Petroleum Agency SA

South African Agency for Promotion of Petroleum Exploration and Exploitation (Pty) Ltd.
Registration No. 1999/015715/07

PETROLEUM HOUSE
151 FRANS CONRADIE DRIVE
PAROW 7500
P.O. BOX 1174
PAROW 7499
SOUTH AFRICA

TEL: +27 21 938-3512
FAX: +27 21 938-3553
plu@petroleumagencysa.com

Enquiries: Phumla Ngesi

Tel (021) 919 3651
Fax (021) 910 0811

OUR REF: 12/3/1/123

29 June 2009

Attention: The Provincial Manager
South African Heritage Resources Agency
P O Box 759
East London
5200

Tel (043) 722 1740
Fax (043) 722 1749

Case ID: 2214

Dear Sir

RE: ENVIRONMENTAL MANAGEMENT PROGRAMME IN RESPECT OF AN APPLICATION FOR EXPLORATION RIGHT FOR OIL & GAS IN PEARSTON DISTRICT, EASTERN CAPE PROVINCE.

The Agency has received the **Environmental Management Programme** (EMPR) supporting the application for exploration right for oil and gas on farms Bouers Hoek and 8 others in Pearston District, Eastern Cape Province for review and decision making.

In terms of section 40(1) of the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA), the Agency, on behalf of the Minister, is required to consult with relevant State Departments which administer any law relating to matters affecting the environment, when considering an EMPR.

It is therefore requested that your Department review the attached EMPR in accordance with Section 40(2) of the MPRDA and provide the Agency with written comments by **no later than 60 days** from the date of receipt of this request.

Please do not hesitate to contact the afore-mentioned should you have any queries.

Yours sincerely

pp P.Ngesi

Nthangeni Nwendamutswu

Manager: Environmental Compliance

BUNDU GAS AND OIL EXPLORATION (PTY) LIMITED

(Reg. No. 2007/034535/07)

Registered Office:
38 Fouche Terrace
Morninghill, Bedfordview
2007
Johannesburg
Gauteng, South Africa
Telephone: +27 (0) 83 628-9190
Facsimile: +27 (0) 86 623-8874
Email pdpcon@icon.co.za

BUNDU GAS AND OIL EXPLORATION (PROPRIETARY) LIMITED

SUBMISSION OF ENVIRONMENTAL MANAGEMENT PROGRAM AND PROOF OF PUBLIC CONSULTATIONS

(CRANMERE – EASTERN CAPE)

IN TERMS OF SECTION 79 (4) OF THE MINERAL AND PETROLEUM DEVELOPMENT ACT, 2002
(Act No. 28 of 2002)

TABLE OF CONTENTS

Registered Office:
38 Fouche Terrace
Morninghill, Bedfordview
2007
Johannesburg
Gauteng, South Africa
Telephone: +27 (0) 83 628-9190
Facsimile: +27 (0) 86 623-8874
Email pdpcon@icon.co.za

BUNDU GAS AND OIL EXPLORATION (PTY) LIMITED

(Reg. No. 2007/034535/07)

June 25, 2009

The Chief Executive
Petroleum Agency SA
P.O. Box 1174
PAROW
7499

Dear Sir,

ACCEPTANCE OF APPLICATION FOR EXPLORATION RIGHT FOR OIL AND GAS ON THE FARMS BOUERS HOEK AND 8 OTHERS IN THE DISTRICT OF PEARSTON, EASTERN CAPE PROVINCE

In response to the letter of acceptance of the application for an exploration right for oil and gas on the farms Bouershoek and 8 others in the district of Pearston, in the Eastern Cape Province ref 30/5/2/3/2/123 ER (12/3/1/123/1 ER).

In compliance with Section 79 (4) of the MPRDA we herewith submit:

(a) The required environmental management programme

(b) Proof of public notification and consultation with interested and affected parties including landowners or lawful occupiers of land, on which the proposed exploration will be conducted, and other affected parties

(c) Details of how the company will substantially and meaningfully expand opportunities for historically disadvantaged persons.

We trust that the above meets with your approval and look forward to working with the agency to secure the requested exploration right.

Peter D. Price
Director
Bundu Gas and Oil Exploration (Pty) Ltd.

ANNEXURE (a)

ENVIRONMENTAL MANAGEMENT PROGRAMME

ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

APPLICATION FOR EXPLORATION RIGHTS

Section 79 of the MPRDA (Act 28 of 2002)

ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE UNDERTAKING OF EXPLORATION ACTIVITIES WITHIN THE GRAAFF-REINET AREA, EASTERN CAPE

(June 2009)

15 YEARS 1993 - 2008

Leaders in Environmental Management

DOCUMENT CONTROL
0789 – Bundu Gas and Oil Exploration EMP

Application for Exploration Rights: Environmental Impact Assessment and Environmental Management Programme

	NAME	SIGNATURE	DATE
Compiled:	**Juanita Rossouw**		22/6/09
Checked:	**Liam Whitlow**		"
Authorized:	**Liam Whitlow**		"

DISTRIBUTION LIST

AGENCY, ORGANISATION OR PERSON	# OF COPIES
Petroleum SA	5
Bundu Gas and Oil Exploration	1

REVISION AND AMENDMENTS

DATE	No.	DESCRIPTION OF REVISION OR AMENDMENT
13-05-09	0	Draft Report
18-06-09	1	Final Report

Table of Contents

Table of Figures

1 EXECUTIVE SUMMARY

The Bundu Gas and Oil Exploration Company wishes to explore for possible commercial viable gas resources within the Cranemere region of the Eastern Cape Province. The proposed exploration will take place in three phases. Phase one of the explorations will include the investigation of all existing information regarding the geology and potential from existing gas emitting wells within the proposed study area. Phase two will involve the interpretation and mapping of all data collected during phase one. Based on the interpretation and mapping of the data preferred exploration drill or target sites will be selected (Phase three).

The drill or target site will consist of an area of approximately 1 hectare which will accommodate the drilling rig, site office (if required), and three sumps or settling ponds. Approximately ten people will work for approximately twelve hours per day for a period of six months to one year on the drill site.

The drill rig will be transported to the preferred site by means of one 5 to 7 ton flat bed truck. It has been recommended that existing access roads be used as far as possible to avoid the additional impact of creating new access roads. If access roads are needed, the exact position of these access roads will be confirmed with the landowner as well as an independent environmental practitioner, and will be kept as short as possible. The sump areas will be constructed by clearing the vegetation and topsoil and excavating an area that will be sufficient for handling the required volume of effluent (water, lubricants and rock slurry) that will be produced during the drilling process. Sump areas will be lined with PVC to prevent any seepage from entering potential underground water resources.

Water required during the drilling operation will be obtained from existing boreholes or dams with the landowners consent, and within existing water-use licence conditions. It is anticipated that the water requirement will be approximately 5 000 litres per day; for the duration of the drilling activity which is anticipated to vary from six months to one year, if drilling conditions are favourable and formations solid. Where necessary the requirements of the National Water Act (Act 36 of 1998) must be adhered to.

After the exploration activity has been completed the site will be rehabilitated in accordance with the pre-exploration site conditions or as agreed with the landowner to the satisfaction of the independent environmental practitioner. Depending on the findings of Phases 1 and 2 as well as the drilling, there may be a necessity to establish more than one exploration drill site. It is important to note however that the proposed methodology will be to rehabilitate the first hole before commencing with the second, and so on. Therefore at any one point in time it is not anticipated that there will be more than one exploration drill site.

Section 7 of the report provides a desktop study of the current conditions of both the biological, biophysical status and socio-economic status of the receiving environment. The environmental impact assessment section (Section 9) assesses all potential impacts which have been identified with regards to the undertaking of the proposed exploration activity. Several potential impacts have been identified which are outlined in Table 9 together with the necessary mitigation measures which should be undertaken in order to reduce the extent of these impacts. The impact regarding water abstraction can be regarded as a potentially significant impact due to the requirement of approximately 5 000 litres of water per day for the drilling operation. It is anticipated that water will

be obtained from existing boreholes with the consent of the landowner, or if required, additional boreholes will be drilled with the consent of the landowner. It has been recommended that all the necessary permits and authorisations regarding the utilisation of water should be obtained from the relevant authority prior to commencement of the exploration activity, if required.

This Environmental Management Programme (EMP) sets out the methods by which proper environmental controls are to be implemented by the contractor. It has been compiled as a guideline for the mitigation and management measures to be implemented during the establishment, operation and rehabilitation phase of the exploration activity.

Continuous consultation with Interested and Affected Parties is encouraged. All additional permits and legal approvals, if required, must be obtained prior to the commencement of the exploration activity. It is further required that all personnel should undergo the necessary environmental awareness training in order to promote environmental consciousness of the potential impacts which the proposed activity might have on the receiving environment.

The landowner and environmental assessment practitioner should be consulted with regards to the preferred target sites proposed for the drilling activity. Issues such as access to the preferred site should be taken into consideration in order to minimize the need for constructing of new access roads. Additionally, the following areas should be defined as sensitive and where possible excluded from the proposed drilling operations and associated disturbances (including access roads):

- All identified protected area's (including the SAMARA Game Reserve);
- Topographic area's with a high erosion potential (with a gradient exceeding 18°); and
- All rivers and wetland areas (with at least a 30m buffer).

Continuous compliance monitoring should be undertaken on a weekly basis by the Contractor. A monthly compliance audit should be conducted by the Contractor and submitted to the competent authority (PASA) within the timeframes they require.

2 INTRODUCTION

Bundu Gas and Oil Exploration Company (hereafter referred to as the Applicant) wishes to explore the possibility of viable commercial gas sources within the Cranemere area.

Natural gas can be associated with oil fields or coal beds, or can occur naturally on its own. These gasses could contain significant amounts of ethane, propane, butane and pentane as well as other heavier hydrocarbons which are normally removed during the preparation process for commercial use.

The exploration for viable commercial gas resources within the Cranemere area is proposed to take place by means of a three phase approach, during which available data together with samples taken from existing boreholes (if any) within the region are evaluated. Based on the findings of these evaluations target sites will be selected for the drilling of the borehole. Depending on the findings of Phases 1 and 2 as well as the drilling, there may be a necessity to establish more than one exploration drill site.

The proposed exploration activity is regulated under Section 79 and 80 of the Minerals and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA) of which the Petroleum Agency of South Africa (PASA) is the competent authority. As part of the required process for applying for an exploration right an Environmental Management Programme (EMPR) must be prepared (in accordance with the requirements of Section 39 of the MPRDA) and submitted to the PASA for review and decision making. Environmental Impact Management Services (EIMS) has been appointed by the Applicant to prepare the required EMPR.

This EMPR, which will form part of the exploration right application, has two main objectives, namely:

1. Give an overview of the proposed activities to be undertaken, the state of the receiving environment, potential impacts which might be associated with the exploration activity as well as mitigation measures to limit these impacts; and
2. Provide an environmental management program to which the applicant should adhere to during the exploration activity.

3 METHODOLOGY

In accordance with Section 79 (4) of the MPRDA the PASA has requested that the Applicant must:

- Notify and consult with any affected party; and
- Submit an EMPR in terms of Section 39 of the MPRDA.

EIMS has been appointed to prepare the EMPR only. The required public notification and consultation is being undertaken by the Applicant.

3.1 ENVIRONMENTAL MANAGEMENT PROGRAMME

This EMPR was carried out in accordance with Section 39 (3) of MPRDA. The regulations require that the EMPR must:

- Provide an overview of the relevant legislation and policies;
- Give a description of the proposed activity;

- Give an overall description of the biophysical and physical status of the receiving environment;
- To identify any potential impacts on the biophysical, physical and socio-economic environment, and;
- To provide mitigation measures to minimize potential impacts that relates to the exploration activity.

The environmental management programme forms part of the EMPR in order to promote efficiency of reporting, reviewing and decision-making (DME, 2000).

3.2 PUBLIC PARTICIPATION PROCESS

Public involvement forms one of the most important processes within the application process. The public participation process involves the identification of key stakeholders and private parties that might be directly or indirectly affected by the proposed exploration activities. The public notification and consultation process is being undertaken by the Applicant and relevant comments and/or concerns raised by the Interested and Affected Parties (I&APs) will be considered in this EMPR.

Public announcement took place on the 30th April, the 7th and 14th May 2009, by means of advertisements which appeared in the Somerset Budget and the Advertiser. I&APs were informed of the intention of the Applicant to undertake the application for exploration right and were invited to attend a public meeting that was originally scheduled to be held on the 19th of February 2009 at the Pearston Country Hotel in Pearston Eastern Cape Province. This meeting was subsequently postponed to the 21st of May 2009.

The contact details of all landowners which will potentially be affected by the exploration activity was obtained and formal correspondence was send to them, notifying of the Applicants intention as well as to invite them to the public meeting (please refer to separate submission made by the Applicant).

All I&APs, requesting to review the EMPR will be given a formal opportunity to review the Draft EMPR and to provide comment. Please refer to Section 7 for further details on the Public Consultation Process.

4 PROJECT DESCRIPTION

This section provides and overview of the proposed exploration activity, and is prepared based on information provided by the Applicant.

4.1 GENERAL OBJECTIVES

The presence of gas within the Cranemere area has been known for over forty years. It has been assumed that the presence of gas within test boreholes within the area originates from small fractured, high pressure shale reservoirs that contained limited gas supplies and is therefore not commercially viable to extract. However, a strong presence of gas has been uncovered at a depth of approximately 2 600 metres. An increase in the commercial gas production from carbonaceous shale within the United States has led to a greater understanding of the commercial potential of gas located in shales. Therefore, the Applicant feels the need to re-investigate the possibility of the commercial value of the presence of gas that was previously detected by historical exploration activities at existing test boreholes within the study area.

The main objective of the proposed exploration activity will be a thorough modern analysis of the reservoir characteristics and design of an artificial fracturing and/or drilling technique to extract the gas. This will be undertaken in order to determine the extent and commercial resource potential of the occurring gas.

4.2 SPECIFIC OBJECTIVES

The exploration activity being proposed by the applicant has the following objectives:

a. Determine and map the geographic extent of all boreholes that have been drilled in and outside the study area.
b. Map the pervasive Karoo dolerites so as to determine their possible controls on gas accumulation.
c. Characterize reservoir(s), whether primarily related to Karoo dolerites, unfractured Ecca sandstones, interbedded fractured sandstones, and/or shales.
d. Determine the possible role of pre-Karoo basement paleotopography and regional structural trends on the study area.
e. Determine the structural or stratigraphic trapping and fracturing mechanisms.
f. Determine the geometry, thickness, lateral extent and quality of the reservoir; whether primarily stratiform, conforming to specific Karoo formation units, or to fractures in dolerite, sandstones, fractured shales or free gas in fractures.
g. If the reservoirs are stratiform, determine the nature of the porosity, percentage porosity, and how it originated. If the reservoirs are fracture-related, determine the relationship to faults, dolerites and regional and local stress fields and to regional lineaments.
h. Determine the potential gas and/or oil volume of the reservoir(s), using standard oilfield practices or modified procedures, depending on what is found out about the character of the reservoir.
i. Delineate and rank acreage, identify sweet spots, trends, plays and potential fairways; rank high-graded areas and less-prospective tracts. Given the apparent structural and stratigraphic complexity of the Cranemere area and the Karoo dolerites within the section, it will be important to determine the degree of reservoir compartmentalization and to delineate those compartments that are likely to produce the largest gas volumes at the highest rates.
j. Determine the producability of gas, identify and evaluate potential markets and gas utilization options.

These specific objectives as set-out above will be undertaken within three distinct phases. The following sections provide a further detailed description of these phases.

4.3 PHASE I: DESKTOP STUDY

A combination of literature research, verbal confirmation by geoscientists and local farmers and field reconnaissance from both past and present information will be used to assess the area for potential gas emissions and/or oil seeps. This information will be used to locate, map and catalogue all existing boreholes, likely to be used for sampling. All additional boreholes, not identified during communications with farmers will be mapped using coordinates determined in the field using a hand-held GPS receiver.

Seismic, gravity, aeromagnetic, data from mining companies and observations of representative well logs, cores and correlative outcrops will be used to commence mapping of the regional and local structure and stratigraphy in the subsurface. Additionally, cores and cuttings of the area that are housed at the Council for Geosciences will be analysed.

It is anticipated that this phase will be conducted over a period of nine months from the date of receiving the exploration right.

4.4 PHASE II: INTERPRETATION AND MAPPING OF FINDINGS

The most important controlling lithological, stratigraphic and structural features of the study area which are most likely to have affected the sourcing, migration and entrapment of potential oil and/or gas will be documented. Available seismic data will be interpreted and geophysical logging operations on any representative borehole(s) that are open will be conducted.

This phase will focus on factors that seem to make the Cranemere area unique for the potential occurrence of oil and/or gas and will include factors that control geological structure, permeability, faults, dolerite dykes and sills, and their effect on localisation of oil and/or gas.

Results from these studies will form a basis for constructing a suite of maps and cross sections that will include details regarding the following:

- Karoo dolerite distribution;
- Thickness isopachs of dolerite;
- Structure lineaments;
- Fault systems;
- Structural cross sections;
- Basement relief and its structural implications;
- Isopachs of Karoo sedimentary intervals;
- Regional paleogeography and depositional systems;
- Fracture systems;
- Potential reservoir fairways, whether fractured or unfractured;
- Preliminary maps and cross sections of potential reservoir compartments.

Phase II is anticipated to continue for 9 months after Phase I has been completed.

4.5 PHASE III: DRILLING AND LOGGING

Data from Phase I and II will be integrated to potentially assist in the identification and characterisation of discrete gas compartments and potential gas volumes. Drilling and coring operations will then be undertaken in order to:

- The determine the critical characteristics of the shale with regard to organic content, permeability, porosity, and other factors;
- Determine and map the geometry and dimensions of oil and/or gas reservoirs, whether subvertical, in fracture haloes paralleling dolerite dykes and sheets, or stratiform;
- Delineate lateral stratigraphic variations and reservoir continuity;
- Gain additional structural and stratigraphic data;

- Test for producability of the target intervals in selected, high-graded sectors of the Cranemere gas field. Wells will be evaluated using geophysical logging, coring, and flow tests as appropriate.

4.5.1 Summary of Drilling Programme

The primary purpose of drilling is to establish additional data points to correlate with existing borehole data. The methodology used during the drilling program will include the following:

- On-site description of cores retrieved;
- Wire line retrieval of cores;
- Immediate insertion of cores into desorption vessels where coal is the source and/or reservoir;
- Analysis of shale permeability using pressure transient analysis where appropriate;
- Calibrate the relations established between geophysical log responses and key lithological and fluid properties, including gas content; and
- Thorough analysis of the cores by Core Lab or other capable oil and gas core laboratory.

4.5.1.1 Core drilling

Intact physical sampling of the representative Karoo succession of the Cranemere area will provide a reliable basis for calibration and correlation of adjacent cored holes. The following data sets can be generated from the proposed HQ drilling program.

i. **Lithological data** - A strict logging standard will be adhered to, to ensure repeatability of standard descriptors and rock types. Particular attention will be paid to secure core storage and handling.
ii. **Core photography** –This will allow information from different holes to be compared quickly and efficiently, and requires standardized camera settings and position.
iii. **Geotechnical data** – This can be derived form direct observations, laboratory testing and wireline logs. Depending upon the results of prior analyses, it may include fracture logging, RQD, physical specimen testing (ISRM Standard – Uniaxial, Triaxial, Shear)
iv. **Coal and shale quality** - The range of analyses to be performed will be determined by the character of the coal and shale encountered in the holes. TOC and vitrinite reflectance work will be conducted as required to determine source rock potential and maturity of shales and to confirm the rank of coals.

4.5.1.2 Logging

The Applicant uses the following logs during the exploration and appraisal of comparable sand, shale and coal:

- Log Spaced/Bulk Density
- Short Spaced/Bed Resolution Density
- Natural Gamma Ray
- Calliper

- Compensated Sonic
- Either, Neutron-Neutron or Dual Spaced Neutron
- Either, Focussed Electric or Dual Resistivity
- Dipmeter
- Borehole Geometry Tool
- Spontaneous Potential (SP)
- Temperature

Detailed neutron-neutron and focused electric logs will only be undertaken if required. The logs required and the intervals to be logged will be nominated by the site supervisor, prior to commencement of logging and, if necessary, may be revised during the logging operation. Records of the logs run, run times and depth intervals should be recorded and be available on site at the completion of the logging operation.

4.5.2 Structural regime, stress field and fracture characterization

The extent to which natural fractures are the controlling influence on the porosity and permeability distribution within the Cranemere area will be determined prior to commencing with the exploration activities. If the presence of a pervasive or local fracture system associated with the Karoo dolerites, faulting or drape compaction are detected, it will be mapped in order to design a borehole drilling and completion program to exploit the directional fabric of the fracture system.

In the instance that gas-bearing intervals are detected in unfractured sandstone, the use of artificial hydraulic fracturing stimulation will be considered in situations where the target zones appears to be naturally impermeable but prospective for gas.

The use of downhole acoustic scanners will be used where appropriate. Downhole acoustic scanners run in conjunction with the standard suite of geophysical tools and provide an extensive coverage of stress determinations, both vertically and horizontally throughout the deposit. Overcoring techniques may also be employed to measure stress magnitude and direction.

4.5.3 Drilling program and well design

There is insufficient information regarding the nature and geometry of the oil or gas reservoirs, so it is not possible to propose well patterns or spacing considerations at this stage.

None of the available records indicate whether the reservoir trends are likely to be strongly directional, perhaps controlled by dolerite dykes or fracture trends, or are more equidimensional in plan. The first well will be a cored HQ well that will be geophysically logged. It may be necessary to repeat this exercise at several other locations, once more designed to gain information concerning the reservoir type, quality and trend. These cored and geophysically logged wells will provide a sound basis for calibration of log response to lithology, and possibly to fluid content as well.

Follow-up drilling in the proposed program is likely to take the form of percussion-drilled wells that will be geophysically logged using the same suite as the cored wells, so that direct comparison will allow identification, correlation and extrapolation of reservoir.

Once the geometry and gross dimensions of the reservoir have been established in this manner, it will be possible to design an appraisal drilling program. This program will be designed to exploit

reservoir trend and character, and may comprise a combination of infill, stepout, and pattern-drilled wells with a view to field evaluation leading to commercial development. Depending on the attitude, continuity and permeability characteristics of the reservoir, the initial vertical wells may require stimulation. Alternatively, the reservoir may prove more suited to horizontal drilling.

In summary, because practically nothing is known of the nature of the reservoir at Cranemere, the precise methods to be employed in appraisal and development of the gas resource cannot be predicted at this stage. The Applicant proposes to follow a phased approach, with knowledge gained at each step being used to adapt the field design to best suit the particular conditions at Cranemere.

4.5.4 Personnel Requirements

It is anticipated that the operation of the drilling rig will require no more than ten (10) personnel, which will include two (2) foremen, two (2) drill operators and six (6) support staff. The foremen will be responsible for supervision and managing of the drilling operations. The drilling rig will be operated at approximately eight (8) to twelve (12) hours per day for a period of six months to one year.

4.5.5 Housing and Infrastructure Requirements

It is anticipated that the drilling team will be housed in the nearby town (Pearston) or village and therefore no onsite housing will be required. Employees will be transported from their lodging to the proposed drill site and back on a daily basis.

The drilling rig will be transported by means of one 5 to 7 ton flat bed truck and only two additional vehicles will be used during the exploration activity for transport of goods and employees to and from site.

4.5.6 Water Use

Water required during the drilling operation will be obtained from existing boreholes or dams with the landowners consent. Water used during the drilling operation will be mixed with several other non-toxic chemicals (cementations binders) to form a slurry, which will be used to produce the casing as well as to maintain pressure within the shaft. The extracted water slurry will be pumped to a sludge and evaporation pond for re-use of water and later disposal of solids at a registered waste disposal site.

It is anticipated that the water requirement will be approximately 5 000 liters per day, for a period of six months to one year, if drilling conditions are favourable and formations solid. It is therefore recommended that all the necessary permits and authorisations regarding the utilisation of water should be obtained from the relevant authority prior to commencement of the exploration activity, where required.

4.5.7 Waste Management

During the drilling process it is anticipated that approximately 10 to 11 m^3 of rock chips, cuttings and sludge will be produced, which can be regarded as non-hazardous natural products. These waste materials will be collected and disposed of at register waste disposal sites. No waste chemicals will be produced during the drilling operations as only sufficient quantities of these non-hazardous chemicals will be transported to site each day.

4.5.8 Rehabilitation

It is anticipated that wells will only be sealed if the gas yield is unacceptable. If the well is found to be acceptable, it will be temporarily capped. Sealing of wells will take place either by partially or completely sealing the hole by pumping cement or a cement/ sand grout, in the collar of the well as indicated in Figure 1. The sumps where mixing and settling of the discard water took place will be removed with the PVC lining and discarded at the nearest waste disposal facility. Stored sub-soils from the excavation of the sumps and well collar will be used as backfill material during the rehabilitation of the sump areas. Topsoil will be replaced and the area will be re-vegetated using a mixture of annual and perennial grass species.

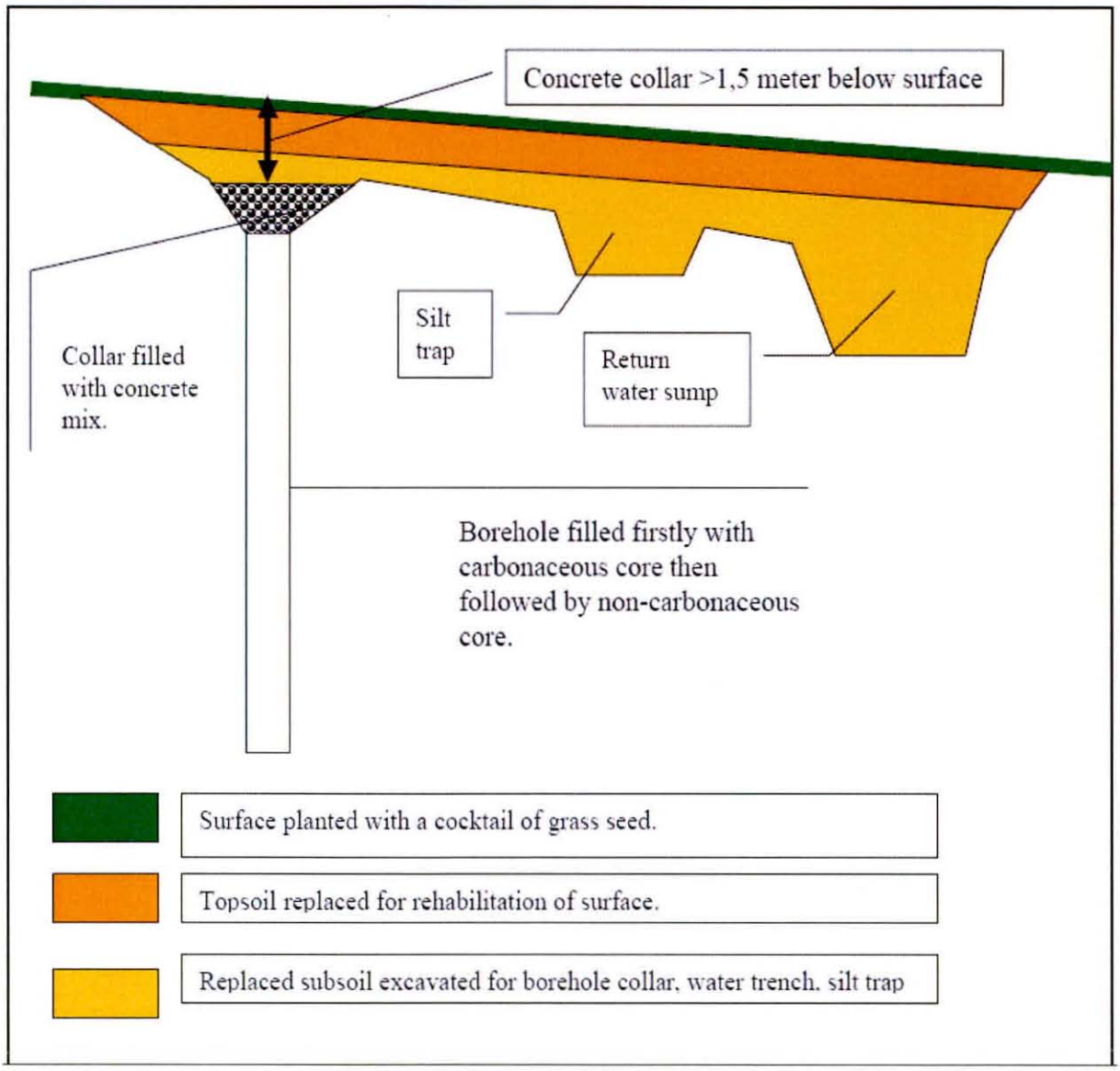


Figure 1: Schematic representation of the rehabilitation process of the exploration well.

5 APPLICABLE LEGISLATION AND POLICIES

There are various legislative requirements which may apply directly or indirectly to an exploration activity. This section provides an overview of the key environmental legislation and is not considered as a complete and comprehensive assessment of all the legal requirements. It is the

Applicants responsibility to ensure that a thorough legal due diligence is carried out prior to commencement of the activities.

5.1 MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT (ACT 28 OF 2002)

According to Section 79 of the Minerals and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA) any person who wishes to undertake the activity of exploration needs to submit an application to the Petroleum Agency of South Africa (PASA). PASA has the opportunity to review the application and should within 14 days from the date of acceptance notify the applicant to:

- notify and consult with any affected parties; and
- to submit an environmental management programme (EMPR) in terms of Section 39 of the Act.

Section 39(3) of the Act gives a description of the activities to be included within the Environmental Management Programme (EMPR).

Table 1: Extract from the Minerals and Petroleum Resources Development Act (Act 28 of 2002).

Section 39 (3) (MPRDA, Act 28 of 2002): "An applicant who prepares and environmental management programme or an environmental management plan must-

- ***a) Establish baseline information concerning the affected environment to determine protection, remedial measures and environmental management objectives;***
- ***b) Investigate, assess and evaluate the impact of his or her proposed prospecting or mining operation on –***
  - ***(i) The environment;***
  - ***(ii) The socio-economic conditions of any person who might be directly affected by the prospecting or mining operation; and***
  - ***(iii) Any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999), with the exception of the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act;***
- ***c) Develop an environmental awareness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risks which may result from their work and the manner in which the risks must be dealt with in order to avoid pollution or the degradation of the environment; and***
- ***d) Describe the manner in which he or she intends to-***
  - ***(i) Modify, remedy, control or stop any action, activity or process which cause pollution or environmental degradation;***
  - ***(ii) Contain or remedy the cause of pollution or degradation and migration of pollutants; and***
  - ***(iii) Comply with any prescribed waste standard or management standards or practices.***

5.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998)

The National Environmental Management Act (Act 107 of 1998) (NEMA) provides the legislative requirements for the protection and sustainable utilisation of our natural resources. NEMA serves to 'provide for:

- co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state;
- certain aspects of the administration and enforcement of other environmental management laws; and
- matters connected herewith'.

Section 28 of NEMA, enforces a duty of care and remediation of an environment which might be, or may have been disturbed or polluted due to actions by any person or organisations. This section therefore implies that the applicant will have a legal obligation in terms of NEMA to minimize impact and to rehabilitate any disturbance caused to the immediate and surrounding environment due to the exploration activities.

Chapter 5 of NEMA defines certain tools available for environmental management in order to ensure the integrated environmental management of activities. Following promulgation of the NEMA and enacted by Chapter 5 of NEMA the National Department of Environmental Affairs and Tourism (DEAT) released regulations for undertaking Environmental Impact Assessments (EIA's) as well as listing notices which list activities which are likely to have a detrimental impact on the environment and as such require an environmental authorisation, to be obtained through the regulated process.

Exploration is listed as an activity which requires an environmental approval under Chapter 5 of NEMA (Activity 7 of GNR 387). However, it is EIMS's understanding that the requirement for an EIA for these specific activities has not yet been enacted and as such, there is not currently a legal requirement for an EIA, in accordance with the requirements of Chapter 5 of NEMA to be carried out.

Whilst the exploration activity does not at present require a NEMA Chapter 5 environmental approval there is a list of other activities which, if required as a component of the exploration, may require a separate EIA approval. It is recommended that once the location and extent of the proposed exploration drill site is determined that a review of the activities listed in GNR 386 and 387 is carried out, to confirm whether any further EIA approvals are required.

5.3 NATIONAL WATER ACT (ACT 36 OF 1998)

The National Water Act (Act 36 of 1998) (NWA) and several mining and water related documents published by the Department of Water and Forestry (DWAF) provides the legislative requirements related to the water resources of South Africa. The purpose of the NWA is to manage and control the means by which all water resources are protected, used, developed, conserved and controlled.

According to Sections 21 and 22 of the NWA, a person may only use water from a water resource if that water use is authorised by a licence under the NWA. Sections 21 and 22 of the NWA identifies certain water uses which require approval from the Department of Water Affairs and Forestry (DWAF) in the form of a relevant water use permit. Table 3 lists the water uses which require a water use licence issued under the Act.

Table 3: Water uses (NWA)

Water uses requiring a water use licence:
a) taking water from a water resource

b) storing water
c) impeding or diverting flow of water in a watercourse
d) engaging in a stream flow reduction activity (including afforestation)
e) engaging in a controlled activity (including irrigation with waste water amongst others)
f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit
g) disposing of waste which may detrimentally impact on a water resource
h) disposing in any manner of water which contains waste form, or which has been heated in, any industrial or power generation process
i) altering the bed, banks course or characteristics of a water course
j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people
k) using water for recreational purposes

Should the proposed development require the use of any water resources or undertake activities listed in Section 21 and 22 of the NWA, then a water use authorisation will be required. It is important to note that the NWA includes wetlands within the definition of a watercourse and therefore should there be any wetlands on the site then certain water use licences may be applicable, prior to commencement.

According to the National Water Act (Act 36 of 1998) the proposed study area is divided into two quaternary water catchments namely the N21C and the N21B, as such the General Authorisation of the NWA makes provision for 45 m^3 and 75 m^3 per hectare per annum, respectively, of water that may be taken from these regions.

Government Notice 704 of the National Water Act (Act 36 of 1998) deals specifically with protection of water resources and water use during mining and mining related activities. According to Regulation 4 of GN 704, no mining activities are allowed to take place under or within the 1:50 year flood or within a horizontal distance of 100 meters from any watercourse, estuaries, borehole or well (whichever is the greatest), except for boreholes and wells drilled specifically for the use during mining. It further indicates that no person may place or dispose of any residue or substance which might cause pollution of water resources in the works.

Regulation 7 of GN 704 make provision for the protection of water resources through the prevention of water containing waste or any substances which might cause pollution of water resources to enter water courses, by reducing the surface flow of water into the opencast workings, by preventing erosion or leaching of material from any residue deposits or stockpiles from any area and by keeping any water system free from any matter or obstruction which may affect efficiency of flow. All prevention measures to prevent pollution of water resources should be taken after the mining operations have been ceased in accordance with Regulation 9 of GN 704.

It is anticipated that the water requirement will be approximately 5 000 liters per day, for a period of six months to one year, if drilling conditions are favourable and formations solid. It is therefore recommended that all the necessary permits and authorisations regarding the utilisation of water should be obtained from the relevant authority prior to commencement of the exploration activity, where required.

Table 2: Extract from GN 704.

GN 704, Regulation 7 says: "*Every person in control of a mine or activity must take reasonable measures to-*

a) *Prevent water containing waste or any substance which causes or is likely to cause pollution of a water resource from entering any water resource, either by natural flow or by seepage, and must retain or collect such substance or water containing waste for use, re-use, evaporation or for purification and disposal in terms of the Act;*
b) *Design, modify, locate, construct and maintain all water systems, including residue deposits, in any area so as to prevent the pollution of any water resource through the operation or use thereof and to restrict the possibility of damage to the riparian or in-stream habitat through erosion or sedimentation, or the disturbance of vegetation, or the alteration of flow characteristics;*
c) *Cause effective measures to be taken to minimise the flow of any surface water or floodwater into mine workings, opencast workings, other workings or subterranean caverns, through cracked or fissured formations, subsided ground, sinkholes, outcrop excavations, adits, entrances or any other opening;*
d) *,design, modify, construct, maintain and use any dam or any residue deposit or stockpile used for the disposal or storage of mineral tailings, slimes, as or other hydraulic transported substances, so that the water or waste therein, or falling therein, will not result in the failure thereof or impair the stability thereof;*
e) *Prevent the erosion or leaching of materials form any residue deposit or stockpiles from any area and contain material or substances so eroded or leached in such area by providing suitable barrier dams, evaporation dams or any other effective measures to prevent this material or substance from entering and polluting any water resources;*
f) ***Ensure that water used in any process at a mine or activity is recycled as far as practicable, and any facility, sump, pumping installation, catchment dam or other impoundment used for recycling water, is of adequate design and capacity to prevent the spillage, seepage or release of water containing waste at any time;***
g) *At all times keep any water system free from any matter or obstruction which may affect the efficiency thereof; and*
h) *Cause all domestic waste, including wash-water, which cannot be disposed of in a municipal sewage system , to be disposed of in terms of an authorisation under the Act."*

Regulation 9 says:

1. "*Any person in control of a mine or activity must at either temporary or permanent cessation of operations ensure that all pollution control measures have been designed, modified, constructed and maintained so as to comply with these regulations."*
2. *Any person in control of a mine or activity must ensure that the instream and riparian habitat of any water resource, which may have been affected or altered by a mine or activity, is remedied so as to comply with these regulations.*"

5.4 CONSERVATION OF AGRICULTURAL RESOURCES ACT (ACT 43 OF 1983)

The Conservation of Agricultural Resources Act (CARA) provides for the control over the utilisation of the natural agricultural resources of the Republic in order to promote the conservation of soil, the water resources and the vegetation, and the combating of weeds and invader plants; and the matters connected therewith.

Regulation 4, 5 and 6 of the CARA (GNR1048) states that every land user shall implement the necessary measures as set-out in the various sections of the regulations to prevent the degradation of land due to excessive soil loss as a result of erosion through the action of water and wind and prevent water logging and salination of soils.

In Regulation 9 it provides further actions that needs to be taken in order to protect veld and includes actions such as the implementation of a suitable soil conservation plan to protect the veld concerned against excessive soil loss as a result of erosion through the action of wind and water or collect sediment from run-off water. In situations where the veld is subjected to wind erosion, suitable wind breaks should be constructed and denuded portions shall be covered with branches, hay, straw, crop residues or any other suitable material.

Regulation 13 deals with the restoration and reclamation of land and says that if any damage to land has occurred that it should be restored or reclaimed to the satisfaction of the executive officer.

Further regulations regarding exotic species (declared weeds and invaders species) are given in Regulation 15. The Act has divided weeds and invader species into three categories of importance of which Category 1 plants are not to occur on a site, Category 2 plants require permits and Category 3 plants are not to be traded with.

It is anticipated that the proposed exploration activities have the potential to cause damage to veld areas and provide the opportunity for weeds and invader species to occur on site, and or cause erosion, and therefore the necessary mitigation measures should be implemented in order to reduce the potential of this occurring. This impact has been identified and assessed in Section 8.2.

5.5 SOUTH AFRICAN HERITAGE RESOURCES ACT

By introducing an integrated and interactive system for the management of national heritage resources, the National Heritage Resources Act (Act 25 of 1999) provides for the protection of South Africa's heritage resources, which are of cultural significance.

Section 38 of the NHRA states that any person who intends to undertake a development must at the earliest stages of the development, notify the responsible Heritage Resources Authority and furnish them with details regarding the location, nature, and extent of the proposed development. The Responsible Heritage Resource Authority could, within 14 days of receipt of such notification; request a heritage impact assessment (HIA) if there is any reason to believe that the heritage resources in the area may be affected.

SAHRA was notified regarding the proposed exploration activities by EIMS, and was given an opportunity to provide comment.

5.6 ATMOSPHERIC POLLUTION PREVENTION ACT (ACT 45 OF 1965)

The Atmospheric Pollution Prevention Act (APPA) serves to provide for the prevention of pollution of the atmosphere, for the establishment of a National Air Pollution Advisory Committee, and for matters incidental thereto. Section 28 and 30 of the APPA deals with matters relating to mining and air pollution, and provides specific prescribed steps or best practice guidelines to prevent dust pollution from mining activities and by the person who undertakes these activities (Fuggel & Rabie, 2005).

It is anticipated that the exploration activities will contribute to dust emissions due to the potential clearing of vegetation and the use of exploration vehicles on un-surfaced roads. The impact of dust emissions can however be reduced by implementing the necessary mitigation measures as discussed in this report. This impact has been identified and assessed in Sections 8.2 and 8.3, and mitigation measures provided in section 9.

6 DESCRIPTION OF THE RECEIVING ENVIRONMENT

This section of the report provides baseline information regarding the receiving environment and assists in determining appropriate protection, remedial measures and environmental management objectives.

6.1 REGIONAL SETTING

The proposed site is situated within the Eastern Cape Province of South Africa. The extent of the site (study area) stretches over six farms situated approximately 55 km east of the town Graaff-Reinet and approximately 20 km west of the town Pearston on the R63. The total exploration area (study area) is approximately 34 000 hectares in size. According to the municipal demarcation board the proposed site is situated within the Blue Crane Route Local Municipality within the Cacadu Municipal District. Please refer to Figure 2 for a locality map showing the extent and location of the study area.

6.2 CLIMATE

According to the Eastern Cape State of the Environment Report (2004) (ECSoER), the Eastern Cape can be divided into nine climatic regions. These nine climatic regions range from areas with late summer precipitation through to areas which receive frost during winter to areas with rainfall throughout the year.

Table 3 presents the climatological information, expressed as a monthly average for a 30-year period (1961- 1990).

Table 3: Climatic information obtained from for the Port Elizabeth weather station[1].

Month	Temperature (° C)				Precipitation		
	Highest Recorded	Average Daily Maximum	Average Daily Minimum	Lowest Recorded	Average Monthly (mm)	Average Number of days with >= 1mm	Highest 24 Hour Rainfall (mm)
January	39	25	18	10	36	9	68
February	38	25	18	11	40	9	121
March	41	25	17	8	54	10	224
April	39	23	14	4	58	9	105
May	35	22	12	2	59	9	76
June	32	20	9	-1	62	8	60
July	33	20	9	-1	47	8	99
August	34	20	10	2	64	10	77
September	39	20	11	2	62	9	429
October	39	21	13	3	59	11	46
November	36	22	15	6	49	11	52
December	36	24	16	9	34	9	95
Year	**41**	**22**	**14**	**-1**	**624**	**112**	**429**

According to Mucina and Rutherford (2006) (Figure 3) the climatic conditions for the area in which the proposed site is located can be described as having non-seasonal rainfall with an optimal rainfall in March and November and maximum rainfall during February and March. The Mean Annual Precipitation for the area has been calculated as being between 270 to 550 mm.

Mean maximum and minimum temperatures for the area in which the proposed site is located has been determined as being 38.6°C during January and -0.3°C during July. The incidence of frost ranges from between 8 to 40 days per year, with the possibility of snow occurring within the higher escarpment areas (Mucina and Rutherford, 2006).

[1] Port Elizabeth was the closest available weather data. It is likely that the site specific weather patterns may differ considerably from those recorded at Port Elizabeth.

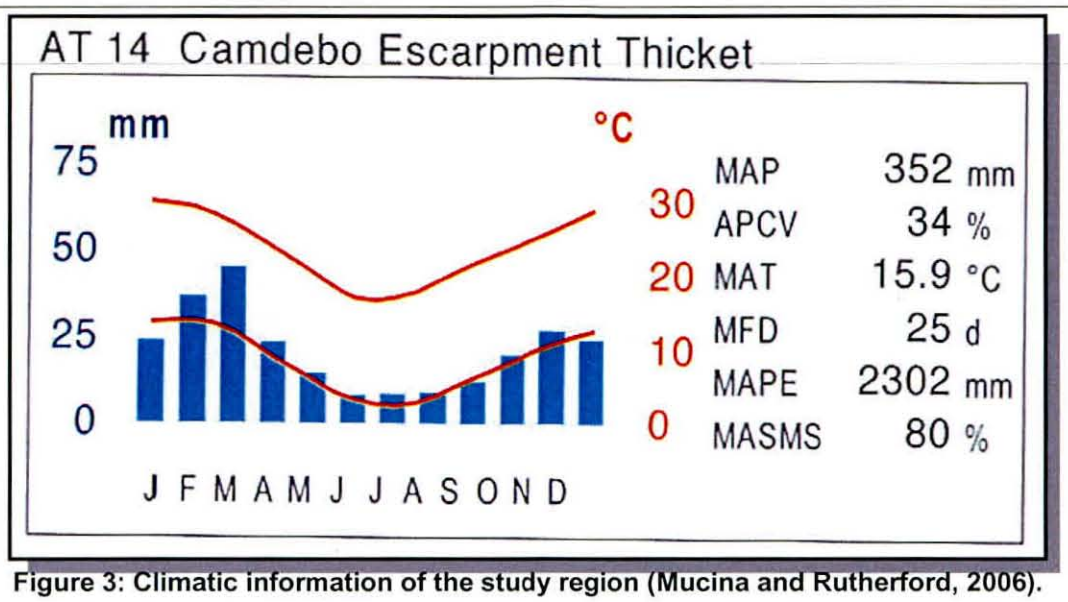


Figure 3: Climatic information of the study region (Mucina and Rutherford, 2006).

6.3 TOPOGRAPHY

According to the available Geographic Information System (GIS) data, the study area can be described as a plain with the majority of the area being characterised by a slope of 0 – 9% (Figure 4). The escarpment forms the northern boundary of the proposed study area and is characterised with a gradient varying between 9 to 25%. It is proposed that all areas with slopes greater then 9% should be avoided as disturbance to these areas could lead to extensive erosion if proper erosion control measures aren't implemented.

Topographic area's with a high erosion potential (with a gradient exceeding 18°) should be defined as sensitive and where possible excluded from the proposed drilling operations and associated disturbances (including access roads).

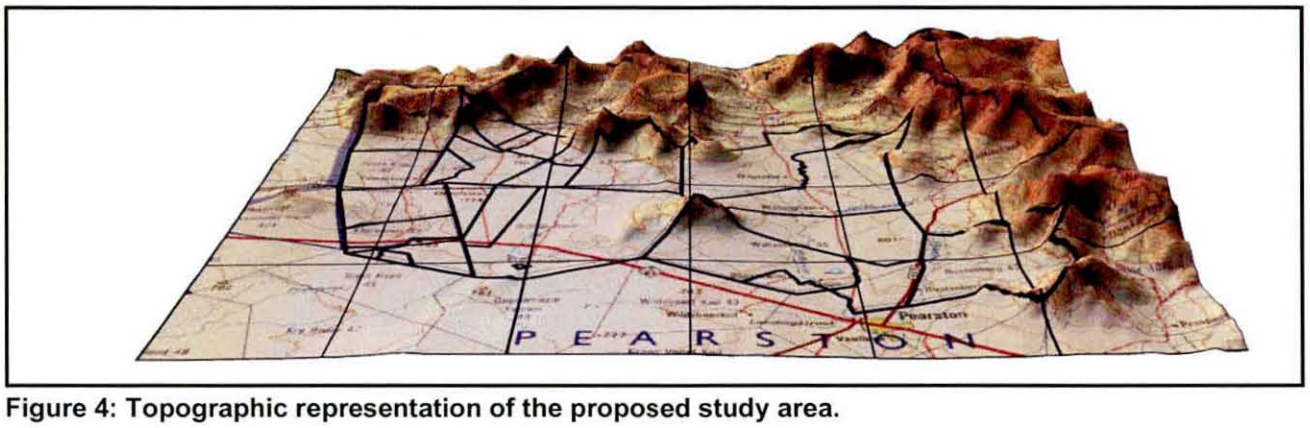
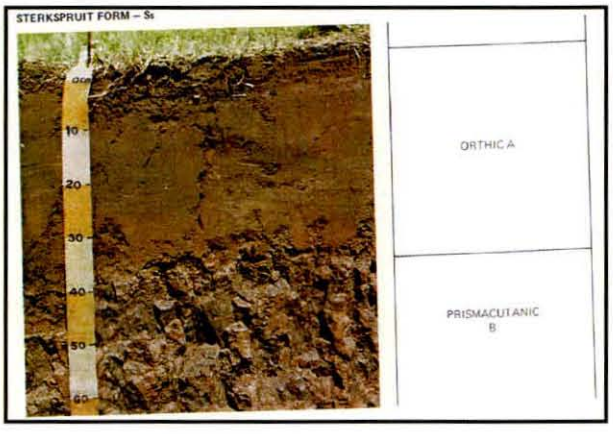
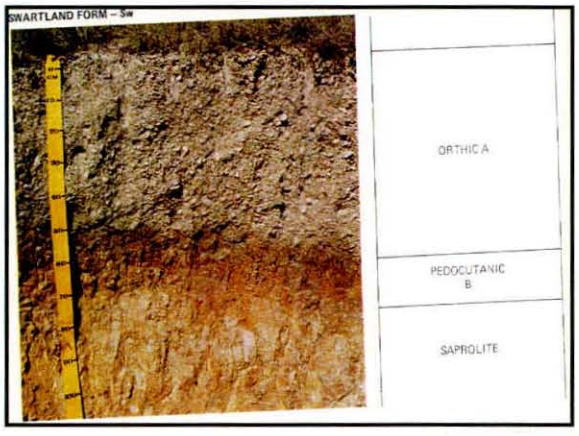


Figure 4: Topographic representation of the proposed study area.

6.4 SOILS

According to the Agricultural Research Council (ARC) and the available GIS data (ARC GIS, 2002) the study area can be characterised by mainly prismacutanic and or pedocutanic diagnostic horizons of mainly red B horizons. According to Macvicar et al. (1977) prismacutanic and pedocutanic B horizons can be describe as having the following characteristics:

Prismacutanic B horizon	Pedocutanic B horizon
	
(i) Has an abrupt transition with an overlying E or A horizon with respect to at least two of the following three properties: a. **Texture:** if the clay content of the material above the abrupt transition is less than 20%, then the clay content below it must be at least twice as high; if the material above the transition has more than 20% clay, then the material below must show an absolute increase of at least 20% clay; b. **Structure:** at least one grade stronger than that of the overlaying horizon; c. **Consistence:** at least two grades harder or firmer than that of the overlying horizon.	(i) underlies a diagnostic topsoil horizon either directly or via a stone-line;
(ii) Has prismatic or columnar structure occasionally primary blocky structure is more pronounced that the secondary prismatic or columnar structure;	(ii) Has a transition with the overlying horizon which is non-abrupt, except that an abrupt transition is permitted where there is no indication of prismatic or columnar structure;
(iii) Lacks evidence of wetness in the form of low chromas or if it has signs of wetness, then the vertical faces of prisms have continuous clay coating of uniform dark colour;	(iii) has structure more strongly developed than defined for the red apedal B, when its upper boundary is not abrupt, a prismatic tendency is permitted;

(iv) Exhibits colour contrast between clayskins and ped interiors	(iv) has clearly expressed cutanic character resulting from illuviation of fine material and manifested as prominent cutans on most ped surfaces;
	(v) does not qualify as a diagnostic G horizon because it lacks sufficient evidence of wetness, as a gleycutanic or prismacutanic B, as a plinthic B or as a red structured B horizon, all of which horizons may have cutanic character to a greater or lesser degree.

The soils within the study region are approximately 450 mm deep and are classified as not being suitable for arable agriculture (Macvicar et al.,1977). The characteristics of the pedocutanic soils make it vulnerable for erosion, and therefore extra care in implementing erosion control measures should be taken.

6.5 GEOLOGY

Mudstone and sandstone are the dominant geological features within the study area. The mudstone and sandstone belongs to the Beaufort Group and Karroo Sequence with some dolerite and alluvium being present (Mucina and Rutherford, 2006).

6.6 LAND TENURE, LAND USE AND LAND CAPABILITY

Approximately 51% of the Eastern Cape Province consists of large open areas with unmanaged natural vegetation which includes forests, woodlands, grassland, shrubland and low fynbos (Eastern Cape SOER, 2004). Urbanisation of the province is of low density with only approximately 9,4% of the province being use for cultivated and plantation forestry (South Africa SOER, 2000) (SASoER).

The proposed study area for which the exploration right is being applied for consists mainly of farm land which is currently utilised for grazing purposes, with other areas being utilised for conservation and hunting purposes. According to the GIS (ENPAT, 2000) the proposed soils within the area does not permit arable agriculture due to structural constraints.

6.7 SURFACE WATER

The proposed study site is located within the Sunday River Catchment of the Fish – Tsitsikamma Water Management area and which can more specifically be divided into the N21C tertiary catchment on the western side and the N30A tertiary catchment on the eastern side of the study area.

According to ECSoER (2004), over-abstraction of groundwater is a major concern within the province. The majority of the water within the Sunday River catchment is used for irrigation purposes followed by urban and rural usage. However, according to water sample tests done within this region the electrical conductivity (EC) and the total dissolved solids (TDS) exceeds the DWAF irrigation, drinking water and industrial use quality requirements. The high TDS levels observed within the water management area can be attributed to the underlying geology of the area and relative low annual precipitation (therefore low levels of salt leaching).

According to the ECSoER (2004), surface water accounts for the majority of the natural available water within the Sunday River catchment. Currently the availability of water exceeds the need for water within the catchment.

It is proposed that all rivers and wetland areas with at least a 30m buffer should be defined as sensitive and where possible excluded from the proposed drilling operations and associated disturbances (including access roads).

6.8 GROUND WATER

The Eastern Cape can be divided in nine ground water regions, of which the study site is located within the Eastern Great Karoo region. The majority of people living within the Eastern Cape rely on groundwater for household uses. However, according to the ECSoER (2004) the Eastern Great

Karoo region has shown a decrease in ground water quality over the past 3 years with numerous outbreaks of cholera as a result of to polluted groundwater sources.

Ground water data for the proposed study area was requested from the Department of Water and Forestry (DWAF). However, no ground water yield data was available for the proposed area and only a chemical analysis that was performed in 1977 could be provided. From the data provided it could be concluded that the ground water of the proposed area has a relatively high TDS (450 to 1000 mg/.) and EC (70 to 150 mS/m) which is indicative of water with a relatively high salt content.

6.9.1.5 Sensitive Floral Species

A complete Red Data floral species list for the quarter degree in which the study area is located has been requested from the South African National Biodiversity Institute (SANBI). Red Data species are classified according to the criteria as set out in Figure 8 and Table 4.

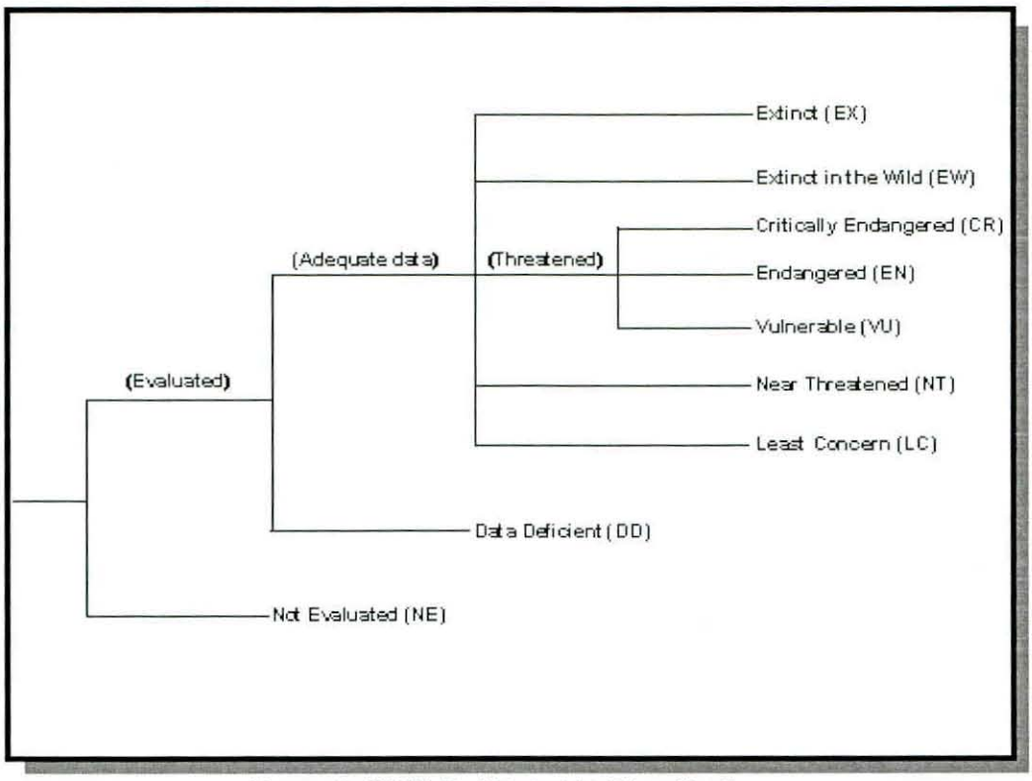


Figure 8: IUCN Red Data List Classification.

Table 4: IUCN Red Data List Classification

Status	
EX (Extinct)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
EXTINCT IN THE WILD (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
CRITICALLY ENDANGERED (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
ENDANGERED (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing

	a very high risk of extinction in the wild.
VULNERABLE (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
NEAR THREATENED (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LEAST CONCERN (LC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
DATA DEFICIENT (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
RARE	Taxa with limited distribution ranges within South Africa and/or known from very few subpopulations, but that are not threatened are included on the national list as species of conservation concern. Their global status according to IUCN categories and criteria of these taxa is Least Concern (LC).
DECLINING	Wild spread taxa that do not qualify for threatened status under any of the IUCN criteria but are nevertheless under pressure, as a result of harvesting for medicinal purposes.

According to data obtained from SANBI nineteen (19) species with Red data status may occur within the study area. Of these nineteen species, seven (7) can be considered to be of least concern, three (3) as rare, three (3) as data deficient, three (3) as near threatened, two (2) as vulnerable and one (1) as being declining.

Species	Status
Aloe striata subsp. *striata*	Least Concern
Euryops brevilobus	Rare
Pentzia incana	Least Concern
Ceropegia stapeliiformis	Least Concern
Chasmatophyllum maninum	Data Deficient
Encephalartos lehmannii	Near Threatened
Euphorbia polycephala	Vulnerable
Faucaria gratiae	Rare
Mestoklema albanicum	Near Threatened
Stapeliopsis pillansii	Least Concern
Gymnostephium papposum	Data Deficient
Huernia kennedyana	Rare
Maytenus undata	Least Concern
Searsia krebsiana	Least Concern
Aloe longistyla	Data Deficient

Dioscorea elephantipes	Declining
Encephalartos lehmannii	Near Threatened
Euphorbia polycephala	Vulnerable

6.9.2 Description of the study area

The proposed study area consists of transformed Karoo veld with some indication of *Acacia karoo* encroachment near rivers and towards the north-western side of the study area.

Figure 9: Karoo veld with indication of *Acacia karoo* encroachment along rivers.

The northern areas, towards the escarpment are characterised by stands of Sweet thorn tree (*Acacia karroo*) (Figure 11), Sisal (*Agave sisalana*) (Figure 10) and Aloe sp. along the ridges (Figure 11).

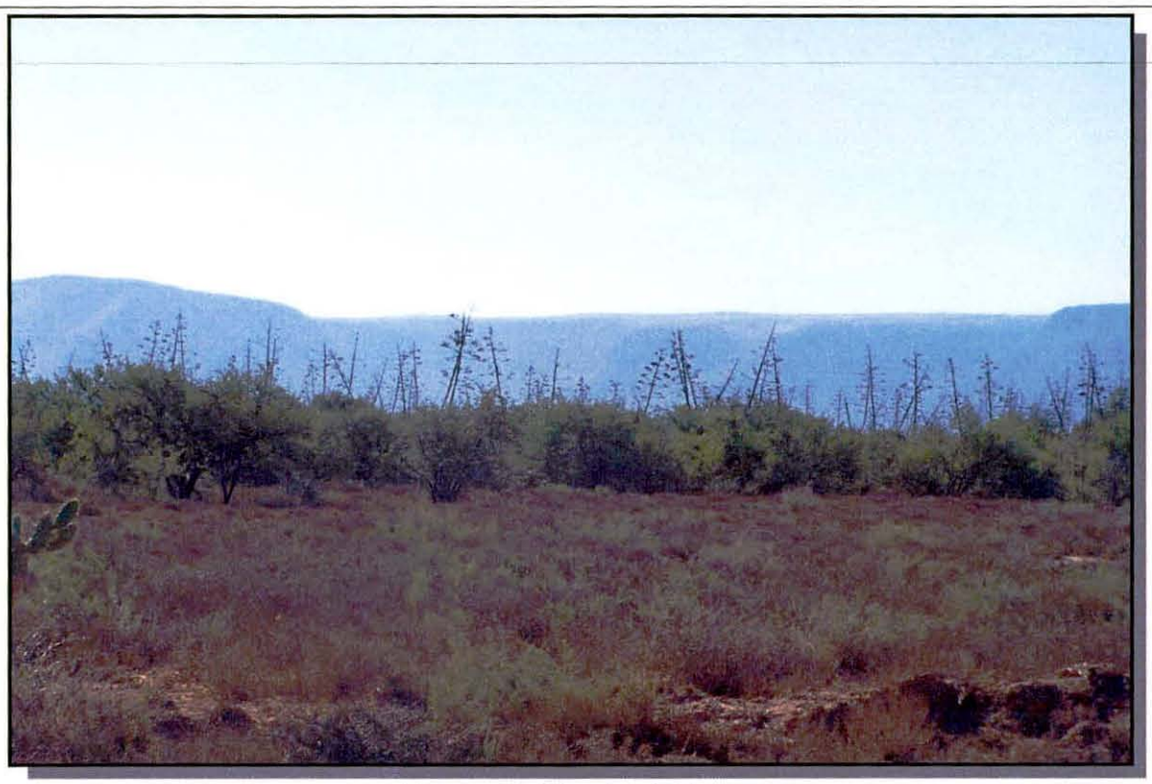


Figure 10: Stands of Sisal.

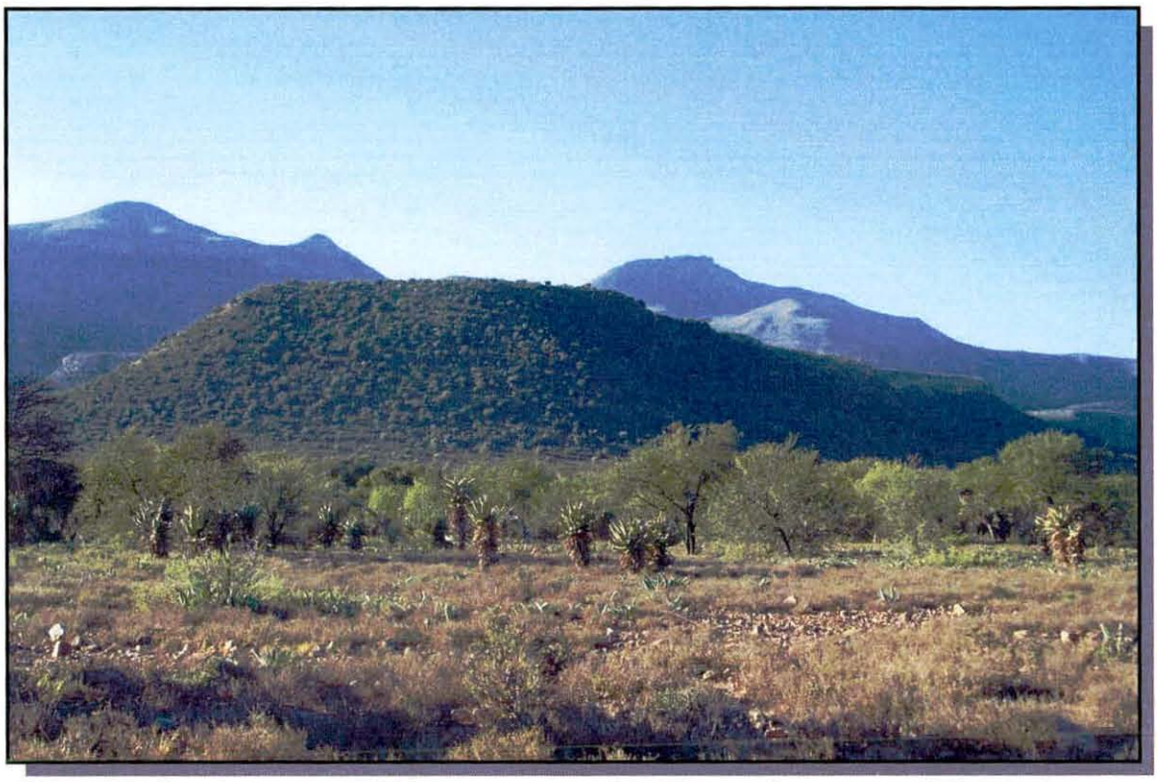


Figure 11: *Acacia karroo* and Aloes occurring along the northern parts of the study area.

The vegetation can currently been seen as being disturbed due to very low rainfall received within the last growth season and the impact of grazing. It is therefore anticipated that the floral

community within the area is currently under threat and can be lost if activity of high disturbance or mismanagement of veld such as overgrazing or removal of vegetation would occur.

6.9.3 Fauna

According to the Bird Atlas of Southern Africa approximately thirty-nine (39) red data bird species are know to occur within the various quarter degrees in which the study area occurs. Of these thirty-nine species eighteen (18) can be considered as being near threatened and twenty-one (21) as vulnerable. According to the Leopards Valley Conservancy Management Plan (Davenport, 2009), ten (10) of the twenty-one (21) vulnerable bird species are confirmed to occur within the study area.

Approximately seventy-five (75) mammal species and sixty-five (65) reptilian species occur within the quarter degree in which the study area is located. Of these seventy-five (75) mammal species, four (4) species can be regarded as being rare and three (3) species as being vulnerable. It is anticipated that due to the remote location, high biodiversity and the proposed area not being densely populated that there is a possibility for most of the mammal and reptilian species to occur within the study area.

6.10 PROTECTED AND SENSITIVE AREAS

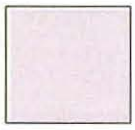
6.10.1 Subtropical Thicket Ecosystem Programme

The National Spatial Biodiversity Assessment Report (2004) and the Subtropical Thicket Ecosystem Programme (STEP) handbook and map book (2006) were used to identify any potential sensitive and protected areas that might occur on or within the vicinity of the proposed study area.

The Albany Thicket Biome in which the proposed study area is located can be considered as a priority area for the conservation of biodiversity in terms of terrestrial, freshwater, estuaries and marine environments. In order to ensure the effective conservation of biodiversity, a system of formal protective areas has been established. STEP adopted the system used by the National Spatial Biodiversity Assessment to indicate priority areas according to the criteria as set out in Table 5.

Table 5: STEP biodiversity priority area classification system (adapted from STEP handbook (2006)):

Key	Priority	
	Least threatened	Ecosystems that cover most of their original extent and which are mostly undamaged, healthy and functioning. Depending on other factors, these ecosystems may be able to withstand some loss of natural area through disturbance or development.
	Vulnerable	Ecosystems that cover much of their original extent but where further disturbance or destruction could harm their health or functioning. These ecosystems can withstand only limited loss of natural area through disturbance or development.
	Endangered	Ecosystems whose original extent has been severely reduced through development or unsustainable land use, and whose health, functioning and existence are under serious threat. These ecosystems can withstand only very minimal loss of natural area through disturbance or development.
	Critical	Ecosystems whose original extent has been so reduced that they are

	**Endangered**	under threat of collapse or disappearance. These ecosystems cannot withstand any further loss of natural area through disturbance or development, therefore every remaining area needs to be protected. In certain cases this category also refers to ecosystems that are essential for maintaining the regional-scale functioning of ecosystem services and processes. Wetlands and indigenous forests are special ecosystems, and are therefore automatically included in this category.
	**Step Corridor**	These "STEP Corridors" are the parts of the landscape that are best able to allow the continuation of large-scale ecological processes (especially the movement of plants and animals) if such areas are restricted to low-impact activities. They are long, wide strips of land that follow the coastline and some of the major river valleys, and they are connected to each other. They vary in width, from a few kilometres up to about 70 km wide in places. The STEP Corridors include existing nature reserves and other protected areas, but mostly avoid towns, intensively cultivated land and areas of dense alien plant invasions.
	**Process Area**	Ecological processes take place wherever healthy biodiversity is present, but the Process Areas represented on the STEP Biodiversity Priorities Map represent areas where large scale ecological processes take place. The STEP Corridors include many of these large scale ecological processes, and on the Map they cover-up some of the Process Areas. Some Process Areas, however, do fall outside the STEP Corridors. The main examples of such areas are the boundaries between different soil types, where species evolution rates are highest. Due to the importance of Process Areas and the services they provide for us and the region's biodiversity, they are of highest priority.
	**Impacted Area**	Indicated by a dark grey striped pattern on the STEP Biodiversity Priorities Map. These are areas where human activities or alien plant invasion have degraded the natural environment severely. Impacted Areas include areas that have been converted to a form of land use that replaces biodiversity (e.g. crops, urban areas, industry). Impacted Areas affect the Ecosystem Status of the landscape: the more of a particular vegetation type is impacted, the higher the Ecosystem Status of that vegetation type will be. In cases where poor land management has degraded the landscape, the management of Impacted Areas needs to be carefully considered. On the one hand, it may be possible to restore such areas so that ecosystems can once again function properly. For example the restoration of an Impacted Area may be a way of re-establishing a connection between two areas of natural vegetation. On the other hand, if restoration will be impossible, such areas may be the best place for development to occur. For example land where alien plants have completely excluded indigenous vegetation may be the best place for the building of certain structures, rather than building on land where indigenous biodiversity still survives.

According to the information obtained from the STEP database, the majority of the study area can be classified as a STEP corridor, with an indication of impacted areas (See Figure 12). Areas classified as endangered (according to STEP) occur within the south-western and south-eastern regions of the proposed study area (Figure 13). These endangered areas have been severely impacted on by development or unsustainable land uses and therefore the ecological functions within these areas are under threat. According to the STEP priority classification the following applies to each of the areas designated within the study area:

- STEP Corridor: parts of the landscape that are best able to allow the continuation of large-scale ecological processes (especially the movement of plants and animals) if such areas are restricted to low-impact activities.
- Impacted Areas: These are areas where human activities or alien plant invasion have degraded the natural environment severely, and as such should where possible be rehabilitated/ restored or if this is not possible would be suitable for development over other un-impacted areas.
- Endangered Areas: These ecosystems can withstand only very minimal loss of natural area through disturbance or development.

Three formal conservation areas can be observed to occur within the region of the proposed study site. The Samara Private Game Reserve and Buchanon Game Reserve are located adjacent to the western boundary of the proposed study area with three of the identified land portions (included in this application) falling within the Samara Private Game Reserve. The Samara game reserve consist of approximately 28 000 hectares of land and is host to a wide variety of game including cheetah and white rhino, whereas the Buchanon Game Reserve consists of approximately 12 168 hectares. The Hoeksfontein Game Reserve is located north of the proposed study area on the escarpment and consists of approximately 3070 hectares. It is proposed that the Samara Private Game Reserve should be defined as sensitive and where possible excluded from the proposed drilling operations and associated disturbances (including access roads). Operations within these areas, if absolutely necessary must be conducted with particular care for the environment and in consultation with landowners.

Several of the farms located within the study area have submitted an application to the Eastern Cape Department of Tourism to be declared a conservancy. The conservancy will consist of approximately 28 000 hectares and consist of the portions as indicated in Figure 14.

6.10.2 Eastern Cape Biodiversity Conservation Plan

The Eastern Cape Biodiversity Conservation Plan (ECBCP) identifies that the majority of the study area is designated with a Biodiversity Land Management Class (BLMC) of 2 and a small area (the area which incorporates Samara) as BLMC 1. These have a recommended land use of Conservation (for BLMC1) and Game Farming, communal livestock and commercial livestock (BLMC2).

The BLMC's provide "guidelines for regulating land-use change so as to avoid or minimize biodiversity impacts in critical biodiversity areas (CBAs). These maps and guidelines should be referred to in all EIAs (and related environmental studies) and should be consulted in the decision-making process for all land-use authorisations" (ECBCP; 2007).

It is also important to note that during the public consultation process (please refer to the minutes of the public meeting attached) a representative from the South African National Parks Board noted that the area was currently included in the panning phase of extensions to the existing National Parks network in the area. It is understood that a bioregional reserve is planned for the area and includes the current exploration area. It is EIMS's understanding that in order not to impact on this plan that special precautions are required during exploration to ensure that no permanent detrimental transformation of the area occurs.

6.11 CULTURAL HERITAGE AREAS

According to the SAHRA national inventory of heritage sites; several areas of provincial heritage importance, which mostly consist of historical buildings, occur in Graaff-Reinet and within the town of Pearston.

According to the GIS database no known cultural or heritage sites occur with in the study area. Several landowners have confirmed that unmarked and marked grave sites, fossil sites, bushman paintings and historic structures occur within the study area. The Environmental Management Plan (EMP) drawn up for the proposed Leopards Valley Conservancy further confirms the occurrence of heritage features on site as well as emphasises that the Cranemere area can be regarded as a fossil rich area (Davenport, 2009).

6.12 AIR QUALITY

Monitoring of air quality in the Eastern Cape Province is performed on a fragmented basis and no co-ordinated monitoring network exists. Monitoring of air quality within the Province is mostly concentrated around areas such as Port Elizabeth and East London and therefore no comprehensive assessment of air quality exists (ECSoER, 2004).

According to municipal demographic statistics (2001) the majority of households within the Blue Crane Route municipality rely on wood and paraffin as a source of energy and heat. Fires are not only used for heating and preparing of food but also have a cultural significance in rural communities. Pollution dispersal is largely affected by the climate and topography of an area and therefore emissions from ground level such as emissions from household fires are not easily disperse and tend to cause localised air pollution (ECSoER, 2004). The major contributor to air pollution within the rural areas of the Eastern Cape Province can therefore be attributed to household energy sources.

6.13 SOCIAL AND ECONOMIC ENVIRONMENT

The proposed site is located within the Blue Crane Route Local Municipality of the Cacadu Municipal District. It consists of approximately 9 835 km^2 with a population size of approximately 35 000 people. Table 6 shows the population distribution for the Blue Crane Route Local Municipality. From the data it can be observed that the black African population group dominated this area followed by the coloured population group during 2001. The gender distribution for the municipality consists of approximately 52% female and 48% males.

Table 6: Population demographics for the Blue Crane Route Local Municipality (MDB, 2001)

Population Groups	2001
Black African	20865
Coloured	11517
Indian	21
White	2605

The age distribution for the population of the local region can be observed in Figure 15. The distribution is typically indicative of a South African rural population which normally shows a higher

8.3 ASSESSMENT OF POTENTIAL IMPACTS

A summary of the potential impacts as well as the different ratings and mitigation measures for each impact can be observed in Table 9.

8.3.1 Topography

It is anticipated that the local topography of the site will be impacted on if the need arises to construct temporary access roads as well as to level the area where the drilling rig will be located. If the topography of the area is to be changed, it is anticipated that the impact will be of a MEDIUM negative impact if the necessary mitigation measures are implemented.

8.3.2 Soil

Due to the small size of the drill site footprint (approximately 1 hectare) it is anticipated that the impact on soil will be minimal and will be restricted to the drill site footprint. Existing roads within the study area should be used as far as possible during the initial ground-truthing and transport of the equipment on to site. This should be done in order to minimize disturbance and avoid compaction of new areas.

The footprint and access road should be clearly demarcated and intrusion to areas outside of the demarcated areas should be avoided. The footprint area should include all working areas, stockpile areas, sumps and turning circles for vehicles. If the need arises to level the site as well as to construct the sump areas, it is recommended that the topsoil of the affected areas should be stripped and stored separately for later use in rehabilitation. It is recommended that the stripping of topsoil should be kept to a minimum in order to retain most of vegetation within the footprint area. Retention of most of the vegetation within the footprint area will help in reducing the effect of wind and water erosion.

If the need arises to construct a temporary access road, the access road should follow the natural contours of the area, as far as practical. The planning of the access road should be done in such a manner to ensure that the shortest possible route with the least impact should be selected. Adequate drainage and erosion protection in the form of off-cut or trenches needs to be provided where necessary.

Several chemical components will be used during the drilling activity. It is anticipated that most of the chemicals that will be used are biodegradable, and therefore will have less of an impact than other conventional chemicals. Even though the chemicals are biodegradable care should still be taken in order to prevent excessive spills. If chemicals are to be stored or mixed on site it should be stored and mixed on an impermeable surfaced within a bunded area. It is recommended that a spill procedure should be put in place in order to prevent potential spills as well as ensure that the correct procedures are followed to clean up spills.

Due to the short duration of the exploration activity it is anticipated that the overall impact on soil will be of a LOW negative significance if the necessary mitigation measures are implemented. Mitigation measures will insure that all compacted soil areas, access roads and cleared areas will be adequately rehabilitated after the exploration activities have been completed.

8.3.3 Geology

It is anticipated that the drilling activity will have no significant impact on the geology of the area. After the activity has been completed, it is anticipated that the collar of the hole will be sealed using cement or a cement/sand grout mixture.

8.3.4 Land tenure, Land use and Land capability

The drill site footprint will be approximately 1 hectare in size and will be fully rehabilitated after the exploration activities have been completed. Therefore, it is anticipated that the exploration activity will only have a temporarily impact on the land use and land capability. The location of the drill site and access routes must be determined in consultation with the relevant landowner.

8.3.5 Surface and Ground Water

The proposed sitting location of the drill rig can have an impact on the surface and groundwater resources of the area and should therefore be taken into consideration during the site selection. It should be insured that during the site selection that the drill rig is not situated near any boreholes or water wells as it may increase the chances of contamination of important groundwater resources.

During the drilling process several biodegradable substances will be applied as a water lubricant slurry mixture to assist with the drilling process. This slurry mixture will be pumped to separate holding ponds or sumps. The possibility of overflowing of this slurry mixture from the sump area exists, however the lubricants intended to be used during the drilling process can be classified as being biodegradable and therefore the impact of potential overflowing of the sump areas can be regarded as being of MEDIUM negative significance. Improper containment of lubricants, fuel and other potential damaging substances can further pose a treat to surface and groundwater resources. Groundwater aquifers can be penetrated during the drilling process which can lead to sediments entering the aquifer and creating offset turbidity. However, it is proposed that casing be set and cemented through aquifers to eliminate the potential of groundwater pollution and disturbance to the aquifer. It is anticipated that the impact of offset turbidity of aquifers, in the unlikely event of this occurring, will have a MEDIUM negative impact due to the majority of the people within the region relying on groundwater as the main source of water supply.

Adequate casing, plugging and rehabilitation of the well area is of critical importance. Should the borehole not be cased adequately it could lead to potential contamination of groundwater aquifers due to migration of borehole fluids into permeable zones. It is anticipated that the impact of improper casing, plugging and rehabilitation of the borehole site will have a MEDIUM negative impact.

8.3.6 Ecology

It is anticipated that due to the small scale and the short duration of the proposed activity that the impact on the ecology within the area will be of a MEDIUM negative impact if the necessary mitigation measures are implemented.

The size of the exploration area (34 000 hectares) makes a detailed ecological assessment impractical. A GIS scan was performed to identify any potential sensitive areas that might occur within the study area. These potential sensitive areas were verified during a site assessment. It is recommended that after the most suitable borehole locations are identified that an Environmental Assessment Practitioner (EAP) or Ecologist (registered Professional Natural Scientist) undertake a

site specific assessment to assess the site for any potential site specific environmental sensitivities. After the assessment the Environmental Management Programme must be amended to include any site specific requirements.

8.3.7 Protected and Sensitive areas

Some sensitive areas such as the Samara Game Reserve, steep slope areas prone to erosion and rivers and streams occur within the proposed study area. The GIS scan identified that several tributaries and the Voëlsriver cross the study area. These tributaries and rivers are not classified as being sensitive however it is recommended that no drilling activities or erection of a construction camp takes within 100 meters of these tributaries and rivers. The assessment of the proposed drilling sites by the EAP will ensure that the impact on any potential sensitive areas will be minimal. Attention is drawn to the fact that any activity within the 1:10 year floodline of a river or within 32m from the bank of a river or stream would result in the requirement for a NEMA EIA Authorisation.

8.3.8 Cultural and Heritage Areas

According to the landowners, several areas with historical value occur within the study area. The area can additionally be regarded as a fossil rich area according to Leopards Valley Conservancy report (Davenport, 2009). However, due to the small scale of the proposed activity it is anticipated that the impact on cultural and heritage sites will not be significant on condition that certain precautionary measures are taken. The geology of the study area is characterised by mudstone and sandstone which are known geological formations with the potential to host fossils due to the manner in which it originated. Should any artefacts or fossils be uncovered or observed during the exploration activity, the activities within that area should be ceased and the South African Heritage Resources Association (SAHRA) should be notified immediately. It is further recommended that a phase 1 heritage impact assessment be conducted by a suitably qualified professional, on the preferred drill site (prior to commencement) to assess the potential of heritage features occurring on that specific site. In the event of heritage features being located on a prospective site, the mitigation measures stipulated by the SAHRA must be followed or the site relocated.

8.3.9 Air quality

It is anticipated that there will be an increase in dust emissions due to the activity of exploration vehicles. The impact of dust emission on air quality will be temporary and of LOW negative significance, due to the isolated location of the study area. It is recommended that speed on dirt roads be reduced in order to reduce excessive dust emissions.

It is recommended that all boreholes emitting gas, and which are not to be used for further testing should be sealed to limit unnecessary fugitive gas emissions.

8.3.10 Socio-economic impact

The socio-economic impact of the exploration activity will be of limited significance due to the small scale and short duration of the proposed activity. It is anticipated that supplies needed for the operation of the drilling equipment and sustain the employees will be locally obtained and thus provide limited input into the local economy.

Early and ongoing communications with the landowners and Interested and Affected parties are of paramount importance to maintain good communications and to address issues which might have a negative impact on their lively hoods and daily activities. Issues such as trespassing, theft, damage to property and livestock and poaching can be minimised by developing a good

relationship with the landowner and establishing a land use agreement between the contractor and the landowner. Employees should further be educated regarding the dangers of open fires. It is recommended that no open fires should be allowed on site and that emergency procedures be put in place in the event of an accidental fire. It is further recommended that issues such as water use and electricity should be included in the land use agreement.

Table 9: Significance of impacts and mitigation mea

Nature of Impact	Impact Source	
Change in topography of the landscape.	Preparation of the drill site, ca access roads.	al landform after the decomissioning. lan, prepared by a SACNASP ecologist, should be in t of drilling operations. ed.
Compaction of soil.	Compaction due to transport o on and off the site and well as set-up.	d where possible. re necessary as part of the rehabilitation.
Loss of topsoil.	Loss of topsoil due to construc area as well as levelling of rig ba	from areas that are to be cleared and stockpiled rehabilitation. for the minimal amount of time.
Contamination of soil due to potential spills.	Spills during transport and chemical substances needed drilling operations.	soil must involve careful removal of soil using o storage containers until treated or disposed of at a e. on site at all time. made aware of the necessary emergency spill sported along exploration access roads, emergency measures must be developed to minimize impacts ed and immediate action must be taken. spill (>35 litres) of any hazardous substance, these nd reported to the Applicant, DWAF and the e necessary. d the extent of the spill, contaminated soil must be on-site. Clean up should be immediate and to the liance Manager and Applicant. diation of spills must be used according to product use.

		ons taken to remediate the spills should be kept at all ance should be done to minimise spillage risk.
Erosion	Erosion due to exposed soil s result of removal of vegetatio site and on the access roads).	bly be located outside of the areas with a gradient sible by only clearing areas that are necessary. here possible to reduce additional exposed areas. management should be implemented in areas where t be avoided. adequate drainage and erosion protection in the form should be provided where necessary. ads should be well maintained. age, the changes in stormwater run-off resulting from st be estimated and the drainage system assessed ikelihood of channelling and resultant erosion gully as should occur directly after exploration activities are ertaken in consultation with a specialist rehabilitation ience with successful rehabilitation in Karoo cient volumes to handle maximum water volumes.
Loss of agricultural potential	Temporary loss of the us exploration area for every activities, such as grazing etc.	n activity should be done so as to impact minimally on d be assessed by an EAP and in consultation with the
Creation of conduits between geological strata		rly sealed during and after exploration activities have potential dewatering of shallow aquifers as well as to ways for the transport of contaminants into aquifers.
Disturbance to water balance within the	Water will be abstracted boreholes or if needed additio	amount of water required for the drilling activities. DWAF permits should be obtained before water

area.	will be drilled. It is anticipated that the water requirements will be approximately 5 000 litres per day.	Local (2)	Medium (3)	Moderate (6)	High (4)			abstraction is undertaken. • All water usage must be compliant with the requirements of the NWA. • The pre-exploration condition of the water resources (based on a detailed hydrocensus) must be utilised as the target for post-exploration closure objectives. All necessary measures must be taken to ensure that the post-exploration condition of the water resources does not differ from the pre-exploration conditions. • Obtain written agreement from landowner to abstract water from existing boreholes. • Do not exceed the estimated amount of water required for the drilling activities. • Abstraction of water should be kept within the permit limits as issued to the landowner by DWAF.
Potential pollution of surface and groundwater.	Potential spills from imported materials such as fuel, lubricants and chemicals to the drill site, the generation of drilling mud and ablution facilities.	Local (2)	Long term (4)	High (8)	High (4)	(56) Medium	(36) Medium	• Where contaminants are transported along exploration roads, emergency containment and mitigation measures must be developed to minimize impacts should accidental spills occur (i.e include spill kits in transporting vehicles). All water usage must be compliant with the requirements of the NWA. • The drilling machine will be positioned on concrete pad with a retaining wall. • All water and spillage will be drained from the containment area into primary and secondary fully lined sumps. • Drilling water should be kept in a closed circuit and re-circulated to the drilling machine. • Conduct a pre-drill hydrocensus and develop screening-level geological and geohydrological model for the exploration area and refine it to locate boreholes, define no-go areas and define which boreholes require special attention to sealing to prevent future pollution conduits. • All holes drilled in the exploration area must have casing cemented through fresh water aquifers to prevent disturbance to the groundwater regimes. • Minimize the area that is disturbed during exploration activities in order to minimize the potential stormwater disturbance and to reduce the sediment loads to receiving water courses. • In the case where water will be required, the water supply pipelines laid down should be done in accordance to the agreement with the landowner and tenants, in such a manner that the surface and natural vegetation are not unduly disturbed (where necessary). • An approved chemical toilet service supplier should be used to supply and maintain chemical toilets for the duration of the proposed activity on the site. • Chemical toilets (preferred) or other approved toilet facilities such as septic drains should be used and sited on the campsite in such a way that they do not cause water pollution, odour or other forms of pollution. • In case where facilities are linked to existing sewerage structures, all necessary
		Local (2)	Long term (4)	Moderate (6)	Medium (3)			
	Drilling of boreholes through overlying strata and aquifers into underlying commodity could, if the borehole is not properly sealed and cased afterwards, generate flow conduits for the dewatering of shallow aquifers and can also lead to new pathways for the transport of contaminants.	Local (2)	Long term (4)	Moderate (6)	High (4)	(48) Medium	(33) Medium	
		Site (1)	Long term (4)	Moderate (6)	Medium (3)			

								regulatory requirements concerning construction and maintenance should be adhere to. • Separation pits (sumps) for wastewater and grease and oil polluted fluids should be excavated and constructed to treat wastewater. Where excavating these pits, topsoil and subsoil should be stored separately. • Sump areas should be lined with PVC to prevent seepage. • In order to contain non-biodegradable oil and fuel spills, drip pans or PVC lining should be provided for mobile pans and drip pans. For stationary drill rigs, thin concrete slabs and/or with PVC lining should be installed before the stationary drill rigs are erected. • Sump areas should be surrounded by a berm or earth wall of at least 50 cm which can withstand heavy rainfall. • No polluted water must be discharged into the surrounding environment. • Sump areas should be constructed in such a way that clean water (stormwater) is diverted away from these areas. • All clean water should be diverted away from the site. • Adequate drainage and erosion protection in the form of cut-off berms or trenches should be provided where necessary. • During rehabilitation, boreholes should be properly sealed after exploration activities have ceased in order to prevent potential dewatering of shallow aquifers as well as to avoid creating potential pathways for the transport of contaminants into aquifers. • Make up water will be introduced when required. • No exploration activities are allowed to take place within the 1:50 year floodline or within 100 meters from a riparian area, river or wetland. • All domestic effluent water from the site should be collected and disposed of in an appropriate manner (in accordance with the legal provisions) such as a French drain system which is situated not closer than 100 metres from any streams, rivers, pans, dams or boreholes. • Develop screening-level geological and geohydrological model for the exploration area and refine it to locate boreholes, define no-go areas and define which boreholes require special attention to sealing to prevent future pollution conduits. • Access route crossings across rivers, streams and wetland areas should be avoided as far as possible. Where such crossings are unavoidable, the relevant NWA and NEMA authorisations must be obtained. • No camp and office site shall be situated closer than 50 meters from any stream, spring, dam or pan, and 100 meters from any residential area or farm homestead. • Only domestic effluent should be allowed to enter drain systems (if available).

Ecology								
Loss of vegetation.	It is anticipated that due to the potential clearing of vegetation that there will be a localized lost in vegetation.	Local (**2**) Site (**1**)	Long term (**4**) Short term (**2**)	Moderate (**6**) Moderate (**6**)	High (**4**) Medium (**3**)	(**48**) Medium	(**27**) Low	• Once prospective drilling sites are identified, an Environmental Assessment Practitioner (EAP) or Ecologist (registered Professional Natural Scientist) undertake a site specific assessment to assess the site for any potential site specific environmental sensitivities prior to commencement. After the assessment the Environmental Management Programme must be amended to include any site specific requirements. The site assessment must include a survey of the preferred footprint area (including access routes) to identify any potential sensitive/ red data species (flora and fauna). • If sensitive species (flora and fauna) occur within the preferred footprint, the option of relocating the footprint must be considered. Alternatively a relocation plan should be considered and should be guided by a qualified specialist. • Vegetation should be retained as far as possible. Sensitive species and areas not to be cleared must be demarcated and disturbance to these prevented. • Unnecessary damage to vegetation should be prevented. • Areas outside the exploration footprint should be considered as no-go areas. • No collection of firewood may occur on site. • All areas impacted on by exploration should be suitably rehabilitated to re-attract faunal species to the area and to prevent the loss of land use capacity. • No unauthorized removal of trees shall be allowed. • No trees or shrubs should be felled or damaged for the purpose of obtaining firewood. • The use of indigenous species to the specific area should be promoted during rehabilitation.
Introduction of alien plant species.	Clearing of vegetation could provide opportunity for alien invasive species to flourish.	Local (**2**) Site (**1**)	Permanent (**5**) Long term (**4**)	Moderate (**6**) Moderate (**6**)	Medium (**3**) Low (**2**)	(**39**) Medium	(**22**) Low	• Retain vegetation were possible. • Establish an alien invasive plant eradication programme for the control of weed species. This must be monitored for a period of time following the decommissioning and rehabilitation to ensure that alien invasive plants do not establish themselves.
Loss of potential habitat.	Clearing of vegetation could lead to the destruction of potential habitat areas for faunal species.	Local (**2**) Site (**1**)	Permanent (**5**) Short term (**2**)	Moderate (**6**) Moderate (**6**)	Medium (**3**) Low (**2**)	(**39**) Medium	(**18**) Low	• Once prospective drilling sites are identified, an Environmental Assessment Practitioner (EAP) or Ecologist (registered Professional Natural Scientist) undertake a site specific assessment to assess the site for any potential site specific environmental sensitivities prior to commencement. After the assessment the Environmental Management Programme must be amended to include any site specific requirements. The site assessment must include a survey of the preferred footprint area (including access routes) to identify any potential sensitive/ red data species (flora and fauna). • If sensitive species (flora and fauna) occur within the preferred footprint, the option