Alumni Exploration East Namibia (PTY) LTD

Draft Environmental Scoping and Environmental Management Plan (EMP) Report for the Proposed Petroleum Exploration Programme for the Petroleum Exploration License (PEP) No. 68 Covering Blocks 2219 and 2319, Nama Basin, OMAHEKE REGION EASTERN NAMIBIA

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MARCH 2015

License

Petroleum Exploration License (PEL) 68, Blocks 2219 and 2319

Type of Exploration

Satellite, Airborne Surveys, Radiometric, Geochemical,
Passive Tellurics and Finally Drilling

Operator

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ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

Dr. Sindila Mwiya

CITATION: *Risk-Based Solutions (RBS), 2015. Environmental Scoping Report for the Proposed Petroleum Exploration (Satellite, Airborne Surveys, Radiometric, Geochemical, Passive Tellurics and finally Drilling) for PEL 68 covering Blocks 2219 and 2319, NAMA BASIN, OMAHEKE REGION, ONSHORE EASTERN NAMIBIA*

STATEMENT OF QUALIFICATIONS / SUMMARY CV /PROFILE OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP) – DR. SINDILA MWIYA

Dr. Sindila Mwiya has more than ten (10) years of direct industry experience in onshore and offshore oil and gas exploration covering general and technical exploration support, Health Safety and Environment (HSE) permitting for Geophysical Surveys such as 2D and 3D seismic and Gravity surveys and drilling operations support, through to production. He has undertaken exploration support, environmental assessment and monitoring projects associated with onshore and offshore oil and gas exploration operations in Namibia, South Africa, Angola and Equatorial Guinea. Through the company Risk-Based Solutions (RBS), the consulting arm of Foresight Group Namibia (FGN) (PTY) LTD which he founded, he has worked and continue to work for global reputable oil and gas companies such as Petrobras Oil and Gas, HRT Africa, Serica Energy, Chariot Oil and Gas Exploration, Eco (Atlantic) Oil and Gas, ION GeoVentures, PGS UK Exploration, TGS-Nopec, Maurel & Prom, GeoPartners, PetroSA Equatorial Guinea, Preview Energy Resources, Sintezneftegaz Namibia LTD and INA Namibia (INA INDUSTRIJA NAFTE d.d). Dr. Sindila Mwiya is highly qualified with extensive experience in petroleum, mining, applied environmental management, cleaner production, geoenvironmental, geological and geotechnical engineering fields.

He has worked as an Environmental Assessment Practitioner (EAP), Project Manager, Lecturer (University of Namibia), External Examiner/ Moderator (Polytechnic of Namibia), Technical Consultant (RBS / FGN), National Technical Advisor (Directorate of Environmental Affairs, Ministry of Environment and Tourism – Cleaner Production Component) and Chief Geologist for Engineering and Environment Division, Geological Survey of Namibia, Ministry of Mines and energy. He has supervised and continue to support a number of MSc and PhD research programmes and has been a reviewer on international, national and regional researches, plans, programmes and projects with the objective to ensure substantial local skills development for sustainable natural resources development, management, and for development policies, plans, programmes and projects financed by governments, private investors and donor organisations. He has provided extensive technical support and has played a significant role in the development of the Namibian Environmental Management Act, 2007, (Act No. 7 of 2007) as well as Environmental Impact Regulations, 2012 that came in force in February 2012.

Among his academic achievements, Dr Sindila Mwiya is a holder of a PhD (Geoenvironmental Engineering - *Development of a Knowledge-Based System Methodology (KBSM) for the Design of Solid Waste Disposal Sites in Arid and Semiarid Environments (Namibia)*), MPhil/PG Cert and BEng (Hons) (Engineering Geology and Geotechnics), qualifications from the University of Portsmouth in the United Kingdom. During the 2004 Namibia National Science Awards, organised by the Namibian Ministry of Education, and held in Windhoek, Dr. Sindila Mwiya was awarded the Geologist of the Year for 2004, in the professional category. Furthermore, as part of his professional career recognition, Dr. Sindila Mwiya is a life member of the Geological Society of Namibia, Consulting member of the Hydrogeological Society of Namibia and a Professional Engineer registered with the Engineering Council of Namibia.

WINDHOEK
MARCH 2015

CONTENT LIST

LIST OF FIGURES

LIST OF TABLES

NON TECHNICAL SUMMARY

Alumni Exploration East Namibia (PTY) LTD holds petroleum rights under the Petroleum Exploration Licence (PEL) No. 68 covering Blocks 2219 and 2319. The PEL 68 is situated in the Gobabis District of the Omaheke Region in Eastern Namibia. The proposed exploration cover the following activities:

- ✓ Satellite imagery;
- ✓ Geochemical sampling and analysis;
- ✓ Transient pulse;
- ✓ Radiometric;
- ✓ Ground Tellurics;
- ✓ Well Drilling (Stratigraphic).

As part of exploration programme and in line with the requirements for the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 gazetted under the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007), an Environmental Scoping together with an Environmental Management Plan (EMP) reports must be prepared by Alumni Exploration East Namibia (PTY) LTD and approved by the Office of the Environmental Commissioner before a new Environmental Clearance Certificate can be issued.

It is estimated that at least 74 reptile, 13 amphibian, 93 mammal, 206 bird species (breeding residents), 77-84 larger trees and shrubs and up to 74 species of grass are known to or expected to occur in the general/immediate PEL No. 68 area of which a moderate proportion are endemics. Groups with the highest proportion of endemics are reptiles (23%) and birds (6 of the 14 Namibian endemics). Although these endemics are known to occur from the general area, it is currently not clear if any of these are associated with the proposed development area(s) or how exactly they will be affected by this development. However, none of these species are exclusively associated with PEL No. 68.

The following is the summary of the likely environmental impacts of the proposed exploration / activities on the receiving environment (physical, biological and socioeconomic environments) without and with mitigations:

(i) **Satellite imagery:** Overall likely negative impact on the receiving environment will be negligible and extremely unlikely probability of occurrence without mitigations. Overall significant impacts will be negligible;

(ii) **Geochemical sampling and analysis:** Overall likely negative impact on the receiving environment will be negligible with extremely unlikely probability of occurrence without mitigations. Overall significant impacts will be negligible. Some field-based activities will have localised low impacts with low probability of occurrence without mitigations and negligible with mitigations. Overall significant impacts will be negligible;

(iii) **Transient pulse:** The activities will have localised low impacts with low probability of occurrence without mitigations and negligible with mitigations**.**

Overall significant impacts will be negligible**.** All desktop related activities and laboratory assessments will have negligible impacts with extremely unlikely probability of occurrence without mitigations. Overall significant impacts will be negligible;

(iv) **Radiometric:** The activities will have localised low impacts with low probability of occurrence without mitigations and negligible with mitigations**.** Overall significant impacts will be negligible**.** All desktop related activities and laboratory assessments will have negligible impacts with extremely unlikely probability of occurrence without mitigations. Overall significant impacts will be negligible;

(v) **Ground Tellurics:** The activities will have localised low impacts with low probability of occurrence without mitigations and negligible with mitigations**.** Overall significant impacts will be negligible**.** All desktop related activities and laboratory assessments will have negligible impacts with extremely unlikely probability of occurrence without mitigations. Overall significant impacts will be negligible;

(vi) **Well Drilling (Stratigraphic):** Overall likely negative impact on the receiving environment will be high and localised impacts without mitigations and localised low impacts with mitigations. Overall significant impacts will be medium without mitigations and low with mitigations.

Current activities of the proposed petroleum exploration activities covering local, regional reconnaissance field-based and initial local field-based activities will have negligible and low localised impacts on the local environment with negligible significant impacts. Based on the findings of this Environmental Assessment Study (Scoping and EMP), it's hereby recommended that the proposed petroleum exploration activities be issued with an Environmental Clearance Certificate with key conditions of adhering to all the provisions of the EMP and applicable regulations. Mitigation measures must be implemented as detailed in Section 6 (EMP) of this report. Once site–specific drilling locality has been identified, a separate field-based and site-specific Environmental Impact Assessment (EIA) and the development of an Environmental Management Plan (EMP) must be implemented for drilling the stratigraphic well within the PEL 68 covering Blocks 2219 and 2319.

1. BACKGROUND

1.1 Introduction

Alumni Exploration East Namibia (PTY) LTD (the proponent) intends to implement petroleum exploration in its PEL No. 68 covering Blocks 2219 and 2319 situated in the Nama Basin in Omaheke Region in eastern Namibia. The proposed exploration activities are aimed at assessing the opportunity for economic hydrocarbon occurrences with the PEL area. In accordance with the provisions of the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 gazetted under the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007) some of the proposed petroleum exploration activities such as drilling cannot be undertaken without an Environmental Clearance Certificate. Alumni Exploration East Namibia (PTY) LTD has appointed Risk-Based Solutions (RBS) as the Environmental Consultants led by Dr. Sindila Mwiya as the Environmental Assessment Practitioner (EAP), CV attached in Annex 1.

The Environmental Assessment process to be undertaken covers Scoping and Environmental Management Plan (EMP) in order to obtain Environmental Clearance Certificate for the proposed geochemical sampling and analysis, transient pulse, radiometric and ground tellurics. Once a site-specific potential stratigraphic well drilling location has been delineated, an Environmental Impact Assessment (EIA) and the development of the Environmental Management Plan (EMP) must be prepared for application of Environmental Clearance Certificate before the drilling operation can be implemented.

1.2 Corporate Profiles

1.2.1 Alumni Exploration East Namibia (PTY) LTD

Africa New Energies Limited (ANE) was founded by two South Africans Stephen Larkin and Brendon Raw in 2008. ANE was incorporated in 2012, where its sole asset is its wholly owned subsidiary, Alumni Exploration East Namibia, which in turn owns 90% of Blocks 2219 and 2319 in Namibia with the Namibian State Owned Oil Company, Namcor owning the remaining 10%. These two oil blocks were awarded in December 2012 after group sister company, Pinpoint Energy Namibia was hired by the UN African Innovation Foundation to assist Namibia to achieve energy independence in an environmentally sustainable way. The findings of the report were that a universal solar access program was only financially feasible if an interim natural gas provision funded an off-grid renewables program.

The team have pioneered the development of an integrated hydrocarbon exploration methodology that triples the probability of drilling success at 1/10th of the cost of traditional hydrocarbon techniques. Results of a Licence-wide Hydrocarbon Lead Indicator ('HLI') satellite survey completed by Scotforth Limited, an industry leader in remote sensing detection of HLI's, during the first year of Licence tenure indicate excellent prospectivity for such a frontier exploration area. Initial modeling of the Petroleum Resource Potential ('PRP') of the emerging prospect inventory in the Licence based only on the results of the satellite survey suggests a possible total mean unrisked PRP of 1.63 billion Barrels of Oil Equivalent (BOE) and a risked PRP of 300 million BOEs. The initial geochemical and radiometric data that has been collected in the Licence area is similarly positive. ANE now aims to further develop and de-risk this emerging prospective resource. Further geochemical and radiometric tests added confidence to the existence and suggest that the hydrocarbons are light crude oil rather than natural gas.

1.2.2 Risk-Based Solutions (RBS) CC

Risk-Based Solutions (RBS) CC, Reg. No., CC/2004/1305, Social Security No. 30027099 and Income Tax No. 3831276011, is the Consulting Arm of Foresight Group Namibia (FGN) (PTY) LTD. Both companies are committed to providing services of excellence in Petroleum, Mining, Energy, Tourism, Agriculture, Fisheries, Properties Development, Applied Environment, Waste Management, Geoenvironmental Engineering, Programme and Project Management and Logistics, and Specialised Training and Industry Research.

1.3 Location, Infrastructure and Services

1.3.1 Location

The Petroleum Exploration License (PEL) No. 68 covering Blocks 2219 and 2319 is situated in onshore Nama Basin around the Galabias District, Omaheke Region in eastern Namibia (Figs. 1.1 - 1.3).

1.3.2 Infrastructure and Services

The PEL 68 has excellent road infrastructure connectivity (Fig. 1.3). The major roads include the B6 tarred road linking Windhoek to Gobabis as well as Namibia to Botswana and the C22 linking Gobabis to Aminuis. The PEL 68 areas falling within the towns and settlements has mobile and fixed telecommunication infrastructure and services. All other related business services such as banking, security and retail are only found in major settlements such as the Town of Gobabis situated to west of the license area.

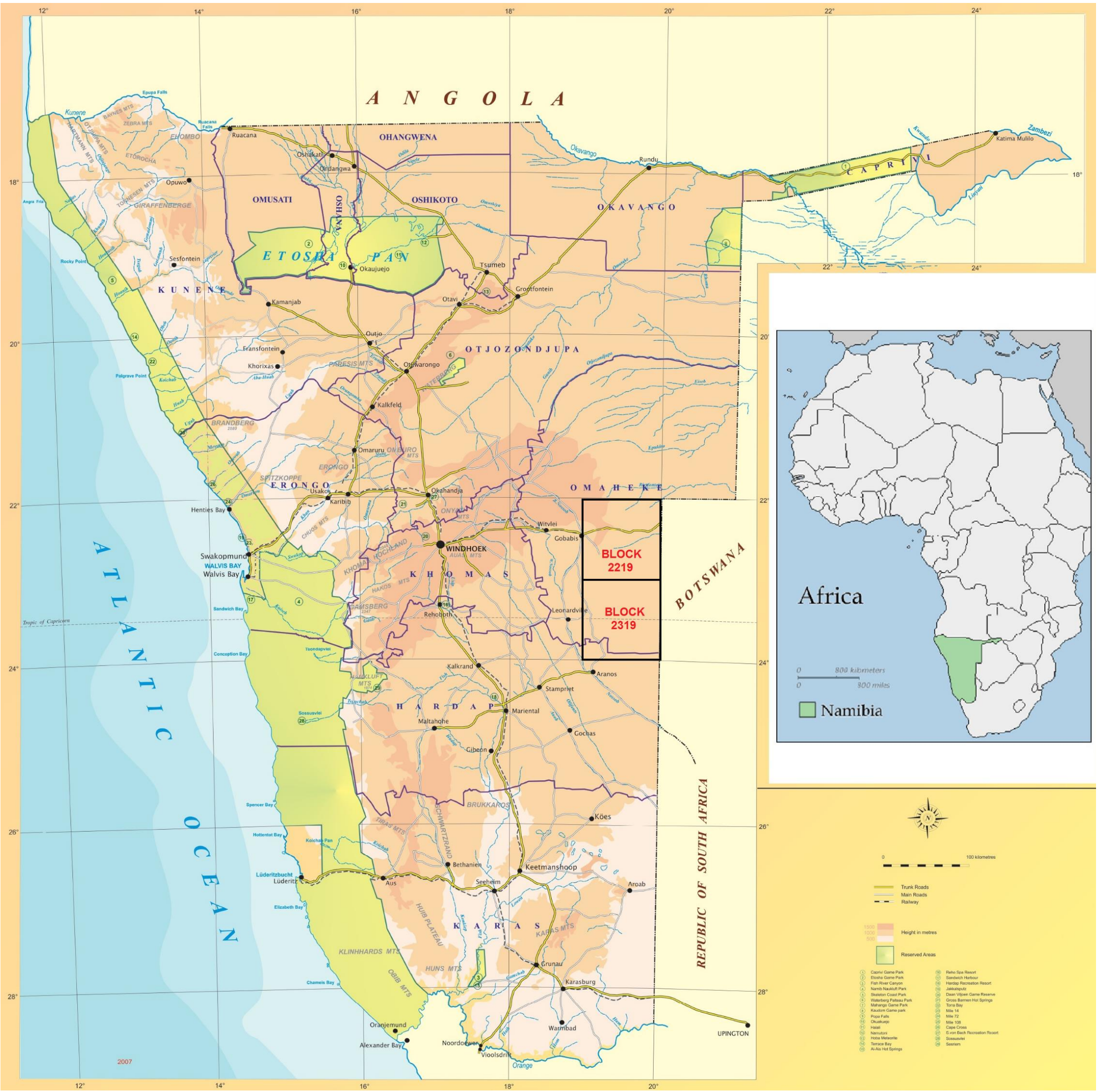

Figure 1.1: Regional location of the PEL. No. 68 covering Blocks 2219 and 2319.

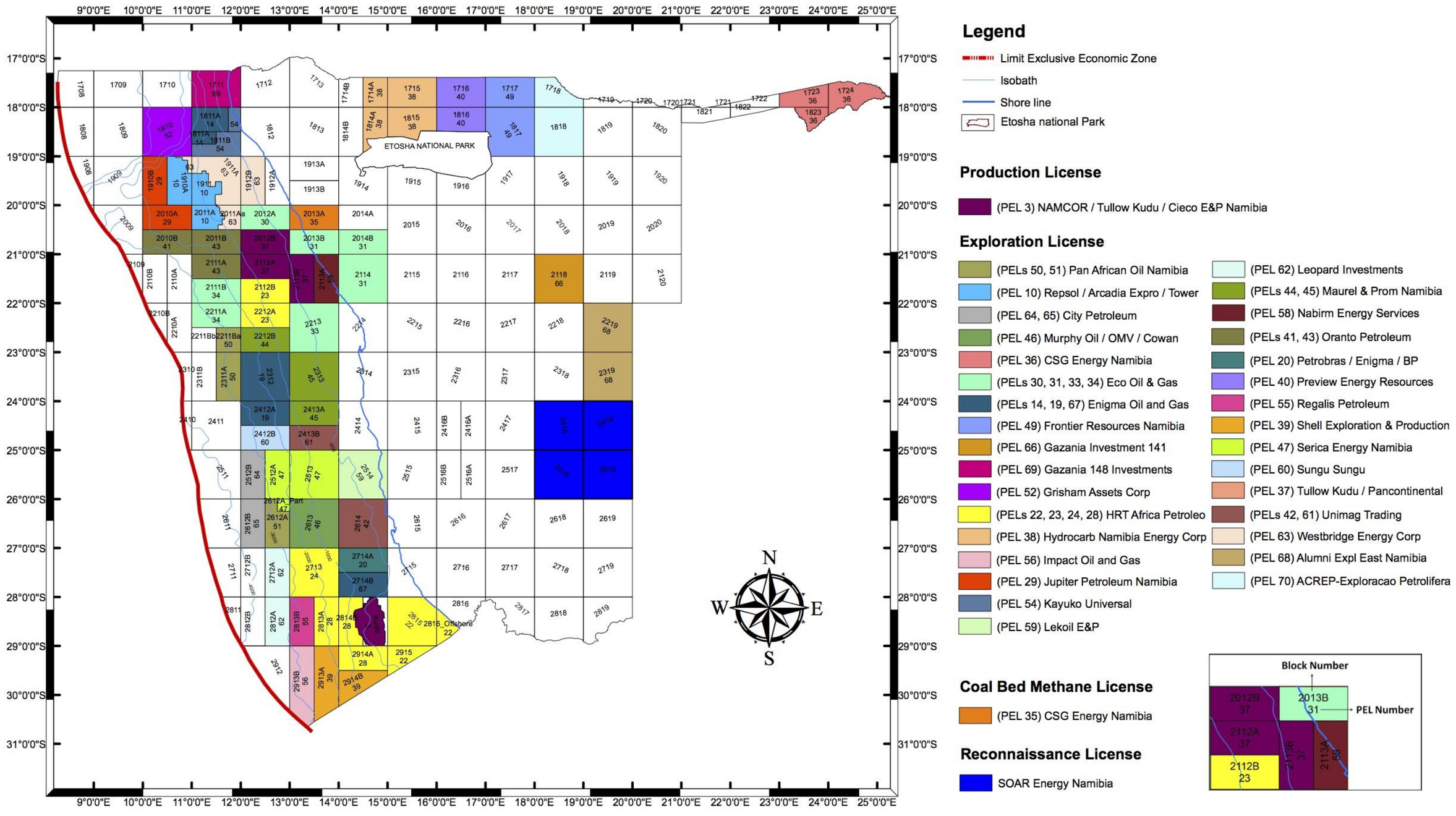

Figure 1.2: Detailed location of the PEL. No. 68 covering Blocks 2219 and 2319 (Source: www.mme.gov.na).

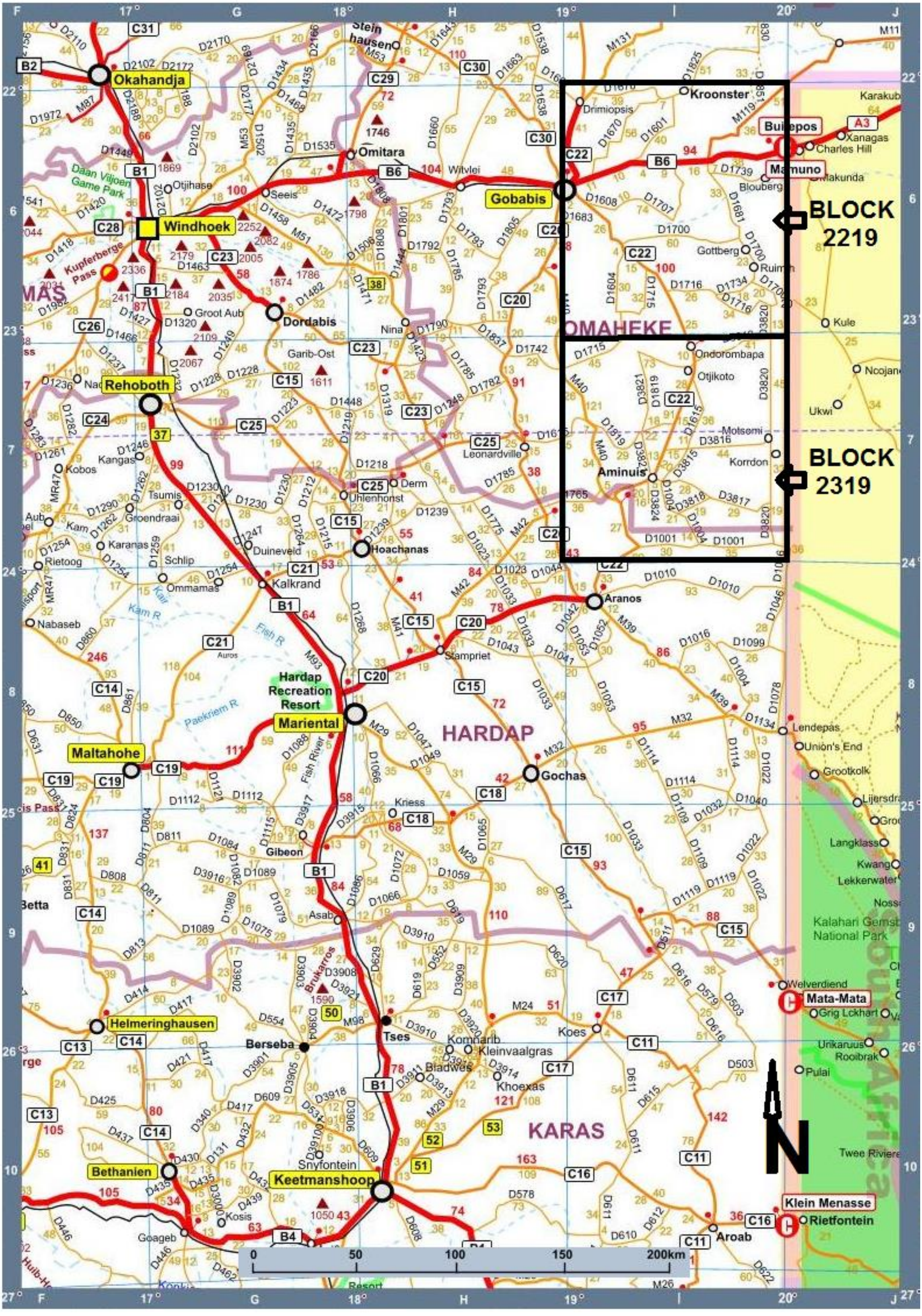

Figure 1.3: Existing infrastructure around the PEL. No. 68 covering Blocks 2219 and 2319 (Source: www.map-of-namibia.com).

1.4 Purpose of EA Process and of Scoping Report

This scoping and Environmental Management Plan (EMP report has been prepared to serve the following objectives:

- ✓ Provide environmental background information for stakeholders or Interested and Affected Parties (I & APs) consultation with respect to the next phase of the Environmental Assessment Process covering Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for possible stratigraphic drilling operations;

- ✓ Provide the Terms of Reference (ToR) for undertaking the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for possible stratigraphic drilling operations. Likely potential positive and negative short- and long-term impacts with respect to the possible stratigraphic drilling operations will be carefully evaluated in the Environmental Impact Assessment (EIA) process with the mitigation measures to be developed in the Environmental Management Plan (EMP) report. The aim will be to collect, assess and document the likely temporal and long-term positive and negative environmental impacts of the proposed project activities on the receiving environment (physical, biology and socioeconomic).

1.5 Structure of the Report

The following is the summary structure outline of this scoping and EMP report.

- ✓ **Section 1: Background** covering the proposed project location with available infrastructure and services;

- ✓ **Section 2: Project Description** covering the summary of the proposed project exploration activities;

- ✓ **Section 3: Regulatory Framework** covering the proposed exploration with respect to relevant legislation, regulations and permitting requirements;

- ✓ **Section 4: Receiving Environment** covering physical, biological and socioeconomic environments of the proposed project area;

- ✓ **Section 5: Impact Assessment** covering the likely positive and negative impacts the proposed project activities are likely to have on the receiving environment;

- ✓ **Section 6: Environmental Management Plan (EMP)** describing the detailed mitigation measures with respect to the identified likely impacts;

- ✓ **Section 7: Conclusions and Recommendations**- Summary of the findings and way forward.

- ✓ **APPENDICES**: (i) CV of the EAP (Dr. Sindila Mwiya);

  (ii) Flora and Fauna Desktop study Report;

  (iii) Socioeconomic Assessment of the PEL area;

2. DESCRIPTION OF THE EXPLORATION METHODS

2.1 General Overview

The following is the summary of the proposed exploration methodologies by Alumni Exploration East Namibia (PTY) LTD with respect to the PEL No. 68 covering Blocks 2219 and 2319:

- ✓ Satellite imagery;
- ✓ Geochemical sampling and analysis;
- ✓ Transient pulse;
- ✓ Radiometric;
- ✓ Ground Tellurics;
- ✓ Well Drilling (Stratigraphic).

The exploration methodology by Alumni Exploration East Namibia (PTY) LTD is aimed at delivering the highest probability of drilling success at the lowest cost – within an African frontier context, where little is known about the geology and where onshore seismic would not be effective or technically feasible. The algorithm, which took ten years to develop, is fed 17 layers of satellite, airborne and surface exploration data where direct and indirect indications of hydrocarbons can be found at low cost. The combination of these layers gives Alumni Exploration East Namibia (PTY) LTD an understanding the geological trap geometry, the nature of the hydrocarbons and a 3D model of the potential reserve. We list five of the most important layers in the diagram.

2.2 Description of the Thematic Layers

The first satellite based layer involves a spectral survey based on proprietary Russian-developed remote sensing technology, which amongst other things detects dullness induced by methane microseepage that is only detectable in the infra-red and ultra-violet spectra off certain seasonal satellite data. This is a direct indicator that gives an initial 2D extent of potential hydrocarbon deposits at a cost of just $7 per square kilometre. More importantly, it being a remote sensing tool– this survey can be performed before a costly license needs to be applied for.

The second layer involves airborne tellurics, see an example from results over the Limpopo Concession. In this instance, we flew a Cessna 100 meters above the ground, flying just above stall speed at 100km/h – enabling the telluric antenna to pick up indications of hydrocarbons down to a depth of 4,500 meters. It is the least expensive way of obtaining depth data very early in the process at a cost of just $30 per square kilometre. Our proprietary visualisation software also shows how we can integrate other data such as geochemical results.

Radiometrics measures changes in potassium, uranium and thorium radioactive isotopes and are an effective extra layer of evidence as they help to define the edge of a hydrocarbons reserve. We look for a dramatic decline in K40 isotopes, often combined with an increase in Uranium 235 while changes in Thorium levels help us to identify faults and structures.

Geochemical evidence of hydrocarbon microseepage is a particularly powerful layer as it is one of the most reliable surface indicators of the presence of oil and gas below. A 15 year

study that analysed over 2,700 wells found that where the geochemical results were positive, commercial discovery rates were over 80%. In contrast, the discovery rate dropped to just 11% where there was no geochemical evidence of microseepage, even where all traditional data such as seismic and local discoveries pointed to likely success. The algorithm is fed with paraffin levels, changes in trace elements such as iodine and finally the extent to which 85 hydrocarbon molecular structures from C1 – C20 are present using the Gore Sorber technique. Gore alone boasts a success rate of 66% in frontier areas.

The final pre-drilling layer involves the integrated ground tellurics technique. This technique combines Magnetto Tellurics, which is well known in the industry and not particularly effective, electro tellurics and radar, which combine to release analogue signals that are able to isolate hydrocarbon payzones as thin as 3 meters.

It is important to note that each of these techniques have had some success in isolation, and that our experts have made a number of discoveries using several of these methods in their collective careers. So we do not for one moment claim to be inventing them, but do claim that our algorithm gives them a statistical robustness and integration that negates their individual weaknesses, dramatically improving their collective effectiveness.

2.3 Exploration Methods Characteristics

The overall aim of the proposed project activities (exploration / prospecting programme) is to search for potential economic petroleum resources within the PEL 68 area. The proposed exploration programme methodologies for the PEL 68 could be characterised into desktop, regional or local field-based activities summarised as follows:

(i) Satellite imagery: Initial desktop exploration activities;

(ii) Geochemical sampling and analysis: Regional field-based reconnaissance activities;

(iii) Transient pulse: Regional or local field-based reconnaissance activities;

(iv) Radiometric: Regional or local field-based reconnaissance activities;

(v) Ground Tellurics: Local field-based reconnaissance activities;

(vi) Well Drilling (Stratigraphic): Detailed site-specific field-based validation activities.

The field-based support and logistical activities will depend on the levels of the regional, local or site-specific activities being undertaken. The activities will be supported by existing tracks and campsites / farmstead. In the absences of existing tracks, the field team will created such new tracks depending on the scale of exploration (regional, local or site-specific activities). In the absences of existing suitable campsite / farmstead, temporary camp will be setup at suitable locations in line with the EMP provisions. The size of the exploration camp will depending on the scale (regional, local or site-specific activities) of exploration being undertaken.

3. REGULATION AND EIA PROCEDURE

3.1 Petroleum Exploration and Production Legislation

In accordance with the Petroleum (Exploration and Production) Act 1991 (Act 2 of 1991), and in an effort to promote petroleum exploration activities in Namibia, the Ministry of Mines and Energy has the mandate to issue three types of licenses namely; Reconnaissance, Exploration and Production Licences (Fig. 3.1). Exploration licence is issued under Section 34 of the Petroleum (Exploration and Production) Act 1991 (Act 2 of 1991), and includes any renewal of such licence. A production licence is issued under Section 50 and includes any renewal of such licence.

3.2 Environmental Regulations

Environmental management in Namibia is governed by the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 gazetted under the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007). Some of the proposed regional, local and site-specific petroleum exploration activities by Alumni Exploration East Namibia (PTY) LTD covering Blocks 2219 and 2319 falls within the categories of listed activities that cannot be undertaken without an Environmental Clearance (Table 3.1). Fig. 3.1 summarise the process for environmental assessment covering scoping, Environmental Impact Assessment (EIA) and the development of Environmental Management Plans (EMP).

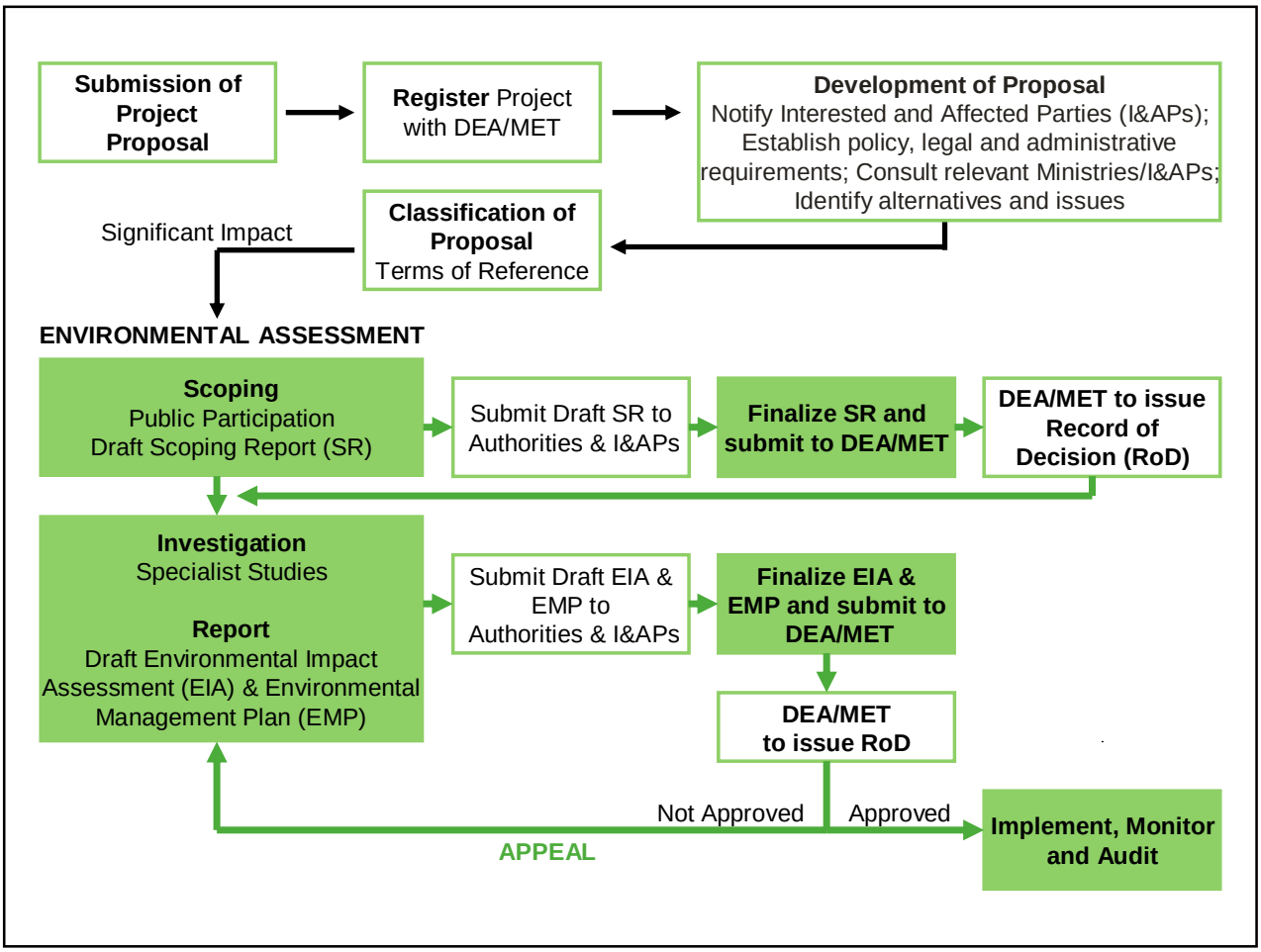

Figure 3.1: Environmental Assessment process in Namibia.

Table 3.1: Characteristic of the proposed exploration activities with respect to the likely environmental requirement compliances.

EXPLORATION ACTIVITY	CHARACTERISTICS	ENVIRONMENTAL REQUIREMENTS COMPLIANCES
1. Satellite imagery	Initial desktop exploration activities	None
2. Geochemical sampling and analysis	Regional field-based reconnaissance activities	None but an Environmental Scoping and a Management Plan (EMP) maybe very useful in support of the Site-Specific Environmental Assessment process for drilling) (Apply for Environmental Clearance)
3. Transient pulse	Regional or local field-based reconnaissance activities	
4. Radiometric	Regional or local field-based reconnaissance activities	
5. Well Drilling (Stratigraphic):	Detailed site-specific field-based validation activities	Scoping, Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) (Apply for Environmental Clearance)

3.3 Other Relevant and Key Legislation Register

The following are some of the key legislation relevant to the proposed petroleum exploration operations and in particular the current aerial gravity and magnetic surveys:

1. The Regional Councils Act, 1992, (Act 22 of 1992);
2. The Local Authorities Act, 1992, (Act 23 of 1992);
3. Hazardous Substances Ordinance 14 of 1974;
4. Atmospheric Pollution Prevention Ordinance 11 of 1976;
5. The Nature Conservation Ordinance, Ordinance 4 of 1975, Amendment Act, Act 5 of 1996 and the current draft Parks and Wildlife Management Bill of 2006;
6. Labour Act, 2007 (Act No. 11 of 2007).

The significance, implication as well as permit requirements associated with some of the above mentioned pieces of legislation will be fully assesses and evaluated during the EIA process.

3.4 Regional and International Initiatives and Conventions

Namibia is part to a number of international environmental agreements such as the following:

- ✓ **Convention on Biological Diversity** ("Biodiversity"), 29 December 1993: Objective: To develop national strategies for the conservation and sustainable use of biological diversity;
- ✓ **Convention on the International Trade in Endangered Species of Wild Flora and Fauna** (CITES or "Endangered Species"), 1 July 1975: Objective: To protect

certain endangered species from over-exploitation by means of a system of import/export permits;

- ✓ **United Nations Framework Convention on Climate Change** ("Climate Change"), 21 March 1994: Objective: To achieve stabilization of greenhouse gas concentrations in the atmosphere at a low enough level to prevent dangerous anthropogenic interference with the climate system;

- ✓ **Kyoto Protocol to the United Nations Framework Convention on Climate Change** ("Climate Change – Kyoto Protocol"), 1 January 1997: Objective: To further reduce greenhouse gas emissions by enhancing the national programs of developed countries aimed at this goal and by establishing percentage reduction targets for the developed countries.

3.5 Recommendations on Regulatory Framework

The proposed petroleum exploration activities in the PEL 68 and especially the detailed site-specific field-based validation activities (drilling) must meet all the applicable national legislative, regulatory and policies frameworks, standards and protocol. It is hereby recommended that the operator must follow the provisions of all relevant national regulatory frameworks as described in this Chapter.

3.6 Corporate Environmental Commitments

In accordance with the petroleum application submitted in December 2011 and the subsequent petroleum agreement signed between the license holders the Government of Namibia, the company has committed to the following environmental obligations:

- ✓ Conduct its operations in a manner likely to promote the conservation of Namibia's natural resources and protection of its environment;

- ✓ Employ the most advanced techniques for the prevention of environmental damage to which its petroleum operations might contribute and for the minimisation of the effect of such operations on neighbouring or adjoining exploration licenses;

- ✓ Implement the proposals contained in its development plan regarding the prevention of pollution, the treatment of wastes, the safeguarding of natural resources and the progressive reclamation and rehabilitation of lands disturbed by petroleum production;

- ✓ Prevent the pollution of all areas of water by the spilling of petroleum, drilling fluid, chemical additive, any gas or any waste product or effluent;

- ✓ Furnish to the Commissioner prior to the drilling of any well a report containing particulars of the technique to be employed, an estimate of the time to be taken, the material to be used and the safety measures to be employed in the drilling of such well;

- ✓ Not flare any combustible gas, except for purposes of testing such gas, or for operational reasons.

4. RECEIVING ENVIRONMENT

4.1 Physical Geography and Visual Impacts

The license area falls within a mixed communal, private commercial farmland with proclaimed settlements in some places. The overall landscape is dominated by topographically low laying areas of the Kalahari Desert landforms cut across by a number of major and minor Ephemeral River Systems. The land uses in these areas are mainly dominated by agriculture (cattle, sheep and goats). Other land use activities found in the general areas include tourism and crop farming in some limited areas due to the limitation on water supply.

4.2 Climate Components

4.2.1 Local Precipitation

The mean annual rainfall is highly variable and may range between 200 mm - 400 mm in various parts of the PEL Area (Fig. 4.1). The distribution of rainfall within the Nama Basin is extremely seasonal with almost all the rain falling in summer - from November to April with occasional winter rainfall (Figs. 4.2 -4.4). Mean annual gross evaporation is between 3000 mm and 3, 400 mm (Fig. 4.1).

4.2.2 Temperature

Ambient air temperature is an important parameter in determining pollution plume behaviour, the depth of mixing height, and position of the inversion layer. The mixing layer is the average thickness of the layer within which pollutants are expected to mix with air over a geographical area. The inversion layer is characterised by an increase in temperature with height. The greater the difference between the emitted pollutant and the ambient air temperature, the resulting plume will have a buoyancy rise. Daytime temperatures range between 35° to 45°C from October to March, the hottest months, and can drop below freezing between June and August. The annual mean temperature is around 32°C with the mean monthly temperatures ranging between 35°C to 23°C throughout the year.

4.2.3 Wind Patterns

The medium-term (days) and short-term (seconds) wind characteristics are of fundamental importance in determining the area of the ground that can be exposed to emissions of Hazardous Air Pollutants (HAPs) from a source. Based on the regional wind patterns, the dominant wind direction is from the north eastern and southwest quadrants (Figs. 4.5 -4.7). Locally, the situation may be different dues various influences including topographic effects.

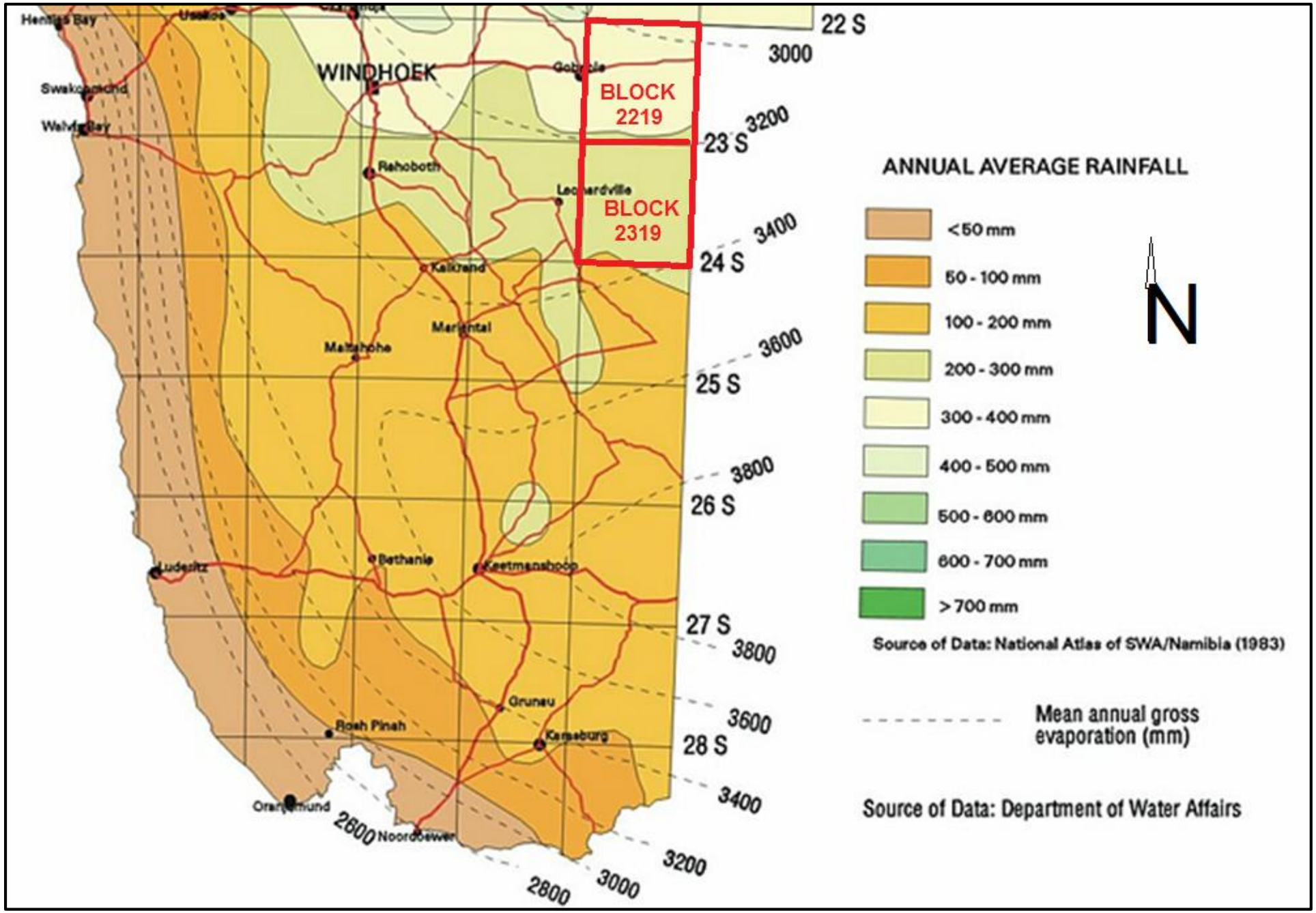

Figure 4.1: Regional climatic pattern of Namibia showing the location of the PEL 68 (Blocks 2219 and 2319).

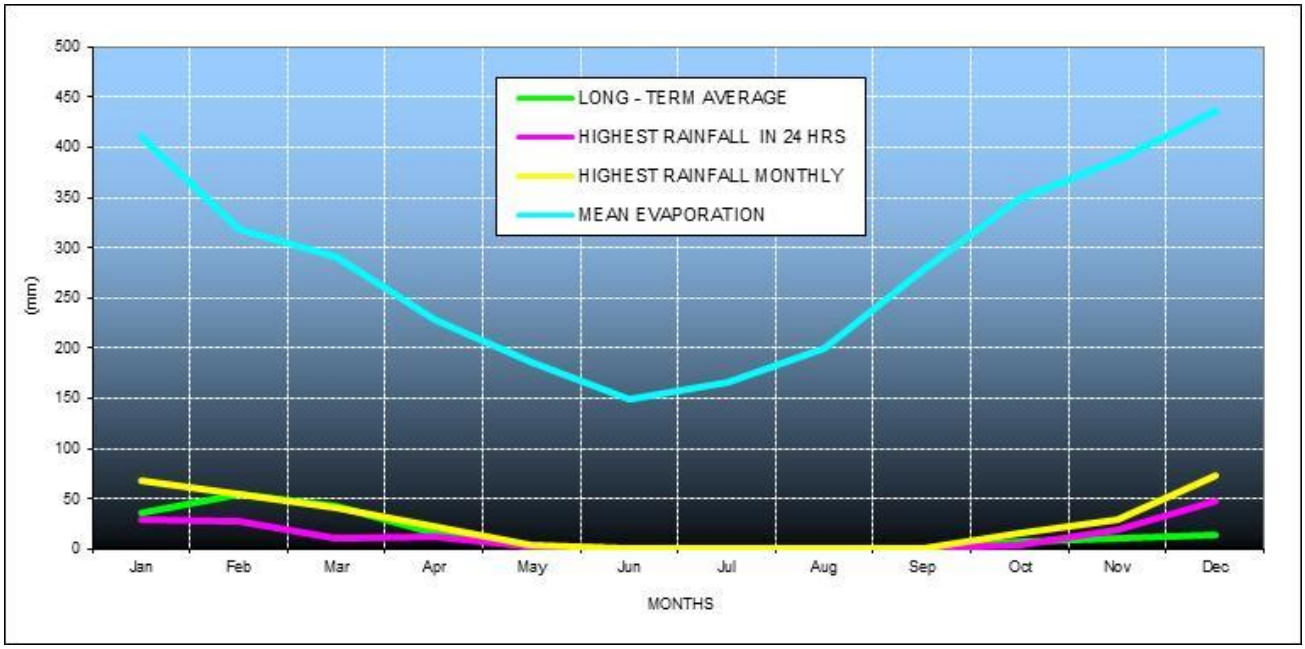

Figure 4.2: Comparative climatic data - mean monthly and annual rainfall and evaporation for Mariental for the period 1983 - 2010 (Data source Metrological Services of Namibia).

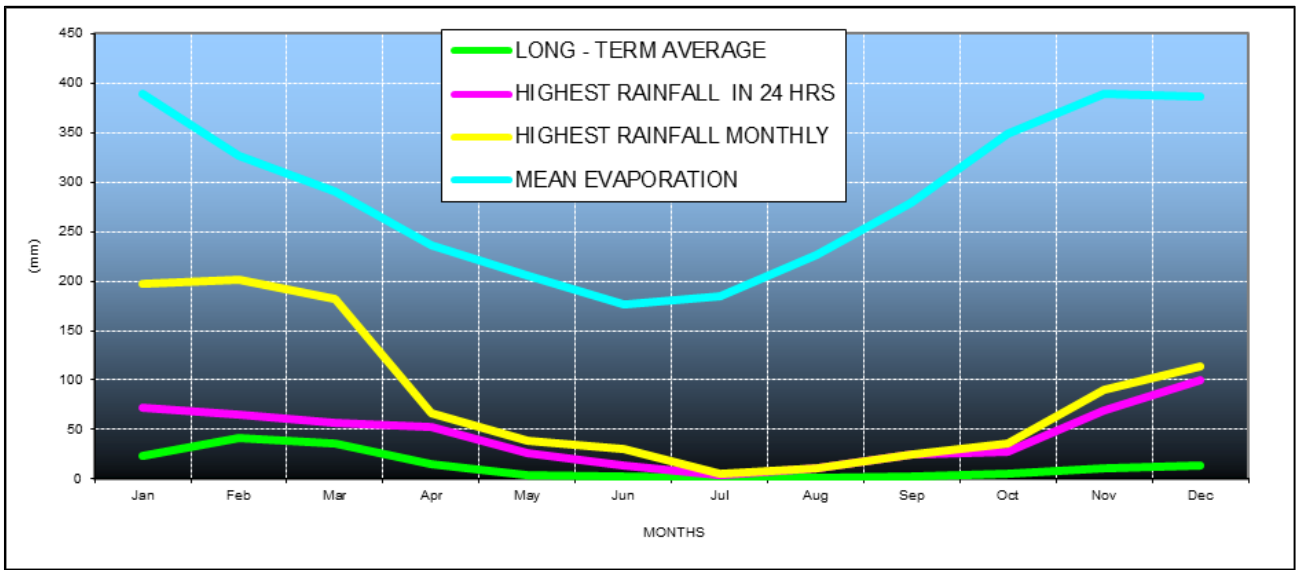

Figure 4.3: Comparative climatic data sets - mean monthly and annual rainfall and evaporation for Keetmanshoop for the period 1948 - 2010 (Data source Metrological Services of Namibia).

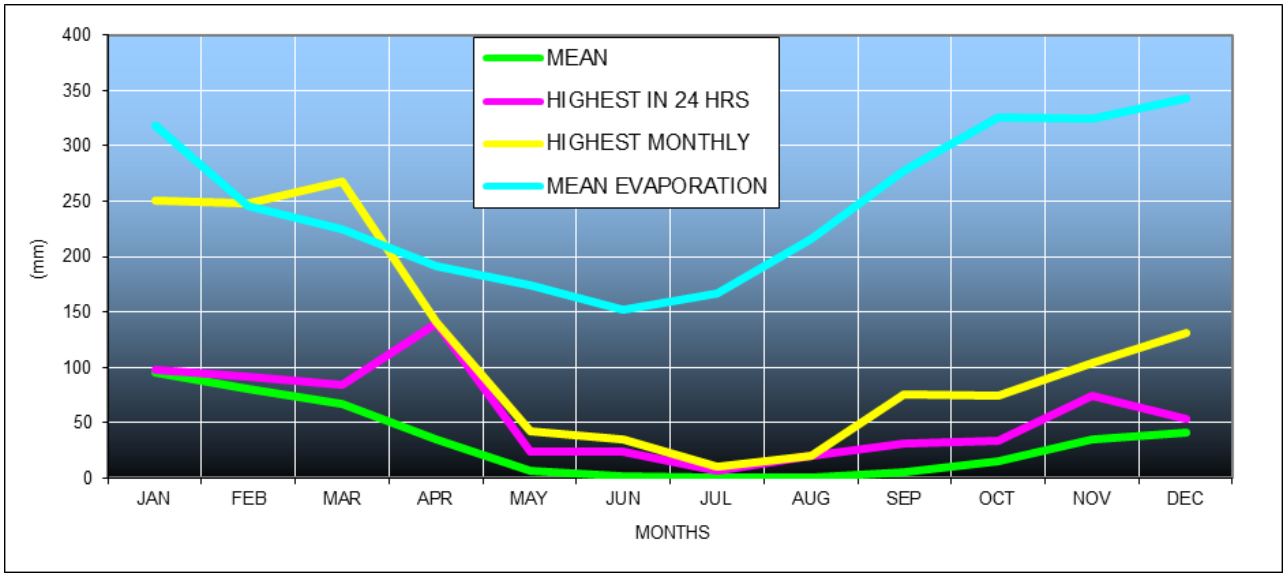

Figure 4.4: Comparative climatic data sets - mean monthly and annual rainfall and evaporation for Gobabis for the period 1914 - 2010 (Data source Metrological Services of Namibia).

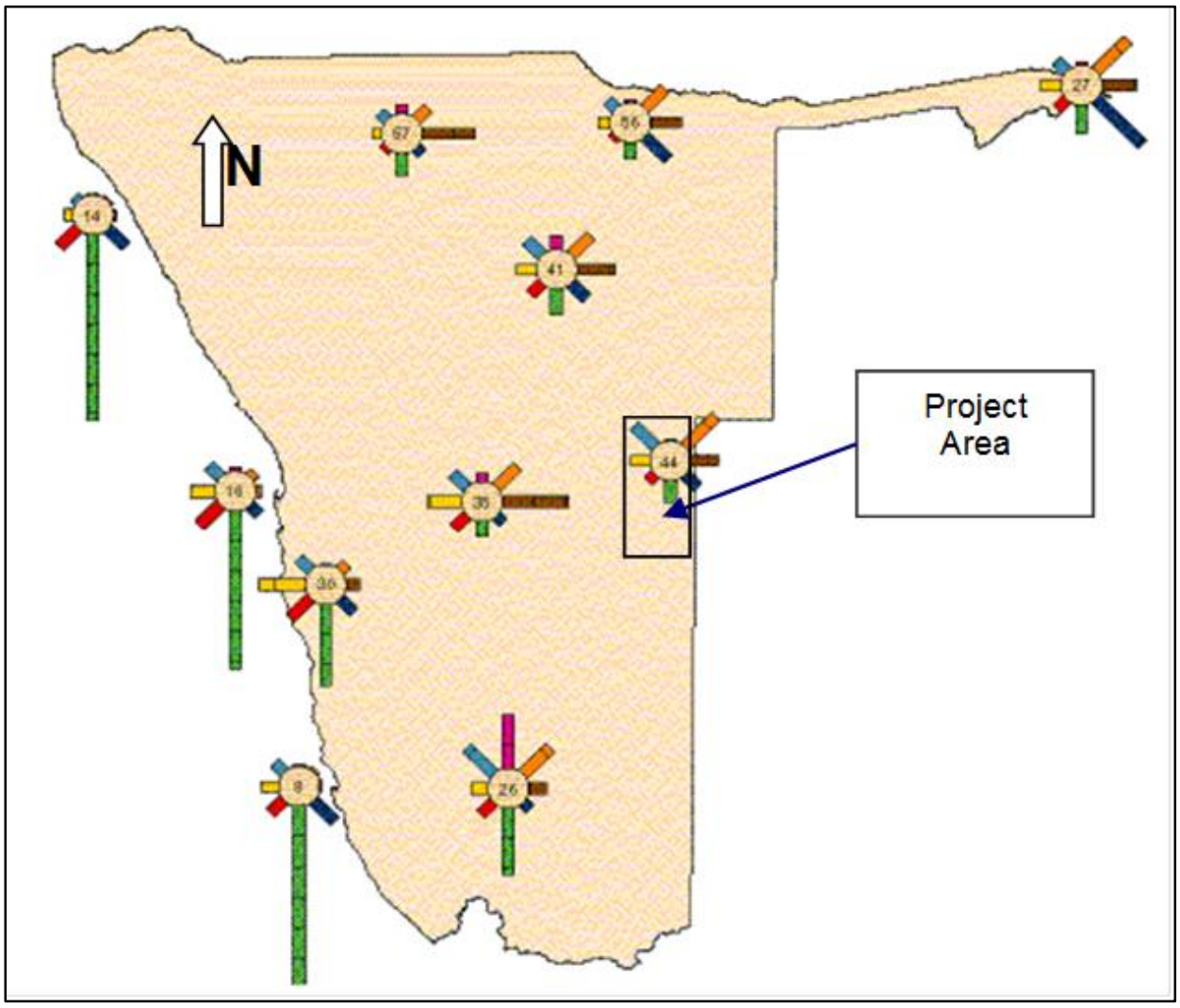

Figure 4.5: Regional wind pattern with the most prevailing winds indicated by the length and colour of the bar (after Directorate of Environmental Affairs, 2002).

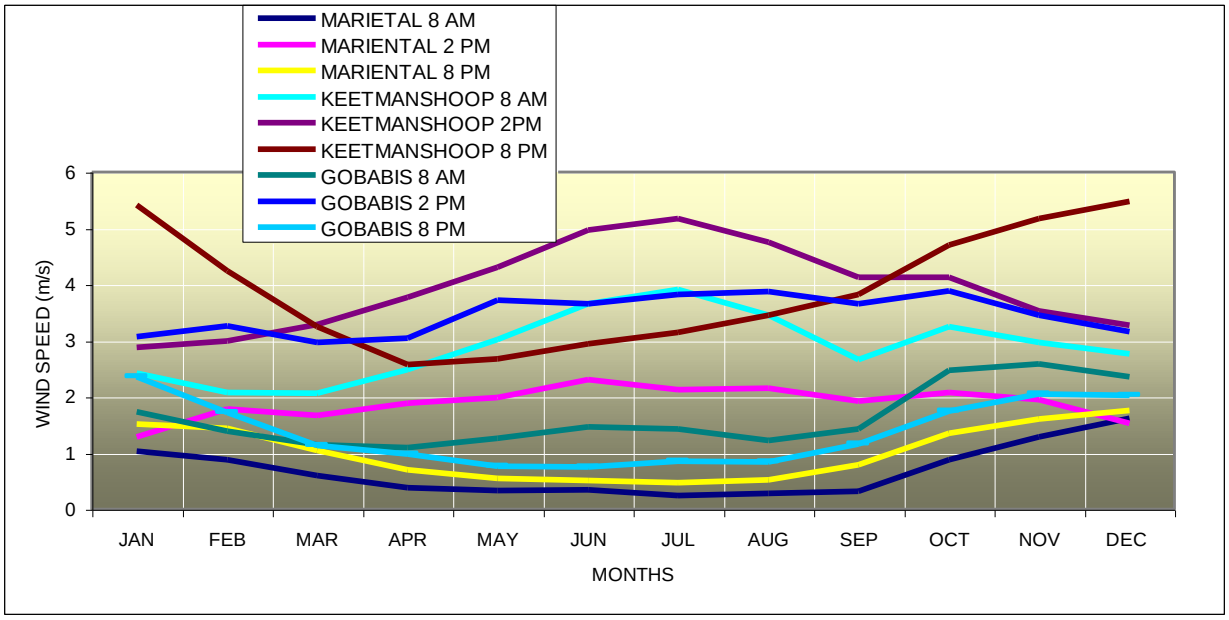

Figure 4.6: Comparative climatic data sets - Average wind speed at Mariental, Keetmanshoop and Gobabis.

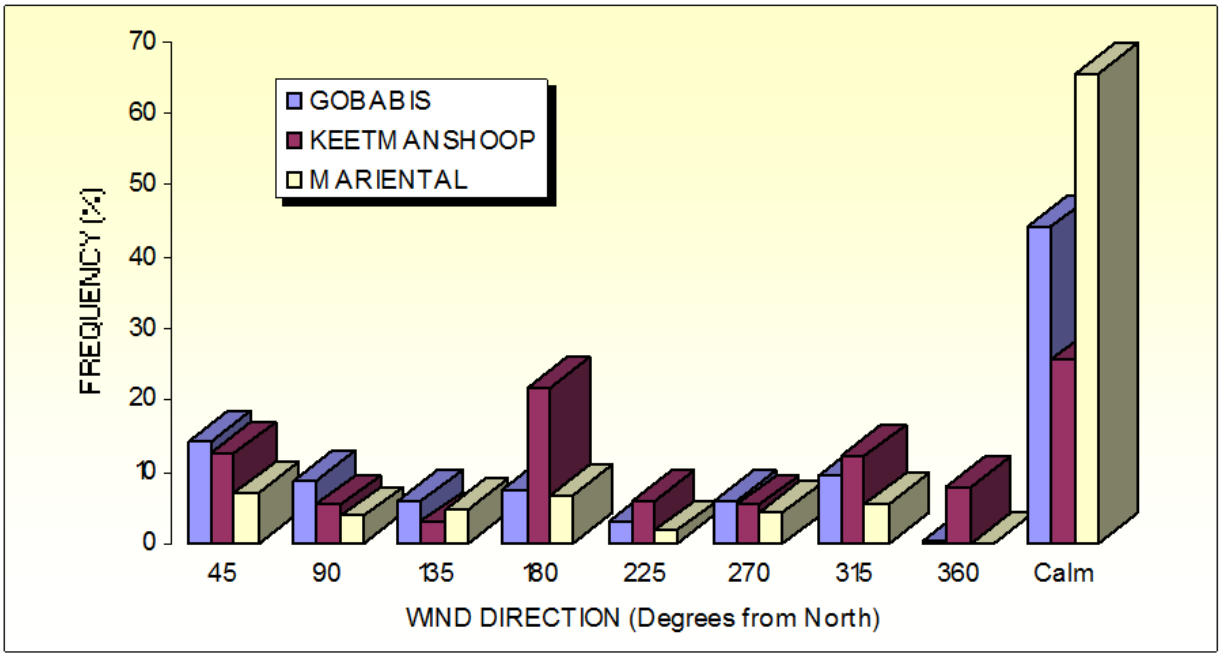

Figure 4.7 Comparative climatic data sets - Wind direction and speed for Mariental, Keetmanshoop and Gobabis weather stations (Data source Metrological Services of Namibia).

4.3 Fauna

4.3.1 Reptiles

Endemic reptile species known and/or expected to occur in the general area make up 22.9% of the reptiles and although not as high as endemism elsewhere – for example the western escarpment areas of Namibia – still makes up a large portion of the reptiles.

Reptiles of greatest concern are probably the two species classified as insufficiently known and rare (*Mehelya vernayi* and *Psammophis jallae*) and the tortoises (*Stigmochelys pardalis* and *Psammobates oculiferus*) which are often consumed by humans; *Python natalensis* which is indiscriminately killed throughout its range and *Varanus albigularis* (food) as well as the various *Pachydactylus* species geckos of which 71.4% are viewed as endemic. Other important species would be the 3 Blind snakes (*Rhinotyphlops* species of which 2 species are endemic) and little known and endemic *Hemirhagerrhis viperrinus* (viperine bark snake) (Annex 2). However, none of the reptiles are exclusively associated with PEL No. 68 (Annex 2). .

4.3.2 Amphibians

Of the 11 species of amphibians expected to occur in the general area, *Pyxicephalus adspersus*, is viewed as near threatened (Du Preez and Carruthers 2009). However, *Pyxicephalus adspersus* is widespread throughout Namibia and not exclusively associated with the PEL No. 68 area. The Omatako, Hardap and Tilda Viljoen Dams as well as the various ephemeral rivers (e.g. Black and White Nossob, etc.) in the general area and their tributaries and ephemeral pans – e.g. Aminuis area – are viewed as important amphibian habitat in the general area (Annex 2). However, none of the amphibians are exclusively associated with PEL No. 68.

4.3.3 Mammals

Of the 93 species of mammals expected to occur in the general area, only 2% are endemic and 30% are classified under international conservation legislation. The most important species under Namibian legislation are those classified as rare (Namibian wing-gland bat, Woosnam's desert mouse, hedgehog and black-footed cat), endemic and vulnerable (especially eland) species. Other important species are pangolin (which are used for traditional medicinal purposes) and the African wild dog that occasionally occurs in the general area (Annex 2). However, none of the mammals are exclusively associated with PEL No. 68.

4.3.4 Birds

The high proportion of endemics – 6 of the 14 endemics to Namibia (i.e. 43% of all endemics) – expected to occur in the general area underscore the importance of this area (Annex 2). . Furthermore 14.9% are classified as southern African endemics (or 3.4% of all the birds expected) and 85.1% are classified as southern African near-endemics (or 19.4% of all the birds expected). The most important species known/expected – although not exclusively associated with the general area – are viewed as the Namibian endemics – especially Rüppell's parrot which requires specific nesting sites – and the species classified as endangered – especially martial and tawny eagles which are often persecuted as stock thieves. The birds classified as endangered, near threatened and vulnerable by the IUCN (2014) – Kori bustard,

white-backed vulture, bateleur, black harrier, martial eagle and secretarybird – are also viewed as important. However, none of these birds are exclusively associated with PEL No. 68.

4.4 Flora

4.4.1 Trees / Shrubs and Grasses

The most important larger trees/shrubs expected to occur in the general area are *Burkea africana*, *Sclerocarya birrea*, *Strychnos cocculoides* and *Strychnos pungens* as all are protected species and used for wood (e.g. *B. africana*) or fruit and the most important grass expected in the area is the endemic *Eragrostis omahekensis* associated with disturbed areas (Annex 2). However, none of these larger tree and shrub species (>1m in height) are exclusively associated with PEL No. 68.

4.4.2 Other Flora Species

Aloes are protected throughout Namibia with 3 aloe species not included in Table 5, but which potentially occur in the general area, and also viewed as important are *Aloe hereroensis*, *A. littoralis* and *A. zebrina* (Rothmann 2004). *Aloe zebrina* can form dense stands, especially under trees, in some parts.

Other species with commercial potential that could occur in the general area include *Harpagophytum procumbens* (devil's claw) – harvested for medicinal purposes and often over-exploited – and *Citrullus lanatus* (tsamma melon) which potentially has a huge economic benefit (Mendelsohn *et al.* 2002). Devils' claw and tsamma melons are usually associated with sandy soils throughout their range.

At least 64 species of ferns, of which 13 species being endemic, occur throughout Namibia. Ferns in the general area include at least 6 indigenous species (*Cheilanthes dinteri*, *Marselia coromandelina*, *M. farinosa*, *M. vera*, *Ophioglossum polyphyllum* and *Pellaea calomelanos*) and no endemics (Crouch *et al.* 2011). The general area is undercollected with more species probably occurring in the general area than presented above.

The overall diversity of lichens is poorly known from Namibia, especially the coastal areas and statistics on endemicity is even sparser (Craven 1998). More than 100 species are expected to occur in the Namib Desert with the majority being uniquely related to the coastal fog belt. Lichen diversity is related to air humidity and generally decreases inland form the Namibian coast (Schults and Rambold 2007). Off road driving is the biggest threat to these lichens which are often rare and unique to Namibia. To indicate how poorly known lichens are from Namibia, the recent publication by Schultz *et al.* (2009) indicating that 37 of the 39 lichen species collected during BIOTA surveys in the early/mid 2000's were new to science (i.e. new species), is a case in point. Lichens are expected to occur in the general PEL No. 68 area – especially rocky outcrops and on southern side of larger trees – but what and how many species in currently unknown.

Although the focus during this literature survey was on the more visible trees, shrubs, grasses and more important other species potentially occurring in the general area, many more species – e.g. herbs – occur throughout the area and are viewed as important (Annex 2). However, none of these "other" plant species presented above are exclusively associated with PEL No. 68.

4.5 Summary of the Socioeconomic Settings

The following is summary of the regional and local socioeconomic setting of the PEL 68 area as detailed in the Annex 3:

- ✓ Kalahari and Aminuis are constituencies in the Omaheke Region of Namibia, which form part of the border between Namibia and Botswana;
- ✓ Aminuis and Kalahari constituencies cover a total area of 25 242.8 km^2 amounting to 29% of the total area of Omaheke Region (84 741.8 km^2);
- ✓ Omaheke is known for cattle farming and the Trans- Kalahari highway;
- ✓ Aminuis and Kalahari Constituencies have a total population of 19 917, which comprises of 48.8% females and 51.2% males in Kalahari constituency and 46.9% females and 53.1% males in Aminuis constituency;
- ✓ Omaheke region had a high share of working age population of about 52.2 percent, while the elderly made up 7.3 percent of the total population;
- ✓ The population in Omaheke Region is growing at an annual rate of 0.5 percent;
- ✓ Aminuis and Kalahari Constituencies have a population density of 0.9 and 0.6 persons per square kilometres (sq km) respectively;
- ✓ The total population of Omaheke increased from 52,735 in 1991 to 68,039 in 2001, and further to 71,233 people in 2011;
- ✓ The Omaheke Region's population has a median age of 21 years;
- ✓ Namibia has a literacy rate of 88.7 percent. The Omaheke Regional literacy rate was 73.3 percent, which is lower than the literacy rate in Namibia;
- ✓ In Aminuis constituency, 27.6 percent of people aged 6 years and above attended school, the school attendance is higher than the average regional attendance;
- ✓ 21.2 percent of children aged 6 years and above attended school in Kalahari Constituency;
- ✓ The Aminuis Constituency consisted of 8.1 percent of the population aged between 0-4 years attending Early Childhood Development (ECD) Programmes;
- ✓ Omaheke Region's Grade 12 pass rate is ranked 12th in Namibia;
- ✓ Elementary occupations made up the largest occupation group in Omaheke Region (37.8%), followed by skilled agricultural and fisheries workers (22.9%), Service Workers (10.6%) and Craft and Related trade workers (9.3%);
- ✓ Elementary occupations, as well as skilled agricultural and fisheries occupations were dominated by males, compared to females, but more females worked as service workers compared to males;
- ✓ The main industries in Omaheke Region are Agriculture, Forestry and Fishing, followed by Administrative and Support service, then Construction industry;

- ✓ Omaheke Region has a higher unemployment rate (39.5%) than the national average (26.8%);
- ✓ Aminuis and Kalahari constituencies have unemployment rates standing at 35.6 percent and 16.8 percent respectively;
- ✓ The labour force participation for Omaheke Region is 65.2 percent. In Aminuis constituency it is 63.2% and 67.8% in Kalahari Constituency;
- ✓ There are 16 174 households in Omaheke Region, with 85.1 percent of the households having access to safe water;
- ✓ 85.1 percent of households in Omaheke region had access to safe water;
- ✓ Detached houses were the most common types of dwelling units, accounting for 53.7 percent of households;
- ✓ The most common source of energy for lighting in Aminuis is Paraffin/Kerocene (49.4%), while in Kalahari, Candles (43.6%) made up the most common source of energy;
- ✓ The most common means of disposing garbage in Omaheke region was burning (38.2%);
- ✓ 90% of Block 2219 and 2319 is located in a remote area, with limited infrastructure, apart from the nearest town Gobabis;
- ✓ Kalahari Wild Silk Manufacturers objective is to contribute to reduction of poverty and enhance secure livelihoods;
- ✓ The Namibian-German Special Initiative Programme (NGSIP) through the National Planning Commission aims to develop rural communities;
- ✓ Aminuis and Kalahari constituencies have one major access point, the Trans-Kalahari Highway linking Namibia and Gobabis.

Block 2219 and 2319 area is very remotely located with limited accessibility. The development is not located adjacent to a major road. The development will have mainly positive impacts on the surrounding areas (Annex 3).

4.6 Ground Components

4.6.1 Regional and Local Geology

The PEL 68 is dominated by sedimentary rocks of the Karoo which have been deposited on a mostly Damaran-age Precambrian basement consisting mainly of metasediments like mica schist, phyllite, carbonate (marble, dolomite, or limestone) (Fig. 4.8). These metasediments have been intruded by granites in some places. In most Karoo Sequence basins sedimentation started with the Permo- Carboniferous Dwyka Formation which was deposited under glacial and periglacial conditions and consists of tillite, mixtite, pebbly mudstone and dark shale.

The material is derived from glaciated highs and was transported into depressions, where it either forms a several-hundred-metres-thick blanket, typical of the marine embayment of the Aranos Basin, or, further upland, fills glacial valleys and tectonic grabens in Kaokoland. With the retreat of the ice mostly fine-clastic material was deposited in marine, lacustrine and distal fluvial environments of the Ecca Group of lower Permian age (Fig. 4.8).

The local lithology is dominated by shale, with the northern portion of the block comprising a conglomerate of arkose and shale (Fig. 4.9). Limestone and siltstone are also present in block 2219. Dolerite intrudes into the shale in the southern reaches of the blocks. All these rock types are potential hosts for hydrocarbons, but the presence of shale could result in the natural gas being difficult to extract, as an environmentally unfeasible fracking processing may be needed. The surface is covered by recent deposits of the Kalahari Group consisting of sands and calcrete.

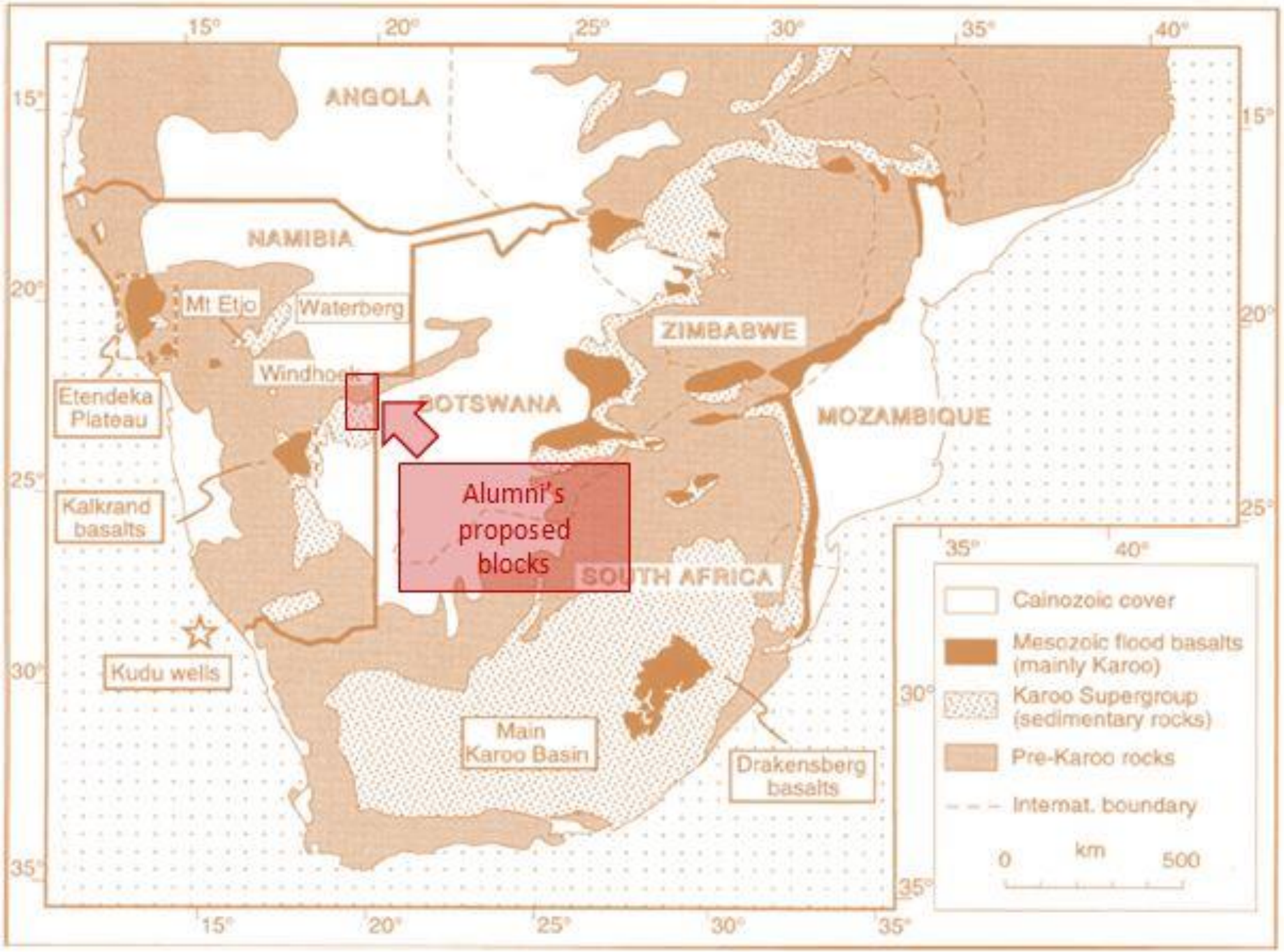

Figure 4.8: Regional geology of Southern Africa (Source:www.africanewenergies.com).

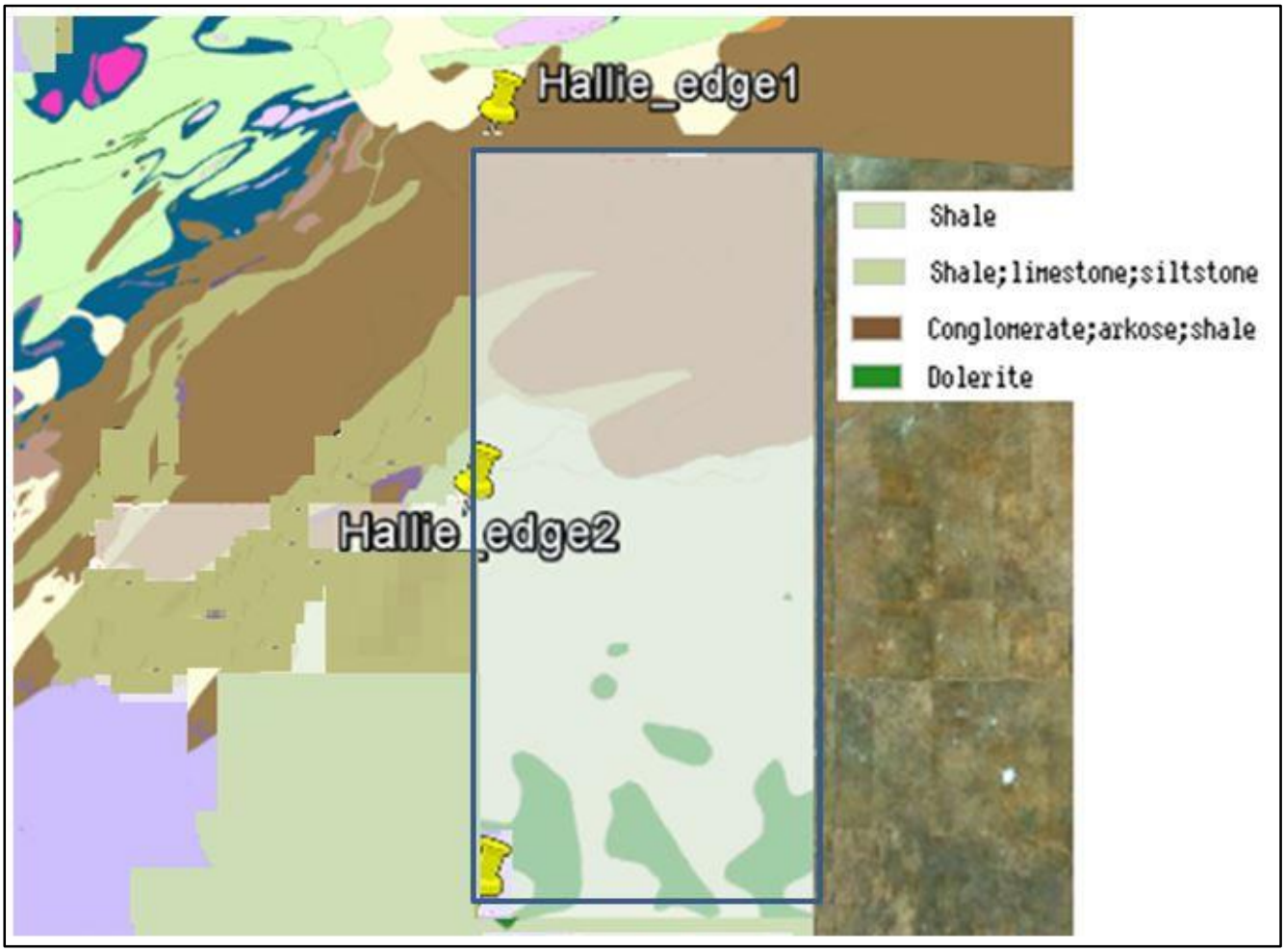

Figure 4.9: Geology of the PEL No. 68 (Source:www.africanewenergies.com).

4.6.2 Hydrocarbons Potential

According to Alumni Exploration East Namibia (PTY) the Gobabis Basin's Zaris Formation and Schwarzrand Subgroup limestones, particularly the biohermal structures are present along the northern and western margins of the Nama basin, are potential source rocks. Thrombolite and stromatolite reefs occur at several stratigraphic levels within the terminal Proterozoic Zaris sub-basin of the Nama to the west of the license area (c. 550–543 Ma) of central Namibia (http://www.africanewenergies.com). The reefs form integral parts of several carbonate platforms within the Nama Group, including the Kuibis platform encompassing most of Zaris sub-basin of the southern Nama Basin. An east-west ridge, the Osis Ridge, divides the Nama Basin into northern and southern compartments. The black carbonaceous Schwarzrand Subgroup shales encountered in the water borehole on the farm Nutupsdrift 112 west of Maltahohe may have been deposited under anoxic back-reef conditions in the sub-basin north of the Osis ridge and appear to have the best source rock potential particularly if the report of oil in the water borehole on Plattfontein 92 can be substantiated.

The reefs are composed of both thrombolites and stromatolites that form laterally continuous biostromes, isolated patch reefs, and isolated pinnacle reefs ranging in scale from a metre to several kilometres in width. In the majority of cases, the reefs occur stratigraphically as an integral facies within the transgressive systems tracts of sequences making up the Kuibis and

Huns platforms. This suggests that a regime of increasing accommodation was required to form well-developed reefs, though reefs also occur sporadically in high-stand systems tract settings. Within a given transgressive systems tract, a regime of increasing accommodation through time favours the transition from sheet-like biostromal geometries to more isolated patch and pinnacle biohermal geometries. Similarly, increasing accommodation in space, such as a transect down depositional dip, shows a similar transition from more sheet-like geometries in up-dip positions to more isolated geometries in down-dip positions. Reefal facies consist of thrombolitic domes, columns and mounds with well-developed internal clotted textures, in addition to stromatolitic domes, columns and mounds, with crudely to moderately well-developed internal lamination.

Stromatolites are better developed in conditions of relatively low accommodation, and up-dip locations, under conditions of higher current velocities and greater sediment influx. Thrombolites are better developed in conditions of relatively high accommodation and low sediment influx. Both types of microbialites are intimately associated with the first calcifying metazoan organisms, which may have attached themselves to the sediment surface or otherwise lived within sheltered depressions within the rough topography created by ecologically complex mats.

The appearance of thrombolitic textures during terminal Proterozoic time is consistent with colonization of cyanobacterial mats by higher algae and metazoans, which would have been an important process in generating clotted textures. Fabrics in the Nama thrombolites are well preserved and show evidence of thrombolitic mesoclots being overgrown by fibrous marine carbonate, interpreted as former aragonite. This was followed by emplacement of geopetal micrite fills, and precipitation of dolomite as an isopachous rim cement, followed by occlusion of remaining porosity by blocky calcite spar.

Historically various localities have been reported of hydrocarbon occurrence in the Nama basin and its related sub basins. The only petroleum encounter within the Nama is the bitumenous material encountered at depths of 700 ft in a water borehole drilled on the farm Plattfontein 92 southwest of Maltahohe and a small amount of oil was reported by farmers from this borehole this area is to the west of the license area. Although no porosity values of Nama-basin rocks are known, there is potential for a secondary porosity in calcareous sandstone lenses that occur in the Nama Basin. Objective reservoir is anticipated to be a secondary porosity in calcareous sandstone lenses that occur in places in the Nama-basin Formation. The Nama rocks are only folded along the margins of the Orogeny. In the rest of the basin they dip in general about 1 degree east. Any up-dip migration would therefore have carried hydrocarbons towards the margins of the basin.

4.6.3 Water Resources

4.6.3.1 Overview

Potential groundwater resources in the area are associated with the primary (sandstones) and secondary hydraulic properties of the local country rocks. The recent cover consisting of variable Kalahari Sands deposits and is a source of water supply in the general area. Local materials such as the gravels, clays and calcretes, are also potential local construction materials that can be used in the various construction activities associated with different infrastructure development in the area. According to the Department of Water Affairs and Forestry, (2001), presently water in the area is used for stock watering and increasingly for

irrigation purposes. Although irrigation has economic advantages such as creating job opportunities, the groundwater resources are limited and need to be protected.

4.6.3.2 Water Assessments and Recommendations

Possible targets for water resources in this area are mainly primary sandstones as well as fractured zones and faults that outcrop on the surface without impermeable infillings. The groundwater potential of the local rock units is generally low, to locally moderate and it improves as one goes further south outside the PEL area (Department of Water Affairs, 2001). Nevertheless, recharge is very limited in the area. A detailed water specialist study is highly recommended to be undertaken as part of the EIA and EMP for the drilling operations. Potential sources of water supply for the proposed exploration activities could be obtained from local resources.

4.6.3.3 Likely Impacts and Risk Assessment to Water Resources

Overall, the proposed exploration activities and only the site-specific drilling operations will have high and localised impacts on the surface and groundwater resources of the area. All other activities will have localised low to negligible negative impacts. Although there are several ephemeral river channels within the PEL area and some are tributaries of the major rivers, the proposed project activities will have very low and negligible risk of pollution to the local Ephemeral River networks within the PEL area.

4.7 Stakeholder Consultations and Engagement

4.7.1 Overview

Consultation and engagement of stakeholders also called Interested and Affected Parties (I & APs) must form part of the environmental assessment process for this project. In line with the environmental regulatory requirements and as part of the project registration with the Department of Environmental Affairs (DEA), a Scoping Report made available to stakeholders as part of the consultation requirements.

4.7.2 Notification of Stakeholders

According to the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 and the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007), a person conducting a public consultation process must give notice to all potential interested and affected parties of the application which is subjected to public consultation. The EIA Regulations clearly state that potential interested and affected parties must be provided with a reasonable opportunity to comment on the application under section 21(6) of the EIA Regulations. In line with the provisions of the regulations, advertisements must be placed in the local newspapers informing all the interested and affected patties about the proposed exploration. Hardcopies copies of the Environmental Scoping Report must be made available to all the registered stakeholders.

5. IMPACT ASSESSMENT RESULTS

5.1 Alternatives to the Project Development Process

The Environmental Assessment procedures has been undertaken in accordance with the provisions of the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 gazetted under the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007). The following alternatives have been considered:

- ✓ **Petroleum (Oil and Gas) Potential:** The Etosha and Nama Basins are the only two (2) well known onshore Sedimentary Basins in Namibia and have been explored by different companies over the years. No economic petroleum resources have been discovered yet and a number of companies are currently undertaking exploration in Etosha and Nama Basin. The proponent intend to explore / prospect for petroleum resources within the PEL No. 68 situated in the Nama Basin;

- ✓ **Other Alternative Land Uses:** Communal and commercial agriculture with growing tourism opportunities are both key important current land use options of the general PEL area. Overall landscape value and uniqueness to support tourism development can be classified as moderate;

- ✓ **Potential Land Use Conflicts:** Considering the current land use practices (communal and commercial agriculture with slowly growing tourism) as well as potential other land uses including petroleum exploration, it's likely that the economic spin-off of the likely successful exploration outcomes in the area can still co-exist with the current existing and potential land use options. However, much more detail assessment of the visual and other socioeconomic impacts will need to be undertaken as part of the full EIA for the drilling phase. The use of thematic mapping thereby delineating zones for specific uses such as conservation, resources exploration or tourism etc, within the PEL area will greatly improve the multiple land use practices and explore possible coexistence model.

5.2 Impact Assessment Criteria

5.2.1 Approach

The impact assessment methodology adapted for the PEL No. 68 are in line with the ToR as well as the matrix criteria widely used internationally. The overall matrix framework has adopted the Leopold matrix which is one of the internationally best known matrix methodology available for predicting the impact of a project on the environment. The Leopold matrix is a two dimensional matrix cross-referencing the following:

- ✓ The activities linked to the project that are supposed to have an impact on man and the environment;

- ✓ The existing environmental and social conditions that could possibly be affected by the project.

The activities linked to the proposed exploration are listed on one axis, while the environmental and social conditions are listed on the other axis, and divided in following three (3) major groups:

- ✓ Physical conditions: receiving environment, air, etc.;
- ✓ Biological conditions: fauna, flora, ecosystems etc., and;
- ✓ Social and cultural conditions: Socioeconomic setting, historical and cultural issues, populations, economy…

The activities of the proposed exploration have the potential to affect the environment in many different ways. The first step in the impact identification has been to identify the various types of activities associated with the development of the proposed exploration, together with their associated emissions and land discharges where appropriate. At a high level, the main sources of impact of the proposed exploration (drilling of two boreholes) are:

- ✓ Physical disturbance to the local environment;
- ✓ Emissions, discharges and wastes;
- ✓ Accidental events.

Accidental events are clearly not a part of the intended activity and their potential occurrence has a low probability of occurrence associated with it. Such impacts have therefor been treated differently. The activities / sources of potential impact due to the project and the receiving environment that could potentially be affected are identified in Table 5.1.

Table 5.1: The impact matrix for the proposed exploration in the PEL No. 68.

ENVIRONMENTAL IMPACT KEY Likely Impact No Impacts			RECEPTORS / TARGETS THAT MAY BE IMPACTED (RESOURCES)						
			PHYSICAL ENVIRONMENT			BIOLOGICAL ENVIRONMENT			
			Natural Environment – Air, Noise, Water, Dust	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic and Cultural – Characteristics of the local societies and communities	Flora	Fauna	Habitat	Others
SOURCES OF POTENTIAL IMPACT	EXPLORATION METHOD	CHARACTERISTICS							
	1. Satellite imagery	Initial desktop exploration activities							
	2. Geochemical sampling and analysis	Regional field-based reconnaissance activities							
	3. Transient pulse								
	4. Radiometric								
	5. Well Drilling (Stratigraphic)	Detailed site-specific field-based validation activities							

5.3 Evaluation of Impacts

5.3.1 Impact Factors (Project Activities)

The proposed petroleum exploration methods have been characterised as sources of impact and have been classified into impact factors in order to assess the likely impacts of the proposed project methods as activities on the physical, biological and socioeconomic environment. Impact factors (proposed exploration activities) have been evaluated separately for each environmental component relevant for the scope of this study.

5.3.2 Evaluation of Project Activities Impacts

5.3.2.1 Summary Overview

In evaluating the degree of potential impacts, the following factors have been taken into consideration:

(i) Impact Severity: The severity of an impact is a function of a range of considerations;

(ii) Likelihood of Occurrence (Probability): How likely is the impact to occur?

5.3.2.2 Severity Criteria for Environmental Impacts

In evaluating the severity of potential environmental impacts, the following factors have been taken into consideration:

- ✓ Receptor/ Resource Characteristics: The nature, importance and sensitivity to change of the receptors / target or resources that could be affected;
- ✓ Impact Magnitude: The magnitude of the change that is induced;
- ✓ Impact Duration: The time period over which the impact is expected to last;
- ✓ Impact Extent: The geographical extent of the induced change, and;
- ✓ Regulations, Standards and Guidelines: The status of the impact in relation to regulations (e.g. discharge limits), standards (e.g. environmental quality criteria) and guidelines.

The overall impact severity has been categorised using a subjective scale as shown in Table 5.2 for magnitude, Table 5.3 for duration and Table 5.4 for extent.

Table 5.2: Scored on a scale from 0 to 5 for impact magnitude.

SCALE		DESCRIPTION
0		no observable effect
1		low effect
2		tolerable effect
3		medium high effect
4		high effect
5		very high effect (devastation)

Table 5.3: Scored time period over which the impact is expected to last.

SCALE		DESCRIPTION
T		Temporary
P		Permanent

Table 5.4: Scored geographical extent of the induced change.

SCALE		DESCRIPTION
L		limited impact on location
O		impact of importance for municipality;
R		impact of regional character
N		impact of national character
M		impact of cross-border character

5.3.2.3 Likelihood (Probability) of Occurrence

The likelihood (probability) of the pre-identified events occurring has been ascribed using a qualitative scale of probability categories (in increasing order of likelihood) as shown in Table 5.5. Likelihood is estimated on the basis of experience and/ or evidence that such an outcome has previously occurred. Impacts resulting from routine/planned events (i.e., normal operations) are classified under category (E).

Table 5.5: Summary of the qualitative scale of probability categories (in increasing order of likelihood).

SCALE		DESCRIPTION
A		Extremely unlikely (e.g. never heard of in the industry)
B		Unlikely (e.g. heard of in the industry but considered unlikely)
C		Low likelihood (egg such incidents/impacts have occurred but are uncommon)
D		Medium likelihood (e.g. such incidents/impacts occur several times per year within the industry)
E		High likelihood (e.g. such incidents/impacts occurs several times per year at each location where such works are undertaken)

5.3.3 Project Activities Summary of Impacts Results

The results of the impacts assessment and evaluation has adopted a matrix framework similar to the Leopold matrix. The Leopold matrix is a two dimensional matrix cross-referencing the following:

- ✓ The activities linked to the project that are supposed to have an impact on man and the environment;
- ✓ The existing environmental and social conditions that could possibly be affected by the project.

The activities linked to the proposed petroleum exploration activities are listed on one axis, while the physical and biological environmental conditions are listed on the other axis, and divided in following two (2) major groups:

(i) Physical Environment:

- ✓ Physical conditions: receiving environment, air, etc.;
- ✓ Biological conditions: fauna, flora, ecosystems etc., and;
- ✓ Social and cultural conditions: Socioeconomic setting, historical and cultural issues, populations, economy…

(ii) Biological Environment:

- ✓ Fauna;
- ✓ Flora;
- ✓ Habitants.

Assessment results of the magnitude, duration, extent and probability of the potential impacts due to the proposed project activities interacting with the receiving environment are presented in form of a matrix as shown in Tables 5.6 – 5.9. The overall severity of potential environmental impacts of the proposed project activities will have low magnitude (Table 5.6), temporally duration (Table 5.7), localised extent (Table 5.6) and low probability of occurrence (Table 5.9). It is important to note that impacts have been considered without the implementation of mitigation measures. The need for and appropriate mitigation measures as presented in the Section 6 of this report have be determined on the basis of the impact assessment presented in this report.

Table 5.6: Results of the scored on a scale from 0 to 5 for negative impact magnitude.

ENVIRONMENTAL IMPACT KEY

SCALE		DESCRIPTION
0		no observable effect
1		low effect
2		tolerable effect
3		medium high effect
4		high effect
5		very high effect (devastation)

SOURCES OF POTENTIAL IMPACT	EXPLORATION METHOD	CHARACTERISTICS	RECEPTORS / TARGETS THAT MAY BE IMPACTED (RESOURCES)						
			PHYSICAL ENVIRONMENT			BIOLOGICAL ENVIRONMENT			
			Natural Environment – Air, Noise, Water, Dust	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic and Cultural – Characteristics of the local societies and communities	Flora	Fauna	Habitat	Others
	1. Satellite imagery	Initial desktop exploration activities	0	0	0	0	0	0	0
	2. Geochemical sampling and analysis	Regional field-based reconnaissance activities	1	1	1	1	1	1	1
	3. Transient pulse		1	1	1	1	1	1	1
	4. Radiometric		1	1	1	1	1	1	1
	5. Well Drilling (Stratigraphic)	Detailed site-specific field-based validation activities	2	2	2	2	2	2	2

Table 5.7: Results of the scored time period over which the impact is expected to last.

ENVIRONMENTAL IMPACT KEY				RECEPTORS / TARGETS THAT MAY BE IMPACTED (RESOURCES)						
				PHYSICAL ENVIRONMENT			BIOLOGICAL ENVIRONMENT			
SCALE		DESCRIPTION		Natural Environment – Air, Noise, Water, Dust	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic and Cultural – Characteristics of the local societies and communities	Flora	Fauna	Habitat	Others
T		Temporary								
P		Permanent								
SOURCES OF POTENTIAL IMPACT	EXPLORATION METHOD		CHARACTERISTICS							
	1.	Satellite imagery	Initial desktop exploration activities	NOT APPLICABLE						
	2.	Geochemical sampling and analysis	Regional field-based reconnaissance activities	T	T	T	T	T	T	T
	3.	Transient pulse		T	T	T	T	T	T	T
	4.	Radiometric		T	T	T	T	T	T	T
	5.	Well Drilling (Stratigraphic)	Detailed site-specific field-based validation activities	T	T	T	T	T	T	T

Table 5.8: Results of the scored geographical extent of the induced change.

ENVIRONMENTAL IMPACT KEY

SCALE		DESCRIPTION
L		limited impact on location
O		impact of importance for municipality
R		impact of regional character
N		impact of national character
M		impact of cross-border character

		EXPLORATION METHOD	CHARACTERISTICS	RECEPTORS / TARGETS THAT MAY BE IMPACTED (RESOURCES)						
				PHYSICAL ENVIRONMENT			BIOLOGICAL ENVIRONMENT			
				Natural Environment – Air, Noise, Water, Dust	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic and Cultural – Characteristics of the local societies and communities	Flora	Flora	Habitat	Others
SOURCES OF POTENTIAL IMPACT	1.	Satellite imagery	Initial desktop exploration activities	NOT APPLICABLE						
	2.	Geochemical sampling and analysis	Regional field-based reconnaissance activities	L	L	L	L	L	L	L
	3.	Transient pulse		L	L	L	L	L	L	L
	4.	Radiometric		L	L	L	L	L	L	L
	5.	Well Drilling (Stratigraphic)	Detailed site-specific field-based validation activities	L	L	L	L	L	L	L

Table 5.9: Results of the qualitative scale of probability occurrence.

ENVIRONMENTAL IMPACT KEY

SCALE		DESCRIPTION
A		Extremely unlikely (e.g. never heard of in the industry)
B		Unlikely (e.g. heard of in the industry but considered unlikely)
C		Low likelihood (egg such incidents/impacts have occurred but are uncommon)
D		Medium likelihood (e.g. such incidents/impacts occur several times per year within the industry)
E		High likelihood (e.g. such incidents/impacts occurs several times per year at each location where such works are undertaken)

SOURCES OF POTENTIAL IMPACT			RECEPTORS / TARGETS THAT MAY BE IMPACTED (RESOURCES)						
			PHYSICAL ENVIRONMENT			BIOLOGICAL ENVIRONMENT			
	EXPLORATION METHOD	CHARACTERISTICS	Natural Environment – Air, Noise, Water, Dust	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic and Cultural – Characteristics of the local societies and communities	Flora	Fauna	Habitat	Others
	1. Satellite imagery	Initial desktop exploration activities	NOT APPLICABLE						
	2. Geochemical sampling and analysis	Regional field-based reconnaissance activities	C	C	C	C	C	C	C
	3. Transient pulse		C	C	C	C	C	C	C
	4. Radiometric		C	C	C	C	C	C	C
	5. Well Drilling (Stratigraphic)	Detailed site-specific field-based validation activities	D	D	D	D	D	D	D

5.4 Evaluation of Significant Impacts

5.4.1 Overview

The significance of each impact has been determined by assessing the impact severity against the likelihood (probability) of the impact occurring as summarised in the impact significance assessment matrix provided in Table 5.10.

5.4.2 Significance Criteria

Significance criteria for negative/adverse impacts (i.e., relative ranking of importance) are defined in Table 5.10. It is important to note that impacts have been considered without the implementation of mitigation measures. The need for and appropriate mitigation measures as presented in the EMP Section 6 of this report have be determined on the basis of the impact assessment presented in this report.

Table 5.10: Scored impact significance criteria.

	IMPACT LIKELIHOOD				
IMPACT SEVERITY	Extremely Unlikely **[0]**	Unlikely **[1]**	Low Likelihood **[2]**	Medium Likelihood **[3]**	High Likelihood **[4]**
Negligible **[A]**	Negligible Impact **[A0]**	Negligible Impact **[A1]**	Negligible Impact **[A2]**	Negligible Impact **[A3]**	Negligible Impact **[A4]**
Low **[B]**	Negligible Impact **[B0]**	Negligible Impact **[B1]**	Negligible Impact **[B2]**	Negligible to Low Impact **[B3]**	Low Impact **[B4]**
Medium **[C]**	Negligible Impact **[C0]**	Negligible Impact **[C1]**	Low Impact **[C2]**	Low to Medium Impact **[C3]**	Medium Impact **[C4]**
High **[D]**	Negligible to Low Impact **[D0]**	Low Impact **[D1]**	Medium Impact **[D2]**	High Impact **[D3]**	High to Unacceptable Impact **[D4]**

5.4.3 Assessment Likely Significant Impacts

The assessment of significant impacts depended upon the degree to which the proposed project activities are likely to results in unwanted consequences on the receptor covering physical and biological environments (Table 5.11). Overall, the assessment of significant impacts has focused on the ecosystem-based approach that considers potential impacts to the ecosystem. The main key sources of impacts that have been used in the determination of significant impacts posed by the proposed petroleum exploration comprised activities. Each of the main areas of impact have been identified and assessed as follows:

- ✓ Positive Impacts are classified under a single category; they are then evaluated qualitatively with a view to their enhancement, if practical;

- ✓ Negligible or Low Impacts will require little or no additional management or mitigation measures (on the basis that the magnitude of the impact is sufficiently small, or that the receptor is of low sensitivity);

- ✓ Medium or High Impacts require the adoption of management or mitigation measures;

- ✓ High Impacts always require further management or mitigation measures to limit or reduce the impact to an acceptable level.

Overall the results of the significant impact assessment matrix for the proposed petroleum exploration activities on the physical and biological environments are shown in Tables 5.11.

Table 5.11: Significant impact assessment matrix for the proposed exploration activities.

ENVIRONMENTAL IMPACT KEY

IMPACT SEVERITY	IMPACT LIKELIHOOD: Extremely Unlikely [0]	Unlikely [1]	Low Likelihood [2]	Medium Likelihood [3]	High Likelihood [4]
Slight [A]	[A0]	[A1]	[A2]	[A3]	[A4]
Low [B]	[B0]	[B1]	[B2]	[B3]	[B4]
Medium [C]	[C0]	[C1]	[C2]	[C3]	[C4]
High [D]	[D0]	[D1]	[D2]	[D3]	[D4]

SOURCES OF POTENTIAL IMPACT	EXPLORATION METHOD	CHARACTERISTICS	RECEPTORS / TARGETS THAT MAY BE IMPACTED (RESOURCES)						
			PHYSICAL ENVIRONMENT			BIOLOGICAL ENVIRONMENT			
			Natural Environment – Air, Noise, Water, Dust	Built Environment – Houses, Roads, Transport Systems, Buildings, Infrastructure	Socioeconomic and Cultural – Characteristics of the local societies and communities	Flora	Fauna	Habitat	Others
	1. Satellite imagery	Initial desktop exploration activities	NOT APPLICABLE						
	2. Geochemical sampling and analysis	Regional field-based reconnaissance activities	B3	B2	B3	B3	B3	B3	B3
	3. Transient pulse		B3	B2	B3	B3	B3	B3	B3
	4. Radiometric		B3	B2	B3	B3	B3	B3	B3
	5. Well Drilling (Stratigraphic)	Detailed site-specific field-based validation activities	D3	D3	D3	D3	D3	D3	D3

5.5 Assessment of Overall Impacts

5.5.1 Summary of the Results of the Impact Assessment

Based on the assessment undertaken and outlined in Tables 5.6 - 5.11, the following is the summary of the overall likely negative and significant impacts of the proposed exploration activities on the receiving environment (physical, biological and socioeconomic environments) without and with mitigations:

(i) **Satellite imagery:** Overall likely negative impact on the receiving environment will be negligible and extremely unlikely probability of occurrence without mitigations. Overall significant impacts will be negligible;

(ii) **Geochemical sampling and analysis:** Overall likely negative impact on the receiving environment will be negligible with extremely unlikely probability of occurrence without mitigations. Overall significant impacts will be negligible. Some field-based activities will have localised low impacts with low probability of occurrence without mitigations and negligible with mitigations. Overall significant impacts will be negligible;

(iii) **Transient pulse:** The activities will have localised low impacts with low probability of occurrence without mitigations and negligible with mitigations**.** Overall significant impacts will be negligible**.** All desktop related activities and laboratory assessments will have negligible impacts with extremely unlikely probability of occurrence without mitigations. Overall significant impacts will be negligible;

(iv) **Radiometric:** The activities will have localised low impacts with low probability of occurrence without mitigations and negligible with mitigations**.** Overall significant impacts will be negligible**.** All desktop related activities and laboratory assessments will have negligible impacts with extremely unlikely probability of occurrence without mitigations. Overall significant impacts will be negligible;

(v) **Ground Tellurics:** The activities will have localised low impacts with low probability of occurrence without mitigations and negligible with mitigations**.** Overall significant impacts will be negligible**.** All desktop related activities and laboratory assessments will have negligible impacts with extremely unlikely probability of occurrence without mitigations. Overall significant impacts will be negligible;

(vi) **Well Drilling (Stratigraphic):** Overall likely negative impact on the receiving environment will be high and localised impacts without mitigations and localised low impacts with mitigations. Overall significant impacts will be medium without mitigations and low with mitigations.

6. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

6.1 Summary of the EMP Objectives

The Environmental Management Plan (EMP) provides a detailed plan of action required in the implementation of the mitigation measures for minimising and maximising the identified negative and positive impacts respectively. The EMP gives commitments including financial and human resources provisions for effective management of the likely environmental liabilities during and after the exploration. Regular assessments and evaluation of the environmental liabilities during the exploration will need to be undertaken and will ensure adequate provision of the necessary resources towards good environmental management at various stages of the project development.

6.2 Specific Mitigation Measures

Based on the findings of the Scoping work, the following specific mitigations have been provided for the proposed exploration programme activities and in particular for the field-based exploration activities:

(i) Mitigation measures for vehicles movements and access tracks management are:

- ✓ Avoid unnecessary affecting areas viewed as important habitat – i.e. Ephemeral Rivers, rocky outcrops; lithops / lichen fields; clumps of protected tree species;
- ✓ Make use of existing tracks/roads as much as possible throughout the area;
- ✓ Do not drive randomly throughout the area (could cause mortalities to vertebrate fauna and unique flora; accidental fires; erosion related problems, etc.);
- ✓ Avoid off-road driving at night as this increases mortalities of nocturnal species;
- ✓ Implement and maintain off-road track discipline with maximum speed limits (e.g.30km/h) as this would result in fewer faunal mortalities and limit dust pollution;
- ✓ Where tracks have to be made to potential exploration sites off the main routes, theroutes should be selected causing minimal damage to the environment – e.g. use the same tracks; cross drainage lines at right angles; avoid placing tracks within drainage lines; avoid collateral damage (i.e. select routes that do not require the unnecessary removal of trees/shrubs, especially protected species);
- ✓ Rehabilitate all new tracks created.

(ii) Mitigation measures to be implemented with respect to the exploration camps and exploration sites are:

- ✓ Select camp sites and other temporary lay over sites with care – i.e. avoid important habitats;
- ✓ Use portable toilets to avoid faecal pollution around camp and exploration sites;

- ✓ Initiate a suitable and appropriate refuse removal policy as littering could result in certain animals becoming accustomed to humans and associated activity and result in typical problem animal scenarios – e.g. baboon, black-backed jackal, etc.;

- ✓ Avoid and/or limit the use of lights during nocturnal exploration activities as this could influence and/or affect various nocturnal species – e.g. bats and owls, etc. Use focused lighting for least effect;

- ✓ Prevent the killing of species viewed as dangerous – e.g. various snakes – when on site;

- ✓ Prevent the setting of snares for ungulates (i.e. poaching) or collection of veld foods (e.g. tortoises) and unique plants (e.g. various Aloe and Lithop) or any form of illegalhunting activities;

- ✓ Avoid introducing dogs and cats as pets to camp sites as these can cause significant mortalities to local fauna (cats) and even stock losses (dogs);

- ✓ Remove and relocate slow moving vertebrate fauna (e.g. tortoises, chameleon, snakes, etc.) to suitable habitat elsewhere on property;

- ✓ Avoid the removal and/or damaging of protected flora potentially occurring in the general area – e.g. various Aloe, Commiphora and Lithop species;

- ✓ Avoid introducing ornamental plants, especially potential invasive alien species, as part of the landscaping of the camp site, etc., but rather use localised indigenous species, should landscaping be attempted, which would also require less maintenance (e.g. water);

- ✓ Remove all invasive alien species on site, especially Prosopis sp., which is already becoming a major ecological problem along various water courses throughout southern Namibia. This would not only indicate environmental commitment, but actively contribute to a better landscape;

- ✓ Inform contractors/workers regarding the above mentioned issues prior to exploration activities and monitor for compliance thereof throughout;

- ✓ Rehabilitate all areas disturbed by the exploration activities – i.e. camp sites, exploration sites, etc.;

- ✓ Implement a policy of replacing 2 tree species (preferably the same species) for every 1 protected tree species having to be removed (if necessary);

- ✓ Although fires are not expected to be a major issue in the general area due to the overall lack of grass cover, some years it may be necessary to consider fire prevention. Ensure that adequate firefighting equipment (e.g. fire beaters; extinguishers, etc.) is available at camp sites and clear kitchen areas to avoid accidental fires;

- ✓ Employ an independent environmental auditor to ensure compliance, especially of the rehabilitation of all the affected areas.

(iii) Mitigation measures for ground components including geology, water and construction materials are:

- ✓ Limit the operation to a specific site and avoid sensitive areas (Ephemeral River Channels and protected flora). This would sacrifice the actual area for other adjacent Ephemeral River areas and thus minimise the effect on fauna and flora associated with these areas;
- ✓ Avoid placing dumping sites, overburden/storage sites and associated infrastructure in sensitive areas. This would minimise the negative effect on the local environment;
- ✓ Avoid driving randomly through the area (i.e. "track discipline"), but rather stick to permanently placed roads/tracks;
- ✓ All solid and liquid wastes generated from the proposed project activities shall be reduced, reused, or recycled to the maximum extent practicable;
- ✓ Burial of waste on anywhere is not allowed and all waste must be disposed at the Municipal Waste Disposal site;
- ✓ No littering in the site area including access roads and powerline area is allowed;
- ✓ Packaging, oil cans, and all other forms of litter must be removed;
- ✓ Trash may not be burned or buried, except at approved sites under controlled conditions in accordance with the municipal regulations;
- ✓ Disposal of wastewater into any public stream is prohibited;
- ✓ All appropriate permits must be obtained before the implementation of the project activities;
- ✓ Rehabilitation of all the disturbed areas and associated tracks must be undertaken.

(iv) Mitigation measures to enhance positive socioeconomic impacts include the following actions to be implemented by the exploration company:

- ✓ Stipulate a preference for local contractors in its tender policy. Preference to local contractors should still be based on competitive business principles and salaries and payment to local service providers should still be competitive;
- ✓ Develop a database of local businesses that qualify as potential service providers and invite them to the tender process;
- ✓ Scrutinise tender proposals to ensure that minimum wages were included in the costing;
- ✓ Stipulate that local residents should be employed for temporary unskilled/skilled and where possible in permanent unskilled/skilled positions as they would

reinvest in the town's economy. However, due to low skills levels of the local population, the majority of skilled positions would be filled with people from outside the area;

- ✓ Must ensure that potential employees are from the area, they need submit proof of having lived in the area for a minimum of 5 years;

- ✓ Must ensure that contractors adhere to Namibian Affirmative Action, Labour and Social Security, Health and Safety laws. This could be accomplished with a contractual requirement stipulating that monthly proof should be submitted indicating payment of minimum wages to workers, against their Identity Documents (IDs) numbers, payment of social security and submission of affirmative action data;

- ✓ Encouraged to cater for the needs of employees to increase the spending of wages locally.

(v) Mitigation measures to minimise negative socioeconomic impacts are:

- ✓ The employment of local residents and local companies should be a priority. To ensure that potential employees are from the area, they need submit proof of having lived in the area for a minimum of 5 years;

- ✓ Providing information such as the number and types of jobs available, availability of accommodation facilities and rental costs and living expenses, could make potential job seekers wary of moving to the area;

- ✓ Addressing unrealistic expectations about large numbers of jobs would be created;

- ✓ Exploration camp if required should be established in close consultation with the land owners;

- ✓ Exploration camp should consider provision of basic services;

- ✓ Employees should be encouraged and assisted to visit family on regular basis and subsidised transport could be provided when employees go on leave;

- ✓ When employees contracts are terminated or not renewed, contractors should transport the employees to their hometowns within two days of their contracts coming to an end;

- ✓ Employ local residents and local companies as far as possible;

- ✓ Tender documents could stipulate that contractors have HIV/Aids workplace policies and programmes in place and proof of implementation should be submitted with invoicing;

- ✓ Develop strategies in coordination with local health officers and NGO's to protect the local communities, especially young girls.

- ✓ Contract companies could submit a code of conduct, stipulating disciplinary actions where employees are guilty of criminal activities in and around the vicinity of the town. Disciplinary actions should be in accordance with Namibian legislation. When a worker is dismissed the employer should transport the worker to his/her hometown within two days of being dismissed. The contractor needs to provide proof these actions;

- ✓ Contract companies could implement a no-tolerance policy regarding the use of alcohol and workers should submit to a breathalyser test upon reporting for duty daily.

- ✓ Request that the Roads Authority erect warning signs of heavy exploration vehicles on affected public roads;

- ✓ Ensure that drivers adhere to speed limits and that speed limits are strictly enforced;

- ✓ Ensure that vehicles are road worthy and drivers are qualified;

- ✓ Train drivers in potential safety issues.

(vi) Mitigation measures to minimise health and safety impacts are:

- ✓ Physical hazards: Follow national and international regulatory and guidelines provisions, use of correct Personal Proactive Clothing at all times, training programme, as well as the implementation of a fall protection program in accordance with the Labour Act;

- ✓ Some of the public access management measures that may be considered in an event of vandalism occurring are:

    - All exploration equipment must be in good working condition and services accordingly;

    - Control access to the exploration site through using gates on the access road(s) if required;

    - The entire site, must be fenced off; the type of fencing to be used would, however, be dependent on the impact on the visual resources and/or cost; and;

    - Notice or information boards relating to public safety hazards and emergency contact details to be put up at the gate(s) to the exploration area.

(vii) Mitigation measures to minimise visual impacts are:

- ✓ Consider the landscape character and the visual impacts of the exploration area including camp site from all relevant viewing angles;

- ✓ Use vegetation screening where applicable. Do not cut down the big trees around the site and use them for site screening;

- ✓ Avoid the use of very high fencing;
- ✓ Minimise access roads;
- ✓ Minimise the presence of secondary structures: remove inoperative support structures;
- ✓ Remove all infrastructure and reclaim, or rehabilitate the project site after exploration activities are completed.

(viii) Mitigation measures to minimise noise impacts are:

- ✓ Limit vehicle movements and adhere to the speed of 60 km/h;
- ✓ Vehicles and all equipment must be properly serviced to minimise noise pollution;
- ✓ Use of protective equipment to minimise Occupational Health Safety impacts dues to noise pollution around the site;
- ✓ National or international acoustic design standards must be followed.

(ix) Additional mitigation measures with respect to land owner:

- ✓ Establishment of Legal sign agreement with landowner for access;
- ✓ Water use for exploration must be obtained with permission of the land owners;
- ✓ Protect all farm infrastructural environmental conditions at all times during exploration;
- ✓ No fire wood harvesting shall be undertaken without the permission of the land owners;
- ✓ Implement regular interaction with neighbouring communities or tourism;
- ✓ Protect and respect historical, archaeological, and cultural heritage(e.g. Rock arts war graves, monuments, fossils historical buildings) at all times;
- ✓ Enter into rehabilitation requirements agreements with land owner;
- ✓ Supply detailed map layout of the operational area to the local land owner and indicating key areas of interest if already known.

6.3 Roles and Responsibilities

6.3.1 Overview

Management of the environmental elements that may be affected by the different activities of the proposed exploration is an important element of the proposed exploration activities. The EMP also identifies the activity groups / environmental elements, the aspects / targets, the indicators, the schedule for implementation and who should be responsible for the management to prevent major impacts that the different exploration activities may have on the environment.

6.3.2 Employer's Representative (ER)

The proponent is to appoint an **Employer's Representative (ER)** with the following responsibilities with respect to the EMP implementation:

- ✓ Act as the site project manager and implementing agent;
- ✓ Ensure that the proponent's responsibilities are executed in compliance with the relevant legislation;
- ✓ Ensure that all the necessary environmental authorizations and permits have been obtained;
- ✓ Assist the exploration contractor/s in finding environmentally responsible solutions to challenges that may arise;
- ✓ Should the ER be of the opinion that a serious threat to, or impact on the environment may be caused by the exploration activities, he/she may stop work; the proponent must be informed of the reasons for the stoppage as soon as possible;
- ✓ The ER has the authority to issue fines for transgressions of basic conduct rules and/or contravention of the EMP;
- ✓ Should the Contractor or his/her employees fail to show adequate consideration for the environmental aspects related to the EMP, the ER can have person(s) and/or equipment removed from the site or work suspended until the matter is remedied;
- ✓ Maintain open and direct lines of communication between the landowners and proponent, as well as any other identified Interested and Affected Parties (I&APs) with regards to environmental matters; and
- ✓ Attend regular site meetings and inspections as may be required for the proposed exploration programme.

6.3.3 Environmental Control Officer (ECO)

The proponent is to appoint an **Environmental Control Officer (ECO)** with the following responsibilities with respect to the EMP implementation:

- ✓ Assist the ER in ensuring that the necessary environmental authorizations and permits have been obtained;
- ✓ Assist the ER and Contractor in finding environmentally responsible solutions to challenges that may arise;
- ✓ Conduct environmental monitoring as per EMP requirements;
- ✓ Carry out regular site inspections (on average once per week) of all exploration areas with regards to compliance with the EMP; report any non-compliance(s) to the ER as soon as possible;

- ✓ Organize for an independent internal audit on the implementation of and compliance to the EMP to be carried out half way through each field-based exploration activity; audit reports to be submitted to the ER;

- ✓ Continuously review the EMP and recommend additions and/or changes to the EMP document;

- ✓ Monitor the Contractor's environmental awareness training for all new personnel coming onto site;

- ✓ Keep records of all activities related to environmental control and monitoring; the latter to include a photographic records of the exploration activities, rehabilitation process, and a register of all major incidents; and

- ✓ Attend regular site meetings.

6.3.4 Contractors and Subcontractors

The responsibilities of the **Contractors and Subcontractors** that may be appointed by the proponent to undertake certain field-based activities of the proposed exploration programme include:

- ✓ Comply with the relevant legislation and the EMP provision;

- ✓ Preparation and submission to the proponent / ER of the following Management Plans:

    - o Environmental Awareness Training and Inductions;

    - o Emergency Preparedness and Response
    - o Waste Management; and;

    - o Health and Safety.

- ✓ Ensure adequate environmental awareness training for senior site personnel;

- ✓ Environmental awareness presentations (inductions) to be given to all site personnel prior to work commencement; the ECO is to provide the course content and the following topics, at least but not limited to, should be covered:

    - o The importance of complying with the EMP provisions;

    - o Roles and Responsibilities, including emergency preparedness;

    - o Basic Rules of Conduct (Do's and Don'ts);

    - o EMP: aspects, impacts and mitigation;

    - o Fines for Failure to Adhere to the EMP;

    - o Health and Safety Requirements.

- ✓ Record keeping of all environmental awareness training and induction presentations; and

- ✓ Attend regular site meetings and environmental inspections.

6.4 Monitoring of the Environmental Performance

6.4.1 Overview

The monitoring process of the EMP performances for the proposed exploration project is divided into two parts and these are:

(i) Monitoring activities and effects to be undertaken by the Environmental Control Officer (ECO);

(ii) Preparation of an Environmental Monitoring Report covering all activities related to the Environmental Management Plan during and at closure of the proposed exploration to be undertaken by the Environmental Control Officer (ECO).

Alumni Exploration East Namibia (PTY) LTD will be required to report regularly (twice in a year) to the Ministry of Environment and Tourism, the environmental performances as part of the ongoing environmental monitoring programme. Environmental monitoring programme is part of the EMP performances assessments and will need to be compiled and submitted as determined by the regulators.

The process of undertaking appropriate monitoring as per specific topic (such as fauna and flora) and tracking performances against the objectives and documenting all environmental activities is part of internal and external auditing to be coordinated by the Environmental Control Officer/ Consultant / Suitable qualified in-house resource person. The second part of the monitoring of the EMP performance will require a report outlining all the activities related to effectiveness of the EMP at the end of the planned mineral exploration to be undertaken by the Environmental Control Officer (ECO). The objective will be to ensure that corrective actions are reviewed and steps are taken to ensure compliance for future EIA and EMP implementation. The report shall outline the status of the environment and any likely environmental liability after completion of the proposed project. The report shall be submitted to the Ministry of Environment and Tourism and will represent the final closure and fulfilment of the Environmental Contract conditions as provided for the Environmental Clearance Certificate to be issued.

7. CONCLUSION AND RECOMMENDATION

7.1 Conclusions

The proposed petroleum exploration activities covering local, regional reconnaissance field-based and initial local field-based activities will have negligible and low localised impacts on the local environment with negligible significant impacts. Mitigation measures must be implemented as detailed in Section 6 (EMP) of this report. Once site–specific drilling locality has been identified, a separate field-based and site-specific Environmental Impact Assessment (EIA) and the development of an Environmental Management Plan (EMP) must be implemented for drilling the stratigraphic well within the PEL 68 covering Blocks 2219 and 2319.

7.2 Recommendations

It's hereby recommended that the proposed exploration activities be issued with an Environmental Clearance Certificate with key conditions of adhering to the provisions of the EMP as well as all other related regulations governing, mineral exploration, water resources management, health and safety and labour. The proponent (Alumni Exploration East Namibia (PTY) LTD) must take all the necessary steps to implement all the recommendations of the EMP for the successful implementation and completion of the proposed exploration programme covering the PEL No. 68. Recommended actions to be implemented by Alumni Exploration East Namibia (PTY) LTD as part of the management of the likely impacts through implementations of the EMP are:

(i) The proponent must obtained permission from the land owners to enter the PEL area in order to undertake field-based exploration / prospecting activities;

(i) The proponent must implement precautionary measures / approach to environmental management. The proponent must develop and implement a full EIA and EMP inclusive of the specialist studies to be undertaken for the drilling stage;

(ii) Before detailed site-specific exploration activities such as drilling operations and access routes are selected, the project environmental officer should consider the flora, fauna and archaeological sensitivity of the area and commission a field survey in advance of any site development as may be required based on the assessment undertaken;

(iii) Contract an Environmental Control Officer/ Consultant / suitable in-house resources person to lead and further develop, implement and promote environmental culture through awareness raising of the workforce, contractors and sub-contractors in the field during the whole duration of the proposed exploration period;

(iv) Provide with other support, human and financial resources, for the implementation of the proposed mitigations and effective environmental management during the planned exploration activities for the PEL No. 68;

(v) Develop a simplified environmental induction and awareness programme for all the workforce, contractors and sub-contractors;

(vi) Where contracted service providers are likely to cause environmental impacts, these will need to be identified and contract agreements need to be developed with costing provisions for environmental liabilities;

(vii) Implement internal and external monitoring of the actions and management strategies developed during the mineral exploration process. Final Environmental Monitoring report be prepared by the Environmental Coordinator / Consultant / Suitable in-house resource person and submitted to the regulators as may be required;

(viii) Develop and implement a monitoring programme that will fit into the overall company's Environmental Management Systems (EMS) as well as for any future EIA for possible drilling and production stages.

7.3 Summary Terms of Reference for Full EIA

A separate field-based and site-specific Environmental Impact Assessment (EIA) and the development of an Environmental Management Plan (EMP) MUST be implemented for drilling operations. The aims and objectives of the Environmental Assessment (EA) covering Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) are:

- ✓ To assess all the likely positive and negative short- and long-term impacts on the receiving environment (physical, biological and socioeconomic environments) at local (drilling location /s), regional (Omaheke Region), national (Namibia) and Global levels using appropriate assessment guidelines, methods and techniques covering the complete project lifecycle. The EIA and EMP to be undertaken for the drilling stage shall be performed with reasonable skill, care and diligence in accordance with professional standards, regulatory guidelines and practices existing at the date of performance of the assessment and that the guidelines, methods and techniques shall conform to the national regulatory requirements, process and specifications in Namibia and in particular as required by the Ministry of Mines and Energy, Ministry of Environment and Tourism and Ministry of Agriculture, Water Affairs and Forestry;

- ✓ The development of appropriate mitigation measures that will enhance the positive impacts and reduce the likely negative influences of the negative impacts identified or anticipated. Such mitigation measures shall be contained in a detailed EMP report covering the entire project lifecycle.

8. BIBLIOGRAPHY / REFERENCES

1. FAUNA AND FLORA [SEE ANNEX 2]

2. SOCIOECONOMIC ASSESSMENT [ANNEX 3]

3. GENERAL BIBLIOGRAPHY / REFERENCES / FURTHER READING

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9. ANNEXES

1. CV of the EAP (Dr. Sindila Mwiya)

2. Flora and Fauna Desktop study Report

3. Socioeconomic Assessment of the PEL area