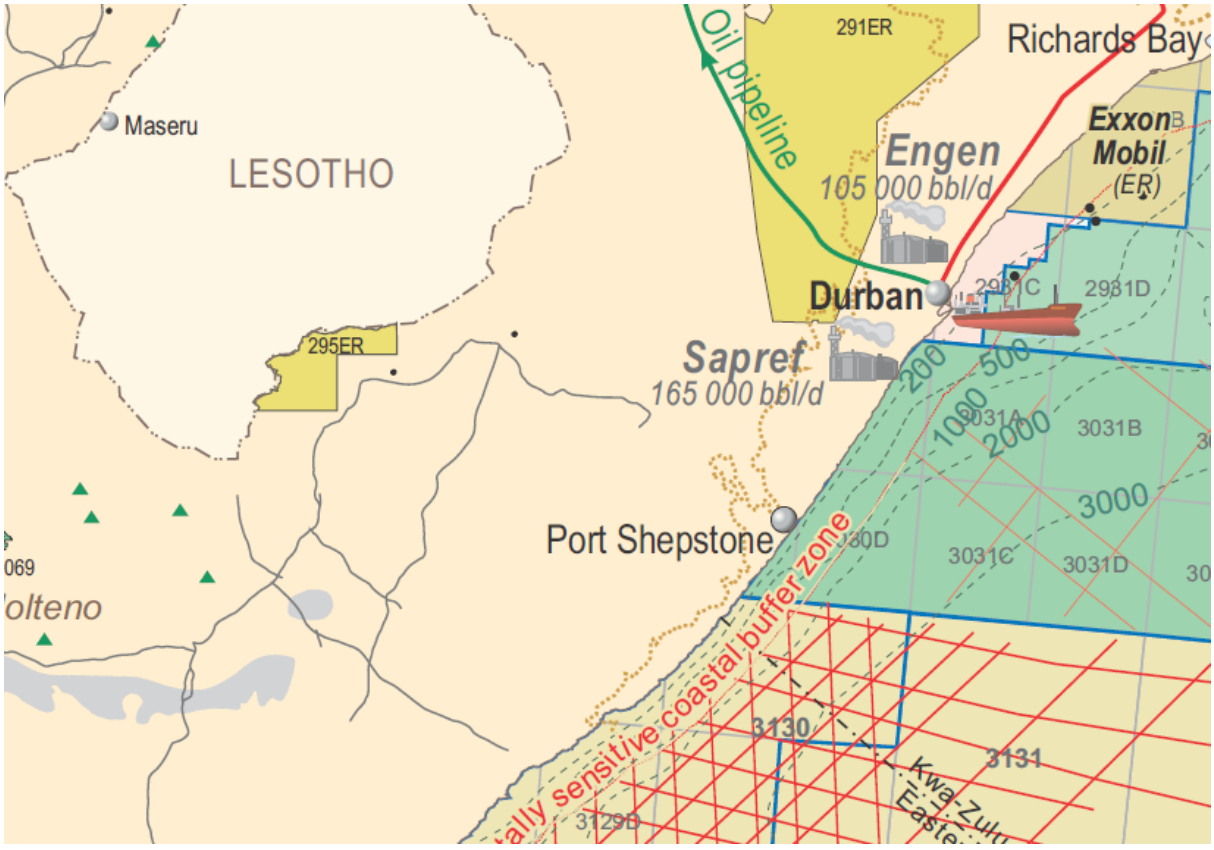

FIGURE 4-5: EXERPT FROM PASA HUBMAP
(source PASA website, August 2016)

4.7.1.2 Properties for Exploration Activities

The nature of exploration and the accuracy of the initial data available at the time of application are such that it is not possible at this point in time to define the location for the exploration activities that are typically undertaken in early-phase exploration. With exploration being very costly and having a low chance of success, Rhino Oil and Gas is motivated to undertake the fewest activities in the most cost effective manner. Thus exploration is undertaken in an iterative manner with the data gained in early phases being used to improve the method and locality of the work planned for the later phases (refer to Section 4.2 for an overview of the exploration process). It is, therefore, only possible to determine the actual properties where ground-based exploration activities (e.g. core boreholes and seismic surveys) may take place once the initial phases have been undertaken. These initial phases can only be undertaken once an ER is granted.

No ground-based exploration activities are proposed within the exploration work programme for which environmental authorisation is being sought. Thus this EIA process has not considered properties or property alternatives.

4.7.1.3 Specific Locality of ground-based activities

The specific locality of future ground-based exploration activities (e.g. core boreholes and seismic surveys) on properties can only be identified once the initial exploration phases have been undertaken and target sites identified. The nature of the proposed exploration activities is such that the target sites are not bound to fixed locations but are somewhat adjustable. This provides Rhino Oil and Gas with flexibility to position the sites for ground-based activities at localities that would avoid local sensitivities. Rhino Oil and Gas would ensure that all proposed activities are undertaken in a lawful and environmentally responsible manner.

No ground-based exploration activities are proposed within the exploration work programme for which environmental authorisation is being sought. Thus this EIA process has not considered localities or locality alternatives.

4.7.2 DESIGN OR LAYOUT ALTERNATIVES

At this stage it is not possible to determine specific layout details for the FTG survey. The survey grid, flight parameters and timing can be adapted to some degree depending on target areas, land use, weather and other restrictions. The FTG survey will cover up to a maximum of 4 000 km^2.

4.7.3 TYPE OF ACTIVITY

Exploration techniques have improved over the past decades such that many of the activities undertaken are now of low intensity and have relatively low risk to the environment. This is particularly true for early-phase exploration where the exploration is not interrogating a resource, but is solely attempting to identify the most prospective areas for further investigation. Being very costly and having a low chance of success, an exploration company is financially motivated to undertake the fewest activities in the most cost effective manner. Thus exploration companies increasingly use remote sensing techniques for the identification of petroleum resources.

The desktop and data processing activities would have no environmental impact and are not considered further in this report. It is relevant to note that Rhino Oil and Gas is intending to gather as much information, as is possible, from desktop and remote sensing methods as opposed to ground-based activities. FTG survey is the only field work proposed for the exploration work programme for which environmental authorisation is being sought.

Rhino Oil and Gas still intend to undertake core hole drilling and seismic surveys as part of further early-phase exploration but would only do so after target sites had been identified and each site subject to the requisite environmental assessment and authorisation process.

4.7.4 TECHNOLOGY ALTERNATIVES

FTG survey is the only technology considered within the exploration work programme for which environmental authorisation is being sought. This remote sensing technique is of low intensity and has relatively low risk to the environment. This is a preferred technology for early-phase exploration.

4.7.5 THE "NO-GO" ALTERNATIVE

The "No-Go" alternative is the non-occurrence of the proposed exploration activities. Thus there would be no acquisition of data (via FTG) for the proposed ER area as proposed. In this case, the residual impacts (i.e. impacts after implementation of mitigation measures) of the proposed activities would not occur.

The implications of not undertaking the proposed early-phase exploration is that no additional information would be derived on the potential for an oil and gas resource in the region. In the absence of the exploration a potential petroleum resource cannot thus be identified, understood or assessed.

Without this knowledge no oil or gas field development would be able to occur. In the absence of oil and gas production there would obviously not be any of the potential risks related to detailed exploration nor future production. Similarly the potential benefits of oil and gas production would not be derived.

5 DESCRIPTION OF THE BASELINE ENVIRONMENT

This chapter provides a general overview of the current baseline conditions (biophysical, cultural and socio-economic) of the ER application area and surrounds.

5.1 BIOPHYSICAL ENVIRONMENT

5.1.1 CLIMATE

5.1.1.1 Temperature

The climate of the proposed ER area is generally milder than in the inlands areas of the broader region as it is strongly influenced by the mountainous topography associated with the Drakensberg Mountains located to the north and west of the ER area. The proposed ER area typically experiences an escarpment climate with warm summers and mild winter that includes periods of very cold conditions with snow. The average summer midday temperature expected within the proposed ER area is 17°C while the average winter midday temperature is 2°C which can drop to below zero.

5.1.1.2 Rainfall

The broader area is characterised by summer rainfall usually in the form of thunderstorms. Mean annual precipitation varies between 700 mm in the east of the proposed ER area up to 1000 mm to the west.

5.1.2 GEOLOGY

5.1.2.1 Regional Setting

The proposed exploration area lies in the north east of the Karoo Basin (see Figure 5-1). The main Karoo Basin in South Africa formed as a result of compression predominantly associated with flexural subsidence, characteristic of foreland basins, during the assembly of the Gondwana super-continent. Consensus on the tectonic setting of the basin, however, remains debated (Tankard et al., 2012; Schreiber-Enslin et al., 2014). The Karoo Basin represents a diverse and complex suite of rock units with an aerial extent of roughly 600 000 square kilometres that attains a maximum sedimentary thickness of 12 kilometres. The north east of the basin is host to several distinct facies of rocks that vary between shore face, fluvial and lacustrine sediments, deposited between the Permian and Triassic.

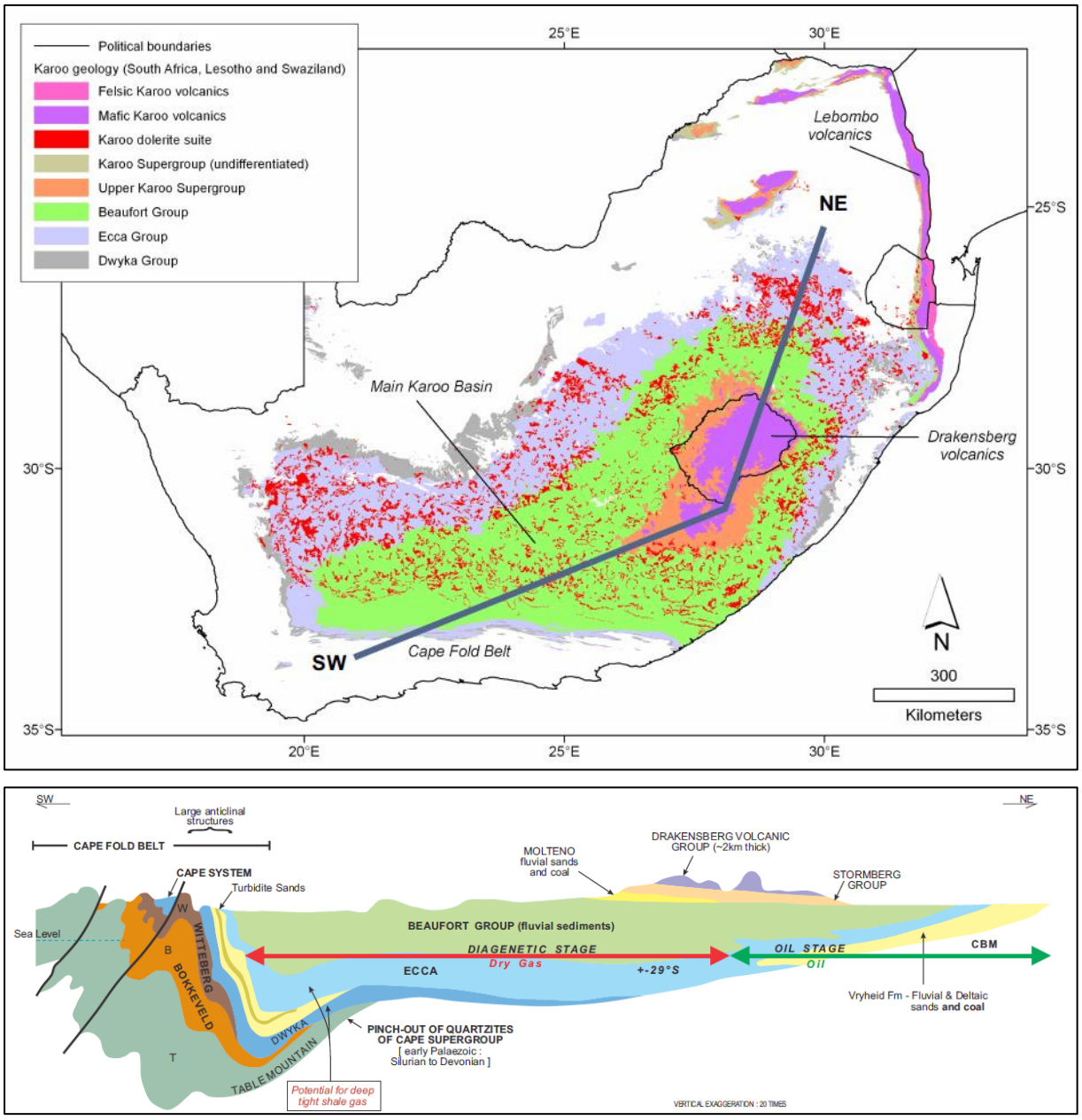

FIGURE 5-1: SIMPLIFIED GEOLOGY OF THE KAROO BASINS
(source PASA brochure)

The deposition of Karoo Supergroup sediments ended in the early Jurassic during the emplacement of the igneous rocks that constitute the Drakensberg Group. The preserved basalts and dolerites attain a maximum thickness of approximately 1 400 m in the Lesotho area. The northern flank of the basin is defined by the erosional limits of the late Carboniferous-Permian Dwyka and Ecca Groups, where they unconformably overlay Archean-Cambrian age, Kaapvaal and Namaqua-Natal basement. The Ecca Supergroup consists mainly of sandstone and shale from the Permian period. The Dwyka Formation within the proposed exploration area consists mainly of tillite from the Carboniferous period.

5.1.2.2 Geology of Proposed ER area

The geology of the proposed ER area comprises the Molteno, Elliot and Clarens Formations (from the Karoo Supergroup) and the Drakensberg Group (see Figure 5-2). The Molteno Formation is overlain by the Late Triassic Elliot Formation with a maximum thickness of approximately 500 m in the south. The formation comprises an alternating sequence of greyish-red or less commonly greenish-grey mudstone and subordinate fine- to medium-coarse sandstone.

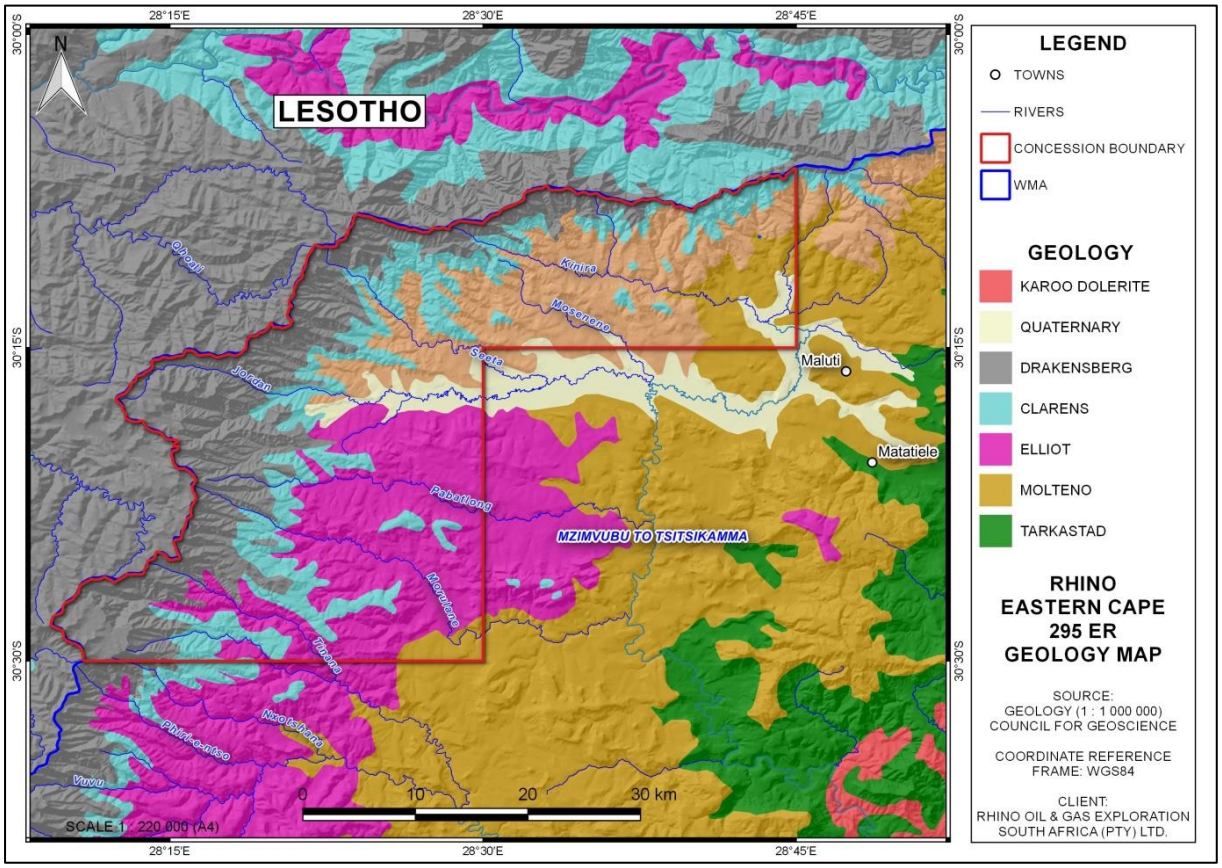

FIGURE 5-2: GEOLOGY OF THE EXPLORATION RIGHT AREA
(Council for Geoscience)

The Late Triassic/Early Jurassic Clarens Formation superimposes the Elliot Formation. This formation represents the final phase of Karoo sedimentation (Lurie, 2008). The Clarens Formation consists of fine- to very fine-grained sandstone and siltstone with subordinate mudstone and occasional chert and nodular limestone horizons (Johnson et al., 2006). The mudstones are generally pale-olive to pale-red in colour and the sandstones are usually very pale-orange, well sorted with sub-angular to sub-rounded grains (Karpeta and Johnson, 1979). The thickness of the Clarens Formation ranges 200-250 m, however, the northern extent of the formation has a thickness of 100 m.

The Drakensberg Group forms the upper part of the Drakensberg Mountains. It is characterised by the dark-grey basaltic lavas with subordinate tuffs and occasional sandstones (Karpeta and Johnson, 1979).

The basalts are made up of altercations of a tough and massive coarsely crystalline rock and easier-weathering vesicular varieties. The total thickness of Drakensberg Group is up to 700 m (Johnson et al., 2006).

Dolerite dykes, also present in the area, are inclined sheets and sills that intruded the Karoo Sequence. Dolerite dykes are generally 3 - 10 m wide and 5 - 30 km long, although some can be followed for 80 km (Johnson et al, 2006). The inclined sheets and sills range from a few metres to 200 m or more in thickness. Quaternary deposits (<2 m in thickness) are generally limited in the study area and concentrate only along the upper Kinira River and its upper tributaries (Karpeta and Johnson, 1979).

5.1.2.3 Resource assessment

Resource assessments of the Karoo Basin have historically emphasized the world-class coal reserves that have dominated the energy history of South Africa. Some limited onshore exploration for hydrocarbon occurrences was undertaken in the 1960s but no commercial hydrocarbon occurrences were discovered. However, it is expected that the north-east Karoo Basin has potential for a tremendous diversity of hydrocarbon resources including shale oil and shale gas, coalbed methane, helium and biogenic gas.

One of the complications recognised during the initial resource exploration effort undertaken in the 1960s was the widespread occurrence of dolerite dykes, especially in the north-east Karoo Basin. The thermal effects of these dykes led some early researchers to state that the dykes were required for distillation of hydrocarbons from adjacent coal and shale beds. The complexity of these dyke intrusions, well documented in the shallow north-east Karoo coal fields, makes it difficult to understand the geometry of any possible reservoir horizons in the adjacent sediments. As a result, there is poor understanding of the relationship between the observed non-commercial oil and gas occurrences and any structural control. Further compounding the perception of an absence of commercial hydrocarbons in the Karoo Basin was the documentation of low-permeability conditions in most drill holes. This led many researchers to conclude that the rocks possessed too low a permeability to produce hydrocarbons and porosities too low to trap them.

5.1.2.3.1 Shale Gas Potential

The development of shale gas fields, which commenced in the United States in the early 21st Century, has demonstrated the ability to produce voluminous economic quantities of hydrocarbons from extremely low permeability rocks. This was made possible by the use of horizontal drilling and hydraulic fracturing to maximize wellbore connectivity with low-permeability hydrocarbon-bearing strata.

As a result, shale gas in South Africa is being reassessed as a potential hydrocarbon resource. Most exploration focus has emphasized the potential gas resource of the deep Karoo Basin in the southern and western sub-basins where the rocks are most thermally mature. Based on limited preliminary data,

Advanced Resources International (ARI, 2011; ARI, 2013), on the behalf of the US Energy Information Administration, assessed the shale gas potential of the Lower Ecca Group shales in the southern Karoo Basin to contain 1,834 Tcf of gas-in-place with recoverable shale gas resources of 485 Tcf. In 2013, ARI completed a reassessment to show that the lower Permian Ecca Group contains 1,559 Tcf of shale-gas-in-place with 370 Tcf as the technically recoverable shale gas resource. In this part of the Karoo Basin, the sediments reach nearly 12 km in thickness (Raseroka and McLachlan, 2008). PASA estimates recoverable shale gas reserves of about 40 Tcf[2].

5.1.2.3.2 Oil Potential

The oil resource potential of the Karoo Basin has largely been ignored because of the historical absence of commercial oil discoveries, and the restricted occurrence of oil accumulations to the north-east Karoo Basin where the rocks are less thermally mature. Further evaluation still needs to be undertaken in the frontier basins.

5.1.2.3.3 Coalbed Methane Potential

The north-east Karoo Basin also has considerable potential as a Coalbed Methane (CBM) resource play due to well-documented gassy coals at relatively shallow drilling depths. Estimates of the CBM resource in the north-east Karoo ranges from 1 Tcf for the Waterberg Coalfield (Anglo Thermal Coal for Waterberg Coalfield) to over 196 Tcf for the NE Karoo region (PASA Unconventional Resources Onshore Report).

5.1.2.3.4 Helium Potential

In addition to the oil and CBM potential of the north-east Karoo Basin, there are also documented reserves of helium in Precambrian-hosted gold mines in some regions. The methane component of these reserves is estimated at over 11.5 billion cubic feet (Bcf) (Molopo Energy Company website; PASA Unconventional Resources Onshore Report). Helium is an extremely valuable strategic resource found in limited areas of the world. A rare gas on earth, the bulk of the current helium production (75%) is from the United States. The most important use of helium currently is for cryogenic cooling (32%), although helium has numerous other industrial uses which include welding, controlled atmosphere (medical and other laboratory testing), leak testing, as a purge gas, breathing mixtures for deep sea diving, and also as a lifting gas.

5.1.3 SEISMICITY

The Southern African region is considered to be relatively stable from a seismic perspective. South Africa is located on the African tectonic plate, which includes the African continent and parts of the floor of the Atlantic and Indian Oceans. In general earth tremors and quakes are infrequent and generally of low

[2] According to a 2014 interview by PASA Resource Development Manager, David van der Spuy. ("SA petroleum Agency's Karoo shale-gas estimate 'far lower'", Business Day BDlive Paul Vecchiattor 2-12-14, http://www.bdlive.co.za/business/energy/2014/02/21/sa-petroleum-agencys-karoo-shale-gas-estimate-far-lower).

magnitude. The largest ever recorded earthquake to occur in South Africa was the Ceres-Tulbagh Earthquake, which occurred in September 1969, and had a magnitude of 6.3 on the Richter Scale.

There are areas in South Africa with higher peak ground acceleration which indicates a greater likelihood of earth quakes. These are found in the Western Cape region and in parts of the northern and western Free State, as well as the Witwatersrand. Within the ER, the Cedarville Fault is an active fault with associated recorded earthquake activity (in 1986 an earthquake of 5.15 was recorded at the town of Matatiele which is located near the fault). The fault and associated geological structures are likely to cause preferred flow paths and form good groundwater exploration targets.

5.1.4 SOILS

Two main landforms within the proposed ER area were mapped using the Soil and Terrain Database (SOTER) methodologies. Medium gradient hills with a slope ranging between 8 and 30% were found to occur on the south- and south eastern portions of the proposed ER area, while high gradient mountains with slope of more than 30% occur within the foothills of the mountainous areas (Figure 5-3). The high gradient mountains are considered to be unsuitable for crop production activities, however, they could be suitable for livestock grazing or nature conservation.

5.1.4.1 Soil Classes

Six dominant soil classes were identified within the proposed ER area (see Table 5-1), namely:

- Freely drained, structureless soils;
- Lithosols (shallow soils on hard or weathering rock);
- Undifferentiated clays;
- Undifferentiated poorly drained soils;
- Undifferentiated shallow soils; and
- Structureless and poorly drained soils.

A description of the properties and limitations associated with each soil class is provided in Table 5-1.

TABLE 5-1: SOIL CLASSES AND THEIR PROPERTIES WITHIN THE PROPOSED ER AREA

Soil class		Favourable properties	Limitations
1	Freely drained, structureless soils	Favourable physical properties	May have restricted soil depth, excessive drainage, high erodibility, low natural fertility
2	Lithosols (shallow soils on hard or weathering rock)	May receive water runoff from associated rock	Restricted soil depth; associated with rockiness
3	Undifferentiated clays which are an association of swelling clay soils, dark clay soils which are not strongly swelling, poorly drained dark clay soils which are not strongly swelling, poorly drained swelling clay soils and dark clay soils, often shallow on hard or weathering rock.	High natural fertility	One or more of high swell-shrink potential, plastic and sticky, restrictive effective depth, wetness
4	Undifferentiated poorly drained soils which are an association of imperfectly drained soils, often shallow and often with a plinthic horizon and wetland soils.	Wetness favourable in dry areas; may sustain wetland vegetation.	Seasonal or excessive wetness.
5	Undifferentiated shallow soils which include Lithosols (shallow soils on hard or weathering rock) and non-soil land classes.	Soil may receive water runoff from associated rock; water-intake areas	Restricted land use options
6	Structureless and poorly drained soils	May have favourable physical properties; relative wetness favourable in dry areas, may sustain wetland vegetation	Low base status, restricted depth, imperfect to poor drainage, excessive wetness, high erodibility

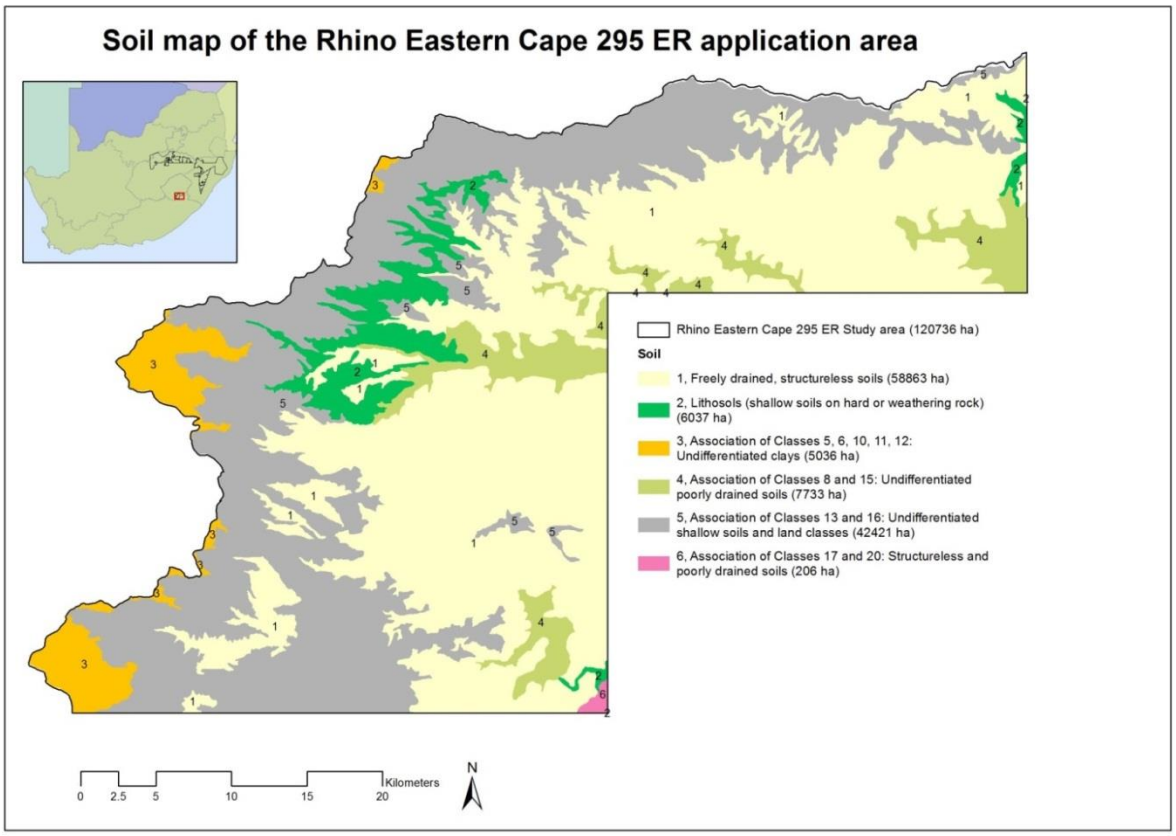

FIGURE 5-3: SOIL CLASSES IDENTIFIED WITHIN THE EXPLORATION RIGHT AREA

5.1.4.2 Land capability classification

The five different land capability classes identified within the proposed ER area are provided in Table 5-2 and illustrated in Figure 5-4. The classes vary from soils with moderate limitations (class III) to soils with extremely sever limitations (class VIII).

The majority of the proposed ER area (61 633 ha) is considered to be non-arable for the purposes of crop cultivation and has moderate to low suitability as grazing land. A small section on the eastern portion of the proposed ER area (400 ha) has wilderness land capability and in terms of land capability class system should preferably only be used for wildlife and habitat conservation. The remaining areas, approximately 27 140 ha, are mapped to have a moderate potential for arable agriculture. These soils are mainly located in valley bottoms where the slope gradients are less steep and pockets of arable land makes crop farming possible (typically in close proximity to villages).

TABLE 5-2: LAND CAPABILITY CLASSES IDENTIFIED WITHIN THE PROPOSED ER AREA

CLASS	DEFINITION	CONSERVATION NEED	USE / SUITABILITY
III	Moderate limitations. Some erosion hazards	Special conservation practice and tillage methods.	Rotation of crops and ley (50%)
IV	Severe limitations. Low arable potential. High erosion hazard.	Intensive conservation practice	Long term leys (75%)
VI	Limitations preclude cultivation. Suitable for perennial vegetation	Protection measures for establishment e.g. Sod-seeding	Veld and / or afforestation
VII	Very severe limitations. Suitable only for natural vegetation	Adequate management for natural vegetation.	Natural veld grazing and afforestation
VIII	Extremely severe limitations. Not suitable for grazing or afforestation.	Total protection from agriculture	Wildlife

5.1.4.3 Degraded land

Due to the high erodibility of the soils present within the proposed ER area a substantial proportion of the proposed ER area has been designated as degraded land (see Figure 5-5). The degradation in this area include barren rock (159 ha) and degraded vegetation (36 851 ha).

5.1.4.4 Restricted areas

It should be noted that sensitive soils with hydromorphic properties which support wetland habitat will be excluded from proposed exploration activity sites by virtue of protection assigned to wetlands. Thus, the only other soil forms that should be protected from exploration activities are soil forms that contain beneficial water-retaining layers in and below the rooting zone. The advantage of these water-retaining layers is that soil water is stored for uptake by crops, especially during drier periods. Significant physical disturbance to these soils could result in a loss of this functionality. Such soils are anticipated to occur in a small portion of the south-eastern corner of the proposed ER area.

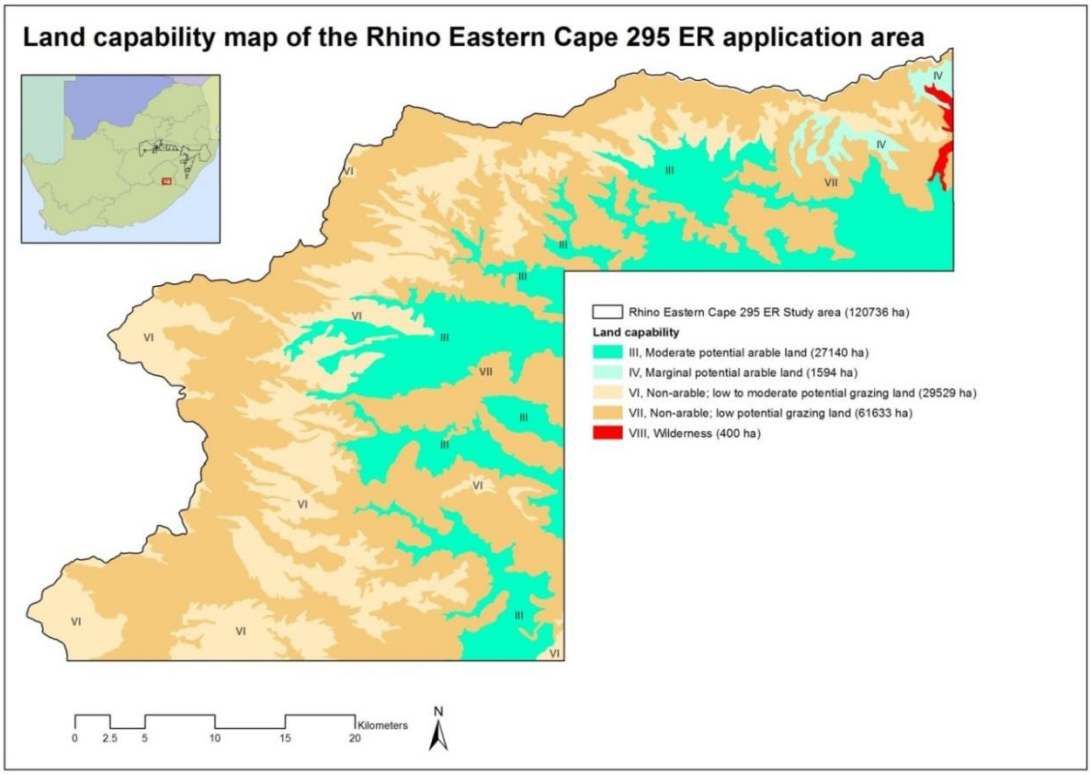

FIGURE 5-4: LAND CAPABILITY MAP OF THE EXPLORATION RIGHT AREA

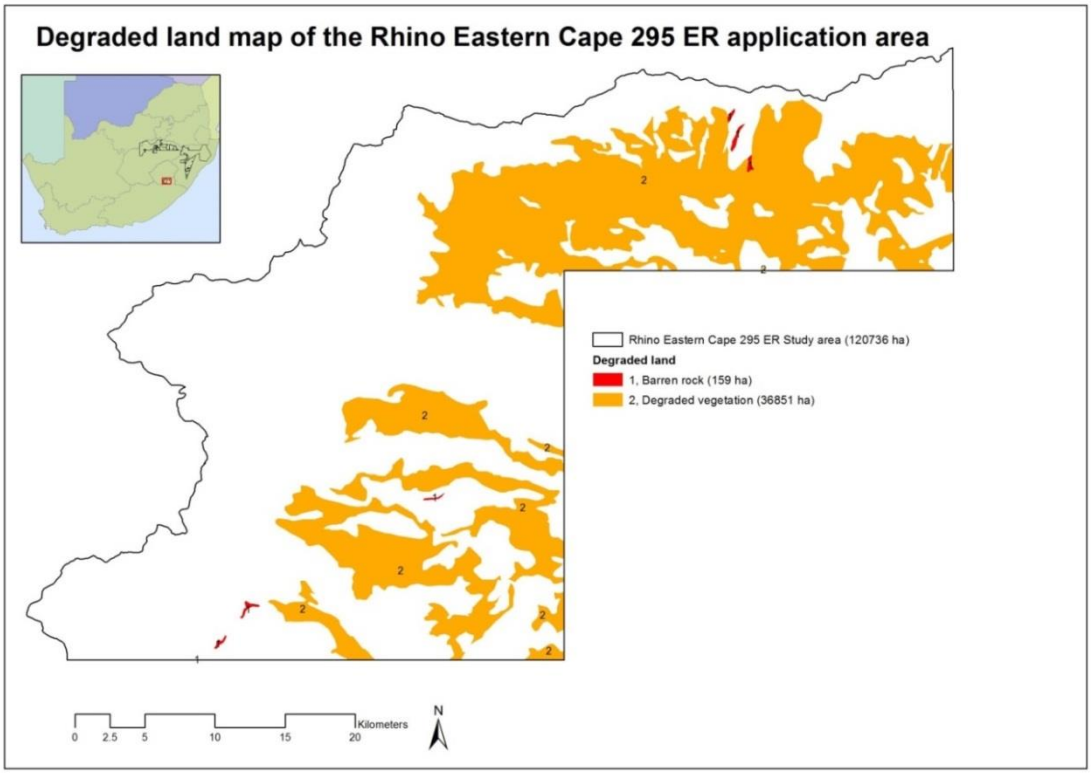

FIGURE 5-5: DEGRADED LAND WITHIN THE EXPLORATION RIGHT AREA

5.1.5 LAND COVER

According the National Land Cover Data Set (2013/2014), the great majority of the ER area comprises grasslands (Figure 5-13). Some of the larger river valleys have thicket/dense bush in the upper reaches. Much of this comprises stands of alien and invasive trees rather than indigenous vegetation (pers. obs). The flatter ground in the lower elevation areas has been largely transformed, either by rural housing and urbanisation or through various forms of cultivation (subsistence and commercial). Many of the valley bottoms contain wetland areas.

5.1.6 HYDROLOGY

5.1.6.1 Catchments and River Systems

THE EXPLORATION AREA FALLS WITHIN THE MZIMVUBU TO KEISKAMMA WATER MANAGEMENT HAS A TOTAL MEAN ANNUAL RUN OFF OF 7 241 MILLION CUBIC METERS (MCM). THE MZIMVUBU TO HAS THE HIGHEST MEAN ANNUAL RUNOFF IN SOUTH AFRICA, AND EQUATES TO ALMOST 15% OF THE COUNTRY (NWRS, SEPTEMBER 2004). THE MZIMVUBU TO KEISKAMMA WMA CONSISTS OF QUATERNARY CATCHMENTS. THE CHARACTERISTICS OF THE QUATERNARY CATCHMENTS AREA ARE INCLUDED IN TABLE 5-3 BELOW. SEE

Separate electronic file

Figure 5-6 for the distribution of the quaternary catchments within the exploration area (WR, 20015).

TABLE 5-3: QUATERNARY CATCHMENT CHARACTERISTICS (WR, 2005)

Quaternary catchment	Mean annual Runoff (mcm)	Catchment area (km^2)
T34B	35.90	242
T34C	33.92	282
T33C	51.52	367
T33D	61.01	461
T33B	94.27	602
T33A	97.37	672

THE MOSENENE RIVER, SEETA RIVER, MABELE RIVER, LEKHETLANE RIVER, MARULANE RIVER RIVERS ARE LOCATED WITHIN THE PROPOSED ER AREA (SEE

Separate electronic file

Figure 5-6). The source of these rivers including their associated tributaries is located within the exploration area. The Mosenene River, Seeta River, Mabele River, Lekhetlane River and the Marulane River flow in a south easterly direction towards the Kinira River which is located approximately 10km east from the proposed ER area. The Tinana and Phinari Rivers drain the southern extent of the area into the Thina River. The Kinira and Thina Rivers are the main tributaries of the Mzimvubu River which flows in a south easterly direction to the Indian Ocean at Port St Johns.

Separate electronic file

FIGURE 5-6: SURFACE WATER FEATURES WITHIN PROPOSED ER AREA, WITH QUATERNARY CATCHMENTS

5.1.6.2 Surface water users

Surface water use consists of a combination of domestic, livestock use and irrigation for crop production in the low lying areas. The uMzimvubu Catchment Partnership Programme has been established to tackle degradation of the upper uMzimvubu landscape, and protect the livelihoods dependent upon it. It is estimated that around 1 million people derive water and a livelihood within the greater catchment (pers comm UCPP).

It is noted that much of the rural population within the proposed ER area is dependent on locally sourced water. Formal supply schemes are present in some villages, but many residents source water from springs and watercourses.

5.1.6.3 Wetlands

The upper section of the Umzimvubu catchment in the Matatiele LM hosts as much as 42 765 ha of wetland (email, UCPP). Numerous wetlands are located within the exploration area. For further information regarding the conservation status of these wetlands refer to Section 5.1.8. The location of the wetlands associated with the exploration area is illustrated in Figure 5-6 and Figure 5-13.

5.1.6.4 Major dams

No major dams are located within the proposed ER area. However, there are several small dams are located within the exploration area which are used for livestock and domestic purposes

5.1.7 Groundwater

5.1.7.1 Aquifer Classification

The exploration area is classified as a minor aquifer region, which implies a moderately yielding aquifer system of variable water quality in terms of the Aquifer Classification Map of South Africa. Although borehole yields in the deeper aquifer are generally, considered low, structural features such as faults and fractures can produce higher yielding boreholes.

On a regional level, the hydrogeology of the proposed ER area comprises fractured and intergranular aquifers with yields in the range of 0.5 to 2 L/s (see Figure 5-7). The aquifer types within the proposed ER area can be further refined according to lithology (refer to Section 5.1.2.2):

- Molteno Formation sandstones comprising fractured and intergranular aquifers. This formation contains quarzitic sandstone units, which could be targeted for groundwater use, especially along dolerite bodies contact zones. Borehole drilling into these rocks has been found to have a 43% success rate and yields generally ranging 0.5-2 L/s (King et al, 1998).

- Elliot Formation sandstones comprising fractured and intergranular aquifers. This formation also contains quarzitic sandstone units and dolerite bodies contact zones suitable for targeting. Borehole drilling into these rocks has been found to have a 34% success rate and yields generally ranging 0.1-0.5 L/s (King et al, 1998).

- Clarens Formation sandstones comprising fractured aquifers. These sandstones are distributed south of the Drakensberg Mountains. Borehole drilling into these rocks has been found to have a 60% success rate and yields generally ranging 0.5-2.0 L/s.

- Drakensberg Group basaltic lavas represent a fractured and intergranular aquifer located along the Drakensberg Mountains. Borehole drilling into these rocks has been found to have a 33% success rate and yields generally ranging 0.1-0.5 L/s.

- Karoo dolerites are anticipated to be associated with intense fracturing in the host rock as well as in the dolerite itself, which is why the contact zones between the dolerite and older sedimentary rock tend to be intergranular and fractured aquifers. These fractured zones allow for highly conductive pathways for water to infiltrate (recharge) and be transmitted. Yields can be considerable if the fracture system induced by both folding and intrusion are interconnected. Borehole drilling into these rocks has been found to have a 35% success rate and yields generally ranging 0.5-2.0 L/s.

- Alluvium deposits are found along the upper Kinira River and its upper tributaries within the proposed ER area. The yields of the associated alluvium/ intergranular aquifers range between 0.1-0.5 L/s. The likelihood of drilling successful boreholes is in the region of 95 %.

Aquifer vulnerability indicates the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer. In terms of the exploration area, the aquifer vulnerability in accordance to the Aquifer Vulnerability Map of South Africa (Conrad et al. 1999c), varies between ‘least’ and ‘moderate’ vulnerability. The areas of ‘least’ vulnerability are areas that are only vulnerable to conservative pollutants in the long term when continuously discharged or leached. The areas of ‘moderate’ vulnerability are areas which are vulnerable to some pollutants, but only when continuously discharged or leached.

Aquifer susceptibility indicates the qualitative measure of the relative ease with which a groundwater body can be potentially contaminated by anthropogenic activities and includes both aquifer vulnerability and the relative importance of the aquifer in terms of its classification. In terms of the Aquifer Susceptibility Map of South Africa (Conrad et al, 1999b), the exploration area is associated with a ‘low’ to ‘medium’ susceptibility aquifer.

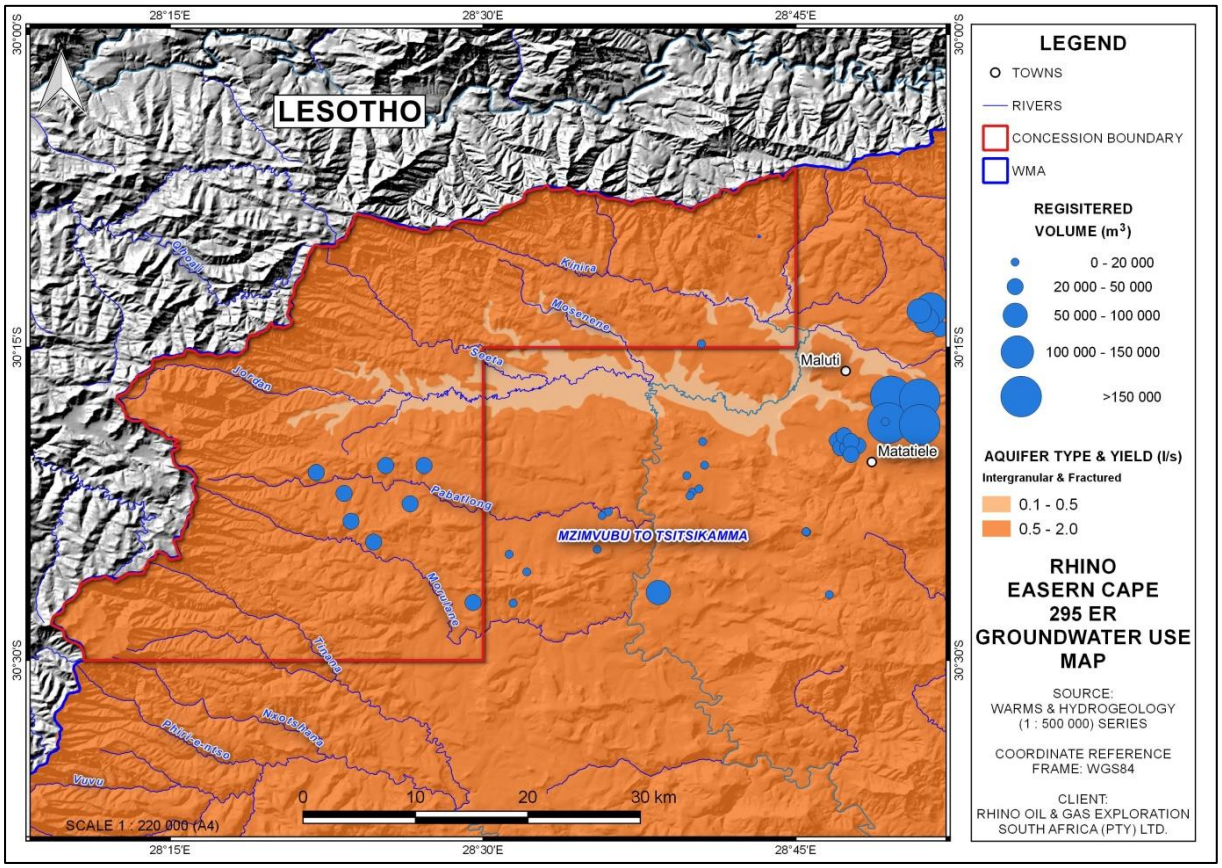

FIGURE 5-7: REGIONAL HYDROGEOLOGY OF THE PROPOSED ER AREA (DWAF, 2006).

5.1.7.2 Groundwater levels

Available data from the National Groundwater Archive (NGA) indicates that groundwater levels range between 0.3 -108 m below ground level, with discharge rates varying between 0.01 - 9.6 L/s. The depth of the boreholes contained within the database range between 2 -180 meters below ground level (mbgl). However, when considering DWS published information (i.e. not the NGA) then the mean depth to groundwater ranges between 15 - 20 mbgl and the recommended borehole drilling depth ranges between 20 – 30 m.

Groundwater also surfaces at various spring sites. These sites include dykes intersecting features, contacts of dolerite sill/sheets, basal contact of fractured sandstone with an underlying less permeable mudstone horizon and on weathered basins (usually weathered dolerite sheets).

5.1.7.3 Groundwater Quality

The anticipated electrical conductivity concentration of groundwater within the proposed ER area is between 0 and 70 mS/m (see Figure 5-8), while and Total Dissolved Solids (TDS) are expected to range between 200 - 449 mg/L. Calcium and magnesium are dominant constituents of groundwater within the proposed ER area, however, groundwater with high fluoride content has been reported to the south.

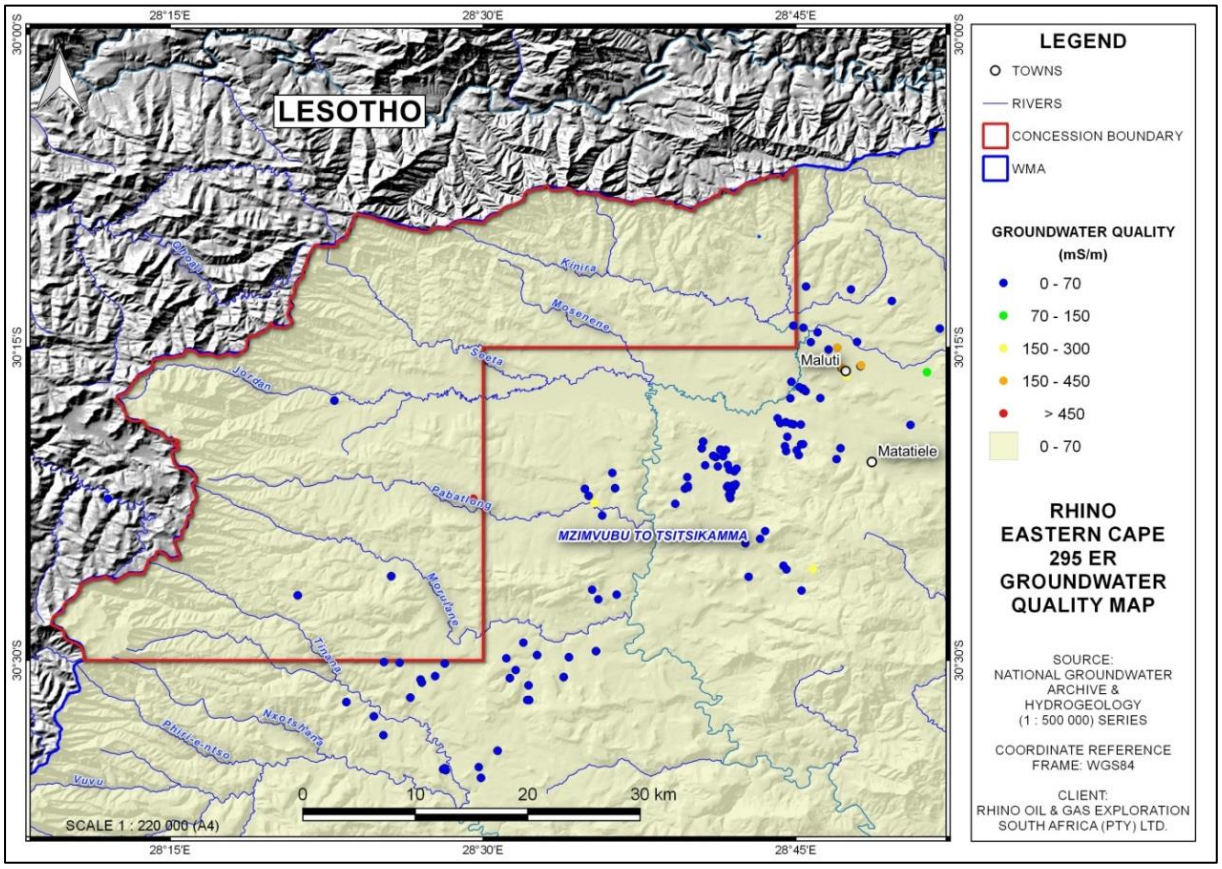

FIGURE 5-8: WATER QUALITY DISTRIBUTION WITHIN THE EXPLORATION RIGHT AREA

5.1.7.4 Groundwater Use

There are 537 registered boreholes in the larger area which includes the proposed ER area, however only 193 of these boreholes are still in use. Of the remaining registered boreholes, 39 are recorded as being destroyed, 63 are abandoned and the status of the remaining 242 boreholes is not known. Registered groundwater use in the area ranges between 1 505 m^3 and 50 000 m^3 per annum (see Figure 5-7) and is used mainly for drinking, livestock watering and irrigation purposes (DWAF, 2008).

It is noted that much of the rural population within the proposed ER area is dependent on locally sourced water. Water may be sourced from groundwater through unregistered boreholes.

Stakeholders within the proposed ER area note that the Cedarville Fault is an important groundwater feature with regards to groundwater development and use. The Cedarville Fault is an active fault with associated recorded earthquake activity (in 1986 an earthquake of 5.15 was recorded at the town of Matatiele which is located near the fault). The fault and associated geological structures are likely to cause preferred flow paths and form good groundwater exploration targets. The fault forms a graben structure with deep weathered and colluvial profiles ideal for primary shallow aquifers.

5.1.8 Biodiversity

5.1.8.1 Flora

The proposed ER area is located within the grassland biome within the Sub-Escarpment Grassland Bioregion and the Drakensberg Grassland Bioregion, which is structurally simple and strongly dominated by grasses which are comprised of various vegetation units. Vegetation units that are associated with the proposed ER area include the Drakensberg Foothill Moist Grassland, the East Griqualand Grassland, the Lesotho Highland Basalt Grassland, the Mabela Sandy Grassland and the Southern Drakensberg Highland Grassland (Mucina and Rutherford, 2006). The distribution of these vegetation units within the proposed ER area are illustrated in Figure 5-9. Further information pertaining to the various vegetation units is discussed below.

Drakensberg Foothill Moist Grassland

The Drakensberg Foothill Moist Grassland vegetation unit is moderately rolling and mountainous and is incised by river gorges of drier vegetation types. This vegetation unit is dominated by forb-rich grassland with short bunch grasses including *Themeda trianda* (Red Grass) and *Tristachia leucothrix* (Hairy Trident Grass). Almost 20% of this vegetation unit has been transformed for cultivated land and by urban sprawl (Mucina and Rutherford, 2006).

East Griqualand Grassland

The East Griqualand Grassland vegetation unit is characterised by hills with slopes covered by grassland with patches of bush clumps with *Leucosidea sericea* (Oldwood) (only wet areas), or *Dispyros lycioides* (Bluebush), *Acacia Karroo* (Currently known as *Vachellia karroo*) and *Zizuphus mucronata* (Buffalo thorn) in low-lying dry areas. Over one quarter of this vegetation unit has been transformed for cultivation (maize), plantations and urban sprawl (Mucina and Rutherford, 2006).

Lesotho Highland Basalt Grassland

The Lesotho Highland Basalt Grassland vegetation unit consist of plateaus and high ridges of mountains separated by deep valleys. Vegetation consists of short grassland with many areas also with *Passerina montana* (Lithaba) dominated shrub land. Smaller shrubs such as *Chrysocoma cillata* (Beebos) and *Pentzia cooperi* are often very common in disturbed areas. Dominant species located at the lower and middle altitudes include *Themeda trianda* (Red grass) while *Festuca caprina* (Bokbaardgras) is located at

lower altitudes. The species *Kniphofia caulescnes* (Caulescent red-hot poker) are predominately evident at higher altitudes. The *Merxmeullera macowanii* (Molalashlolo) grass is located along water courses and drainage lines. Almost 10% of this vegetation unit has been transformed predominantly by cultivation. The vegetation unit is also highly utilised for grazing by sheep, goats, cattle and donkeys. The majority of the disturbances to this vegetation unit take place within the lower altitudes (Mucina and Rutherford, 2006).

Mabela Sandy Grassland

The Mabela Sandy Grassland vegetation unit is characterised by flat valley basins. This vegetation unit is dominated by species-poor, low tussock-dominated, sour grasslands without indigenous trees. *Sporobolus pyramidalis* (Cat's tailgrass) and *Artistida junciformis* (Wire grass) are indicator species. More than 20% of this vegetation unit has been transformed due to cultivation related activities such as maize and urban sprawl. Threats to the remainder of the vegetation unit include heavy grazing by livestock particularly in communal areas (Mucina and Rutherford, 2006).

Southern Drakensberg Highland Grassland

The Southern Drakensberg Highland Grassland vegetation unit is characterised by steeply sloping mountainous areas which support dense tussock grassland on slopes sometimes with dwarf-shrubby component of dwarf shrubland on exposed rocky areas. Dominant species associated with this vegetation unit include *Themeda triandra* (Red grass), *heteropogon contortus* (Black Speargrass), *Eragrostis racemose* (Narrow heart love grass), *Eragrostis chloromelas* (Boer love grass), *E. curvula* (Curved love grass), *Elionurus muticus* (Wire grass), *Trachypogon spicatus* (Giant spear grass), *Andropogon appendiculatus* (Blougrass), *Harphochloa falx* (Terpillar grass) and *Tristachya leucothrix* (Trident grass). More than 5% of this vegetation unit has been transformed due to cultivation related activities (Mucina and Rutherford, 2006).

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FIGURE 5-9: DISTRIBUTION OF VEGETATION UNITS WITHIN THE EXPLORATION RIGHT AREA

5.1.8.2 Fauna

Numerous faunal species such as birds, amphibians, reptiles, mammals, fish and insects are associated with the various vegetation units located in the proposed ER area. The lower slopes of the Drakensberg Mountains support a greater variety of faunal species to that of the peaks. According to International Union Conservation of Nature (IUCN), red data faunal species likely to occur within the proposed ER area are included in the below.

TABLE 5-4: FAUNAL SPECIES OF CONSERVATION CONCERN POSSIBLY OCCURING WITHIN THE PROPOSED ER AREA

SPECIES	COMMON NAME	CONSERVATIONAL STATUS (IUCN)
Birds		
Bugeranus carunculatus	Wattled Crane	Vulnerable
Balearica regulorum	Grey Crowned Crane	Endangered
Anthropoides paradiseus	Blue Crane	Vulnerable
Heteromirafra ruddi	*Rudd's Lark*	Endangered
Gypaetus barbatus	*Bearded Vulture*	Critically Endangered
Circus maurus	*Black Harrier*	Endangered
Gyps coprotheres;	*Cape Vulture*	Endangered
Mammal		
Mystromys albicaudatus	White-tailed Rat	Endangered
Insects		
Paracilacris lateralis	Drakensberg Grass False Shieldback	Vulnerable
Reptiles		
Bradypodion thamnobates	Dwarf chameleon	Near threatened
Fish		
Oreochromis mossambicus	Mozambique Tilapia	Near threatened
Tomichia cawstoni	-	Critically endangered

The White-tailed Rat is the most widely distributed of all the species of conservation concern within the ER application area. Although its current geographic range is considered relatively wide, the extensive fragmentation of habitat and its decline due to grazing and agriculture has resulted in the listing of this species as endangered. Little is known about its preferred habitat with species accounts providing varying descriptions from 'black loam areas that consist of good vegetation cover' to 'sandy soils with good cover' and 'rocky, well covered slopes of dolerite and/ or basalt origin'.

In the region the 3 Crane species and the Black Harrier will favour wetland areas, particularly for breeding, but all will forage and occur widely in in high altitude grasslands. The vulture species forage extremely widely, but nesting sites and breeding are invariably restricted to south-facing vertical cliffs. Rudd's Lark is restricted to short grassland on crest and hilltops at 1700 to 2200 mamsl. A small isolated population is known from the Matatiele area, but its current status in this area is unclear and other populations could be present but overlooked.

5.1.8.3 Sites of conservation importance

Protected Areas

The Malekgalonyane (Ongeluksnek) Nature Reserve is located within the extent of the proposed ER area (see Figure 5-10). The 13 000 ha reserve was proclaimed in 1976. All areas with protected status under the National Environmental Management: Protected Areas Act, 2003 (No. 57 of 2003); Biodiversity Act, 2004 (Act 10 of 2004); National Forests Act, 1998 (No. 84 of 1998) and Mountain Catchment Areas Act, 1970 (No. 63 of 1970) (including those under application) have been excluded from the extent of the ER application.

The Maloti Drakensburg Transfrontier Conservation and Development Area (MDTFCA) straddles the 300km border between Lesotho and South Africa incorporating more than 600km of mountain range. Of distinct significance is the exceptional biodiversity of the region which includes over 2 500 species of flowering plant, approximately 13% of which are locally endemic. The Malekgalonyane (Ongeluksnek) Nature Reserve forms part of the MDTFCA.

National Protected Areas Expansion Strategy

The aim of the National Protected Area Expansion Strategy (NPAES) is to achieve cost effective protected area expansion for ecological sustainability and adaptation to climate change. The NPAES sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion. It deals with land-based and marine protected areas across all of South Africa's territory (SANBI BGIS).

Much of the proposed ER area is located in a NPAES focus area (see Figure 5-10). Focus areas are important for the land-based protected area expansion network as these areas are large, intact and unfragmented areas which are suitable for creation or expansion of large protected areas.

Stewardship areas

Provincial government (through Eastern Cape Parks and Tourism) and the Matatiele Local Municipality have identified areas for protection through the declaration of stewardship areas under the Matatiele Water Factory Project. The proposed declaration of stewardship areas aims to improve land management of the upper catchment landscape, enhance ecosystem services and build climate change resilience, which can generate sustainable livelihood benefits and enhance water security of the region. The initial draft of the Matatiele stewardship process was adopted by the Matatiele Council in May 2015 (https://umzimvubu.org/projects/current-activities/).

The initial draft comprises a stewardship plan and priority maps for the entire Matatiele Local Municipality area which includes seven target protected areas (see Figure 5-10), based on the expansion of Eastern Cape protected areas along with key criteria such as freshwater and biodiversity priority areas as identified in the status quo research. The initial identified target areas are indicated to guide initial discussions and are considered to undergo further refinement and discussion over time

(https://umzimvubu.files.wordpress.com/2014/10/matatiele-stewardship-process-outline-draft-1.pdf).

Biodiversity Hotspots

The Eastern Cape is known nationally and internationally for its high levels of biodiversity and endemism. The Maputaland-Albany-Pondoland Biodiversity hotspot extends stretches across 275 000 km^2 through parts of Mozambique, Swaziland and South Africa (see Figure 5-11) and is a globally recognised biodiversity hotspot. The Drakensberg-Alpine centre of endemism also extends over part of the area.

National Threatened Ecosystems

Section 52 of the National Environmental Management: Biodiversity Act, 2004 (No. 10 of 2004) provides for the listing of threatened ecosystems at both national and provincial level. The Mabela Sandy Grassland and the East Griqualand Grassland vegetation units are listed as vulnerable ecosystems within the proposed ER area (see Figure 5-9). Vulnerable ecosystems have a high risk of undergoing significant degradation. No critically endangered ecosystems are located within the proposed ER area (Mucina and Rutherford, 2006).

Freshwater ecosystems

The Water Research Commission and partners undertook the National Freshwater Ecosystem Priority Areas project (NFEPA). The project produced several outcomes including the Atlas of Freshwater Ecosystem Priority Areas in South Africa, which provides strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. The NFEPA is supported by an implementation manual that provides guidance on the use of FEPA maps when planning and decision-making impacts on freshwater ecosystems. The manual provides ecosystem management guidelines for river FEPAs, wetland FEPAs, sub-quaternary catchments associated with river FEPAs, and Upstream Management Areas. The purpose of freshwater ecosystem management is to conserve biodiversity patterns and ecological processes and to maintain natural variability. Management should aim to prevent the occurrence of large-scale damaging events, as well as the repeated, chronic, persistent, subtle events.

There are numerous NFEPA Rivers and wetlands located within the proposed ER area (Figure 5-7). The present ecological state of the NFEPA rivers located within the proposed ER area are classified as Class C (Moderately modified). The majority of the NFEPA wetlands are floodplain wetlands with the remainder consisting of channelled valley-bottom, flat and seep wetlands (Figure 5-7).

According to the NFEPA implementation manual, mining in any form (including prospecting/exploration) should not be permitted in wetland FEPAs or within 1km of a wetland FEPA buffer, or within 1km of a riverine buffer (including all associated wetland systems and tributaries) within a FEPA catchment. It is noted that there is no legislation regarding buffers around rivers or wetlands in the National Water Act, 1998. The width of a buffer required around a watercourse or wetland depends on many factors such as the risk the proposed development poses to the water resources, the sensitivity of receiving environment

and the proposed mitigation measures. The “Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries” (Macfarlane et al., 2014), currently under development by the Institute of Natural Resources is regarded as the most up to date tool for buffer zone determination.

Critical Biodiversity Areas (CBAs)

The Eastern Cape is globally recognised for its high biodiversity value and scenic beauty. It has the highest biome diversity of any province in South Africa. Recognising these important natural resources and the need to conserve them, the Department of Economic Development and Environment Affairs (DEDEA) together with the Department of Water and Sanitation (DWS) have collaborated to draw up the Eastern Cape Biodiversity Conservation Plan (ECBCP). The ECBCP addresses the urgent need to identify and map critical biodiversity areas and priorities for conservation in the Province. Critical Biodiversity Areas (CBAs) are terrestrial and aquatic features in the landscape that are critical for conserving biodiversity and maintaining ecosystem functioning (SANBI). The overall aim is to promote the sustainable utilisation of natural resources by avoiding the loss or degradation of natural habitat in CBAs and promoting sustainable development and natural resource utilisation throughout the landscape, particularly in natural areas. The ECBCP provides an assessment of the value of areas as determined by their necessity in meeting defined conservation targets.

The distribution of terrestrial CBAs located within the exploration area is illustrated in Figure 5-11. Category 1 Terrestrial CBAs are important given that these areas consist of endangered vegetation types and are essential for meeting biodiversity targets for biodiversity features. Category 2 and 3 Terrestrial CBAs are important as these areas consist of endangered and vulnerable vegetation types respectively (ECCPH, August 2007).

The distribution of aquatic CBAs located within the exploration area is illustrated in Figure 5-12. Category 1 Aquatic CBAs are important given that these areas comprise important river sub-catchments and wetlands. Category 2 CBAs are important given that these areas consist of important sub-catchments (ECCPH, August 2007).

It is therefore evident that much of the proposed ER area is considered to be ecologically sensitive. It must however be noted that a significant amount subsistence agriculture is taking place in the lower lying area of the region (See Figure 5-13). Many of the datasets do not give cognisance to this, or such use may have escalated in intensity. It is therefore likely that certain areas assigned conservation planning status may in reality be disturbed or cultivated.

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FIGURE 5-10: EXTENT OF THE PROPOSED ER AREA IN RELATION TO SITES WITH CONSERVATION STATUS

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FIGURE 5-11: AREAS OF ASSESSED TERRESTRIAL BIODIVERSITY STATUS WITHIN THE PROPOSED ER AREA

Separate electronic file

FIGURE 5-12: AREAS OF ASSESSED AQUATIC BIODIVERSITY STATUS WITHIN THE PROPOSED ER AREA

5.1.9 AIR QUALITY

5.1.9.1 Emission sources and pollutants of concern

There is no comprehensive emission inventory of priority sources and pollutants in the Eastern Cape. However, the 2013 Air Quality Management Plan for the Province highlighted sources of emissions for the Alfred Nzo and Joe Gqabi District Municipalities (DM). Industrial and manufacturing in the Joe Gqabi DM includes a large timber processing plant at Ugie and smaller plants in the forestry area in the east. There are no major industrial and manufacturing activities in the Alfred Nzo DM. There may be small boilers at the hospitals and prisons in the region.

The energy use profile for cooking and heating functions for the proposed ER area is diverse. Paraffin and wood use are used predominantly for heating purposes, followed by electricity. Other sources such as gas, coal, solar heating and animal dung are limited in use. During the winter period, more people rely on wood burning as a source of warmth, especially if they do not have electricity, as is the case in many rural areas.

The burning of wood for heating is associated with several consequences for indoor and ambient air quality and for human health. Smoke resulting from incomplete combustion of wood contains many chemical substances that are harmful such as hazardous air pollutants (HAPs), fine particle pollution (ash), and volatile organic compounds (VOC).

Motor vehicle emissions for Alfred Nzo and Joe Gqabi DM are not a significant source of air pollution when compared to urban areas. Other sources of air pollution in Joe Gqabi DM include waste burning and informal brick making using clamp kilns. Some tyre burning is carried out.

5.1.9.2 Ambient air quality

The majority of the proposed ER area is rural in nature and is comprised mostly of small towns, isolated farmsteads, (refer to Section 5.3.6), scattered communities and agricultural activities such as livestock grazing and crop cultivation. It follows that the air quality is expected to be good. Air quality may be compromised at times near waste burning sites and informal brick makers and in winter around concentrations of houses where fuel burning is used as a source of warmth. Veld fires are also a major contributor to reduced air quality in winter.

5.2 CULTURAL ENVIRONMENT

5.2.1 HERITAGE/CULTURAL RESOURCES

Only a few heritage surveys have been conducted in this area and the available data is incomplete and biased in terms of rock art. The area is exceptionally rich in rock art occurrences. Numerous San and pastoralist rock art sites are located in rock shelters in the sandstone outcrops. Of the 60 heritage sites

known in the area, 46 of these are rock art sites. It is highly likely that more sites are present in the area. the project area contains some of the finest executed shaded polychrome rock paintings in southern Africa. In fact, some of these paintings eland, in particular, are so exquisite that their artist has been dubbed the “San Michelangelo of Matatiele” (Woodhouse 1982). Flaking of the rock face typically occur in most shelters with subsequent permanent damage to the paintings. Many shelters are frequented by herd boys and other human visitors who often scribble their names over the paintings or even scratch-out complete images. Livestock often take shelter in the rock shelters and rub themselves against the painted surfaces thereby causing more damage. Several rock shelters and archaeological sites have been excavated in the project area (Malithetana 1 Rock Shelter, Kholokwe 1 Rock Shelter, Khinira 7 open site, Mafusing Rock Shelter). These shelters contained Later Stone Age tool and bone assemblages. Collectively, they provide evidence of San occupation of the southern Drakensberg area spanning various millennia.

There is very limited data on sites from the historical period, cultural landscape of living resources in the project area. This is more likely due to a lack of field surveys rather than an indication of their absence. The well-known Mariazelle Mission Station and the smaller Maria Linden Mission as well as the Ongeluksnek Mountain Pass are known historical features. Given the history of the greater Matatiele area it is to be expected that sites relating to the Griqua occupation of the area (from the 1860’s onward) could be located following systematic survey.

5.2.2 PALAEONTOLOGICAL RESOURCES

Paleontological surveys of the area are also limited although the underlying geology suggests that the area is very sensitive from a paleontological point of view. Fossils are associated with the Clarens Elliot Formation and Molteno Formations. Fossils associated with the Clarens Formation are well-known for the presence of dinosaur trackways and other trace fossils. The Molteno Formation is globally known for the presence of plant fossils belonging to the *Dicroiidium* assemblage. Very few vertebrate remains have been recorded from the formation, but trace fossils, including well-defined dinosaur trackways have been described from different localities in the Karoo Basin. The Elliot Formation is well-known for the abundance of prehistoric life forms that it contains. This includes reptilian (mainly dinosaur) fossils and fish fossils (SAHRIS).

The lower elevation sections of the proposed ER area are underlain by formations of high (Clarens Formation, Stormberg Subgroup, Karoo Supergroup) and very high sensitivity (Molteno and Elliot Formations). Taking the above into consideration there is a high likelihood of fossil occurrence within the proposed ER area.

5.3 SOCIO-ECONOMIC ENVIRONMENT

The proposed ER area is located within the Matatiele Local Municipality (MLM) which falls within the Alfred Nzo District Municipality (ANDM) and the Elundini Local Municipality (ELM) which falls within the Joe Gqabi District Municipality (JGDM). Further detail regarding the demographics of the Matatiele Local Municipality (MLM) and the ELM is provided below.

5.3.1 POPULATION

5.3.1.1 Population

The ANDM has a total population of 804 500 people. The ANDM population is predominantly female, constituting approximately 55% of the total population, while males constitute 45% (ANDM, 2014/2015).

The MLM consists of a population of approximately 203 843 people. The MLM has a similar population distribution to the ANDM, with females and males constituting 54% and 46% of the population, respectively (MLM, 2014/2015).

The ELM has an estimated population of 123 600 people. The male and female ratio constitutes 46.6% and 53.4% respectively of the overall population (ELM, 2012/2017).

5.3.2 EMPLOYMENT

The average unemployment rate for the ANDM is currently estimated to be 43.5% (ANDM, 2014/2015). The unemployment rate is currently estimated at 38.2% for the MLM, 2014/2015). The average unemployment rate of Elundini Local Municipal is 23.11% (ELM, 2012/2017).

5.3.3 HOUSEHOLDS

The majority of residents within the ANDM reside in traditional dwellings that are made of traditional materials (70%). Only 29% of the residents reside in formal dwellings such as a house, flat in block town house cluster (ANDM, 2014/2015). Approximately 49.7% of the MLM population and 33% of the ELM population live in formal houses/buildings. The remainder of the population reside in huts, shacks and caravans (MLM, 2014/2015 and (ELM, 2012/2017).

5.3.4 BASIC SERVICES

In the ANDM approximately 47% of households do not have access to drinking water. Waterborne sanitation is only provided in urban areas which constitutes approximately 79% of households. Toilets in rural areas comprise pit toilets. The bucket system has been totally eradicated. Approximately 6% of the population have access to electricity while the remainder of the population sources energy from alternatives means such as wood, gas and paraffin.

In the MLM approximately 49% of all households have access to clean drinking water through local water supply schemes. The remainder of the households rely on water from rivers, springs and dams. Waterborne sanitation is only provided in urban areas within the local municipality. Toilets in rural areas comprise pit toilets while the bucket system has been totally eradicated. Approximately 45% of households use electricity for lighting, leaving 65% of household's using alternative means of energy for lighting (MLM, 2014/2015).

Approximately 54 750 residents within the ELM obtain their drinking water from springs and rivers. Water borne sanitation is found in most urban area. The rural areas make use of pit toilets while the buck system has been eradicated. Approximately 43.6% of households use electricity for lighting within the ELM (ELM, 2012/2017).

5.3.5 EDUCATION

The ANDM has low education and literacy levels. Some 8% of the population has no education while 53% have only some form of primary school education. Only 14.2% of the population have completed grade 12, while only 4% of the population has attained any higher qualification (ANDM, 2014/2015).

The percentage of non-scholars in the MLM was 9.4% in 2011. The percentage of Children between the ages 6-13 that enrolled in school was 94.4% in 2011. Approximately 12.7% of the population have obtained a matric and the percentage of people that obtained a higher education is 3.1% (MLM, 2014/2015).

In the ELM approximately 15.9% of the population consists of non-scholars. Approximately 11.80% of the population have obtained a matric while only 5.2% of the population have obtained a higher education (ELM, 2012/2017).

5.3.6 CURRENT LAND COVER AND USES

5.3.6.1 Land Cover

See Section 5.1.5.

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FIGURE 5-13: LAND COVER AND SOCIAL FEATURES

5.3.6.2 Agricultural activities

Agricultural activities are limited to the low lying areas where the topography, water and soils are suitable for agriculture. Agricultural activities associated with the proposed ER area include a combination of commercial and subsistence farming. Commercial farming consists mainly of livestock farming (cattle, sheep and goats), maize and in some areas potatoes. In some areas commercial farming can be associated with irrigation. Subsistence farming is mostly associated with villages which undertake both subsistence and small scale commercial farming. Hand to mouth subsistence farming involves small amounts of cultivation and little profitability which is mostly associated with individual households. Small scale commercial farming takes place where produce is sold within the local villages. The grasslands around most of the villages and rural settlements is heavily grazed by mixed herds of domestic livestock.

5.3.6.3 Eco-tourism

The region is well known for its scenic beauty (particularly views of the Drakensberg) and revenue is generated from numerous eco-tourism activities. Many of these activities are widely dispersed but focus points include the Mehloding hiking trail and Malekgalonyane (Ongeluksnek) Nature Reserve.

The Mehloding hiking trail has a duration of four days and starts at the village of Motseng and follows a north easterly direction, passing through villages of Masupha, Mpharane, Goxe, Pepela, and ends nears the Qachas Nek border post.

5.3.6.4 Villages

Numerous villages are located within the exploration area (see Table 5-6). In addition to this, the relevant wards in which these villages are located are also provided in Table 5-5 below. The larger of these villages are shown in Figure 5-13.

TABLE 5-5: WARDS AND ASSOCIATED VILLAGES (DEMARCATION BOARD)

MUNICIPALITY	RELEVANT WARD	RELEVANT VILLAGES
Elundini Local Municipality	Ward Councillor: Ward 12	Mahaneng, eMazizini
	Ward Councillor: Ward 13	Mashata, Sethathai. Mabutyana, Mohoabatsana' Mutkuk Swquobong, Thoteng Koebung, Ha-Sefoko, Black Fountain, New stand
Matatiele Local Municipality	Ward Councillor: Ward 7	Ha-Nkonwane, Tisita
	Ward Councillor: Ward 8	Nchodo, Bellford, Mafube Mission Monkhankhaneng, Nkosana, Pehong Matewu,
	Ward Councillor: Ward 11	Felleng, Mapfontein, Ponstseng, Tsikarong Tereseng, Tutaneng, Pepela, Mabua Makomereng, Goxe, Potlo, Kwambobo, Sabasaba

MUNICIPALITY	RELEVANT WARD	RELEVANT VILLAGES
	Ward Councillor: Ward 12	KwaNkau, Nkaus, Sekhutlong, Kwasikulumi, Moqhobi, Machekong, Phuthing
	Ward Councillor: Ward 13	Ha-Tlakanelo, Ha-Mohapi, Mpharane, Mahareng, Likamoreng, Kabaka, Tsekong, Ha-Masupha
	Ward Councillor: Ward 14	Lowell, Collingwood, Mariazell Mission Mapheelle, Ha-Moeketsi, Letlapeng Ha-Ramoshanyana, Thabachitja Liqalabeng, Koaring, Mapoleseng Kraal, Mafikalisiu, Tlokoeng, Mafikadisiu, Mateleng, Mafikallisiu
	Ward Councillor: Ward 15	Likhalong, Mosana
	Ward Councillor: Ward 16	Mtshatshaneni, Ha-Majono, Lekhahla, Lihetlane
	Ward Councillor: Ward 25	Matshona

5.3.6.5 Towns

There are no major towns located within the proposed ER area. Matatiele to the east is the largest town in the region.

5.3.6.6 Core Astronomy Areas

To date no Core or Central Astronomy Advantage Areas have been declared within the exploration right application area.

5.3.6.7 Local transport network

No main roads are associated with the ER area; rather numerous gravel roads linking the various villages are located within the exploration area.

There are no railways lines within the ER area.

5.3.6.8 Border posts

Two border posts into Lesotho are located within the exploration area. These include the Qacha's Nek Border post and the Ongeluksnek Border post. The location of these border posts is illustrated in Figure 5-13.

5.3.6.9 Existing Mineral Rights

Rhino Oil and Gas obtained data from the National DMR on mineral rights holders. This data indicated that there are no other mineral rights holders with the proposed ER area. There is thus no requirement for consultation with mineral rights holders.

5.3.6.10 Land Claims

SLR submitted a request to the Regional Land Claims Commissioner: Eastern Cape with respect to the proposed ER area. The commissioner indicated that Chief Lebenya has a pending claim on a large number of the properties within the ER application area.

6 IMPACT DESCRIPTION AND ASSESSMENT

This Chapter describes and assesses the significance of potential impacts related to the proposed exploration activities. The potential impacts of the proposed aerial FTG survey are addressed below.

The potential impacts of core hole drilling and seismic surveys have not been assessed in this EIA as they do not form part of the proposed 'early-phase exploration' work for which Rhino Oil and Gas are seeking environmental authorisation. Refer to Section 4.5.1 for further details.

All impacts are systematically assessed and presented according to predefined rating scales (see Section 3.3.5). The significance of impacts with and without mitigation is also assessed. The status of all impacts should be considered to be negative unless otherwise indicated. Mitigation or optimisation measures are proposed which could ameliorate the negative impacts or enhance potential benefits, respectively.

6.1 AIRBORNE FULL TENSOR GRADIOMETRY

For a description of the FTG activity please refer to Section 4.5.5.

6.1.1 BIOPHYSICAL IMPACTS

The flying of a light aircraft to undertake an FTG survey is not anticipated to have any impact of significance on the biophysical environment. Overpass flights of light aircraft are not uncommon over the region, even protected areas. Other than a momentary flight response, it is estimated that the impact of noise on wildlife would be **insignificant**.

6.1.2 CULTURAL/ HERITAGE IMPACTS

The flying of a light aircraft to undertake an FTG survey is not anticipated to have any impact of significance on the cultural or heritage environment. Any noise impact would be as described below.

6.1.3 SOCIO-ECONOMIC IMPACTS

6.1.3.1 Noise Impacts

Description of impact

The noise generated by a light aircraft flying at a low altitude (approximately 100 m) could be a nuisance to or result in the localised disturbance of a receptor. No health impacts (such as loss of hearing or increased blood pressure) are anticipated based on the proposed FTG survey.

Assessment

Based on a light aircraft (e.g. Cessna) flying at a low altitude of + 80 m, it is estimated that the maximum noise level would not exceed 70 dBA outdoors and 60 dBA indoors. The latter is similar to conversational speech measured at 1 m.

It is estimated that in good weather the survey (up to a maximum of 4 000 km^2) would take less than seven days to complete. At any one location the duration of the overflight would be tens of seconds. At a receptor location there would be a gradual increase in sound level above the ambient level as the aircraft approaches; increase to a maximum level overhead; then decrease to below the residual level as the aircraft recedes. Thus the noise outdoors would be audible for no more than a minute or two as the aircraft passes over (i.e. very low duration). Indoors the noise generated would probably not be noticed. Although the survey would cover wide areas, the extent of the impact is localised for each receptor. Where there are no receptors there would be no impact. Thus, depending on the selected flight path, an impact is possible.

Although aircraft noise would increase noise levels in what are largely quiet rural and agricultural areas, only a slight disturbance or nuisance is anticipated (i.e. **low** intensity). Based on these considerations and the fact that disturbances from light aircraft are not uncommon with a multitude of light aircraft working in and traversing the region, the significance of this impact is considered to be **very low** before and after mitigation.

Mitigation

- All planned survey flights should comply with local civil aviation rules.
- Flight paths must be pre-planned to avoid special nature reserves, national parks and world heritage sites. Where this is not possible, an altitude of 2 500 feet (762 m) should be maintained (as per Section 47(1) of NEMPRAA), unless permission is obtained from the management authority or in an emergency.
- All pilots must be briefed on ecological risks associated with flying at a low level over sensitive areas.
- Where flights are planned to occur over game farms, landowners should be notified of the survey programme prior to survey commencement.

TABLE 6-1: IMPACT OF FTG AIRCRAFT ON NOISE

RATING SCALES	WITHOUT MITIGATION	WITH MITIGATION
Status	**Negative**	**Negative**
Intensity	**Low**	**Very low**
Duration	**Very low**	**Very low**
Extent	**Very low**	**Very low**
Consequence	**Very Low**	**Very Low**
Probability	**Medium**	**Medium**
Significance	**Very Low**	**VERY LOW**

Confidence	High	High
Nature of cumulative impact	Other activities that may contribute to the cumulative impact include other disturbances from light aircrafts, which are not uncommon in the region. Cumulative impact is considered to be of LOW significance.	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	None	
Degree to which impact can be mitigated	Very Low	

6.2 LOCAL LIMITATIONS TO EXPLORATION

As discussed in the preceding sections, the flying of a light aircraft to undertake an FTG survey would be unlikely to pose significant risk to the environment. As a result there are relatively few constraints arising from legislation, regulation, guidelines and best practice that would apply. Compliance with civil aviation rules would be key as would maintenance of a minimum altitude of 2 500 feet (762 m) over protected areas (as per Section 47(1) of NEMPRAA).

The flying of a light aircraft to undertake an FTG survey would have no effect on water use or availability and could therefore be undertaken without regard for water related constraints and restrictions.

At the time of completion of the EIA report there was no indication of any change to the public or landowner position with regards the application. The majority opinion is opposed to exploration for unconventional gas or petroleum resources in the ER application area. Rhino Oil and Gas has been advised of this and the challenges it may pose to exploration.

6.2.1 EFFECT OF GRANTING OF AN EXPLORATION RIGHT

Description of impact

There is strong public opinion and I&APs refer to a significant body of evidence from around the world (not least that fracking is banned in a growing number of countries and territories), that late phase exploration and production of unconventional gas has huge risks to society and the environment. Such risks are borne by the landowners and local communities who do not participate in the economic benefits that accrue to the right holder and government. While there may be a consumer driven need for hydrocarbon extraction, the risks and costs to society and the environment far outweigh the benefits. The extraction of unconventional hydrocarbons is therefore not wanted in the Eastern Cape.

Even though early-phase exploration may have impacts of low significance, the public have raised concern that the granting of an exploration right would set in motion the development of a petroleum extraction project that would be extremely difficult to stop. Because the granting of this exploration right will set in a motion a process with an unknown outcome and risk, it should not be approved.

Assessment

The MPRDA provides that the State, as custodian of mineral and petroleum resources in South Africa, may issue mineral and petroleum rights to applicants. Such rights must enable the sustainable development of South Africa's mineral and petroleum resources within a framework of national environmental policy, while promoting economic and social development.

The granting of a right has no effect on the presence or absence of a resource, merely on whom has the entitlement to that mineral (i.e. minerals and petroleum exist regardless of the holder). A mineral and/or petroleum right is only part of the regulatory approval required by a holder and in isolation does not enable the holder to access the subject mineral. A holder must also have obtained environmental authorisation in terms of Chapter 5 of the NEMA. Furthermore, a mineral and/or petroleum right and environmental authorisation do not provide blanket approval for any conceived operation, but are both particular to the specific activities that the holder has detailed in an application. The holder is also required to negotiate access with the land owner and determine payment of compensation for loss or damages due to the specific activities. It is therefore presented that the grant of a right over a parcel of land does provide the holder carte blanche with respect to the mineral and land in question. There is thus not necessarily a direct conflict with the land owners' right to use the surface. It would in fact be the undertaking of specified activities that could result in an impact on or conflict between the land owner and the mineral and/or petroleum rights holder (if any). Such specified activities would have been subject to approval through an environmental authorisation process. In the case of this application by Rhino Oil and Gas, only remote sensing activities are included which have been shown not to have any impact on the environment.

Any further exploration (beyond what may be approved in an environmental authorisation) would have to be subject to the requisite environmental assessment and authorisation process under the NEMA and an amendment to the ER in terms of the MPRDA. Such processes assess the merits of an application in light of the principles of sustainable development as set out in Section 2 of NEMA. An environmental authorisation process would not grant approval for the undertaking of activities resulting in impacts of unacceptable significance. A decision could include a refusal of the authorisation if unacceptable impacts were predicted as a result of the specified activities. Each of the right approval sections in the MPRDA (80 and 84) sets out that rights may only be granted if the activity will not result in unacceptable pollution, ecological degradation or damage to the environment. Thus a decision to grant the current ER application by Rhino Oil and Gas (for remote sensing activities only) does not guarantee that future applications for further exploration or production would be approved.

It is also noted that the specified activities associated with a mineral and/or petroleum right may also be subject to approval requirements under other legislation. The need for such authorisations (e.g. water use licence, land use planning permission etc) provide further permitting frameworks for impact assessment and management.

Mitigation

- The conditions of the exploration right and environmental authorisation (if granted) should specifically limit exploration activity in terms of the approvals to desktop and remote sensing activities.
- Any further exploration or future production activities must be subject to the requisite environmental assessment and authorisation process under the NEMA and an amendment to the exploration right in terms of the MPRDA.

6.3 "NO-GO" ALTERNATIVE IMPACTS

Description of impact

The "no-go" alternative is the non-occurrence of the proposed exploration activities. The positive implications of not going ahead with the proposed exploration are:

- no impacts resulting from the FTG survey within the exploration right area;
- no (reduced) chance of any risks arising from further exploration or future production; and
- allayment of the current majority opposition from the public.

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 in the Eastern Cape;
- Lost economic opportunities related to sunken costs (i.e. costs already incurred) of initial desktop investigations in the proposed exploration licence area;
- If economic oil and gas reserves do exist and are not developed, South Africa / Rhino Oil and Gas would lose the opportunity to maximise the use of its own indigenous oil and gas reserves; and
- Other sources of energy would need to be identified and developed in order to meet the growing demand in South Africa.

Assessment

As noted in the Need and Desirability section (see Section 4.3), there is a drive from national and provincial Government to stimulate development and grow the economy of South Africa. In order to facilitate this economic growth, there is a need to ensure that there is sufficient capacity in the country's electricity supply by diversifying the primary energy sources within South Africa. One of the proposals to meet this aim is to develop the oil and gas sector within the country.

Onshore exploration and production of unconventional oil and gas could bring about significant economic growth. Since the scale and potential of such an industry are not known, the potential impacts associated with the future industry are also not known. It is also acknowledged that the onshore production of unconventional oil and gas could potentially result in environmental damages. Since the scale,

technology, location and extent of these possible activities are not known, the potential biophysical and socio-economic impacts associated with the future industry are also not known.

If onshore exploration does not proceed and domestic gas is not considered as a possible energy source, the anticipated electricity demand for South Africa would need to be met through other means (e.g. renewables, coal, nuclear or imported gas), all of which would have their own biophysical and socio-economic impacts. Since the scale, technology, location and extent of these possible alternatives are not known, the potential impact associated with these alternatives is not known.

The great majority of I&APs that have participated in the EIA process have expressed their opposition to all forms of oil and gas exploration in the Eastern Cape and to this application in particular. Thus the "no-go" alternative would alleviate much of the anxiety and concerns related to potential future shake gas development should reserves be identified for further exploration and/or future production.

Given the wide array of unknown facts regarding the potential for economic growth and the potential for environmental impacts arising from unconventional gas production, as well as the unknown facts of the future energy mix in the absence of gas, the overall impact associated with the "no-go" alternative is considered to be of **unknown significance**.

Mitigation

The only way to derive information on the potential of domestic onshore unconventional oil and gas resources is to undertake early-phase exploration such as is proposed. It is only with the results of exploration in hand that many of the current unknowns and assumptions can be confirmed. Such results may confirm that onshore domestic onshore unconventional oil and gas is prospective or that it is not.

In many cases it would only be through the undertaking of early-phase exploration that data and information necessary to understand the potentially affected environmental parameters and the risks thereto of a domestic onshore unconventional oil and gas industry could be derived.

7 CONCLUSIONS AND RECOMMENDATIONS

This chapter summarises the key findings of the EIA.

The proposed exploration right application with its associated activities requires authorisation in terms of both the MPRDA and NEMA. SLR, appointed as the environmental assessment practitioner by Rhino Oil and Gas, has undertaken a Scoping and EIA process in terms of the EIA Regulations 2014 to inform an authority decision on the application made for environmental authorisation under the NEMA. The range of impacts, as identified through the Scoping process, has been assessed in the EIA. The two main objectives of this EIA are, firstly, to assess the significance of environmental impacts resulting from the proposed exploration activities and secondly to suggest the methods and commitments required to mitigate negative impacts and enhance benefits.

Rhino Oil and Gas is proposing to undertake exploration for potential hydrocarbon resources. The current ER application only includes remote exploration techniques which are early-phase activities, aimed identifying areas with the ER area which may be suitable for further exploration activities to identify possible petroleum resource within the ER application area (approximately 110 527 ha). The initial three-year exploration work programme is restricted to analysis of existing data and an aerial full tensor gradiometry gravity survey. If the application is approved Rhino Oil and Gas would be in a position to conduct the remote exploration techniques and to develop a more detailed understanding of the potential oil and gas resources in the application area. Thereafter, should Rhino Oil and Gas propose to conduct ground-based exploration activities (core boreholes and seismic surveys) this would necessitate a further application to PASA and a separate environmental assessment and authorisation process in terms of NEMA.

7.1 SUMMARY OF SPECIALIST FINDINGS

Specialist studies were commissioned but not completed for this EIA as the revised scope of the exploration work programme did not warrant their inclusion. The generic feedback from the specialists was that certain portions of the proposed ER application area are considered to be environmentally sensitive and that care would be required in selecting sites for ground-based exploration if impacts are to be avoided to an acceptable level. However, accurate representation of such sensitivities was problematic at the scale of the ER application area. The specialists suggested that measures should be put in place to select target exploration sites outside of areas of moderate to high sensitivity and previously disturbed areas should be favoured. It was recommended by the specialists that evaluation of specified sites be undertaken by appropriate specialists at the time when application is made for environmental authorisation of those activities.

7.2 ENVIRONMENTAL IMPACT STATEMENT

7.2.1 KEY FINDINGS

The key finding of the EIA is of a stark contrast between very low significance impacts resulting from an exploration work programme which is limited to desktop and remote sensing methods and extremely strong public opposition to all forms of exploration for onshore unconventional gas.

As discussed below, the assessment concludes that the impacts of proposed exploration activities would be extremely limited in extent, widely dispersed, of very short duration and very low intensity and would there have very low significance. On the simple merits of the application there is therefore no environmental reason why the exploration activities should not be approved. All of the ER application area, as shown in Figure 1-1 would be suitable for the undertaking of the remote sensing exploration methods as proposed. It is noted however that the proposed activities are likely to be the first in a series of exploration stages comprising activities that would likely increase in impact significance (if exploration was successful and the project proceeded to the following stages). The intensity and duration of such impacts would likely increase with each subsequent phase, but would likely become confined to increasingly limited target areas.

The public opposition to the exploration right application has been strongly voiced and have been received almost unanimously from all the sectors of society that have participated in the EIA. It is evident however that the majority of the opposition is not directly against the merits of exploration activities as proposed, but rather against the anticipated outcome and risks that, if successful, could result from exploration. The public perception is interpreted to be that issuing of an exploration right will lead to successful exploration; that would result in production which, must happen with the use of hydraulic fracturing; which will lead to widespread impacts on water and land causing devastation to local livelihoods. The perception is informed by the widely publicised, purported negative effects of hydraulic fracturing and the decisions taken by many governing bodies from around the world to suspend such activities. The related concern is that once an exploration right is granted, it will be nearly impossible to stop the process later, even if the environmental risks to local receptors outweigh the benefits. This is seen to arise from a mistrust and or misunderstanding of the governance framework that is in place to regulate petroleum exploration and production; concern as to whether government can balance the needs and interests of local people against such development that would potentially contribute to national coffers and an expectation that enforcement of compliance with environmental management obligations would be poor. For these reasons the public approach is to ‘close the door on exploration before it opens’, thereby preventing any future risk, or potential benefit, from resulting.

7.2.2 SUMMARY OF IMPACTS

7.2.2.1 Noise from Aerial FTG Surveys

The flying of a light aircraft to undertake an FTG survey is not anticipated to have any impact of significance on the biophysical environment. Overpass flights of light aircraft are not uncommon over the region, even protected areas. Other than a momentary flight response, it is estimated that the impact of noise on wildlife would be **insignificant** (A. Jongens, pers comm). There will similarly not be any impacts of significance on the cultural or heritage environment.

The flying of a light aircraft for the FTG survey will generate noise that could impact on receptors. Based on a light aircraft (e.g. Cessna) flying at a low altitude of + 80 m, it is estimated the maximum noise levels would typically not exceed 70 dBA outdoors and 60 dBA indoors. The latter level is similar to conversational speech measured at 1 m. It is likely that in good weather the FTG survey (up to a maximum of 4 000 km^2) would take less than seven days to complete. At any one location the duration of the overflight would be tens of seconds.

The noise generated by a light aircraft flying at a low altitude (approximately 100 m) could be a nuisance to or result in the localised disturbance of a receptor. No health impacts (such as loss of hearing or increased blood pressure) are anticipated from the proposed FTG survey. At a receptor location there would be a gradual increase in sound level above the ambient level as the aircraft approaches; increase to a maximum level overhead; then decrease to below the residual level as the aircraft recedes. Thus the noise outdoors would be audible for no more than a minute or two as the aircraft passes over (i.e. very low duration). Indoors the noise generated would probably not be noticed. Although the survey would cover wide areas, the extent of the impact is localised for each receptor. Where there are no receptors there would be no impact. Thus, depending on the selected flight path, an impact is possible.

Although aircraft noise would increase noise levels in what are largely quiet rural and agricultural areas, only a slight disturbance or nuisance is anticipated (i.e. **low** intensity). Based on these considerations and the fact that disturbances from light aircraft are not uncommon with a multitude of light aircraft working in and traversing the region, the significance of this impact is considered to be **very low** before and after mitigation. All planned survey flights should comply with local civil aviation rules. Flight paths must be pre-planned to avoid special nature reserves, national parks and world heritage sites.

7.2.2.2 Local Limitations to Exploration

As discussed in the preceding section, the flying of a light aircraft to undertake an FTG survey would be unlikely to pose significant risk to the environment. There are thus relatively few constraints arising from legislation, regulation, guidelines and best practice. Compliance with civil aviation rules would be key as would maintenance of a minimum altitude of 2 500 feet (762 m) over protected areas (as per Section 47(1) of NEMPRAA).

The flying of a light aircraft to undertake an FTG survey would have no effect on water use or availability and could therefore be undertaken without regard for water related constraints and restrictions.

At the time of completion of the EIA report there was no indication of any change to the public or landowner position with regards the application. The majority opinion is opposed to exploration for unconventional gas or petroleum resources in the ER application area.

7.2.2.3 Effect of Granting of an Exploration Right

Even though early-phase exploration may have impacts of low significance, the public have raised concern that the granting of an exploration right would set in motion the development of a petroleum extraction project that would be extremely difficult to stop. Because the granting of this exploration right will set in a motion a process with an unknown outcome and risk, it should not be approved.

The MPRDA provides that the State, as custodian of mineral and petroleum resources in South Africa, may issue mineral and petroleum rights to applicants. Such rights must enable the sustainable development of South Africa's mineral and petroleum resources within a framework of national environmental policy, while promoting economic and social development.

The granting of a right has no effect on the presence or absence of a resource, merely on whom has the entitlement to that mineral (i.e. minerals and petroleum exist regardless of the holder). A mineral and/or petroleum right is only part of the regulatory approval required. A holder must first have obtained environmental authorisation in terms of Chapter 5 of the NEMA. Both a mineral and/or petroleum right and environmental authorisation are particular to the specific activities that the holder has detailed. A holder is also required to negotiate access with the land owner and determine payment of compensation for loss or damages due to the specific activities. It is therefore not the grant of a right over a parcel of land, but the undertaking of specified activities that could result in an impact on or conflict between the land owner and the mineral rights holder (if any). Such specified activities would have been subject to approval through an environmental authorisation process. In the case of this application by Rhino Oil and Gas, only remote sensing activities are included which have been shown not to have any impact on the environment.

Any further exploration (beyond what may be approved in an environmental authorisation) would have to be subject to the requisite environmental assessment and authorisation process under the NEMA and an amendment to the ER in terms of the MPRDA. Such processes assess the merits of an application in light of the principles of sustainable development as set out in Section 2 of NEMA. An environmental authorisation process would not grant approval for the undertaking of activities resulting in impacts of unacceptable significance. A decision could include a refusal of the authorisation if unacceptable impacts were predicted as a result of the specified activities. Each of the petroleum right approval sections in the MPRDA (80 and 84) sets out that rights may only be granted if the activity will not result in unacceptable

pollution, ecological degradation or damage to the environment. Thus a decision to grant the current ER application by Rhino Oil and Gas (for remote sensing activities only) does not guarantee that future applications for further exploration or production would be approved.

It is also noted that the specified activities associated with a mineral and/or petroleum right may also be subject to approval requirements under other legislation. The need for such authorisations (e.g. water use licence, land use planning permission etc) provide further permitting frameworks for impact assessment and management.

7.2.2.4 No-go

The positive implications of not going ahead with the proposed exploration are:

- no impacts resulting from the FTG survey;
- no (reduced) chance of any risks arising from further exploration or future production; and
- allayment of the current majority opposition from the public.

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 in the Eastern Cape;
- Lost economic opportunities related to sunken costs (i.e. costs already incurred) of initial desktop investigations in the proposed exploration licence area;
- If economic oil and gas reserves do exist and are not developed, South Africa / Rhino Oil and Gas would lose the opportunity to maximise the use of its own indigenous oil and gas reserves; and
- Other sources of energy would need to be identified and developed in order to meet the growing demand in South Africa.

As noted in the Need and Desirability section (see Section 4.3), there is a drive from national and provincial Government to stimulate development and grow the economy of South Africa. In order to facilitate this economic growth, there is a need to ensure that there is sufficient capacity in the country's energy supply by diversifying the primary energy sources within South Africa. One of the proposals to meet this aim is to develop the domestic oil and gas sector within the country.

Onshore exploration and production of unconventional oil and gas could bring about significant economic growth. Since the scale and potential of such an industry are not known, the potential economic impacts associated with the future industry are not known. It is also acknowledged that the onshore production of unconventional oil and gas could potentially result in environmental damages. Since the scale, technology, location and extent of these possible activities are not known, the potential biophysical and socio-economic impacts associated with the future industry are also not known.

If onshore exploration does not proceed and domestic gas is not considered as a possible energy source, the anticipated electricity demand for South Africa would need to be met through other means (e.g. renewables, coal, nuclear or imported gas), all of which would have their own biophysical and socio-economic impacts. Since the scale, technology, location and extent of these possible alternatives are not known, the potential impact associated with these alternatives is not known.

The great majority of I&APs that have participated in the EIA process have expressed their opposition to all forms of oil and gas exploration in the Eastern Cape and to this application in particular. Thus the "no-go" alternative would alleviate much of the anxiety and concerns related to potential future shake gas development should reserves be identified for further exploration and/or future production.

Given the wide array of unknown facts regarding the potential for economic growth and the potential for environmental impacts arising from unconventional gas production, as well as the unknown facts of the future energy mix in the absence of gas, the overall impact associated with the "no-go" alternative is considered to be of **unknown significance**.

7.3 IMPACT MANAGEMENT OBJECTIVES AND OUTCOMES

The overall impact management objective for Rhino Oil and Gas is to undertake exploration in a socially, environmentally and economically sustainable manner. With only remote sensing exploration methods under consideration by the applicant, no specific impact management objectives or outcomes are necessitated.

7.4 FINAL PROJECT ALTERNATIVES

The focus of the application for environmental authorisation is now only on remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey). Rhino Oil and Gas has excluded the core hole drilling and seismic surveying from the proposed 'early-phase exploration' work. A benefit of this revised approach is that any future application for ground-based exploration activities would be focussed on specified sites, thereby enabling directly affected parties to participate meaningfully and the future environmental assessment to investigate and report on the site's environmental attributes. This addresses some of the concerns raised by I&APs relating to the location of proposed ground-based exploration activities.

If the revised application is approved, Rhino Oil and Gas would only be in a position to conduct remote exploration techniques and to develop a more detailed understanding of the potential oil and gas resources in the application area. Thereafter, should Rhino Oil and Gas propose to conduct ground-based exploration activities at target sites, this would need to be informed by a further application to PASA and a separate environmental assessment and authorisation process.

7.5 RECOMMENDATION / OPINION OF ENVIRONMENTAL ASSESSMENT PRACTITIONER

The key principles of sustainability, including ecological integrity, economic efficiency, and equity and social justice, are integrated below as part of the supporting rationale for recommending an opinion on whether the proposed project should be approved or not.

Ecological integrity

It is SLR's opinion that the remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey) as proposed would have no direct impact on the ecology, biodiversity or conservation status of any habitat or species within the ER application area.

Economic efficiency

It is SLR's opinion that the remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey) as proposed would have no direct impact on any aspect of the local economy within the ER application area.

Equity and social justice

It is SLR's opinion that the remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey) as proposed would have no direct impact on any social aspect within the ER application area. That being said, there remains the fact the majority of I&APs consulted are opposed to the grant of the Exploration Right application for unconventional gas or petroleum resources.

It is therefore the opinion of SLR in terms of the sustainability criteria described above and the nature and extent of the proposed early-phase exploration programme (remote sensing only), that the generally VERY LOW significance of the impacts, with the implementation of the proposed mitigation measures, should support a positive decision being made by the Minister of Mineral Resources (or delegated authority) in this regard. Since the proposed exploration activities are associated with Rhino Oil and Gas's initial three-year exploration work programme, the applicant requests that that Environmental Authorisation (should it be granted) be issued and remain valid for a period of three years or more.

7.6 FINANCIAL PROVISION

In terms of Section 24P of NEMA and associated regulations pertaining to the financial provision (GN. R1147), 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.

The estimated cost for management and / or rehabilitation of potential negative environmental impacts that might be incurred during the proposed remote sensing exploration activities is nil.

7.7 DEVIATIONS FROM SCOPING

As discussed in Section 1.2, and detailed in Section 4.4, the extent of the ER application area has changed since acceptance of the Scoping Report due to the removal of the Malekgalonyane (Ongeluksnek) Nature Reserve from the ER application area. This change did not require any addition to the Plan of Study as presented in the EIA.

As discussed in Section 1.2 and detailed in Section 4.5.1, Rhino Oil and Gas excluded the ground-based core hole drilling and seismic survey from the proposed 'early-phase exploration' work for which they are seeking environmental authorisation. The current focus of the application and the related environmental assessment work is now only on remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey). This change did not require any addition to the Plan of Study as presented in the EIA.

The Plan of Study presented in the Scoping Report detailed the undertaking of six specialist studies. However, with exclusion of core hole drilling and seismic survey activities from the scope of the EIA (see Section 4.5.1) these studies are not applicable and as such their findings have not been incorporated into the EIR. Detailed investigations of target sites would need to be undertaken during the environmental assessment and authorisation application process for future ground-based exploration activities.

In accepting the Scoping Report, the PASA specified a condition that where desktop data was used during environmental assessment this should be subject to authentication by physical assessment. With core hole drilling and seismic survey activities no longer included in the scope of the EIA there was no merit in undertaking such work.

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9 ENVIRONMENTAL MANAGEMENT PROGRAMME

This chapter lists the auditable environmental management objectives, outcomes and actions required to avoid or minimise impacts on the environment from the proposed exploration activities.

9.1 INTRODUCTION

This EMPR is based on the results of the EIA undertaken by SLR for the Exploration Right ("ER') application to explore for petroleum products on various farms in the magisterial districts of Matatiele and Mount Fletcher, Eastern Cape, South Africa (12/3/295 ER). The EMPR aims to address the potential environmental impacts resulting from the proposed early-phase exploration work for which authorisation is sought. The EMPR has been prepared as per the requirements of the EIA Regulations 2014 and Appendix 4 thereto. The EMPR, once approved by the competent authority, is a legal document and Rhino Oil and Gas is overall accountable and responsible for the implementation thereof.

9.2 DESCRIPTION OF THE ASPECTS OF THE ACTIVITY COVERED BY THE EMPR

Details of the activities proposed by Rhino Oil and Gas that are regulated by this EMPr are described in Section 4.5 of the EIA report. The activities covered by the EMPr include an aerial full tensor gradiometry gravity survey (maximum total survey size of 4000 square kilometres).

9.3 DETAILS OF THE EAP

Details and the expertise of the EAP who prepared this EMPr are provided in Section 3.1.1 of the EIA report.

9.4 RESPONSIBLE PERSONS

It is the responsibility of Rhino Oil and Gas to implement the EMPR and to make sure that all the actions are carried out. The successful implementation of the EMPR is dependent on clearly defined roles and responsibilities for each of the management actions given. Roles have been ascribed to the following parties:

Position	Responsibility in terms of the EMPR
Rhino Exploration Manager	Overall responsible for the Exploration programme including its planning and design, operations and closure phases. Takes overall responsibility for compliance to the EMPR.
Rhino Exploration Geologist	Responsible for the management of the Exploration programme, all employees and contractors. Takes responsibility for implementation of the EMPR.
Rhino SHEQ Manager:	Environmental personnel at Rhino Oil and Gas responsible for: • Overseeing environmental compliance of all operations with respect to EMPR and legislation; • Appointment of external parties required to fulfil EMPR obligations; • Provision of awareness and training material;

	• Conducting regular inspection meeting with the Exploration Geologist; • Report non-compliance to the Exploration Geologist.
Contractors	Appointed to supply specific exploration services to Rhino Oil and Gas. The Site Manager must be nominated to ensure for implementation of the EMPR with respect to contractor activities. Reports non-compliance to the Rhino SHEQ Manager.
Independent Environmental Scientist	External party (or parties) appointed to supply specific environmental services, required by the EMPR, through the course of exploration. Such services may include: Site Assessment, water quality monitoring, Rehabilitation monitoring, EMPR compliance audits.

9.5 STRUCTURE OF THE EMPR

The EMPR is set out to provide environmental management i) objectives, ii) outcomes and iii) actions. Each of these is presented for the following phases of the exploration work programme:

- planning and design;
- undertaking of exploration; and
- rehabilitation and post closure.

Pre-construction and construction phases are not considered as they do not have relevance to the exploration work programme.

9.6 IMPACT MANAGEMENT OBJECTIVES

The section below provides a description of the objectives of the EMPr.

The overall objective of impact management is to avoid the occurrence of impacts, then reduce the significance of negative impacts and enhance positive impacts as far as practicably possible and lastly to rehabilitate any disturbances resulting from exploration. The key objectives are to:

- undertake exploration in a socially, environmentally and economically sustainable manner;
- meet all regulatory conditions;
- maintain Rhino Oil and Gas' reputation;
- provide for a forum for consultation with land owners and affected parties; and
- facilitate socio-economic development where practicable.

9.6.1 PLANNING AND DESIGN

Specific impact management objectives for the planning and design phase are to:

- Identify the grid routes for the FTG;
- Implement a screening approach when identifying potential routes in order to avoid impacts; and
- Consult with land owners where required.

9.6.2 UNDERTAKING OF EXPLORATION

Specific impact management objectives during the exploration phase are to:

- minimise disturbance to the ecological environment;
- minimise disturbance on the biophysical environment including the protection of soils, surface water and groundwater during exploration operations;
- minimise disturbances to cultural and heritage sites;
- minimise disturbance to current land uses, land owners and neighbouring activities; and
- gather environmental information relevant to monitor potential impacts and inform assessment and management of future activities.

9.6.3 REHABILITATION AND POST CLOSURE

The primary closure objective is to ensure that exploration decisions and actions throughout operations, and specifically during closure, enable a condition approximating the pre-exploration condition or better to be achieved at any site impacted by an exploration activity.

9.7 IMPACT MANAGEMENT OUTCOMES

The section below provides a description of the desired outcomes (i.e. standards to be achieved) of mitigation that is proposed in order to manage, remedy, control or modify potential impacts. The specific actions identified to achieve these outcomes are described in the following section.

9.7.1 PLANNING AND DESIGN

Specific impact management outcomes for the planning and design phase are to:

- select FTG grid routes that satisfy exploration need and legislative requirements; and
- collate sufficient data to provide for confirmation of impacts during and post exploration.

9.7.2 UNDERTAKING OF EXPLORATION

Specific impact management outcomes during the exploration phase are:

- No significant change to the soil properties or land use potential of a site;
- No significant change to the quality or availability of any water resource;
- No significant nuisance effect to any receptor (noise, vibration, dust or privacy);
- No damage to or reduction in condition of existing infrastructure;
- No significant or long-term change to vegetation, habitat or fauna occurring at or adjacent to a site;
- No loss of a heritage or palaeontological resource;

- No significant change in ambient air quality;
- No uncompensated disruption of land use nor loss of income for land owners;
- No negative effect on the local economy;
- Compliance with the EMPR; and
- No environmental incidents or emergencies.

9.7.3 REHABILITATION AND POST CLOSURE

Specific impact management outcomes during the rehabilitation phase are:

- Ensure no post-closure health or safety hazards;
- Ensure rehabilitated land is stable and productive in the long term, either for on-going agricultural use or as a self-sustaining vegetation cover;
- Minimise long term maintenance requirements on rehabilitated areas; and
- Open, accurate and transparent communication with stakeholders;

9.8 IMPACT MANAGEMENT ACTIONS

The mitigation actions, as necessary to achieve the objectives and outcomes set out in the preceding sections, are presented in tabular format below. The action plans include the timeframes for implementing the mitigation actions together with the assignment of responsibility for implementation.

9.8.1 PLANNING AND DESIGN

The planning and design phase for the exploration activities requires the sequential implementation of a number of actions in order to inform the determination of FTG grid routes. Each of the actions are described below:

9.8.1.1 Identification of Target Sites from Geological Information

Exploration is an iterative process with data acquired from a prior stage required to improve the knowledge and understanding of the resource, which may then be subject to more intensive exploration at a later stage. Exploration begins with the identification of target areas based on a general geological understanding, often informed by publically available data. The analysis and interpretation by Rhino Oil and Gas' geologists and geophysicists of the available and acquired data would result in the identification of potentially prospective areas. On completion of this work, Rhino Oil and Gas would propose target FTG grid routes in order to acquire additional data that could improve the understanding of the potentially prospective areas.

9.8.1.2 Site screening

The target FTG grid routes must be subject to desktop screening in terms of relevant technical and environmental criteria. Key considerations for the screening of FTG routes would be the presence of protected areas in terms of NEMPRAA, private game farms and other noise sensitive receptors.

Only if this screening confirms that there are no fatal flaws to the proposed grid route would Rhino Oil and Gas initiate the FTG survey. Prior notice will be given to the owners of noise sensitive receptors directly under the survey route.

9.8.2 UNDERTAKING OF EXPLORATION

Management actions required during the undertaking of exploration are described in Table 9-1.

TABLE 9-1: ENVIRONMENTAL ACTIONS DURING EXPLORATION

Objectives and Goals	Management Actions	Implementation Programme	
		Responsibility	Implementation & Frequency
Roles and Responsibilities			
To define roles and responsibilities for the implementation of the EMPR.	Ultimate responsibility for the implementation of and compliance with the EMPR during exploration rests with Rhino Oil and Gas. Rhino Oil and Gas is to nominate an Exploration Manager to be responsible for overseeing compliance with the EMPR. The Exploration Manager is responsible for implementation, monitoring and auditing of compliance with the EMPR. The Exploration Manager may assign specific tasks and roles required by the EMPR to other suitably qualified personal including the Exploration Geologist and SHEQ Manager.	Rhino Oil and Gas Exploration Manager	On approval of EMPR, continuous Weekly.
	Rhino Oil and Gas is to ensure that all contractors and sub-contractors are aware of and familiar with operations, the key environmental issues and consequences of non-compliance to the EMPR. Adherence to the conditions of the right and the EMPR must be included as a contractual requirement. All contractors must be provided with a copy of the EMPR and related plans and procedures	Exploration Manager SHEQ Manager	Throughout the duration of a contract.
	Each contractor is to provide Rhino Oil and Gas with a signed letter indicating their acknowledgement of the conditions of the right and EMPR. Contractors are responsible for compliance with the EMPR for all aspects of their work package. Any incident or non-compliance is to be immediately reported to Rhino Oil and Gas.	Exploration Manager Contractor	Throughout the duration of the contract.
	The Exploration Manager must ensure that a SHEQ Manager is involved in the management of operations. Rhino Oil and Gas must ensure that these personnel are suitably trained and are provided with the necessary resources and authority to implement and monitor the EMPR.	Exploration Manager	Throughout the duration of the contract.

Objectives and Goals	Management Actions	Implementation Programme	
		Responsibility	Implementation & Frequency
	The SHEQ Manager is to ensure regular compliance checks during all exploration work periods. Records are to be kept.	SHEQ Manager	Weekly during exploration
Environmental Awareness and Training			
Ensure that all persons involved in exploration are aware of the objectives of the EMPR as well as the consequences of their individual actions	Environmental induction training must be provided to all persons involved in exploration, including permanent workers, contractors and consultants.	SHEQ Manager	Prior to commencement of work at a site. On appointment of new personnel. Repeat annually.
	Contract or job-specific training must be provided to those contractors or personnel involved in activities which risk assessment has identified as having high risk.		
Occupational Health and Safety			
Ensure the safety of workers involved in exploration.	All activities are to be managed in compliance with the requirements of the Mine Health and Safety Act and Regulations thereto,as well as other legislation relevant to the activity.	SHEQ Manager	During exploration
FTG Survey			
Minimise disturbance during surveys.	All planned survey flights should comply with local civil aviation rules. Flight paths must be pre-planned to avoid national parks, nature reserves and world heritage sites. Where this is not possible, an altitude of 2 500 feet (762 m) should be maintained (as per Section 47(1) of NEMPRAA), unless permission is obtained from the management authority or in an emergency. All pilots must be briefed on ecological risks associated with flying at a low level over sensitive areas. Where flights are planned to occur over game farms or other potentially noise sensitive receptors, landowners should be notified of the survey programme prior to survey commencement.	SHEQ Manager and independent environmental scientist.	Prior to and during surveys
Planning for further ground-based exploration			
Avoid targeting sites for exploration that are likely to have technical, practical, cultural or environmental sensitivities.	Screening of target core hole drill sites and seismic alignment routes against appropriate GIS datasets. The screening should include the application of minimum separation distance from the site/route perimeter and sensitive environmental features/attributes. Enviro-legal assessment to ascertain the authorisations that would be required for the exploration activity.	Exploration manager and independent environmental scientist.	Prior to application for environmental authoirisaiton or land owner consultation

Objectives and Goals	Management Actions	Implementation Programme	
		Responsibility	Implementation & Frequency
Ensure accommodation of landowner' needs through negotiated approach	The owners of land or occupiers at target exploration sites/routes are to be consulted and agreement obtained to access, establish and undertake exploration on a target site.	Exploration manager	Post screening of sites
Understanding of status of environmental features/attributes to enable detection of change, if any.	Initiate fieldwork, sampling, analysis of key environmental attributes relevant to the target site/route.	Exploration manager and independent environmental scientist.	Post screening of sites and land owner agreement. Prior to commencement of exploration
Ensure that exploration sites are lawful and environmentally appropriate.	Make application to PASA, and any other authority, for the requisite authorisation(s) of the exploration activity at the specified site/route. Undertake the assessment and reporting process required to inform the authority decision on the authorisation(s).	Exploration manager and independent environmental scientist.	Prior to commencement of exploration
Public Relations			
To keep affected parties informed of developments.	The owners and lawful occupiers of land over which exploration is located must be upated on progress and developments.	Exploration geologist	Annually or at a new development.
To ensure that public complaints are recorded and addressed.	Rhino Oil and Gas must maintain a complaints register for the exploration. The complaints register must record the following: Date when complaint/concern was received; Name of person to whom the complaint/concern was reported; Nature of the complaint/concern reported; The way in which the complaint/concern was addressed (date to be included).	SHEQ Manager	During exploration
	Any complaints regarding the exploration must be brought to the attention of the SHEQ Manager within 24 hours after receiving the complaint.	SHEQ Manager	During exploration
	Rhino Oil and Gas must assess the merits of every complaint and initiate an investigation when required.	SHEQ Manager	As required, within 48 hrs
	Each complaint must be investigated and remedied where possible. A response should be provided to the complainant.	SHEQ Manager	During construction within 72 hours

Objectives and Goals	Management Actions	Implementation Programme	
		Responsibility	Implementation & Frequency
	The complaints register must be kept up to date for inspection by members of PASA.	SHEQ Manager	During construction
Environmental Risks and Emergencies			
Minimise the risk for environmental emergencies occurring and implement controls to deal with situations, should they occur.	Risk assessments to be undertaken for all exploration activities. Environmental 'Emergency Response Plans' are to be developed for potential high risks. Rhino Oil and Gas is to provide contractors with a copy of the Emergency Response Plan and require contractors to produce Emergency Response Plans for their unique activities.	Regional SHEQ Manager	Prior to exploration. For any new activty.
Ensure appropriate response to an emergency and prevent the recurrence of repeat incidents	In the case of an emergency the appropriate response in terms of the Emergency Response Plan should be initiated. Such Emergency Response and reporting must be in terms of Section 30 of the NEMA	Exploration Manager and Regional SHEQ Manager	During exploration, at an incident.
EMPR Compliance			
Implementation of the required management measures and compliance with the EMPR	A copy of the right and EIA/EMPR must be kept at the operations or site office.	Exploration Manager	During exploration
	Each contractor must keep a copy of the EMPR at their site office/vehicle and this copy must be available to their staff.	Contractor	Throughout the duration of the contract.
	Contractors must implement any procedures and written instructions in terms of the EMPR issued to them by Rhino Oil and Gas. Contractors must not deviate from the EMPR or written instructions without approval from Rhino Oil and Gas.	Contractor	Throughout the duration of the contract.
	The SHEQ Manager must monitor and audit the exploration activities to ensure compliance with this EMPR and the right.	SHEQ Manager	Weekly during exploration
	A register of all environmental incidents is to be maintained. The SHEQ Manager is to inform the Exploration Geologist of all incidents.	SHEQ Manager	On an incident during the construction phase
	Records relating to the compliance and non-compliance with the conditions of the EMPR must be kept in good order. Such records must be available for inspection at the site office and must be made available to PASA within seven (7) working days of the date of the written request by the PASA for such records.	SHEQ Officer	During construction phase

Objectives and Goals	Management Actions	Implementation Programme	
		Responsibility	Implementation & Frequency
Appointment of Independent Environmental Scientist	Rhino Oil and Gas is to appoint a suitably qualified and experienced IES for the undertaking of actions required by this EMPR .	Exploration Manager	Prior to start of exploration

9.8.3 REHABILITATION AND POST CLOSURE

No management actions are required for the rehabilitation or closure of the proposed 'early-phase exploration' work for which Rhino Oil and Gas are seeking environmental authorisation.

9.9 MONITORING IMPLEMENTATION OF ACTIONS

No environmental monitoring is required for the proposed 'early-phase exploration' work for which Rhino Oil and Gas are seeking environmental authorisation.

9.10 REPORTING ON EMPR COMPLIANCE

The SHEQ Manager at Rhino Oil and Gas must conduct internal management audits against the commitments in the EMPR. These audits must be conducted on an on-going basis during activities until final closure. The findings must be documented for both record keeping purposes and for informing continual improvement. A quarterly audit report must be produced and submitted to PASA.

In addition, and in accordance with Regulation 55 of the Mining regulations (GN R527) and as set out in NEMA GNR982, an independent professional must conduct an EMPR performance assessment in accordance with the timeframes as specified in the Environmental Authorisation (if provided) or at least every 2 years. Compliance with the provisions of the EMPR and the adequacy of the EMPR relative to the activities and risks must be assessed in the performance assessment. This report must be submitted to PASA.

9.11 ENVIRONMENTAL AWARENESS PLAN

This section includes an environmental awareness plan for the proposed exploration project.

Rhino Oil and Gas will commit to informing all employees and contractors of environmental risk which may result from the undertaking of exploration. The purpose of the environmental awareness plan is to ensure that management and all personnel understand the general environmental requirements of the activities and localities in which work is undertaken. The environmental awareness plan should enable Rhino Oil and Gas to achieve the objectives of their environmental policy. The plan should describe how employees will be informed of environmental risks which may result from their work, the manner in which the risk must be dealt with in order to avoid pollution or degradation of the environment and the training required for general environmental awareness and the dealing of emergency situations and remediation measures for such emergencies.

The environmental awareness plan should communicate:

- The importance of conformance with the environmental policy, procedures and other requirements of good environmental management;
- The significant environmental impacts and risks of individuals work activities associated with the operation of the site and explain the environmental benefits of improved performance;
- Individuals' roles and responsibilities in achieving the aims and objectives of the environmental policy; and
- The potential consequences of not complying with environmental procedures.

In addition, greater environmental awareness must be communicated to personnel involved in specific activities which can have a significant impact on the environment and management must ensure that they are competent to carry out their tasks on the basis of appropriate education, training and/or experience.

Rhino Oil and Gas must present induction training (repeated annually), which includes an environmental awareness aspect, to all personnel and contractors involved with exploration. The information required includes a description of the local environment, the sensitive aspects of this environment, the risks associated with the exploration activities and the obligations of personnel towards environmental controls and methodologies. All exploration activities should be approached in a risk-averse manner and the precautionary principle should always be applied.

The induction and environmental awareness training provided by Rhino Oil and Gas must communicate to individuals at a level of detail specific to the requirements of their job, but should generally comprise:

- Basic SHEQ awareness training for all prior to involvement in exploration.
- General environmental awareness training must be given to all Employees and contractors prior to any involvement in field based exploration. The Environmental Code of Conduct should be displayed at each exploration site. Personnel and contractors who have not attended the training must not be allowed on any site.
- Specific environmental awareness training to be provided to personnel and contractors whose work activities can have a significant impact on the environment.

Records should be kept of all awareness training.

10 APPENDICES

APPENDIX 1: CO-ORDINATES OF THE EXPLORATION RIGHT AREA

APPENDIX 2: PROPERTIES INCLUDED IN THE EXPLORATION RIGHT APPLICATION AREA

APPENDIX 3: EAP UNDERTAKING

APPENDIX 4: PROOF OF REGISTRATIONS OF THE PRACTITIONERS

APPENDIX 5: CURRICULA VITAE OF THE PROJECT TEAM

APPENDIX 6: PUBLIC PARTICIPATION PROCESS

Appendix 6.1: Authority Correspondence since submission of the Scoping Report

Appendix 6.2: I&AP database

Appendix 6.3: I&AP Submissions post completion of Scoping Report

Appendix 6.4: Land Claimant information

Appendix 6.5: I&AP correspondence since submission of the Scoping Report