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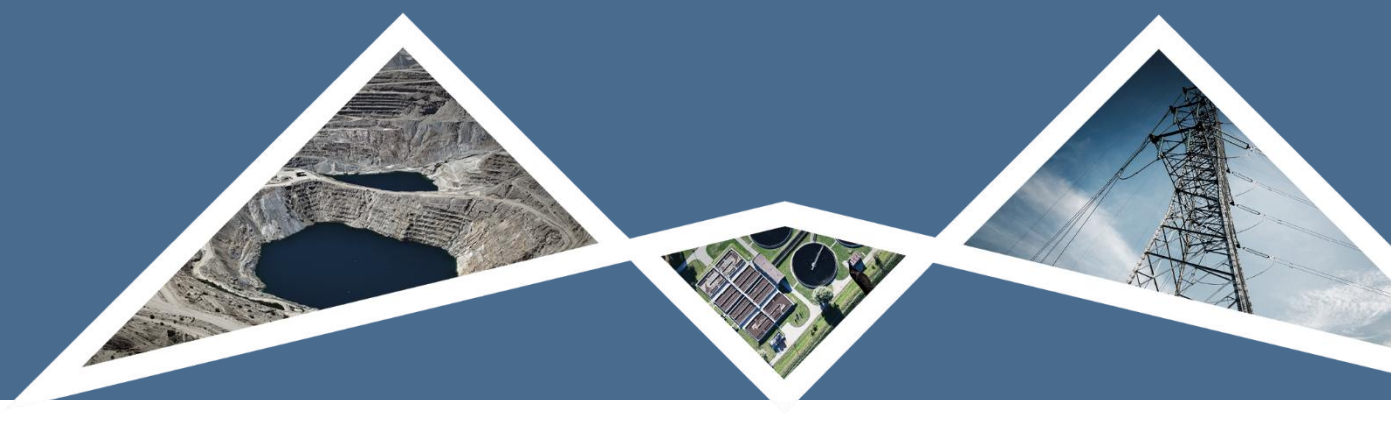
T 011 789 7170 E info@eims.co.za W www.eims.co.za

SCOPING REPORT

12/3/386 EA APPLICATION:

MOTUOANE EXPLORATION RIGHT 386 APPLICATION, WITHIN VARIOUS FARMS IN MATJHABENG AND MOQHAKA LOCAL MUNICIPALITIES, LEJWELEPUTSWA AND FEZILE DABI DISTRICT MUNICIPALITIES, FREE STATE PROVINCE, SOUTH AFRICA

MAY 2025



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	NAME	SIGNATURE	DATE
COMPILED:	Vukosi Mabunda	Not Signed – Sent Electronically	2025/02/28
CHECKED:	Sikhumbuzo Mahlangu	Not Signed – Sent Electronically	2025/02/28
AUTHORIZED:	Liam Whitlow	Not Signed – Sent Electronically	2025/04/25

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2025/05/07	REVISION 1	Final for Public Review and Comment

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ACRONYMS AND ABBREVIATIONS

2D	Two-dimensional
AA	Administrative Authority
AWD	Accelerated Weight Drop
BID	Background Information Document
CA	Competent Authority
CBA	Critical Biodiversity Area
CBL	Cement Bond Log
CMA	Catchment Management Agency
CO	Carbon Monoxide
CR	Critically Endangered
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
DMRE	Department of Mineral Resources and Energy
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
ECA	Environmental Conservation Act
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIMS	Environmental Impact Management Services (Pty) Ltd.
ELWU	Existing Lawful Water Use
EMPR	Environmental Management Program
EMS	Environmental Management System
EN	Endangered
EPF	Exploration and Production Forum
ER	Environmental Risk
ESA	Ecological Support Area
ESO	Environmental Site Officer
FEPA	Freshwater Ecosystem Priority Area
FIT	Formation Integrity Test
GA	General authorisation
GIS	Geographic Information Systems

GNR	Government Notice Regulation
GPS	Global Positioning System
Ha	Hectare
HIA	Heritage Impact Assessment
Hz	Hertz
I&AP's	Interested and Affected Parties
IDP	Integrated Development Plan
IEP	Integrated Energy Plan
IUCN	International Union for Conservation of Nature
LC	Least Concern
MAE	Mean Annual Evaporation
mamsl	meters above mean sea level
MAP	Mean Annual Precipitation
MP	Marginally Protected
MPRDA:	Mineral and Petroleum Resources Development Act
MT	Magnetotellurics Survey
NAAQS	National Ambient Air Quality Standards
NEMA	National Environmental Management Act
NEMAQA:	National Environmental Management: Air Quality Act
NEMBA	National Environmental Management: Biodiversity Act
NEMWA:	National Environmental Management: Waste Act
NFEPA	National Freshwater Ecosystem Priority Areas
NGDB	National Groundwater Database
NHRA	National Heritage Resources Act
NO_2	Nitrogen Dioxide
NPAES	National Protected Area Expansion Strategy
NT	Near threatened
PASA	Petroleum Agency South Africa
PM	Particulate Matter
PM_{10}	Particles with a diameter of 10 micrometers or less
PM_{20}	Particles with a diameter of 2.5 micrometers or less.
PPP	Public Participation Process
Ptn	Portion
RE	Remaining Extent
SAHRA	South African Heritage Resources Agency
SAHRIS:	South African Heritage Resources Information System

SANBI	South African National Biodiversity Institute
SANS	South African National Standards
SAPAD	South African Protected Areas Database
SCC	Species of conservation concern
SEI	Site Ecological Importance
SO_2	Sulphur Dioxide
TC	Total concentration
TDS	Total Dissolved Solids
TOPS	Threatened and Protected Species
TVD	True Vertical Depth
VOC	Volatile Organic Compounds
VU	Vulnerable
WMA	Water Management Area
WUL	Water Use Licence

GLOSSARY OF TERMS

This section provides a catalogue of terms and definitions, which may be used in this report and, or other documents drafted for the project.

Table 1: Glossary of terms.

Term	Definition	Reference
Clearing/Clearance	Clearing/Clearance refers to the removal of vegetation through permanent eradication and in turn no likelihood of regrowth. 'Burning of vegetation (e.g., fire- breaks), mowing grass or pruning does not constitute vegetation clearance, unless such burning, mowing or pruning would result in the vegetation being permanently eliminated, removed or eradicated'.	**Department of Environmental Affairs, 2017. Clearance of Indigenous Vegetation Explanatory Document**
Competent Authority	In respect of a listed activity or specified activity, means the organ of state charged by this Act with evaluating the environmental impact of that activity and, where appropriate, with granting or refusing an environmental authorisation in respect of that activity.	**National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) as amended, NEMA 1998 hereafter**
Construction	According to the regulations this term is defined as – the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint'. In this application, construction refers to the site establishment, seismic surveys and drilling activities.	**NEMA, EIA Regulations, 2014, as amended**
Critical Biodiversity Area	Areas that are deemed important to conserve ecosystems and species. For this reason, these areas require protection.	**SANBI**
Decommissioning	means to take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily recommissioned;	**NEMA, EIA Regulations, 2014, as amended**

Environment	the surroundings within which humans exist and that are made up of— the land, water and atmosphere of the earth; (ii) micro-organisms, plant and animal life; (iii) any part or combination of (i) and (ii) and the interrelationships among and between them; and (iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.	**National Environmental Management Act 1998 (Act No. 107 of 1998), as amended, NEMA hereafter**
Environmental Authorisation	This is a decision by a Competent Authority to authorise a listed activity in terms of the National Environmental Management Act (NEMA). The authorisation means that a project, either in totality or partially, can commence subject to certain conditions. The Competent Authority has a right to refuse to grant authorisation for a project in totality or partially.	**NEMA, EIA Regulations, 2014, as amended**
Environmental Assessment Practitioners	The individual responsible for the planning, management, coordination or review of environmental impact assessments, strategic environmental assessments, environmental management programmers or any other appropriate environmental instruments introduced through regulations.	**NEMA, 1998**
Fatal Flaw	An environmental or social negative impact that is not possible to mitigate and significant enough to prevent the scheme from being able to be implemented.	**NEMA, 1998**
Fauna	Animal life that occurs in a specific geographical region and/habitat.	**SANBI**
Flora	plant life that occurs in a specific geographical region and/habitat.	**SANBI**
Indigenous vegetation	Refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.	**NEMA, EIA Regulations, 2014, as amended**
Interested and Affected Parties (IAPs)	a) any person, group of persons or organisation interested in or affected by such operation or activity; and (b) any organ of stale that may have jurisdiction over any aspect of the operation or activity.	**NEMA, 1998**
Protected Area	A protected area is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.	**International Union for Conservation of Nature (IUCN)**
	These are areas aimed at the protection and conservation of areas which are ecologically viable and have high biodiversity. Example of Protected Areas include but are not limited to National Parks, Nature Reserves, world heritage sites and marine protected areas	**National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)**
Public Participation Process	In relation to the assessment of the environmental impact of any application for an environmental authorisation, means a process by which potential Interested and Affected Parties are given opportunity to comment on, or raise issues relevant to, the application.	**NEMA, 1998, as amended**
Regulated Area of a watercourse	An area for which a General Authorisation or a Water Use Licence would need to be obtained prior to undertaking any activities.	**National Water Act 36 of 1998**
Screening	Screening determines whether or not a development proposal requires environmental assessment, and if so, what level of assessment is appropriate Screening is therefore a decision-making process that is initiated during the early stages of the development of a proposal.	**NEMA, EIA Regulations, 2014, as amended**

Species of Conservation Concern	IUCN Red List definition: Threatened species, and other species of significant conservation importance: Extinct, Extinct in the Wild, Near Threatened, Data Deficient. In South Africa, the following additional categories are added: Rare, Critically Rare.	**SANBI**
Watercourse	Watercourse refers to: (a) a river or spring; (b) a natural channel in which water flows regularly or intermittently; (c) a wetland, lake or dam into which, or from which, water flows; and (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.	**National Water Act 36 of 1998**
Wetland	**land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil**	**National Water Act 36 of 1998**

EXECUTIVE SUMMARY

Motuoane Energy (Pty) Ltd (hereafter referred to as Motuoane – the applicant) compiled and submitted an application for an Exploration Right (ER) to explore hydrocarbons, in terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 – MPRDA, as amended) to the Administrative Authority (AA), the Petroleum Agency South Africa (PASA) in 2024. The accepted (not yet approved) ER is located over an area of approximately 58 000 hectares (ha) / 580km^2, covering various farms near the towns of Welkom, Virginia, Hennenman and Odendaalsrus, within the Free State Province. The local municipalities in which the proposed exploration area is located are Matjhabeng and Moqhaka Local Municipalities, which are part of the Lejweleputswa and Fezile Dabi District Municipalities respectively. Noticeable boundaries of ER386 are 28°13'28.95"S; 26°55'2.76"E in the South, 27°57'37.57"S; 26°48'49.15"E in the West, 27°59'13.57"S; 27°11'13.06"E in the East and 27°46'34.45"S; 26°57'44.05"E in the North, the central coordinates are approximately 27°58'23.27"S; 26°59'38.94"E.

Motuoane proposes to explore all saleable gases including but not limited to Methane, Carbon Dioxide, Helium, and Nitrogen in the licensed area. Published reports, general experience, experience within Motuoane and contacts with individuals familiar with the area indicate the presence of potentially commercial quantities of these gases. Direct evidence includes gas-emitting boreholes, nearby commercial gas production, gas encountered during drilling and underground mining operations. Due to the large area and complex exploration methodology, the ER will be required for an initial period of three years with the option to renew three additional periods of two years resulting in a total of nine years.

Exploration Right 386 is a consolidation of Technical Cooperation Permit (TCP) 235 and 240 & Exploration Right Application (ERA) 341 which were tenures in 2024 before ER386 application was submitted to PASA on the 8th of October 2024. TCP235 & TCP240 were granted in October 2023 for a 12 Month Term, an ER application was applied for in October 2024. ERA341 was an application previously submitted to PASA which was held up due to changing legislation and subsequently withdrawn. The areas (ERA341, TCP235 and TCP240) were then consolidated to one ER (ER386). Motuoane's application for an exploration ER for hydrocarbons was accepted on the 22nd of October 2024 in terms of Section 79 of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 – MPRDA, as amended).

The proposed activities to be undertaken as part of the exploration activities include the following:

- Identifying existing blowers within the ER, undertaking well workover and intervention if necessary;
- The undertaking of new core exploration well drilling and undertaking well workover and intervention where necessary (at preidentified / new areas of interest);
- Undertaking seismic survey and/or magnetotellurics survey activities (at preidentified / new areas of interest);
- Clearance of an area of 300m^2 or more of indigenous vegetation within specified geographical area;
- Clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation; and
- Perform gas composition analysis on gas from existing boreholes and newly drilled wells on the ER.

The main activities are core exploration drilling and seismic survey activities. The proposed approach is to first determine and map the geographic extent of all boreholes currently emitting gas on and near the ER area. Then measure rates and monitor pressures where possible and perform gas composition analysis. The geophysical wireline logging of existing boreholes (where possible) will include monitoring of water levels. If no existing gas emitting boreholes are identified near a target area, new drilling activities are proposed within that area using percussion or rotary drilling method. Although up to eleven (11) Target Areas (TA) with 500m buffer (1km corridor) within the exploration right may be undertaken over the 9-year period, the current Works Program caters for only three (3) drilling wells. It must be noted that there may be a single, multiple or no drilling activities within some of the TA. Should more than 3 drilling wells be required within the ER, the current Works Program will be required to be updated accordingly. Majority of the TA's, Target Area 3 (ED G), Target Area 4 (ED H), Target Area 5 (ED J), Target Area 6 (ED I), Target Area 7 (ED F) and Target Area 8 (VEG A) as well as seven (7)

seismic transects (Transects, ED 1-5, VEG 1-2) are proposed within the western section of the exploration right on the agricultural fields between Saaiplaas, Bronville, Thabong and Whites. Two target areas, Target Area 1 (RSB D) and Target Area 2 (RSB E) are located in the south of ER386, approximately 7km southeast of Meloding while Target Area 9 (HF C) and associated transects (Transects HF 1, HF2 and HF7) is located approximately 6km west the eastern boundary of ER386 (N1). There are currently two target areas proposed within the northern section namely, Target Area 10 (GP B) and Target Area 11 (GP A) and three seismic transect (Transect G1, G2 and G3) R34 located between Odendaalsrus and Kroonstad.

Each exploration well will have an overall depth of up to 650m and a maximum width of 350mm, commencing with a 6m x 323mm spud hole section, followed by 80m x 254mm conductor hole section, then an intermediate hole section of 450m x 203mm and finally an open hole section of 650m x 144mm. The actual casing sizes and configurations will vary depending on the specific geological characteristics and functional requirements. Each borehole will be steel cased and have cement barriers to prevent leaks as well as plugged at the end of exploration to prevent groundwater seepage.

The seismic survey activities are proposed throughout the exploration right as and when necessary. Motuoane will search records at the Council for Geoscience and the Petroleum Agency for seismic data that was acquired on the Exploration Right in the past. If no data are available, Motuoane will either acquire its own seismic or telluric data on the property, following proper environmental protocols and with the written permission of the landowner. The preliminary proposed transects for seismic / telluric survey approximately 100km long around known structures and possible drill locations. Seismic and/or telluric locations and lengths are subject to be changed as knowledge increases. Although the Vibroseis technique is the likely method to be undertaken for the seismic activities. There is also a potential alternative to the Vibroseis known as the Propelled Energy Generators (PEGs), more commonly referred to as the Accelerated Weight Drop Seismic (AWD) which Motuoane may consider over the Vibroseis.

EIMS will compile and submit the required documentation in support of applications for:

- An Environmental Authorisation (EA) in accordance with the National Environmental Management Act (Act 107 of 1998) (NEMA), Environmental Impact Assessment (EIA) Regulations, 2014 as amended for the following listed activity:
    - EIA Regulations, 2014 as amended GNR 983 Activity 21C; and
    - EIA Regulations, 2014 as amended GNR 984 Activity 18.
- Other NEMA EIA Regulations, 2014 as amended applicable listed activities are:
    - EIA Regulations, 2014 as amended GNR 983 Activity 27; and
    - EIA Regulations, 2014 as amended GNR 985 Activity 12.
- Additional listed activities and/or water uses may be identified during the process

NEED AND DESIRABILITY FOR THE ACTIVITY

Exploration for additional domestic hydrocarbon reserves is considered important, and any discoveries would be well received by the local market. The Department of Energy's Integrated Resource Plan (2010-2030) supports this view, stating that regional and domestic gas options should be pursued. The government's official position is that exploration and development of oil and gas fields should be encouraged. The identification of potential geological structures or "prospects" within the proposed exploration licence area for future exploration and possible well-drilling provides an opportunity to develop a South African oil and gas industry resulting in long-term benefits consisting of access to new energy sources, improved security of supply, major in-country investments in a development project and reduced dependence on the importation of hydrocarbons. There is also potential in the long-term for local economic stimulation through direct employment, future business opportunities, royalties and tax revenues.

Motuoane has undertaken three authorised drilling activities (3 exploration boreholes) to date in the extended region, however the information recorded (observations) is inadequate to make a conclusive detailed reporting on the quantity of hydrocarbons and/or suitable drilling locations for production purposes. Therefore, Motuoane proposes to undertake up to 11 new exploration boreholes and to acquire ground based seismic surveys (~100km of new seismic transects) within the ER386 area. The seismic survey will be used to better understand the subsurface discontinuities, layering, and probable rocks/structures. Analysis of the seismic surveys and additional drilling wells will provide more precise information to determine the viability of the exploration project into the production phase. The proposed activities, if approved, will allow the applicant to determine if there is an economically viable resource available in the area. It is important to note that the exploration right will not provide the required authorisation for production activities to be undertaken. As such, any future intention to undertake production of hydrocarbons within the exploration right area would require a further application, investigation and public consultation process.

PURPOSE OF THE SCOPING REPORT

The purpose of the scoping process is to:

- Identify the policies and legislation that are relevant to the activity;
- To motivate the need and desirability of the proposed activity, including the need and desirability of the activity;
- To identify and confirm the preferred activity and technology alternative through an impact and risk assessment and ranking;
- To undertake a preamble impact and risk assessment process including cumulative impacts and a ranking process of all the identified alternatives focusing on the geographical, physical, biological, social, economic, and cultural aspects of the environment;
- To identify the key issues to be addressed in the assessment phase;
- To agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required, as well as the extent of further consultation to be undertaken to determine the impacts and risks the activity will impose on the preferred site through the life of the activity, including the nature, significance, consequence, extent, duration and probability of the impacts to inform the location of the development footprint within the preferred site; and
- To identify suitable measures to avoid, manage, or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

PUBLIC PARTICIPATION PROCESS

According to Section (2)(4)(f) of NEMA, the participation of all Interested and Affected Parties (I&APs) must be promoted, and all potential I&APs must be informed early and in an informative and proactive way regarding applications that may affect their lives or livelihood. To give effect to the above sections, it is essential to ensure that there is an adequate and appropriate opportunity for Public Participation (PP) in decisions that may affect the environment. The Public Participation Process (PPP) for the proposed project has been undertaken in accordance with the requirements of NEMA in line with the principles of Integrated Environmental Management (IEM). The PPP commenced on the 14th of March 2025 with an initial notification and call to register to interested and affected parties (I&APs). The comments received from I&APs during the initial call to register and commenting period so far have been captured in Public Participation Report in **Appendix C**.

Comments received during this Scoping Report review period will also be collated and added to the Public Participation Report which will be submitted to the Competent Authority (CA). Should the CA accept the Scoping Report, an Environmental Impact Assessment (EIA) Report including an Environmental Management Programme (EMPr), will also be compiled and presented for public comment as part of this EIA process during which time further stakeholder engagement will take place.

This Scoping Report will be available for public review and comment for a period of 30 days from **15th of May 2025 to the 18th of June 2025**. Contact details are provided below:

- Environmental Impact Management Services (Pty) Ltd (EIMS)
- P.O. Box 2083 Pinegowrie 2123
- Phone: 011 789 7170 / Fax: 011 787 3059
- Contact: Alex Msipa
- EIMS Reference No: 1681
- Email: motuoane386@eims.co.za

PROJECT ALTERNATIVES

In terms of the EIA Regulations published in Government Notice (GN) R982 of 2014, as amended, feasible and reasonable alternatives must be identified and considered within the EIA process. According to the above-mentioned, an alternative is defined as *"…in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to the:*

(a) property on which or location where it is proposed to undertake the activity;

(b) type of activity to be undertaken;

(c) design or layout of the activity;

(d) technology or process to be used in the activity;

(e) operational aspects of the activity; and

(f) includes the option of not implementing the activity."

The alternatives discussed in this report are:

- The No-Go Option;
- Location / property alternatives;
- Technology or Process alternatives;
- Scale alternatives; and
- Design or layout alternatives.

The preferred option under each category of alternatives is discussed in detail in **Section 5** of this report.

Each of the identified risks and impacts at the various project phases were assessed. The assessment criteria include the nature, extent, duration, magnitude / intensity, reversibility, probability, public response, cumulative impact, and irreplaceable loss of resources.

The most significant risks and impacts identified were those that remain high in terms of significance even post mitigation measures being considered. The following preliminary identified impacts were determined to have a potentially moderate final significance at this stage:

- Negative impact on groundwater quality during operation and closure phases;
- Negative impact on identified wetlands and aquatic species;
- Negative impact on soils and agricultural activities;
- Negative impact on vegetation and habitats;

- Mortality / disturbance of terrestrial species; and
- Positive socio-economic impact through employment opportunities.

The negative impacts will be further interrogated and assessed during the EIA phase of the project. Potential preliminary mitigation measures have been identified and will be refined based on input from the Environmental Assessment Practitioner (EAP), public consultation, and specialist assessments during the EIA phase of the project. The associated EMPr will identify appropriate mitigation mechanisms for avoidance, minimisation and / or management of the negative impacts and enhancement of the positive aspects.

SPECIALIST STUDIES

Various specialist assessments as identified through the DFFE National Web-Based Environmental Screening Tool Report and Site Sensitivity Verification will be undertaken to support the EA Application. The specialist assessments will be undertaken in compliance with the NEMA EIA and DFFE specialist guidelines / protocols (including Risk Assessment Matrix as per NWA) and any other applicable guidelines / protocols. The following EIA-phase specialist studies are to be conducted:

- Agricultural Potential, Soils & Land Capability;
- Air Quality Impact Assessment;
- Climate Change Assessment;
- Aquatics and Wetland Impact Assessment;
- Archaeological and Cultural Heritage Assessment;
- Palaeontological Impact Assessment;
- Terrestrial Biodiversity Impact Assessment;
- Geohydrological Impact Assessment;
- Social Impact Assessment;
- Noise Impact Assessment; and
- Financial Provisions.

Baseline specialist studies were conducted to inform the scoping report, and a summary of preliminary findings are as follows:

a. Agricultural Potential, Soils & Land Capability:

The land capability sensitivity (DAFF, 2017) is dominated by land capabilities with “Low Moderate to Moderate”, with isolated areas associated with “Very Low to Low” as well as “Moderate to Moderate-High” sensitivity. The field crop boundaries were also identified following the agricultural theme screening tool. The overall site sensitivity of the ER ranges from Very Low -Low to Moderate – High. If the crop fields found within the ER are active, the prospecting activities will have an overall high residual impact on the agricultural production ability of the land. However, if the crop fields within the ER are inactive, the prospecting activities will have an overall low to medium residual impact on the agricultural production ability of the land. The state of the crop fields as well as the soils present within the ER will need to be confirmed following a site visit. An agricultural specialist should be consulted for the identification and classification of soils within the ER as well as suitable mitigation and recommendations.

b. Air Quality Impact Assessment:

Available data for the Welkom South African Weather Service Station was used to establish baseline meteorological conditions for the proposed project site. The dataset included a minimum of hourly average wind speed, wind direction and temperature. The main pollutant of concern from the proposed project are Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), Volatile Organic Compounds (VOC)

and Particulate Matter (PM), with PM_{10} and $PM_{2.5}$ the fractions associated with health impacts. Nuisance impacts as from dust fallout would be more localised. The flow field is dominated by winds from the northeastern sector. Potential sensitive receptors within the project area include individual households and residential areas (i.e. Welkom, Hennenman, Virginia and Ventersburg). Sources of pollution in the study area include agriculture, mining, biomass burning, vehicle entrainment, vehicle tailpipe and wind erosion. The project is expected to have medium negative significance rating without mitigation and low negative significance rating with mitigation. During the construction phase, the most sensitive receptors will likely have a medium sensitivity rating of 750m (residential) and medium sensitivity rating of 100 m (residential) for operational phase.

c. Climate Change Impact Assessment

The climate change specialist study, which will follow the scoping phase, will assess the significance of impacts of the project greenhouse gas (GHG) emissions generated, along with the potential impact of climate change on the operation of the project. Several hazards were identified during the baseline assessment including wildfires: the settlements within the study area are at low risk of wildfires with the projection of 30 fire danger days per year over the project area; drought: the settlements within the study area are at very low risk of drought with the Standardized Precipitation Index (SPI) of -0.38 for the project area; exposure to heat extremes: the settlements within the study area are at high risk of encountering increasing heat stresses; and, flooding: the settlements within the study area are at slight to moderate risk of increased extreme rainfall days with low increase in exposure to urban flooding. The impact significance is based on the quantified GHG emissions from the project. As the quantification of GHG for the project will only be undertaken during the impact assessment phase, the significance rating can only be provided once the impact assessment has been undertaken. No fatal flaws, however, are expected due to the climate impacts.

d. Aquatics and Wetland Impact Assessment:

Aquatic Biodiversity Theme sensitivity is Very High for the ER due to five (5) wetlands, three (3) rivers and one (1) FEPA Sub catchment area occurring within the ER. A key consideration for the impact assessment is the presence of the water resources in proximity to the target areas. The available data suggests the presence of wetlands within the target areas, as well as wetlands and a river within the 500 m regulated area. Construction could result in the encroachment into water resources and result in the loss or degradation of these system, most of which are functional and provide ecological services. These disturbances could also result in the infestation and establishment of alien vegetation which would affect the functioning of the systems. Leaks and/or spillages could result in contamination of the receiving water resources. Contaminated water resources are likely to influence the associated biota. An increase in stormwater runoff could result in physical changes to the receiving systems caused by erosion, run-off and sedimentation, and the functional changes could result in changes to the vegetative structure of the systems. A Freshwater specialist will delineate wetlands identified within the ER as well as suitable mitigations and recommendations in the EIA Phase.

e. Archaeological and Cultural Heritage Assessment:

Based on historical archaeological records and heritage studies in the region, there are thirty-two (32) heritage features inclusive of structures, buildings, or complexes as well as three grave sites within the ER. It is proposed that buffers be placed around each of these features, with proposed activities not taking place within 30m of the buildings or structures, and 50m of the grave sites. If the buffers are adhered to, these known features will be avoided, and in doing so, there will be little to no impact on the features. Two Grade II provincial heritage features were also identified intersecting with the ER Area. Proposed activities, particularly the proposed seismic survey transects, intersect with the assigned 2km buffers of these features. It is argued that due to the nature of the proposed seismic activities, the project will have no impact on these features nor the sense of place the buffers aim to preserve. While the features identified represent markers of heritage significance (in particular, ruins and graves), the occurrence of below-ground heritage finds may be possible. For this reason, as a mitigation measure proposed, a Heritage Finds or Chance Find Procedure for addressing heritage finds must be adopted as part of construction processes.

Should finds of an alarming significance, for example, a grave or high density of small finds be discovered during construction, this procedure will inform the next steps taken to ensure the documentation of these finds, and further action to be taken should a heritage professional deem necessary. Altogether, post-mitigation of the identified heritage impacts is rated a Medium to Low Negative, given that the impacts can be avoided, and the potential for a heritage procedure to allow for the documentation, recording, and further assessment of undiscovered finds and sites.

- Palaeontological Impact Assessment:

The bulk of the site is underlain by the Karoo Supergroup Formations covered by vegetation, grass, trees, roads, and buildings. According to the Council for Geoscience (CGS) 1:250 000 geological maps (Geological Map Sheet 2726 Kroonstad and Geological Map Sheet 2826 Winburg), the surface geology of the study area is characterized by a variety of lithologies, formations, and intrusions. These include geologically recent Quaternary deposits; sediments of the Beaufort and Ecca Groups within the Karoo Supergroup; dolerite dykes, sheets, and sills associated with the Karoo Dolerite Suite; and post-Karoo kimberlite pipes and dykes. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of all Karoo Supergroup geological formations are ranked as VERY LOW to VERY HIGH, and here the impact is potentially VERY HIGH for the Beaufort Group, HIGH for Quaternary (Qs), MODERATE for Ecca rocks and the Quaternary (Qc). A wide range of possible fossil remains occur in the Cenozoic, though these are often sparse, such as: mammalian bones and teeth, tortoise remains, ostrich eggshells, non-marine mollusc shells, ostracods, diatoms, and other micro fossil groups, trace fossils (e.g. calcretised termitaria, rhizoliths, burrows, vertebrate tracks), freshwater stromatolites, plant material such as peats, foliage, wood, pollens, within calc tufa. The Jurassic Dolerite does not contain fossils.

However, it is anticipated that no visible evidence of fossiliferous outcrops will be found in within the target areas and seismic transects during the EIA Phase based on previous studies in the area and thus an overall medium palaeontological significance is likely to be allocated for the project area. It is therefore, currently considered that the proposed development will not lead to detrimental impacts on the palaeontological reserves of the area and construction of the development may be authorised in its whole extent. The ECO for this project must be informed that the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) has a Very High Palaeontological Sensitivity. If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation (recording and collection) can be carried out.

- Terrestrial Biodiversity Impact Assessment:

The ER overlaps with the Critical Biodiversity Areas (CBA) 1, CBA 2, Ecological Support Areas (ESA) 1, and ESA 2 according to the Free State Biodiversity Spatial Plan CBA map. Moreover, the ER also overlaps with two (2) South Africa Protected and Conservation Areas Data (SAPAD), namely Thabong Game Ranch and Tara Wildlife Safaris areas, an Endangered vegetation type (Vaal-Vet Sandy Grassland) as well as National Protected Area Expansion Strategy (NPAES) areas. According to the Mining and Biodiversity Guidelines, the ER overlaps with highest biodiversity importance, correlating to the highest risk for mining. No sensitive flora species are listed as likely to occur in the ER, however, one (1) reptile species and two (2) mammal species are likely to occur.

The activities are likely to drive habitat destruction causing displacement of fauna and flora and possibly even direct mortality. Land clearing destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting sites, and wildlife movement corridors such as rivers, streams and drainage lines, or other locally important features. The removal of natural vegetation may reduce the habitat available for fauna species and may reduce animal populations and species compositions within the area. Prospecting activities may also lead to pollution in terms of noise, air (dustfall), and light. The specialist's preliminary mitigation measures for the proposed activities include avoidance mitigation (Very High SEI Areas): No destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last

remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages) and Minimisation and restoration mitigation (Low SEI Areas): Any development activities of medium to high impact acceptable followed by appropriate restoration activities. A site visit and a full assessment in the correct flowering season must be conducted by a suitably qualified ecologist, during the EIA phase in order to ensure the presence of all potential SCC or protected fauna and flora on site. Any individual of any protected plant species that are present needs a relocation or destruction permit in order to be removed or destroyed due to the development.

- Geohydrological Impact Assessment:

The topography of the greater study area generally has a jagged topography and can be classified as a central interior plain or plateau. Large dolerite intrusions are observed throughout the study area and because of its relative resistance to erosion, the Karoo dolerite sheets generally give rise to very prominent high-standing topographic features. The greater study is situated in primary catchment (C) of the Vaal River drainage system which covers a total area of approximately 580.0km^2. The resource management falls under the Vaal Water Management Area (WMA5) (previously Middle Vaal WMA). The study area encompasses several quaternary catchments of the Vaal WMA. These include Quaternary Catchments C25B, C42H, C42J and C60H. The main watercourses within the Middle Vaal WMA are the Mooi, Vet, and Vaal Rivers. The primary rivers in and around the study area include the Vals River towards the northeast of the study area, the Sand River in the central parts of the study area, and the Vet River towards the southwest of the study area. According to the DWS Hydrogeological map (DWS Hydrogeological map series 2726 Kroonstad) the study area is predominantly underlain by a Class d2 intergranular and fractured aquifer (typically associated with median borehole yields ranging between 0.1 and 0.5 L/s), while small portions towards the northwest of the study area are underlain by a Class d3 intergranular and fractured aquifer (typically associated with median borehole yields ranging between 0.5 and 2.0 L/s). Three main hydrostratigraphic units/aquifer systems can be inferred in the saturated zone: - a shallow Quaternary (perched and unconfined) aquifer, a shallow, intergranular and fractured aquifer within the Beaufort Group, and a deeper, fractured aquifer within the Ecca Group and pre-Karoo rocks. Under natural conditions this area exhibits certain regions where there is pronounced interaction between surface and groundwater. The average thickness of the unsaturated zones of Groundwater are between 14.90m to 18.20m while an approximation of recharge for the study area is estimated at ~3.50% of MAP i.e., ~19.48 mm/a.

Potential sources identified include the migration of saline groundwater from the deep, fractured aquifer to the overlying, potable aquifer(s) during the gas exploration phase, migration of stray gas from the deep, fractured aquifer to the overlying, potable aquifer(s) during the gas exploration phase and migration of contaminants from the plant footprint as well as associated waste facilities and infrastructure into local water resources and host aquifers. Potential aquifer pathways have been identified are vertical flow through the unsaturated/vadose zone as well as saturated zone to the underlying intergranular and fractured rock aquifers. Preferential flow-paths include the contact between the depth of weathering and fresh un-weathered rock, fractures, faults, joints and bedding planes. If not adequately sealed and suitably mitigated, gas exploration and exploration wells will form preferential flow paths and serve as a direct connection between the deeper, fractured aquifer and shallow, potable aquifer unit(s). Three potential receptors were identified as follows; shallow, inter-granular as well as the intermediate, fractured aquifer units situated within the plume migration footprint(s); down-gradient drainages and streams including associated riparian zone aquifer system(s) and baseflow contribution, and private or neighboring boreholes associated with relevant fracture zones and/or structures(s)if intercepted by the pollution plume migration footprint. It is recommended that an integrated groundwater and surface water monitoring protocol and network be developed for implementation. It is imperative that monitoring be conducted to serve as an early warning and detection system.

- Social Impact Assessment:

A more in-depth assessment of social impacts and possible mitigation measures will be possible once further stakeholder consultation has taken place. The following categories of social impacts will be investigated:

    - Health and social well-being.

- Quality of the living environment.
- Economic impacts and material well-being.
- Cultural impacts.
- Family and community impacts.
- Institutional, legal, political and equity impacts.
- Gender impacts.

It is very likely that a number of social changes processes will be set in motion by the project. Whether these processes cause social impacts will depend on the successful implementation of suggested mitigation measures. However, it must be considered that the social environment is dynamic and constantly changing, making it difficult to predict exact impacts. External processes not related to the project, like political changes or global economic changes can alter the social environment in a short period of time and therefore alter the predicted impacts. In conclusion, a number of potential impacts has been identified. None of these possible impacts is seen as a fatal flaw in the possible successful execution of the proposed project, but this can only be confirmed once fieldwork has been done, and the potential impacts have been finalised and assessed. Most of the potential impacts can be mitigated. The importance of addressing the potential impacts as early in the project cycle as possible must be underlined, since failure to do so may result in the development of risks and an exponential increase in project cost.

- Noise Impact Assessment:

The regulatory framework, including national noise control regulations and South African National Standards, and comparison to International Finance Corporation guidelines were used to inform the noise study. Potential Noise Sensitive Receptors (NSRs) were identified from maps of the area using Google EarthTM aerial imagery. The ability of the environment to attenuate noise as it travels through the air was studied by considering meteorology, land use, and terrain data. Potential sensitive receptors within the project area include individual households and residential areas (i.e., Welkom, Hennenman, Virginia and Ventersburg). Noise Propagation Factors identified are meteorology (wind speed, direction, temperature), terrain (gently sloping, no major topographical barriers) and ground absorption (mixed surfaces such as concrete, grass, vegetation). Impact Significance based on Scoping Phase Assessment are medium negative significance without mitigation and low negative significance with mitigation for construction phase while medium negative significance with and without mitigation for operation phase (dependent on distance to receptors). The decommissioning phase is preliminary assigned medium negative significance (without mitigation) and low negative significance (with mitigation). The desktop sensitivity assessment for the various phases were found to be medium sensitivity within 600m of residential receptors for the construction phase, medium sensitivity within 200m of residential receptors for the operation Phase (daytime) and medium sensitivity within 600m of residential receptors for the operation Phase (night-time). It should be noted that the activities will be limited to the daytime, but the night-time sensitivity is based on the receptor locations, not the project operations.

1 INTRODUCTION

Motuoane Energy (Pty) Ltd (Motuoane) (hereafter referred to as the applicant) has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) as the Independent Environmental Assessment Practitioner (EAP) to assist with undertaking the required assessment and authorisation processes (including the statutory public participation), and to compile and submit the required documentation in support of application for:

- An Environmental Authorisation (EA) in accordance with the National Environmental Management Act (Act 107 of 1998) (NEMA), Environmental Impact Assessment (EIA) Regulations, 2014 as amended for the following listed activity:
    - EIA Regulations, 2014 as amended GNR 983 Activity 21C; and
    - EIA Regulations, 2014 as amended GNR 984 Activity 18.
- Other NEMA EIA Regulations, 2014 as amended applicable listed activities are:
    - EIA Regulations, 2014 as amended GNR 983 Activity 27; and
    - EIA Regulations, 2014 as amended GNR 985 Activity 12.
- Additional listed activities and/or water uses may be identified during the process.

Motuoane proposes to explore all saleable gases including but not limited to Methane, Carbon Dioxide, Helium, and Nitrogen in the licensed area. Published reports, general experience, experience within Motuoane and contacts with individuals familiar with the area indicate the presence of potentially commercial quantities of these gases. Direct evidence includes gas-emitting boreholes, nearby commercial gas production, gas encountered during drilling and underground mining operations. Due to the large area and complex exploration methodology, the ER will be required for an initial period of three years with the option to renew three additional periods of two years resulting in a total of nine years.

Exploration Right 386 is a consolidation of Technical Cooperation Permit (TCP) 235 and 240 & Exploration Right Application (ERA) 341 which were tenures in 2024 before ER386 application was submitted to PASA on the 8th of October 2024. TCP235 & TCP240 were granted in October 2023 for a 12 Month Term, an ER application was applied for in October 2024. ERA341 was an application previously submitted to PASA which was held up due to changing legislation and subsequently withdrawn. The areas (ERA341, TCP235 and TCP240) were then consolidated to one ER (ER386). Motuoane's application for an exploration right (ER) for hydrocarbons was accepted on the 22nd of October 2024 in terms of Section 79 of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 – MPRDA, as amended). The accepted application for an exploration right (ER386) is located over an area of approximately 58 000 hectares (ha), covering various farm portions in Welkom near the towns of Virginia, Hennenman and Odendaalsrus, Free State Province. The boundaries of ER386 are 28°13'28.95"S; 26°55'2.76"E in the South, 27°57'37.57"S; 26°48'49.15"E in the West, 27°59'13.57"S; 27°11'13.06"E in the East and 27°46'34.45"S; 26°57'44.05"E in the North, the central coordinates are approximately 27°58'23.27"S; 26°59'38.94"E.

The proposed activities to be undertaken as part of the exploration activities include the following:

- Identifying existing blowers within the ER, undertaking well workover and intervention if necessary;
- The undertaking of new core exploration well drilling and undertaking well workover and intervention where necessary (at preidentified / new areas of interest);
- Undertaking seismic survey and/or magnetotellurics survey activities (at preidentified / new areas of interest);
- Clearance of an area of 300m^2 or more of indigenous vegetation within specified geographical area;
- Clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation; and
- Perform gas composition analysis on gas from existing boreholes and newly drilled wells on the ER.

The main activities are core exploration drilling and seismic survey activities. The proposed approach is to first determine and map the geographic extent of all boreholes currently emitting gas on and near the ER area. Then measure rates and monitor pressures where possible and perform gas composition analysis. The geophysical wireline logging of existing boreholes (where possible) will include monitoring of water levels. If no existing gas emitting boreholes are identified near a target area, new drilling activities are proposed within that area using percussion or rotary drilling method. Although up to eleven (11) target areas (TA) with 500m buffer (1km corridor) within the exploration right may be undertaken over the 9-year period, the current Works Program caters for only three (3) drilling wells. It must be noted that there may be a single, multiple or no drilling activities within some of the target areas. Should more than 3 drilling wells be required within the ER, the current Works Program will be required to be updated accordingly.

Majority of the TA's, Target Area 3 (ED G), Target Area 4 (ED H), Target Area 5 (ED J), Target Area 6 (ED I), Target Area 7 (ED F) and Target Area 8 (VEG A) as well as seven (7) seismic transects (Transects ED 1 to 5, VEG 1 & 2) are proposed within the western section of the exploration right on the agricultural fields between Saaiplaas, Bronville, Thabong and Whites. Two target areas, Target Area 1 (RSB D) and Target Area 2 (RSB E) are located in the south of ER386, approximately 7km southeast of Meloding while Target Area 9 (HF C) and associated transects (Transects HF 1, HF2 and HF7) are located approximately 6km west the eastern boundary of ER386 (N1). There are currently two target areas proposed within the northern section namely, Target Area 10 (GP B) and Target Area 11 (GP A) and three seismic transect (Transect G1, G2 and G3) R34 located between Odendaalsrus and Kroonstad. Each exploration well will have an overall depth of approximately 650m and a maximum width of 350mm, commencing with a 6m x 323mm spud hole section, followed by 80m x 254mm conductor hole section, then an intermediate hole section of 450m x 203mm and finally an open hole section of 650m x 144mm. The actual casing sizes and configurations will vary depending on the specific geological characteristics and functional requirements. Each borehole will be steel cased and have cement barriers to prevent leaks as well as plugged at the end of exploration to prevent groundwater seepage.

The seismic survey activities are proposed throughout the exploration right as and when necessary. Motuoane will search records at the Council for Geoscience and the Petroleum Agency for seismic data that was acquired on the Exploration Right in the past. If no data is available, Motuoane will either acquire its own seismic or telluric data on the property, following proper environmental protocols and with the written permission of the landowner. There are sixteen (16) preliminary proposed transects for seismic / telluric survey, approximately 100km long around known structures and possible drill locations. Seismic and/or telluric locations and lengths are subject to be changed as knowledge increases. Although the Vibroseis technique is the likely method to be undertaken for the seismic activities. There is also a potential alternative to the Vibroseis known as the Propelled Energy Generators (PEGs), more commonly referred to as the Accelerated Weight Drop Seismic (AWD) which Motuoane may consider over the Vibroseis.

It must be noted that there are at least 14 approved renewable energy projects from various applicants located within ER386. Motuoane and the renewable energy applicants will need to discuss the way forward and/or make necessary arrangements to coexist especially for TA 3 (EDG) and Transects EDG1 and EDG2 as the renewable energy projects overlap with the target areas.

1.1 REPORT STRUCTURE

This report has been compiled in accordance with the 2014 NEMA EIA Regulations, as amended. A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in **Table 2** below.

Table 2: Report structure.

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
Appendix 2(2)(a):	Details of – i. The Environmental Assessment Practitioner (EAP) who prepared the report; and ii. The expertise of the EAP, including a curriculum vitae;	**Section 1.6** **Appendix B**
Appendix 2(2)(b):	The location of the activity. Including – i. The 21-digit Surveyor General code of each cadastral land parcel; ii. Where available, the physical address and farm name; iii. Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	**Section 1.9**
Appendix 2(2)(c):	A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is – i. A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or ii. On a land where the property has not been defined, the coordinates within which the activity is to be undertaken;	**Section 1.9**
Appendix 2(2)(d):	A description of the scope of the proposed activity, including – i. All listed and specified activities triggered; ii. A description of the activities to be undertaken, including associated structures and infrastructure;	**Section 2.5**
Appendix 2(2)(e):	A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process;	**Section 3**

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
Appendix 2(2)(f):	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	**Section 2.6**
Appendix 2(2)(h):	A full description of the process followed to reach the proposed preferred activity, site and location within the site, including – i. Details of all alternatives considered; ii. Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; iii. A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; iv. The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; v. The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – a. Can be reversed; b. May cause irreplaceable loss or resources; and c. Can be avoided, managed or mitigated; vi. The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives; vii. Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; viii. The possible mitigation measures that could be applied and level of residual risk; ix. The outcome of the site selection matrix; x. If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and xi. A concluding statement indicating the preferred alternatives, including preferred location of the activity;	**Sections 5, 6, and 7**
Appendix 2(2)(i):	A plan of study for undertaking the environmental impact assessment process to be undertaken, including – i. A description of the alternatives to be considered and assessed within the preferred site, including the option of not proceeding with the activity; ii. A description of the aspects to be assessed as part of the environmental impact assessment process;	**Section 9**

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
	iii. Aspects to be assessed by specialists; iv. A description of the proposed method of assessing the environmental aspects, including a description of the proposed method assessing the environmental aspects to be assessed by specialists; v. A description of the proposed method of assessing duration and significance; vi. An indication of the stages at which the competent authority will be consulted; vii. Particulars of the public participation process that will be conducted during the environmental impact assessment process; and viii. A description of the tasks that will be undertaken as part of the environmental impact assessment process; ix. Identify suitable measures to avoid, reverse, mitigate or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored;	
Appendix 2(2)(j)	An undertaking under oath or affirmation by the EAP in relation to – i. The correctness of the information provided in the report; ii. The inclusion of comments and inputs from stakeholders and interested and affected parties; and iii. Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	**Section 10** **Section 11**
Appendix 2(2)(k):	An undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment;	**Section 11**
Appendix 2(2)(l):	Where applicable, any specific information required by the competent authority; and	None
Appendix 2(2)(m):	Any other matter required in terms of section 24(4)(a) and (b) of the Act.	None

1.2 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations relating to this scoping phase assessment should be noted:

- The application is limited to the proposed Motuoane ER386 footprint and associated infrastructure in Welkom within the Matjhabeng and Moqhaka Local Municipalities, Free State Province;
- The information provided by the applicant is considered accurate, adequate, unbiased, and no information that could change the outcome of the scoping process has been withheld;
- The preliminary site sensitivity verification and specialist desktop assessments are sufficient for the scoping phase and the site-specific information that will be obtained from the specialist studies for this project during the EIA Phase will be accurate, objective and sufficient for the level of assessment required;
- Detailed assessment of the positive and negative environmental impacts of the proposed project will be undertaken during the Environmental Impact Assessment phase;
- In determining the significance of impacts, with mitigation, it is assumed that mitigation measures proposed in the report are correctly and effectively implemented and managed throughout the life of the project;
- In accordance with the Protection of Personal Information Act (Act 4 of 2013), personal information (emails, contact numbers, address) are blanked out and/or excluded during the Public Participation and only provided to the competent authority officials;
- Personal information of I&APs made available to the competent authority will only be used by the authorities to confirm or obtain information regarding this specific project; and
- The information presented in this report was the most accurate and relevant at the time of compilation of the report.

1.3 PURPOSE OF THE REPORT

The purpose of the scoping phase is to gather information on the proposed site and establish an understanding of the study area and the receiving environment. This phase will also determine how the proposed activities will potentially impact on the environment. The assessment of feasible alternatives will be considered in this report. The report will further identify any Interested and Affected Parties in the study area, engage with such parties and relevant authorities and identify environmental issues and potential impacts. This Scoping report is intended to guide the EIA process and the required specialist studies by:

- Providing an overview of the legal requirements with regards to the proposed Motuoane ER386 project;
- Provide a project description of the proposed Motuoane ER386 project as well as the anticipated environmental and social impacts that will be further investigated in the EIA phase;
- Setting the scope for the EIA process as well as the Terms of Reference (ToR) for the proposed specialist studies; and
- Outlining the approach and methodologies to be used in the Scoping and EIA phase including the impact assessment methodology.

1.4 THE SCOPING AND EIA REQUIREMENTS

The list of activities applied for in terms of the NEMA EIA Regulations 2014 as amended is discussed in **Section 2.5**. These listed activities triggered by the proposed development of Motuoane ER386 facility must follow the required Environmental Impact Assessment process as required by the National Environmental Management (Act 107 of 1998) (NEMA) Environmental Impact Assessment (EIA) Regulations 2014, as amended. Based on these Regulations, a Scoping and EIA process must be followed. The Application Form will be submitted to the Competent Authority (CA), the Department of Mineral Resources and Energy (DMRE) through the Administrative

Authority (AA), the Petroleum Agency of South Africa (PASA). The DMRE is the relevant CA stipulated in the 2014 NEMA EIA Regulations application procedures as the applicant is a private company and the proposed Motuoane ER386 is a mining application, thus, is in line with the identified activities which the Member of the Executive Council of the National Department of Forestry, Fisheries and the Environment (DFFE) has delegated to the DMRE as the CA.

1.5 THE SCOPING PHASE

The Scoping and EIA process must be undertaken in accordance with the 2014 EIA Regulations No. 982, as amended. The main objectives of the current Scoping Phase, in terms of the regulatory requirements stipulated in *Appendix 2* of the 2014 EIA Regulations, are to:

a) identify the relevant policies and legislation relevant to the activity;

b) motivate the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;

c) identify and confirm the preferred activity and technology alternative through an impact and risk assessment and ranking process;

d) identify and confirm the preferred site, through a detailed site selection process, which includes an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified alternatives focusing on the geographical, physical, biological, social, economic, and cultural aspects of the environment;

e) identify the key issues to be addressed in the assessment phase;

f) agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks the activity will impose on the preferred site through the life of the activity, including the nature, significance, consequence, extent, duration and probability of the impacts to inform the location of the development footprint within the preferred site; and

g) identify suitable measures to avoid, manage or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

Once the Draft scoping process is complete, a Final Scoping Report must be prepared detailing the scope of the EIA required for the proposed activities. This Scoping Report has been compiled in accordance with the requirements set out in Appendix 2 of the 2014 EIA Regulations, as amended, which outlines the contents of a Scoping Report and provides the requirements necessary for undertaking the Public Participation Process. A final Scoping Report will be prepared and submitted to the CA (DMRE) through the AA (PASA) for review and decision making. The competent authority will communicate the decision within 45-days of submission of the Final Scoping Report. The decision can either be an acceptance or rejection of the Scoping Report. The process can only proceed into the EIA Phase upon the receipt of approval of the Scoping Report. It must be noted that the approval may be issued with recommendations and/or requirements for the EIA Phase.

1.6 DETAILS OF THE EAP

EIMS is appointed by Motuoane as the independent EAP and to assist in preparing and submitting the EA application, Scoping and EIA Reports, and undertaking a Public Participation Process (PPP) in support of the proposed exploration on the Motuoane ER386 footprint. The contact details of the EIMS consultant and EAP who compiled this Report are indicated in **Table 3**.

Table 3: Details of the Environmental Assessment Practitioner.

EAP:	Mr. Vukosi Mabunda
Tel No:	+27 11 789 7170
Fax No:	+27 86 571 9047
E-mail:	vukosi@eims.co.za
Professional Registrations:	• Registered Environmental Assessment Practitioner with Environmental Assessment Practitioner Association of South Africa – EAPASA (Reg. No: 2019/867) • Professional Natural Scientist with the South African Council for Natural Scientific Professions – SACNASP (Reg. No: 134178).

1.7 EXPERTISE OF THE EAP

EIMS is a private and independent environmental management-consulting firm that was founded in 1993. EIMS is an independent specialised environmental consulting firm offering the full spectrum of environmental management services across all sectors within the African continent. EIMS has successfully completed hundreds of assignments over the years with an excess of 30 years' experience in conducting EIA's for both the government and private sector. Please refer to the EIMS website (www.eims.co.za) for examples of EIA documentation currently available.

In terms of Regulation 13 of the EIA Regulations (GN R. 982) as amended, an independent EAP, must be appointed by the applicant to manage the application. EIMS is compliant with the definition of an EAP as defined in Regulations 1 and 13 of the EIA Regulations, as well as Section 1 of the NEMA. This includes, inter alia, the requirement that EIMS is:

- Objective and independent;
- Has expertise in conducting EIA's;
- Comply with the NEMA, the environmental regulations and all other applicable legislation;
- Considers all relevant factors relating to the application; and
- Provides full disclosure to the applicant and the relevant environmental authority.

This Scoping Report was prepared by Vukosi Mabunda, a Registered EAP employed by EIMS. His CV is included in **Appendix B** of this report. Mr Vukosi Mabunda is currently an Environmental Assessment Practitioner and a Geographic Information Systems (GIS) Specialist with 7 years' working experience. Vukosi is a Registered Environmental Assessment Practitioner with the Environmental Assessment Practitioners Association of South Africa (EAPASA). He is one of the few dual registered professionals with SACNASP as a Professional Geospatial Scientist and Professional Environmental Scientist. Vukosi has dual professional background in Geographic and Environmental Sciences with a Master of Science Degree in Geography obtained in 2021 from the University of Johannesburg. Vukosi has experience in Project Management, small to large scale Basic Assessments, Environmental Impact Assessments, Environmental Auditing, Water Use Licensing, and Public Participation.

1.8 SPECIALIST CONSULTANTS

One of the objectives of a Scoping Report is to identify the required specialist assessment to be undertaken during the EIA Phase. Based on a review of the National Web-Based Environmental Screening Tool Report (DFFE Screening Tool), EAPs Site Sensitivity Verification and review of available information, the following specialist assessments have been pre-identified as necessary assessments required for the Scoping and EIA.

Table 4: Details of the specialist team.

Discipline	Consultant / Company	Representative / Specialist
Agricultural Potential, Soils & Land Capability	The Biodiversity Company	Andrew Husted
Air Quality	Airshed Planning Professionals	Reneé von Gruenewaldt
Climate Change Assessment	Airshed Planning Professionals	Reneé von Gruenewaldt
Noise Impact Assessment	Airshed Planning Professionals	Nick Grobler
Archaeological and Cultural Heritage Assessment	EIMS (Pty) Ltd	Dr Lucien James
Palaeontological Impact Assessment	Dr Heidi Fourie	Dr Heidi Fourie
Terrestrial Biodiversity Assessment	The Biodiversity Company	Andrew Husted
Aquatics and Wetland Assessment	The Biodiversity Company	Andrew Husted
Geohydrological Assessment	Gradient Groundwater Consulting	JFW Mostert
Social Assessment	Equispectives Research and Consulting Services	Dr Ilse Aucamp
Financial Provisions	EIMS (Pty) Ltd	Liam Whitlow

The specialist studies listed above in **Table 4** will involve the gathering of data relevant to identifying and assessing preliminary environmental impacts that may occur as a result of the proposed project. These preliminary impacts were assessed according to pre-defined impact rating methodology (**Section 7.1**). Preliminary mitigation / management measures to minimise potential negative impacts or enhance potential benefits are put forward in this Scoping Report and will be adjusted where relevant during the EIA phase once detailed assessments are concluded and input from the public has been considered.

1.9 DESCRIPTION OF THE PROPERTY

Table 5 provides a description of the property details of the proposed Motuoane ER386 site as well as the distance to the nearest towns. The proposed project will be located within the Matjhabeng Local Municipality and Moqhaka Local Municipalities. See **Figure 1** and **Figure 2** for the locality of the exploration proposed for the Motuoane ER386.

Table 5: Locality details.

Property	Motuoane ER386 is located on various farms / farm portions, refer to **Appendix C**.
Property Name, 21-digit Surveyor General Code and Ownership	Motuoane ER386 is located on various farms / farm portions, refer to **Appendix C**.
Application Area (Ha)	Motuoane ER386 is approximately 58 000 ha.

Magisterial District	The project area falls within the Matjhabeng and Moqhaka Local Municipalities, Lejweleputswa and Fezile Dabi District Municipalities.
Distance and direction from nearest towns	• 6km east of southern Virginia (Meloding), 7km east of central Virginia, 1.5km northeast of northern Virginia (Saaiplaas); • 6.5km east of central Welkom, adjacent to west Welkom (Thabong); • 1km southeast of Riebeeckstad; • Adjacent to Hennenman. The boundaries of ER386 are 28°13'28.95"S; 26°55'2.76"E in the South, 27°57'37.57"S; 26°48'49.15"E in the West, 27°59'13.57"S; 27°11'13.06"E in the East and 27°46'34.45"S; 26°57'44.05"E in the North, the central coordinates are approximately 27°58'23.27"S; 26°59'38.94"E.
Surrounding land uses	The study area can be subdivided into four sections namely, the northern section, southern section, western section, and the eastern section (refer to **Figure 1** for the site locality). • The northern section is closer to the R34 and located between Odendaalsrus and Kroonstad. There are currently two target areas proposed within this section namely, Target Area 10 (GP B) and Target Area 11 (GP A) and three seismic transect (Transect G1, G2 and G3). This section consists almost entirely of cultivated land with several natural and artificial watercourses. • The eastern section is located immediately north of Ventersburg and bounded by the N1 and Phomolong. This section is primarily dominated by cultivated land, open areas and minor game farms. There are distinctive watercourses within this area including the Kromspruit which is immediately to the north of the sole proposed drilling site, Target Area 9 (HF C) 500m assessment area within this section. There are three proposed transects within this section, namely, Transect HF1, HF2 and HF7. Which intersect the Kromspruit, Rietspruit and Slootspruit. • The tip of the southern section is approximately 8.5km south of southern Virginia (Meloding) while the two target areas, Target Area 1 (RSB D) and Target Area 2 (RSB E) are approximately 7km east of southern Virginia. The R73 cuts across this section. Similarly to the northern and eastern sections, the southern section is primarily dominated by cultivated land, open areas and minor game farms, several natural and artificial watercourses. Although the two target areas within this section, two of the three seismic transects intersect the Sandrivier. There is also a canal that separated the two target areas. • The western section is the section where majority of the exploration activities are being proposed. This section is within a mining area and adjacent to mining towns. The edges of the residential areas of Saaiplaas, Bronville and Thabong form part of the eastern boundary of this section and ER386. There are six target areas Target Area 3 (ED G), Target Area 4 (ED H), Target Area 5 (ED J), Target Area 6 (ED I), Target Area 7 (ED F) and Target Area 8 (VEG A) as well as seven (7) seismic transects (Transects ED 1-5, VEG 1-2). Although this section also consists largely of cultivated land, open areas and minor game farms, several natural and artificial watercourses, it is the most transformed section within the ER comprising of mining activities, residential areas, road and electrical infrastructure. This section also comprises of several farms earmarked for renewable energy developments.

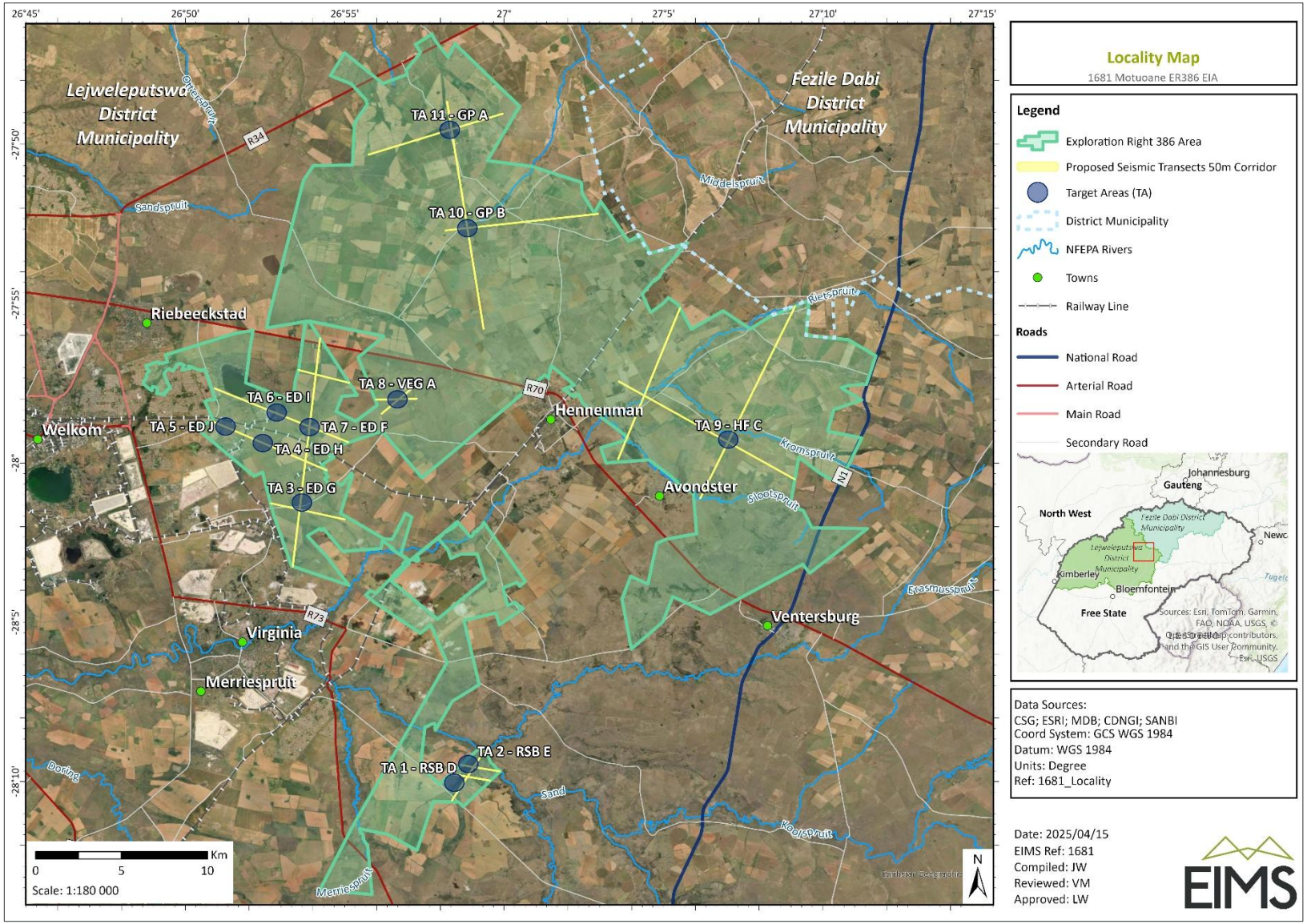


Figure 1: Aerial imagery locality map indicating the location of the proposed Motuoane ER386.

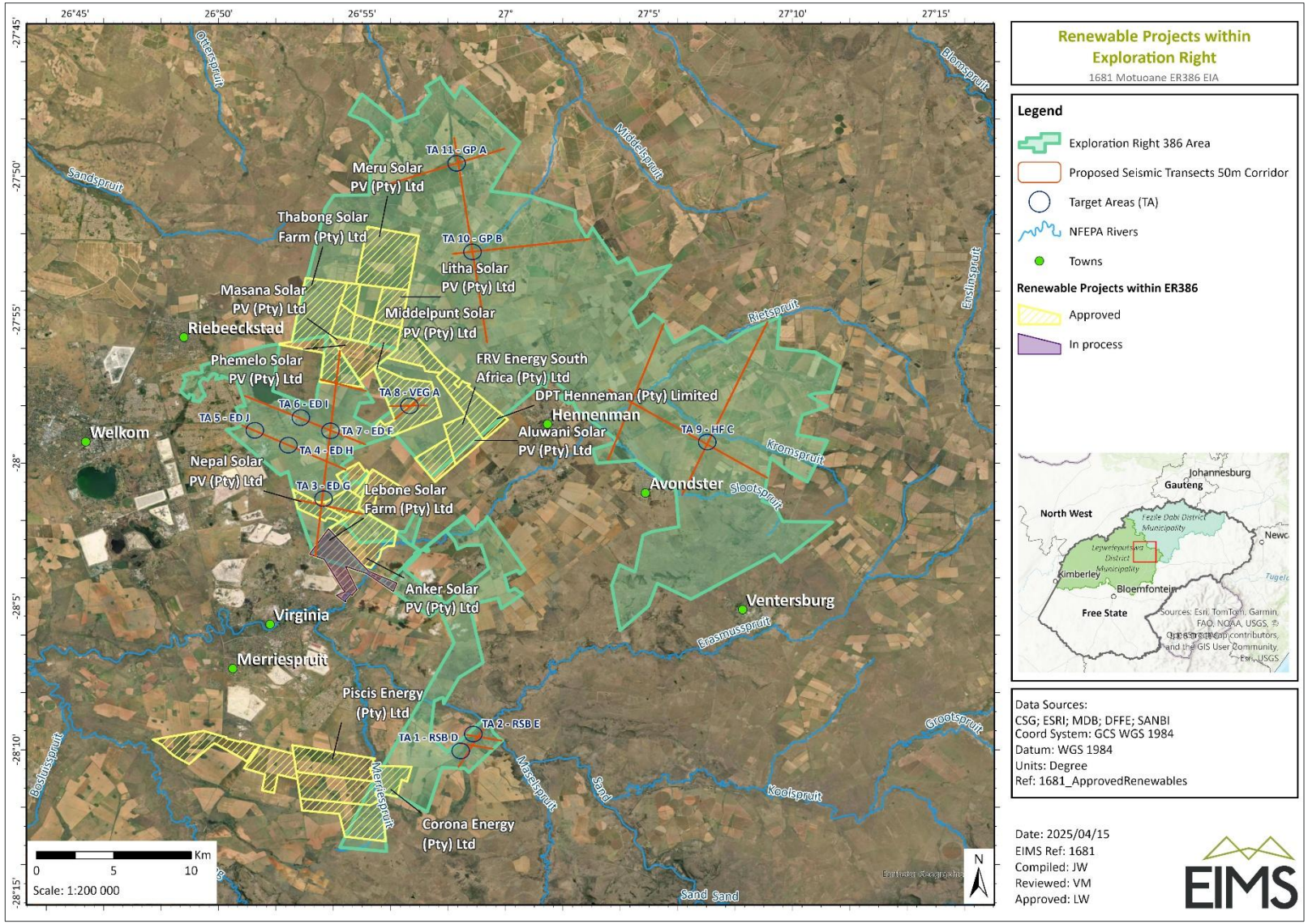


Figure 2: Locality map indicating the properties within the ER386 footprint.

2 DESCRIPTION AND SCOPE OF THE PROPOSED PROJECT

This section provides a detailed description for the proposed project. Most of the key information presented in this chapter was obtained from the applicant. The aim of the project description is to describe the proposed activities planned to take place at the Motuoane ER386 project area. Furthermore, the project description is designed to facilitate the understanding of the proposed project related activities which are anticipated to lead to the preliminary impacts identified and assessed in this Scoping Report, and for which management measures have been, or will be designed. Important project aspects are indicated in **Table 6**.

Table 6: Details of main project aspects.

Aspect	Details		Latitude	Longitude
Drilling Site	Target Site 1: RSB D – 500m Buffer Drilling Area		28°10'2.21"S	26°58'26.26"E
	Target Site 2: RSB E – 500m Buffer Drilling Area		28° 9'26.86"S	26°58'52.57"E
	Target Site 3: ED G – 500m Buffer Drilling Area		28° 1'14.61"S	26°53'39.39"E
	Target Site 4: ED H – 500m Buffer Drilling Area		27°59'22.60"S	26°52'25.84"E
	Target Site 5: ED J – 500m Buffer Drilling Area		27°58'51.58"S	26°51'15.72"E
	Target Site 6: ED I – 500m Buffer Drilling Area		27°58'25.06"S	26°52'51.95"E
	Target Site 7: ED F – 500m Buffer Drilling Area		27°58'52.58"S	26°53'53.88"E
	Target Site 8: VEG A – 500m Buffer Drilling Area		27°58'0.25"S	26°56'39.30"E
	Target Site 9: HF C – 500m Buffer Drilling Area		27°59'16.03"S	27° 7'1.82"E
	Target Site 10: GP B – 500m Buffer Drilling Area		27°52'38.16"S	26°58'50.81"E
	Target Site 11: GP A – 500m Buffer Drilling Area		27°49'32.99"S	26°58'17.68"E
Seismic Transect	Transect ED1 (13.5km long)	ED1 Start point ED1 Endpoint	27°56'6.84"S 28° 3'13.17"S	26°54'14.31"E 26°53'22.38"E
	Transect ED2 (3km long)	ED2 Start point ED2 Endpoint	27°57'4.76"S 27°57'29.78"S	26°53'33.62"E 26°55'5.49"E
	Transect ED3 (7.5km long)	ED3 Start point ED3 Endpoint	27°57'39.09"S 27°59'21.03"S	26°50'56.55"E 26°55'6.63"E
	Transect ED4 (6.5km long)	ED4 Start point ED4 Endpoint	27°58'41.27"S 28° 0'13.79"S	26°50'48.96"E 26°54'25.25"E
	Transect ED5 (4km long)	ED5 Start point ED5 Endpoint	28° 1'15.96"S 28° 1'47.01"S	26°52'40.83"E 26°55'0.01"E
	Transect G1 (13.5km long)	G1 Start point G1 Endpoint	27°48'39.11"S 27°55'46.58"S	26°58'12.51"E 26°59'21.34"E

Aspect	Details		Latitude	Longitude
	Transect G2 (7.5km long)	G2 Start point G2 Endpoint	27°50'20.21"S 27°49'1.96"S	26°55'46.11"E 26°59'58.28"E
	Transect G3 (8km long)	G3 Start point G3 Endpoint	27°52'41.75"S 27°52'10.53"S	26°58'10.21"E 27° 2'57.40"E
	Transect H1 (12km long)	HF1 Start point HF1 Endpoint	28° 1'7.36"S 27°55'3.47"S	27° 6'9.01"E 27° 9'10.29"E
	Transect H2 (9.5km long)	HF2 Start point HF2 Endpoint	27°59'53.41"S 27°55'7.17"S	27° 3'34.59"E 27° 5'30.54"E
	Transect H7 (11km long)	HF7 Start point HF7 Endpoint	27°57'25.83"S 28° 0'31.28"S	27° 3'35.90"E 27° 9'8.00"E
	Transect RSB1 (3.5km long)	G3 Start point G3 Endpoint	28°10'35.47"S 28° 9'4.72"S	26°58'22.20"E 26°59'21.22"E
	Transect RSB2 (2km long)	G3 Start point G3 Endpoint	28° 9'45.45"S 28° 9'57.70"S	26°58'20.75"E 26°59'33.85"E
	Transect RSB3 (2km long)	G3 Start point G3 Endpoint	28° 9'27.69"S 28° 9'40.51"S	26°58'39.14"E 26°59'51.37"E
	Transect VEG1 (3km long)	G3 Start point G3 Endpoint	27°58'26.94"S 27°57'29.26"S	26°56'9.64"E 26°57'18.90"E
	Transect VEG2 (2km long)	G3 Start point G3 Endpoint	27°58'0.54"S 27°57'59.08"S	26°55'58.33"E 26°57'16.20"E

2.1 NON-INVASIVE EXPLORATION

2.1.1 BACKGROUND DATA COLLECTION AND DATA MANAGEMENT

Affected landowners will be identified and contacted in preparation for the ground exploration activities. Existing gas emitting boreholes will be sought if they exist, photographed, measured and analysed. Meetings will be set up with mining companies in the vicinity to see if they have had any experience with gas and gas emitting boreholes. Any gas emitting boreholes found will then be mapped and analysed.

In order to acquire information from the existing gas wells, wellhead control and measurement equipment will be designed and installed to measure pressure, flow rate and collect gas samples for analysis. In addition, existing gravity/magnetic data will be obtained and analysed. Any available cores and cuttings from previous mining/exploration activities will also be analysed. The need to undertake additional aerial gravity/magnetic surveys can only be determined once all available existing data has been reviewed and analysed, however if required, a risk assessment is to be prepared prior to undertaking this activity and compliance with the mitigation measures put forward in the Environmental Management Programme (EMPr) will be binding on the applicant. Geophysical data will be acquired and reprocessed where practical so as to analyse and interpret the data. Surface mapping (surface geological features and outcrops) of the various parts of the exploration area

will also be undertaken during this phase. Data from surface mapping along with initial data gathered will be analysed and geological maps prepared. Reservoir studies using magnetic, geological and geophysical data will be conducted. In addition, analyses on gas samples taken will also be undertaken.

2.1.2 PREPARATIONS FOR SEISMIC SURVEYS

Motuoane will search records at the Council for Geoscience and the Petroleum Agency for seismic data that was acquired on the Exploration Right in the past. If no data is available, Motuoane will either acquire its own seismic or telluric data on the property, following proper environmental protocols and with the written permission of the landowner. Background information from the drilling programme as well as existing wells where conditions permit, and geological maps will be used to identify the final transect routes within the approved area. A team will be assembled to effectively prepare and plan the transect routes. The team / applicant will identify and contact landowners in preparation for activities. The team's plan will detail the period of surveying, the access routes, transects path to be followed, temporary site camp and laydown area, among other aspects which will be used to inform and prepare the applicant for environmental compliance audits. Once approved by the applicant and team will mobilize to undertake the seismic surveys which should last for a couple of weeks if weather conditions permit.

2.1.3 GEOLOGICAL AND GEOPHYSICAL LOGGING

Geological and Geophysical logging, utilizing the samples obtained from the drilling programme as well as existing wells where conditions permit. The samples will be analysed for the presence of hydrocarbons as well as to determine the physical properties of the rocks. This analysis will allow for the determination of the lithology and associated properties as well as the presence of hydrocarbons. Geophysical logging and surface structures data (surface geological features and outcrops) will be integrated into maps.

2.1.4 SEISMIC SURVEYS

Seismic surveying along the transects through a Vibroseis technique will be undertaken by a small team (approximately 15 personnel) by deploying an array of energy sources from a small-sized Seismic Vibrator and an array of sensors or receivers (geophones) on the identified area of interest (**Figure 3**). A single Seismic Vibrator consisting of a vibrating baseplate that is connected to the ground will be used. The vibrating plate emits a low frequency signal (4-80 Hz) into the ground, called a sweep. The vibrator vehicle moves slowly along the pre-determined lines (transects) using GPS for navigation. It stops, emits a signal 8-20 seconds long, moves approximately 10 meters ahead, stops, emits a signal and so on until all the transects have been traversed (**Figure 3**). Several small geophones will be used to convert the ground movements or seismic waves from the Seismic Vibrator into voltage, which will be recorded at a nearby recording station (**Figure 3**). The team will then generate and analyse the 2-D sub-surface geological network and identify areas of interest for further exploration. The outcome of the seismic survey will be used to inform preferable drilling locations.

Although the Vibroseis technique is the likely method to be undertaken for the seismic activities. There are also potential alternatives to the Vibroseis known as the Propelled Energy Generators (PEGs), more commonly referred to as the Accelerated Weight Drop Seismic (AWD) as well as Magnetotellurics Survey (MT) which Motuoane may consider over the Vibroseis. AWD are light weight, highly portable seismic energy sources designed for a multitude of applications within the fields of geology, geophysics, civil engineering, and more. AWD systems utilize simple and effective elastomer band technology to propel the hammer to a high velocity. The AWD is comprised of two easily manageable components for fast and efficient installation and de-installation in the field. The AWD's lightweight, streamlined design also affords its users economy in shipping. The AWD-40Kg is designed to easily mount on trucks, bakkie, trailers, and all-terrain vehicles (**Figure 3**). AWD is a variant of seismic source of the "weight drop" type. The hammer is equipped with an inclined platform, allowing it to be installed at an angle of 45 degrees, and a special stop, adding stability in an upright position, what allows to perform survey on shear waves (**Figure 3**). The source AWD-40PS is mounted on a compact

lightweight frame equipped with reliable wheel blocks. The source can be used on a rugged terrain. The total weight of the source without battery pack is less than 120 kg. The energy of a single impact reaches 1000J.

Magnetotellurics (MT) is a passive geophysical technique that uses naturally occurring electromagnetic fields to image the subsurface electrical resistivity structure by measuring the Earth's natural time-varying electric and magnetic fields. The MT method utilizes naturally occurring, broadband electromagnetic waves over the Earth's surface to image subsurface resistivity structure. The electromagnetic waves originate from regional and worldwide thunderstorm activity and from the interaction of solar wind with the Earth's magnetosphere. Due to the remote nature of the sources and the high refractive index of the Earth relative to air, the electromagnetic waves are assumed to be planar and to propagate vertically into the Earth. However, the scattering of electromagnetic waves by subsurface structure can be arbitrary in polarization, necessitating a tensor description (Wannamaker *et al*., 2005). Accordingly, two components of electric field (Ex and Ey) and three components of magnetic field (Hx, Hy and Hz) are measured. The frequencies of the waves (signals) range from about 1 Hz to a fraction of milli Hertz, which allows to image a wide depth range. A detailed account of the MT method is given in Vozoff (1991).

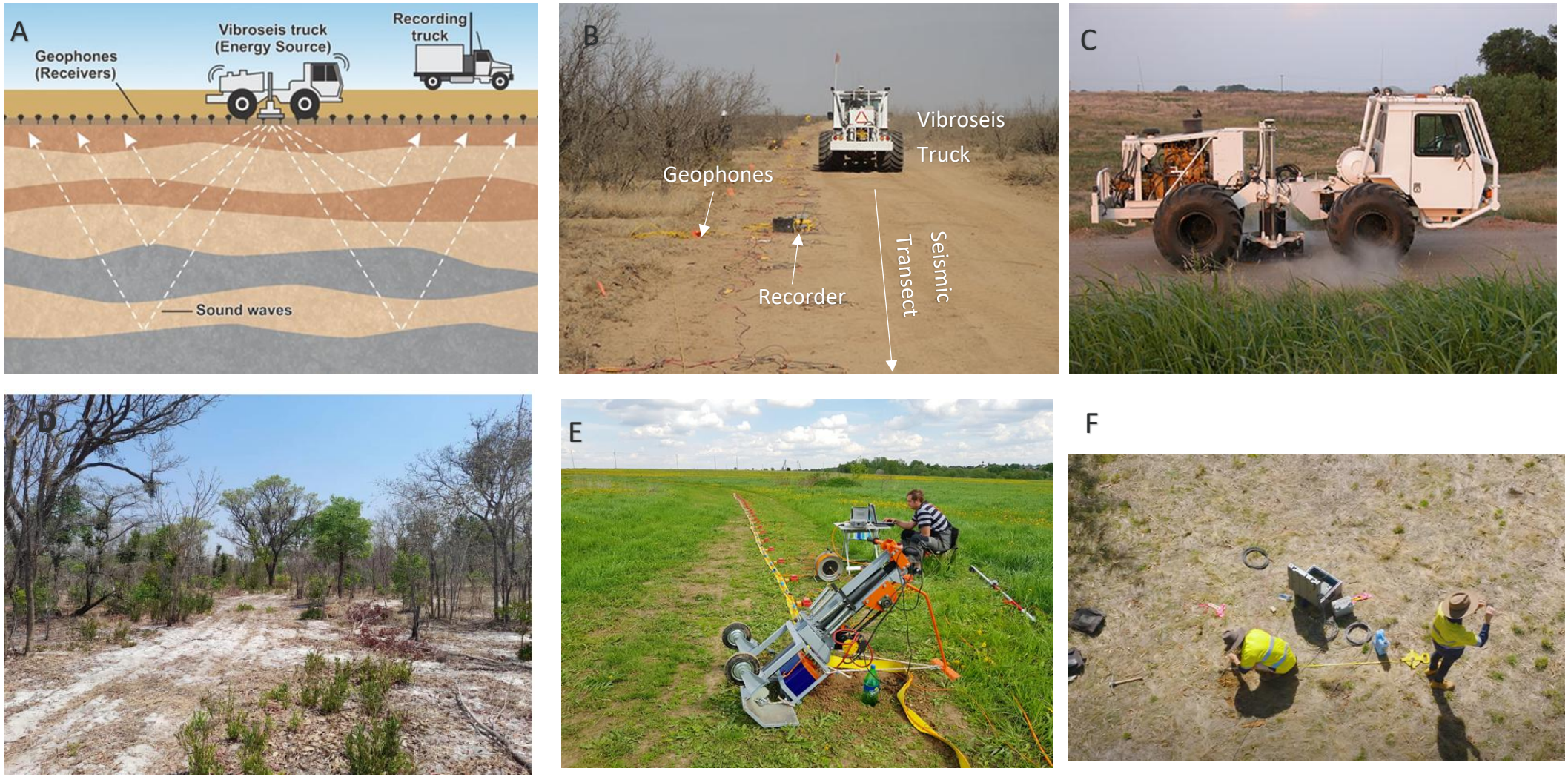


Figure 3: Seismic surveying process and potential impacts. (A) Showing an animated Vibroseis process, (B) Showing a real life Vibroseis process, (C) Showing minimal dust generated from the process, (D) Showing minimal vegetation impact associated with a new access path (transect route), (E) Showing the weight drop alternative method and (F) showing magnetotelluric survey.

2.2 INVASIVE EXPLORATION ACTIVITIES

2.2.1 GEOTECHNICAL INVESTIGATIONS

Once the seismic, geological and geophysical data has been analysed this information will delineate the areas susceptible for geotechnical investigations. The Motuoane Exploration Area is situated towards the east of de Bron fault. In the northern part of the ER, a major horst structure i.e. de Bron horst is present between the de Bron and Homestead faults respectively. No gold bearing sediments occur in the horst. Detailed drilling defined the eastern limit of this horst structure along the Homestead fault. East of the Homestead fault, gold bearing sediments were intersected again. Two major fault systems, i.e. the Virginia and Ventersdorp faults, occur in the eastern part of the central region, often referred to as the "MELA" region. The displacement again was towards the west. Despite this major north-south striking structures several east-west faults are also present or could be extended into the ER. The east-west structures are the oldest structures in the Witwatersrand basin. Many kimberlite fissures and Karoo age dolerite dykes intruded into the younger strata along these structures. The east-west structures were right laterally displaced by north-south striking structures resulting in a very complex tectonic environment. The Importance of these structures is vested in the presence of methane gas occurrence associated in or in proximity of the structures.

Drilled explorations wells will be evaluated based on gas flow, pressure and gas composition, prior to making a decision to either complete the well as a production well or to suspend or abandon it. Hydrocarbons have been reported from the Welkom Goldfields from conventional mineral exploration boreholes and mine workings since the early 1900's. Hydrocarbons are believed to be derived from the crustal microbial methanogens in fractures within the Witwatersrand that has migrated through the Witwatersrand/Ventersdorp and into the Karoo Dwyka and Ecca Group Vryheid Formations. The anticipated geology and stratigraphy are based on the lithographic log in 0. The underlying geology through which Motuoane Energy No 1 Bloemskraal will be drilled will consist of sedimentary rocks of the Karoo Supergroup followed by the lavas of the Ventersdorp Supergroup. The information from the seismic survey and drilling will be used to map the geology of the area.

2.2.2 WELL DRILLING

Using the data gathered during the preceding background review and surveying, up to eleven (11) exploration boreholes will be sited. The proposed drilling process entails the construction of exploration well using a two-string telescopic casing design is outlined below and illustrated on **Figure 4**:

- The Spud casing will be set and cemented in to case off the unconsolidated material to approximately 6m True Vertical Depth (TVD);
- Drilling will be continued past the unconsolidated material to approximately 80mTVD, conductor casing will be cemented from shoe to surface;
- The hole is then percussion drilled ahead and into the Ventersdorp Lavas below the base of the Karoo at approximately 450 m TVD; Intermediate casing will be run and cemented to surface;
- Integrity of this section will be tested by running a Cement Bond Log (CBL) and the pressure tested prior to drilling out the casing shoe. A further Formation Integrity Test (FIT) is then performed on drilling out the casing shoe; and
- The next section (open hole section) will be percussion drilled through the primary target, the Ventersdorp Supergroup, to a depth ± 650 m TVD. This section TVD maybe called earlier if significant gas flows are encountered.

The project will involve the drilling of up to 11 wells within the assessed 500m buffer drilling sites. Each exploration well will have an overall depth of approximately 650m and a maximum width of 350mm, commencing with a 6m x 323mm spud hole section, followed by 80m x 254mm conductor hole section, then an intermediate hole section of 450m x 203mm and finally an open hole section of 650m x 144mm. The actual casing sizes and configurations will vary depending on the specific geological characteristics and functional

requirements. Each borehole will be steel cased and have cement barriers to prevent leaks as well as plugged at the end of exploration to prevent groundwater seepage (**Figure 5**). Drilling activities are estimated to be one to two weeks per hole during which time there will be a drill rig, a service truck and an LDV on site. Intermittent use of a TLB will be used during site establishment and demobilisation. In order to establish the gas contents a mobile desorption laboratory will be established.

The construction of each drill pad will disturb an area of up to 50 x 50 m (**Figure 5**). Within the disturbed area, the drill rig and drilling rods will be located. Impermeable, lined sumps will be used to circulate and store the drill fluid and mud consisting of drilling foams and Bentonite. Exploration trays, hazardous and general storage, waste storage, chemical toilets, and any site offices required will also be placed inside the drill pad (**Figure 5**). Each drill site will be suitably rehabilitated before drilling continues at the next drill site. Depending on the results of the sampling, each borehole will either be plugged entirely or left as is for future analysis. Regardless of which of these options is chosen, the borehole will be capped with a steel cap that is engraved with the borehole number according to industry specifications.

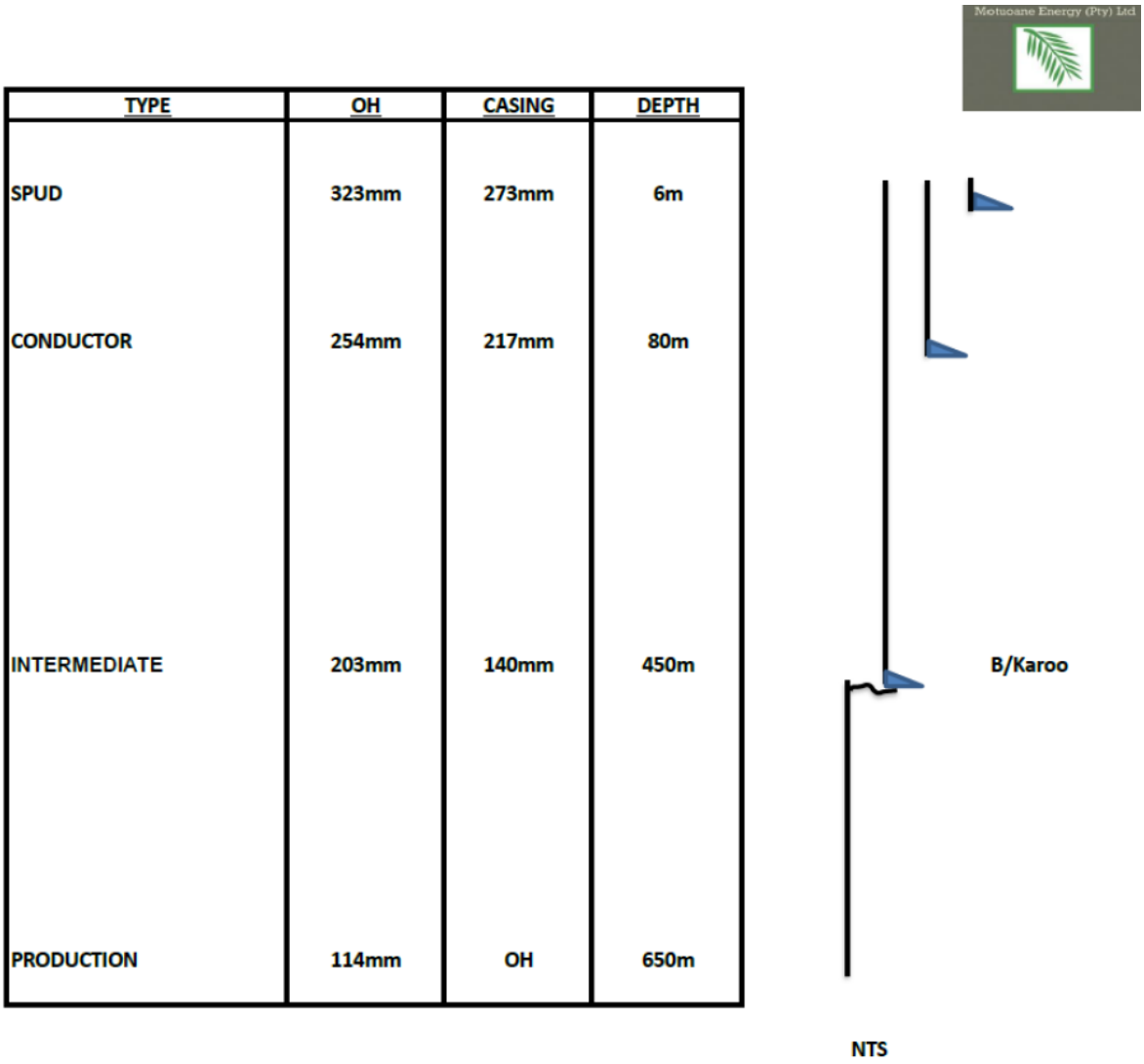


Figure 4: Vertical Well Plan (iKapa Resources, 2024)

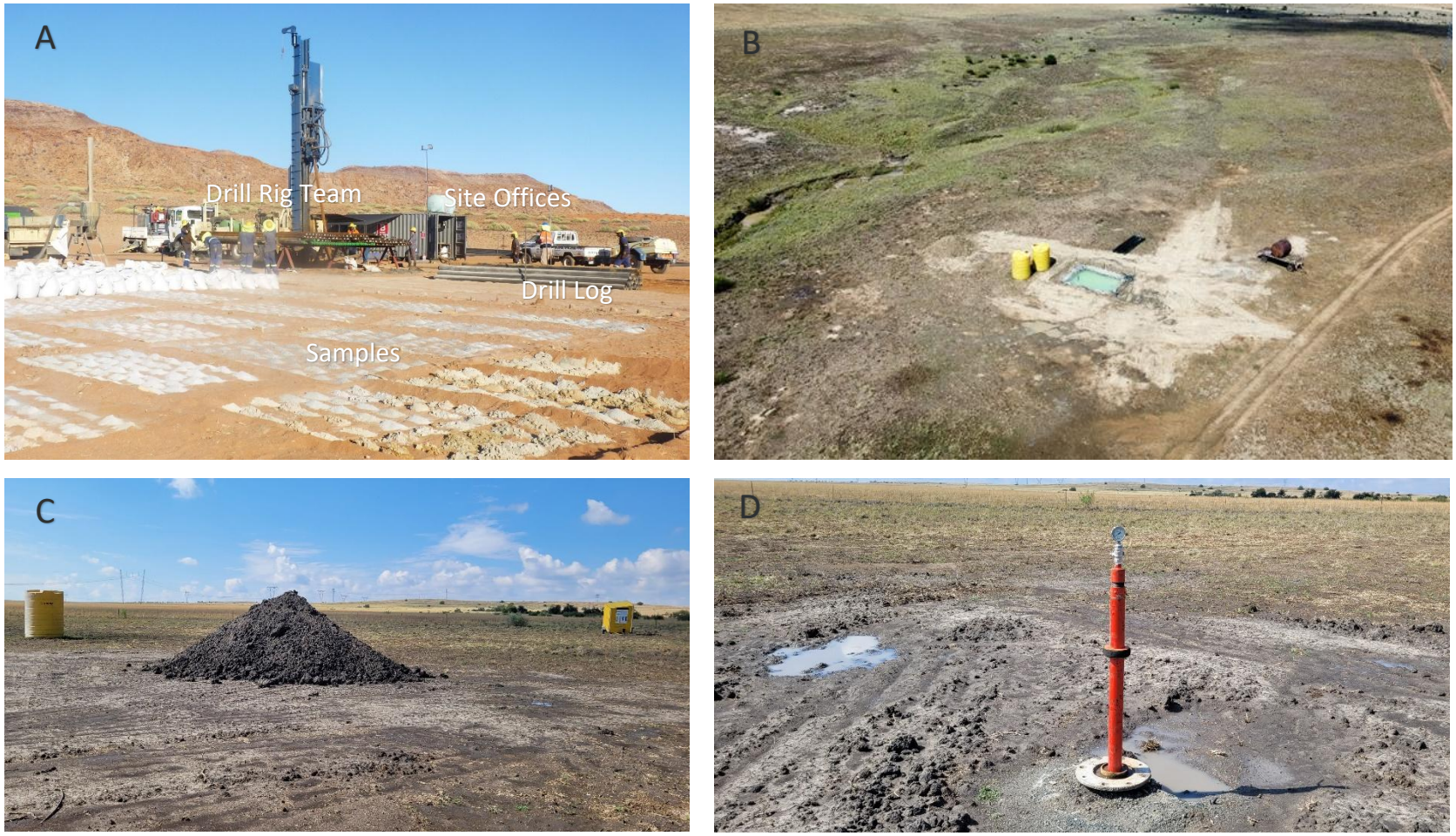


Figure 5: Exploration drilling and potential impacts. (A) Showing the drilling process and associated infrastructure, (B) Showing the drill pad footprint at one of the active Motuoane drilling sites, (C) Showing some of impacts associated with drilling activities including contained vegetation clearance and topsoil humps and (D) Showing the final borehole, steel cased and have cemented to prevent leaks.

2.3 SUPPORTING INFRASTRUCTURE

None of the proposed exploration activities require the establishment of any permanent infrastructure. Sites will be accessed on existing roads or farm tracks as available. Where access is not available, access tracks to accommodate a vehicle, approximately 3.5m wide will be created. These will be rehabilitated accordingly at the end of exploration. Existing accommodation in the area will be utilised for staff and not on site.

Equipment for seismic surveys and drilling will be provided by specialist contractors. The majority of equipment, consumables and even labour for these services is specialised. Contractors and suppliers will be encouraged to source locally as much as is feasible. Electricity, if required, will be provided by on-site generators which must be placed on impermeable surfaces. Water required for the operation of the drilling rig, as well as potable water will be obtained locally, by agreement with landowners or the local municipality. The daily water requirements for drilling operations will be a maximum of 5000 litres per day.

Chemical toilets will be provided for the personnel. The toilets will be supplied and managed by a specialist contractor and the sewage disposed of at the nearest wastewater management facility, or as required by the local authority. All general and hazardous waste generated at the survey and/or drilling site will be separated and stored in containers, before being removed from site and disposed at an appropriate waste disposal facility. The material recovered from the drilling will most likely be stored in a shed for analysis and record keeping. Mineral residues produced during drilling practices will be managed in terms of Government Notice Regulation 632 on the Planning and Management of Residue Stockpiles and Residue Deposits (July 2015) under the National Environmental Management Waste Act (Act 59 of 2008) (NEMWA). Water from the drilling operations will be disposed of in accordance with the provisions of the National Water Act and the National Environmental Management Waste Act (as applicable).

2.4 DECOMMISSIONING AND CLOSURE

A rehabilitation plan will be included in the EMPr. The EMPr shall outline the closure objectives that are aimed at re-instating the landform, land use and vegetation units to the same state as before exploration operations take place, unless a specific, reasonable alternate land use is requested by the landowner. As such, the intended end use for the disturbed exploration areas and the closure objectives will be defined in consultation with the relevant landowner. Proof of such consultation will be submitted together with the Application for Closure Certificate. The overall aim of the rehabilitation plan is to rehabilitate the environment to a condition as close as possible to that which existed prior to exploration. This shall be achieved with a number of specific objectives.

- Making the area safe. i.e.: Decommission exploration activities so as to ensure that the environment is safe for people and animals. This entails refilling excavations, sealing and grouting exploration wells where applicable, etc.
- Recreating a free draining landform. This entails earthworks infilling, reshaping, levelling, etc. to recreate as close as possible the original topography and to ensure a free draining landscape.
- Re-vegetation. This involves either reseeding or allowing natural succession depending on the area, climate etc.
- Storm water management and erosion control. Management of storm water and prevention of erosion during rehabilitation. E.g. cut off drains, berms, etc. and erosion control where required.
- Verification of rehabilitation success. Entails monitoring of rehabilitation.

Once exploration has been completed, all areas disturbed by exploration activities will be rehabilitated. This will be undertaken in accordance with the rehabilitation and closure plan as required by the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations, GNR 1147, gazetted in November 2015. This includes the determination of the financial provision as well. A closure certification

application will be applied for in accordance with section 43 of the Mineral and Petroleum Resources Development Act, 2002.

2.5 LISTED AND SPECIFIED ACTIVITIES TRIGGERED

In terms of Section 24(2) of NEMA, the Minister and/or any MEC in concurrence with the Minister may identify activities which require authorisation as these activities may negatively affect the environment. Environmental Impact Assessment (EIA) Regulations were promulgated in 2014 and amended in 2021 in terms of Section 24(5) and Section 44 of the National Environmental Management Act (NEMA), Act 107 of 1998 and consist of the following:

- *Regulation 982* provide details on the processes and procedures to be followed when undertaking an Environmental Authorisation process (also referred to as the EIA Regulations);
- *Listing Notice 1* (Regulation 983, as amended) defines activities which will trigger the need for a Basic Assessment process;
- *Listing Notice 2* (Regulation 984, as amended) defines activities which trigger an Environmental Impact Assessment (EIA) process. If activities from both R 983 and R 984 are triggered, then an EIA process will be required; and
- *Listing Notice 3* (Regulations 985, as amended) defines certain additional listed activities for which a Basic Assessment process would be required within identified geographical areas.

The above regulations were assessed to determine whether the proposed project will trigger any of the above listed activities, and if so, which Environmental Authorisation Process would be required. The triggered listed activities presented in **Table 7** and the applicant will require an Environmental Authorisation (EA) in terms of GNR 984 Listing Notice 2 of the NEMA EIA Regulations 2014 as amended. A Scoping and EIA process is required in line with all the requirements of the NEMA EIA Regulations, 2014, as amended.

Table 7: Relevant NEMA listed activities relevant to the proposed development.

Activity No(s):	Activity	Portion of the proposed project to which the applicable listed activity relates.
GNR 983 Activity 21C	Any activity including the operation of that activity associated with an onshore seismic survey which requires an exploration right in terms of section 79 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity as contained in this Listing Notice or in Listing Notice 3 of 2014, required to exercise the exploration right, excluding (a) any desktop study, (b) any arial survey, and (c) a hydraulic fracturing activity which is included in activity 20A in Listing Notice 2 of 2014, in which case that activity applies	The proposed activities include the undertaking of onshore seismics / telluric survey over 100km long around known structures and possible drill locations.
GN984, Activity 18	Any activity including the operation of that activity which requires an exploration right in terms of section 79 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity as contained in this Listing Notice, in Listing Notice 1 of 2014 or in Listing Notice 3 of 2014 required to exercise the exploration right, excluding (a) any desktop study; (b) any arial survey; (c) any onshore seismic survey which is included in activity 21C in Listing Notice 1 of 2014, in which case that	The proposed activities include the undertaking of up to 11 Diamond Core / Percussion Drilling activities for hydrocarbons, which requires an exploration right in terms of section 79 of the MPRDA

Activity No(s):	Activity	Portion of the proposed project to which the applicable listed activity relates.
	activity applies; (d) a hydraulic fracturing activity which is included in activity 20A, in which case activity 20A of this Notice applies; and (e) the processing of a petroleum resource, including the beneficiation or refining of gas, oil or petroleum products, in which case activity 5 of this Notice applies	
Other NEMA EIA Regulations, 2014 as amended applicable listed activities to be assessed in the EIA		
GNR 983 Activity 27	Clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan	The proposed activities will require the Clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation for up to eleven (11) 50m x 50m drilling pads
GNR 985 Activity 12	The clearance of an area of 300 square meters or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan (b). Free State: i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; ii. Within critical biodiversity areas identified in bioregional plans; iv. Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland.	The proposed activities will require the clearance of an area of 300 square meters or more of indigenous vegetation for up to eleven (11) 50m x 50m drilling pads and access roads where necessary.

There are currently no additional listed activities and/or water uses identified for the project. However, should the final drilling / surveying location be within the regulated area for a watercourse as per DWS regulations (refer to Section 3.5), then the applicant must apply for a Water Use Authorisation for the triggered Section 21 activity of the National Water Act.

2.6 NEED AND DESIRABILITY OF THE PROPOSED ACTIVITY

The needs and desirability analysis component of the "Guideline on need and desirability in terms of the EIA Regulations (Notice 819 of 2014)" includes, but is not limited to, describing the linkages and dependencies between human well-being, livelihoods and ecosystem services applicable to the area in question, and how the proposed development's ecological impacts will result in socio-economic impacts (e.g., on livelihoods, loss of heritage site, opportunity costs, etc.). This section of the report provides the need and desirability for the proposed Motuoane ER386.

The current available information recorded (observations) in the region is inadequate to make a conclusive detailed reporting on the quantity of hydrocarbons and/or suitable drilling locations for production purposes. Therefore, Motuoane proposes to undertake up to eleven (11) new exploration boreholes and to acquire ground

based seismic surveys (~100 km of new seismic transects). The seismic survey will be used to better understand the subsurface discontinuities, layering, and probable rocks/structures. Analysis of the seismic surveys and additional drilling wells will provide more precise information to determine the viability of the exploration project into the production phase. All of the proposed activities fall within the Motuoane ER386 extent. There will be no additional areas or petroleum resources added to the exploration right.

The proposed activities, if approved, will allow the applicant to determine if there is an economically viable resource (natural gas including Helium) available in the area. It is important to note that the exploration right will not provide the required authorisation for production activities to be undertaken. As such, any future intention to undertake production of hydrocarbons within the exploration right area would require a further application, investigation and public consultation process.

Helium is a non-renewable natural resource that is mostly recovered from natural gas deposits. Thus, helium is typically a by-product of natural gas fields. It is important to note that helium is found in recoverable quantities in only a few locations around the world, many of which are being depleted. In the gas fields of Virginia in the Free State, the source of helium in recent studies indicated as being unique given the high helium content in the gas field. This makes this development a potential “game changer” in the helium industry in that Motouane could produce helium as its prime product, with methane potentially being a by-product. This is a different strategy to how helium is currently recovered worldwide. The uniqueness of this situation is that as pressure increases on reducing gas production worldwide, helium production will also decline. However, in the case of Motouane, this status quo is reversed, meaning that the Virginia Gas fields may well become a significant strategic helium resource in the world. The importance of the demand for helium is that an economic need and desirability would be low if a sufficient demand now, or in the future, could not be established. In this regard, all indications are that the demand for helium is strong and sustainable, thus contributing strongly to the economic need and desirability of this exploration.

The White Paper on the Energy Policy (1998) is the overarching policy document that guides future policy and planning in the energy sector. It states that the government will, inter alia, “promote the development of South Africa’s oil and gas resources…” and “ensure private sector investment and expertise in the exploitation and development of the country’s oil and gas resources”. The successful exploitation of these natural resources would contribute to the growth of the economy.

The National Development Plan (NDP) (2012) provides the context for all development in South Africa, with the overarching aim of eradicating poverty and inequality between people in South Africa. The NDP identifies the need to diversify the current energy mix and to reduce carbon emissions. Gas will play a more significant role in the energy mix and the exploration of gas as an alternative to coal for energy production has been recognised as a planning priority. The position of the NDP is reiterated in the Draft Integrated Energy Plan (IEP) (2013), which seeks to determine how current and future energy needs can be addressed efficiently. Main objectives outlined in the plan include security of supply, increased access to energy, diversity in supply sources and primary sources of energy and minimising emissions. The plan indicates that projected demand for natural gas between 2010 and 2050 would be second only to petroleum products, primarily due to increased growth in the industrial sector. It also identifies significant potential for natural gas in terms of power generation and direct thermal uses.

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

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

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

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

Table 8: Needs and desirability analysis for the proposed exploration activities.

Ref No.	Question	Answer
1	Securing ecological sustainable development and use of natural resources	
1.1	How were the ecological integrity considerations taken into account in terms of: Threatened Ecosystems, Sensitive and vulnerable ecosystems, Critical Biodiversity Areas, Ecological Support Systems, Conservation Targets, Ecological drivers of the ecosystem, Environmental Management Framework, Spatial Development Framework (SDF) and global and international responsibilities.	Although the study area has been disturbed through the active mining operations and agricultural activities, based on the proposed development and site sensitivity verification, several specialist studies form part of this environmental impact assessment including: • Agricultural Potential, Soils & Land Capability • Air Quality & Climate Change Assessment; • Aquatics and Wetland Assessment; • Archaeological and Cultural Heritage Assessment; • Palaeontological Impact Assessment; • Terrestrial Biodiversity Assessment; • Financial Provisions; • Geohydrological Assessment; • Social Assessment; and • Noise Assessment. These studies will assist in identifying any Threatened Ecosystems, Sensitive and vulnerable ecosystems, Critical Biodiversity Areas, Ecological Support Areas, Conservation Targets and Ecological drivers of the ecosystem. Where sensitive species or ecosystem drivers are identified, relevant mitigation measures will be put forward to prevent or minimise the impacts. The findings and impact assessment will be discussed during the EIA Phase.
1.2	How will this project disturb or enhance ecosystems and / or result in the loss or protection of biological diversity? What measures were explored to avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	The overall ER footprint is approximately 58 000ha. Based on the preliminary assessments, the study area's natural state has been disturbed through mining, agriculture and other infrastructure developments, it is not anticipated that there will be major areas of increased ecological importance that will be identified by the specialists. However, the proposed project entails the exploration drilling using core and percussion methods which can have detrimental environmental and health impacts if not controlled. Therefore, should the specialists identify areas of species of conservation concern and/or major health risks, then best environmental practices will be recommended (mitigation hierarchy). As stipulated in the mitigation hierarchy, the EAP / specialist will recommend to first avoid adverse impacts, then minimize impacts that cannot be avoided, and lastly offset, or compensate for, unavoidable impacts. Refer to baseline ecological statement in **Section 4** and the impact assessment in **Section 7** of this report.
1.3	How will this development pollute and / or degrade the biophysical environment? What measures were explored to either avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	

Ref No.	Question	Answer
1.4	What waste will be generated by this development? What measures were explored to avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and / or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	This development will possibly generate various general and minor hazardous waste, the majority of which will be generated during the construction phase. The general waste will be stored in designated areas and through the process of recovery and recycling, the volume of general waste being disposed to landfill will be minimised. The hazardous portion of the waste stream will also be adequately stored prior to disposal at a suitably licenced hazardous waste disposal facility. Safe disposal certificates will be obtained from the disposal facility used. Waste has been identified as an impact and assessed in **Section 7**. However, it is anticipated that the following measures can be utilised to reduce the impact of the waste on the receiving environment: Waste must be stored correctly. All hazardous waste such as oil must be stored separately and disposed of at a registered facility. Proof of disposal must be kept by the Applicant.
1.5	How will this project disturb or enhance landscapes and / or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	A heritage impact assessment is being conducted as part of the EIA to determine areas of archaeological and/or cultural heritage and associated mitigation measures. Based on the National Web-Based Screening Tool Report, the relative Archaeological and Cultural Heritage Theme relative sensitivity is *Very High.* Therefore, the proposed project area intersects landscapes and / or sites that constitute the provincial and/or nation's cultural heritage. However, the pre-identified heritage features are within the greater extent of the ER and not within the preliminary TA. Therefore, chances of actual impact on cultural heritage features are less. The heritage specialist has provided the heritage features and buffer requirements in the scoping phase and a Chance Find Protocol procedure discussed in detail in **Section 4.6.**
1.6	How will this project use and / or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	Refer to the impact assessment in **Section 7** of this report. It is acknowledged that due to the nature of gas resources, an onshore (potentially non-renewable) gas resource will be depleted should the project proceed to production phase. It has not yet been conclusively determined if the gas field is biogenic (renewable) or thermogenic (non-renewable). Although gas production will however contribute significantly to the country's economy as well as the transition from dirtier energy production (coal) to renewable energy production in the future, the current project is an exploration project, and minimal gas will be used or lost during this project and therefore the exploration project will have minor impact on the natural gas resource. It must be noted that there are at least 14 approved renewable energy projects from various applicants located within ER386. Motuoane and the renewable energy applicants will need to discuss the way forward and/or make necessary arrangements to coexist especially for TA 3 as the renewable energy projects overlap with the target area. Coexisting arrangements has been successfully arranged for the Motuoane ER315 footprint and therefore, it is anticipated that the same can be achieved for the ER386 which will result in no to minimal impact on the planned solar farms.
1.7	How will this project use and / or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and / or impacts on the ecosystem jeopardise the integrity of the resource and / or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?	

Ref No.	Question	Answer
		It is anticipated that the project will have a low impact on the localised ecology. Refer to the impact assessment in **Section 7** of this report.
1.7.1	Does the proposed project exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e., de-materialised growth)?	The proposed project, if it successfully identifies economical viable gas field in the area will provide an opportunity for South Africa to move away from dirtier energy (coal) while transitioning to a more renewable energy source. This can be translated into a "reduced dirty resource dependency".
1.7.2	Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used?	It should be noted that the current project is an exploration project and not a production project. The harvesting of this gas resource (during production) would constitute a better use thereof as it is currently not being harvested in this area for any commercial beneficial use. In fact, several historically drilled gold prospecting boreholes in the area are undergoing uncontrolled release of Methane into the atmosphere without being flared or burned (to only release CO_2 which is a lower order GHG pollutant).
1.7.3	Do the proposed location, type and scale of development promote a reduced dependency on resources?	The location, type and scale of the proposed development currently do not promote a reduced dependency on the importation of gas resources from other countries as at this stage, the activities are at the exploration phase. However, if the project proceeds to the production phase, it will further provide an opportunity to reduce dependency on more harmful resources such as coal for energy production. As such, this project should not be viewed in isolation in terms of resources but in a holistic manner both nationally and globally.
1.8	How were a risk-averse and cautious approach applied in terms of ecological impacts:	
1.8.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	In order to prevent repetition, the reader is directed to the assumptions and limitations presented in **Section 1.2**.
1.8.2	What is the level of risk associated with the limits of current knowledge?	The level of risk is considered low at this stage and will be further interrogated during the EIA phase (where applicable).
1.8.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	As final drilling locations, seismic transects and associated infrastructure cannot be identified at this stage, it is fortunate that a strategic assessment of target areas (500m buffers) and transects (50m corridors) is able to be undertaken as part of this EIA process in order to identify areas of high sensitivity and even no-go areas. In this manner, a risk-averse and cautious approach is able to be more fully realised in future project planning.
1.9	How will the ecological impacts resulting from this development impact on people's environmental right in terms following?	

Ref No.	Question	Answer
1.9.1	Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	The application and proposed development footprint occur predominantly on properties that are of commercial agricultural concerns. The final well placing and seismic transect will be discussed and agreed with each affected landowner prior to commencement of drilling and surveying and where necessary, appropriate compensation negotiated. Furthermore, as mentioned above, this EIA process is undertaken at a more strategic level assessment of the receiving environment within proposed development corridors which allows input from numerous specialist disciplines to identify highly sensitive or no-go areas which can then be excluded from development where necessary. The positive impact of job creation has been identified by the social specialist and the requirement for local upliftment in the form of employment creation or social programmes put forward. Refer to the impact assessment in **Section 7** in this report.
1.9.2	Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	
1.10	Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	A medium to low impact on third party wellbeing, livelihoods and ecosystem services is currently foreseen at this stage of this application as the predominant land use of the affected properties is commercial agriculture as mentioned above, and the site sensitivities from a socio-economic and biophysical point of view have been identified prior to the final placement of infrastructure. Refer to the impact assessment in **Section 7** of this report.
1.11	Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives / targets / considerations of the area?	As discussed above, this project is anticipated to have a low overall impact on the ecological integrity objectives or targets as consideration of these aspects will be undertaken prior to final placement of infrastructure. Refer to the impact assessment in **Section 7** in this report.
1.12	Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	As part of the scoping phase, suitable alternatives are being considered and will be finalised in the EIA phase once due consideration of alternatives has been completed. Refer to **Section 5** for the details of the alternatives considered at this stage.
1.13	Describe the positive and negative cumulative ecological / biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Refer to **Section 7** of this report for the identified impacts, their assessment and recommended mitigation measures. This aspect will be further explored in the EIA phase and findings thereof presented in the EIA Report and EMPr.
2	**Promoting justifiable economic and social development**	
2.1	What is the socio-economic context of the area, based on, amongst other considerations, the following:	
2.1.1	The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks or policies applicable to the area	Refer to **Section 4.5** of this report for a breakdown of the demographics and social environment in the project area. Details of the IDP's for the Lejweleputswa District Municipality (LDM), Fezile Dabi District Municipality (FDM) as well as the Matjhabeng and Moqhaka Local Municipalities are

Ref No.	Question	Answer
		included in **Section 4.5.** The proposed project will promote and support the sustainability of existing business in the local and regional economy and assist in increasing local beneficiation and shared economic growth. More detail will be provided in the Social Assessment report that will form part of the EIA.
2.1.2	Spatial priorities and desired spatial patterns (e.g., need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),	It is anticipated that the use of local labour will be utilised as far as possible. Labourers will mostly be sourced from surrounding towns and areas such as Welkom, Virginia and Hennenman.
2.1.3	Spatial characteristics (e.g., existing land uses, planned land uses, cultural landscapes, etc.), and	Refer to the baseline environment in **Section 4** of this report.
2.1.4	Municipal Economic Development Strategy ("LED Strategy").	Considering the location of the activities, it is not anticipated to significantly promote or facilitate spatial transformation and sustainable urban development.
2.2	Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	This project will result in positive socio-economic impacts in the local, regional and national economy. Refer to the impact assessment in **Section 7** in this report
2.2.1	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	It is anticipated that the use of local labour will be utilised as far as possible. Labourers will mostly be sourced from surrounding towns and areas such as Welkom, Virginia and Hennenman.
2.3	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	At this stage of the application process, there has not been specific feedback from the relevant communities on how this development will impact on their physical, psychological, developmental, cultural and/or social needs. While the baseline receiving environment is presented in **Section 4**, this aspect will be updated during the EIA phase once more consultation has been undertaken.
2.4	Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?	None of the identified impacts are anticipated to have a high negative impact significance post mitigation. It is therefore not anticipated that this project will result in negative equitable impact distribution in the short- and long-term.
2.5	**In terms of location, describe how the placement of the proposed development will:**	
2.5.1	Result in the creation of residential and employment opportunities in close proximity to or integrated with each other.	It is anticipated that the use of local labour will be utilised as far as possible. Labourers will mostly be sourced from surrounding towns and areas such as Welkom, Virginia and Hennenman (to a limited extent) both locally and regionally.
2.5.2	Reduce the need for transport of people and goods.	The activities are not anticipated to have an impact on the transportation of goods and people.

Ref No.	Question	Answer
2.5.3	Result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms of public transport),	The activities are not anticipated to have any significant impact on the public transport.
2.5.4	Compliment other uses in the area,	The proposed project has a small footprint (~ 1m^2) per drilling site after closure and rehabilitation which allows it to coexist with the other uses in the area.
2.5.5	Be in line with the planning for the area.	Refer to item 2.1.1 of this table (above).
2.5.6	For urban related development, make use of underutilised land available with the urban edge.	Not applicable. The proposed project is not located in an urban area.
2.5.7	Optimise the use of existing resources and infrastructure,	The proposed approach is to first determine and map the geographic extent of all boreholes currently emitting gas on and near the ER area. Then measure rates and monitor pressures where possible and perform gas composition analysis. Motuoane will also search records at the Council for Geoscience and the Petroleum Agency for seismic data that was acquired on the Exploration Right in the past. Existing access roads will be used as far as possible.
2.5.8	Opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g., not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),	
2.5.9	Discourage “urban sprawl” and contribute to compaction / densification.	This project is located in a rural setting and is not anticipated to have an impact on or any control over urban sprawl in the nearby towns.
2.5.10	Contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,	Refer to items 2.5.7 – 2.5.9 of this table (above).
2.5.11	Encourage environmentally sustainable land development practices and processes	This project will have a minimal impact on the current land uses in the application area as the wells are insignificantly small in area (~ 1m^2 each). This will allow for existing land uses to continue while this exploration project is ongoing.
2.5.12	Take into account special locational factors that might favour the specific location (e.g., the location of a strategic mineral resource, access to the port, access to rail, etc.),	Refer to alternative analysis in **Sections 5** and the introduction part of this section.
2.5.13	The investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential).	As mentioned in 2.5.11 above, this project will not sterilise existing land uses and therefore it will in fact result in higher economic returns per land area as both agriculture and gas exploration can occur simultaneously.

Ref No.	Question	Answer
2.5.14	Impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and	The proposed activities will have a minimal impact on the existing sense of place. Furthermore, a detailed Heritage Impact Assessment is included in this assessment which has identified numerous existing cultural and heritage sites which allows for their protection from negative impacts.
2.5.15	In terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	Given the scale of the development, it is not anticipated that the activities will contribute significantly to settlements or areas in terms of direct socio-economic returns however the development will have limited temporary employment opportunities for the locals.
2.6	**How was a risk-averse and cautious approach applied in terms of socio-economic impacts:**	
2.6.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Refer to **Section 1.2** of this report.
2.6.2	What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	The level of risk is considered low as the project is not expected to have far reaching negative impacts on socio-economic conditions.
2.6.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	The limited information relating to the final site-specific location of drill sites will likely be raised by the landowners. Motuoane should provide as much additional information as possible further consultation with the landowners will be held in the EIA phase.
2.7	How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:	
2.7.1	Negative impacts: e.g., health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	Refer to the impact assessment in **Section 7** of this report. Both positive and negative socio-economic impacts have been identified and relevant mitigation measures put forward to reduce negative impacts and enhance positive impacts as far as practicable.
2.7.2	Positive impacts. What measures were taken to enhance positive impacts?	
2.8	Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	
2.9	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	

Ref No.	Question	Answer
2.10	What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	
2.11	What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	By conducting an EIA Process, the applicant ensures that equitable access has been considered. The potential impact on existing land uses has been identified from the start of this application process and an assessment of this impact as well as mitigation measures put forward to prevent undue negative impacts in this regard. Refer to the impact assessment in **Section 7** of this report.
2.12	What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	Refer to the impact assessment in **Section 7** of this report. The EMPr will specify timeframes within which mitigation measures must be implemented.
2.13	What measures were taken to:	
2.13.1	Ensure the participation of all interested and affected parties.	Refer to **Section 6** of this report, describing the public participation process undertaken for the proposed project.
2.13.2	Provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,	Refer to **Section 6** of this report, describing the public participation process undertaken for the proposed project. advertisement, notification letter and site notice have been made available in English, Afrikaans and Sesotho to assist in understanding of the project. Further public consultation will be held during the review period of the Scoping / EIA report for the project. Furthermore, public meetings will be undertaken during the current Scoping phase and also in the EIA phase consultation during which any additional consultation requirements of the I&APs will be identified and addressed where necessary.
2.13.3	Ensure participation by vulnerable and disadvantaged persons,	
2.13.4	Promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,	
2.13.5	Ensure openness and transparency, and access to information in terms of the process,	
2.13.6	Ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge,	

Ref No.	Question	Answer
2.13.7	Ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein will be promoted?	
2.14	Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	
2.15	What measures have been taken to ensure that current and / or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	Potential future workers will have to be educated on a regular basis as to the environmental and safety risks that may occur within their work environment. Furthermore, adequate measures will have to be taken to ensure that the appropriate personal protective equipment is issued to workers based on the conditions that they work in and the requirements of their job.
2.16	Describe how the development will impact on job creation in terms of, amongst other aspects:	
2.16.1	The number of temporary versus permanent jobs that will be created.	It is anticipated that the use of local labour will be utilised as far as possible. Labourers will mostly be sourced from surrounding towns and areas such as Welkom, Virginia and Hennenman. Details in terms of job figures and employment opportunities will be made available for the EIA-phase report.
2.16.2	Whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area).	
2.16.3	The distance from where labourers will have to travel.	
2.16.4	The location of jobs opportunities versus the location of impacts.	
2.16.5	The opportunity costs in terms of job creation.	
2.17	What measures were taken to ensure:	
2.17.1	That there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment.	The Scoping and EIA Process requires governmental departments to communicate regarding any application. In addition, all relevant departments are notified at various phases of the project by the EAP and any feedback received from government departments is considered where relevant.
2.17.2	That actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures.	

Ref No.	Question	Answer
2.18	What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	Environmental attributes that may be impact by this project have been identified and where relevant, specialist input has been solicited to ensure that a rigorous impact assessment process is undertaken. Where positive impacts on the interests of the public have been identified (e.g. job creation, impact on existing land use, etc.), mitigation measures are put forward to enhance positive impacts and/or reduce negative impacts.
2.19	Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	The majority of the proposed mitigation measures for this application are in alignment with the approved adjacent exploration right (Motuoane ER315) EMPr mitigation measures and therefore these measures have been tested in the real world. Refer to the impact assessment and mitigation measures in **Section 7** of this report.
2.20	What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	The proposed survey activities are not anticipated to produce significant pollution, environmental damage or adverse health effects in the long term. Financial provisioning for closure and rehabilitation as well as the rehabilitation plan will be undertaken in the EIA Phase.
2.21	Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	Refer to **Section 5.1**, description of the process followed to reach the proposed preferred site.
2.22	Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	Refer to the impact assessment and mitigation measures in **Section 7**. The impacts will be further explored in the EIA phase and findings thereof presented in the EIA Report and EMPr.

3 POLICY AND LEGISLATIVE CONTEXT

This section provides an overview of the governing legislation identified which may relate to the proposed project. The primary legal requirement for this project stems from the need for an EA to be granted by the competent authority, which is the DMRE, in accordance with the requirements of the NEMA EIA Regulations 2014, as amended. In addition, there are numerous other pieces of legislation governed by many acts, regulations, standards, guidelines and treaties on an international, national, provincial and local level, which should be considered in order to assess the potential applicability of these for the proposed activity. The key legislation applicable to this project is discussed in the subsections below. The contents of this report are based on a review of the information that was available at the time of the compilation of the report. The discussion in this chapter is by no means an exhaustive list of the legal obligations of the applicant in respect of environmental management for the proposed Motuoane ER386 project.

3.1. CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA

The constitution of any country is the supreme law of that country. The Bill of Rights in chapter 2 section 24 of the Constitution of South Africa Act (Act No. 108 of 1996) makes provisions for environmental issues and declares that: *"Everyone has the right -*

a) to an environment that is not harmful to their health or well-being; and

b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:

i. prevent pollution and ecological degradation;

ii. promote conservation; and

iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".

The State must therefore respect, protect, promote and fulfil the social, economic and environmental rights of everyone and strive to meet the basic needs of previously disadvantaged communities. The Constitution therefore recognises that the environment is a functional area of concurrent national and provincial legislative competence, and all spheres of government and all organs of state must cooperate with, consult and support one another if the State is to fulfil its constitutional mandate. The application for the additional activities for the Motuoane Exploration project will ensure that the environmental right enshrined in the Constitution contributes to the protection of the biophysical and social environment.

3.2. THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002

The Mineral and Petroleum Resources Development Act, 2002 (MPRDA) aims to "make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources". The MPRDA outlines the procedural requirements that need to be met to acquire mineral and hydrocarbon rights in South Africa.

In terms of the MPRDA an Exploration Right was required and issued prior to the commencement of any exploration activities. The MPRDA also requires adherence with related legislation, chief amongst them is the National Environmental Management Act (Act No. 107 of 1998, NEMA) and the National Water Act (Act No. 36 of 1998, NWA). Several amendments have been made to the MPRDA. These include, but are not limited to, the amendment of Section 102, concerning amendment of rights, permits, programmes and plans, to requiring the written permission of the Minister for any amendment or alteration; and the section 5A(c) requirement that landowners or land occupiers receive twenty-one (21) days' written notice prior to any activities taking place on their properties. One of the most recent amendments requires all mining related activities to follow the full NEMA process as per the 2014 EIA Regulations, which came into effect on 8 December 2014.

An Exploration Right is exclusive, transferable, valid for 3 years, and renewable for a maximum of 3 periods of 2 years each. Exploration is very similar to prospecting, in that an Exploration Right only allows the holder of the

right to conduct such activities as per the Exploration Works Programme to establish the presence of economically viable hydrocarbon resources. An exploration right does not grant the holder the right to conduct any production related activities. Motuoane submitted an application for an ER in October 2024 and was accepted on the 22nd of October 2024 (PASA Ref: 12/3/386). In support of the ER application, the applicant is required to conduct an EIA process comprising of the preparation of environmental Scoping and EIA Reports, an EMPr, as well as Interested and Affected Party (I&AP) consultations, all of which must be submitted to the PASA for adjudication. This report has been compiled in accordance with Regulation 21 and Appendix 2 of the EIA Regulations (2014, as amended) in order to satisfy the criteria for a Scoping Report.

3.3. THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998

The main aim of the National Environmental Management Act, 1998 (Act 107 of 1998 – NEMA) is to provide for co-operative governance by establishing decision-making principles on matters affecting the environment. In South Africa, EIAs became a legal requirement in 1997 with the promulgation of regulations under the Environment Conservation Act (ECA). Subsequently, NEMA was passed in 1998. Section 24(2) of NEMA empowers the Minister and any MEC, with the concurrence of the Minister, to identify activities which must be considered, investigated, assessed and reported on to the competent authority responsible for granting the relevant EA. On 21 April 2006, the Minister of Environmental Affairs and Tourism (now Department of Forestry, Fisheries and the Environment – DFFE) promulgated regulations in terms of Chapter 5 of the NEMA. These regulations, in terms of the NEMA, were amended several times between 2010 and 2022. The NEMA EIA Regulations, 2014, as amended, are the current regulations.

The objective of the EIA Regulations is to establish the procedures that must be followed in the consideration, investigation, assessment and reporting of the listed activities that are triggered by the proposed project. The purpose of these procedures is to provide the competent authority with adequate information to make informed decisions which ensure that activities which may impact negatively on the environment to an unacceptable degree are not authorised, and that activities which are authorised are undertaken in such a manner that the environmental impacts are managed to acceptable levels. In accordance with the provisions of Sections 24(5) and Section 44 of the NEMA the Minister has published Regulations (GN R. 982) pertaining to the required process for conducting EIAs in order to apply for, and be considered for, the issuing of an EA. These EIA Regulations provide a detailed description of the EIA process to be followed when applying for EA for any listed activity.

Based on review on the NEMA EIA Regulations, 2014 as amended, the applicant is required to appoint an EAP to undertake a Scoping and EIA Application process for the proposed project, which includes conducting the public participation process (refer to **Section 6**). An environmental Scoping and Impact Assessment process is reserved for activities which have the potential to result in significant impacts which are complex to assess. Scoping and Impact Assessment studies accordingly provide a mechanism for the comprehensive assessment of activities that are likely to have more significant environmental impacts. **Figure 6** below provides a graphic representation of all the components of a full EIA process. The listed activities the proposed project triggers and consequently requires authorisation prior to commencement are detailed in **Section 2.5** (**Table 7**).

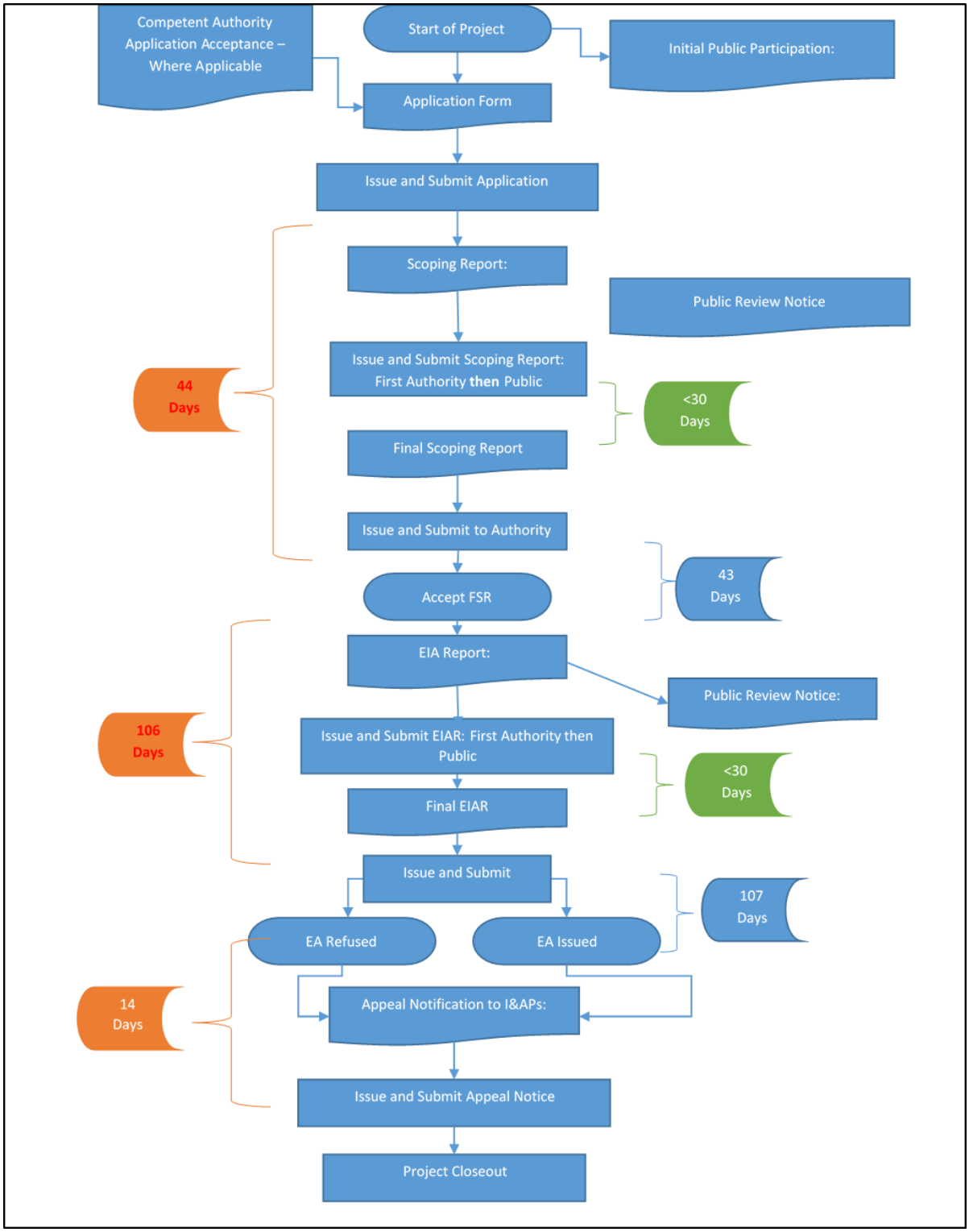


Figure 6: EIA process diagram.

NEMA is the main Environmental Legislation in South Africa and other Specific Environmental Management Acts (SEMA's) support its objectives. Examples of SEMA's include the following:

- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008);
- National Water Act, 1998 (Act No. 36 of 1998);
- National Heritage Resources Act, 1999 (Act No. 25 of 1999);

- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004); and
- National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004).

Some specific Environmental Management Legislation is discussed in **Sections 3.5 to 3.21.** The key principles of NEMA as outlined in Chapter 3 can be summarised as follows:

- sustainability must be pursued in all developments to ensure that biophysical and socio-economic aspects are protected; or
- there must be equal access to environmental resources, services and benefits for all citizens including the disadvantaged and the vulnerable. Adverse environmental impacts shall be distributed fairly among all citizens;
- environmental governance must include the participation of all interested and affected parties who must be catered for to allow their effective participation; and
- Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.

The polluter pays principle (Section 28 of NEMA) must be applied in all cases where any person has caused pollution or undertaken any action that led to the degradation of the environment.

3.4. NEMA ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014 AS AMENDED

In terms of section 24(2) of NEMA, the Minister and or any MEC in concurrence with the Minister may identify activities that require authorisation as these activities may negatively affect the environment. The Act requires that in such cases the impacts must be considered, investigated and assessed before their implementation, and reported to the organ of state charged by law with authorising, permitting, or otherwise allowing the implementation of an activity. The NEMA EIA Regulations guide the processes required for the assessment of impacts of Listed Activities.

The requirement for the undertaking of Environmental Impact Assessments or Basic Assessments began in 1997 with the promulgation of the EIA Regulations under the Environment Conservation Act, 1989 (ECA) (Act No. 73 of 1989). These were followed by the 2006, 2010 and 2014 regulations. **Table 9** is a summary of the progression of the EIA regulations to date.

Table 9: Summary of the South African EIA regulations from inception to date.

EIA Regulations	Government Gazette
EIA Regulations promulgated in terms of the ECA, Act No 73 of 1989	GNR 1182 & 1183: Government Gazette No 18261, 5 September 1997
Amendment of the ECA EIA Regulations	GNR 670 and GNR 672 of 10 May 2002, Government Gazette No 23401
2006 EIA Regulations promulgated in terms of the NEMA, Act No 107 of 1998	GNR 385, 386 and 387 Government Gazette No 28753, Pretoria, 21 April 2006
2010 EIA Regulations promulgated in terms of the NEMA, Act No 107 of 1998	GNR 543, 544, 545 and 546 Government Gazette No 33306, Pretoria, 18 June 2010
2014 EIA Regulations promulgated in terms of the NEMA, Act No 107 of 1998	GNR 982, 983, 984 and 985 Government Gazette No 38282, Pretoria, 04 December 2014
Current Amendment of the 2014 EIA Regulations promulgated in terms of the NEMA, Act No 107 of 1998	GNR 982, 983, 984 and 985 Government Gazette No 44701, Pretoria, 2021 as amended

3.5. THE NATIONAL WATER ACT, 1998

National Water Act, 1998 (Act 36 of 1998 – NWA) makes provision for two types of applications for water use licences, namely individual applications and compulsory applications. The NWA also provides that the responsible authority may require an assessment by the applicant of the likely effect of the proposed licence on the resource quality, and that such assessment be subject to the NEMA EIA Regulations. A person may use water if the use is –

- Permissible as a continuation of an existing lawful water use (ELWU);
- Permissible in terms of a general authorisation (GA);
- Permissible under Schedule 1; or
- Authorised by a licence.

The water use processes are described in **Figure 7.**

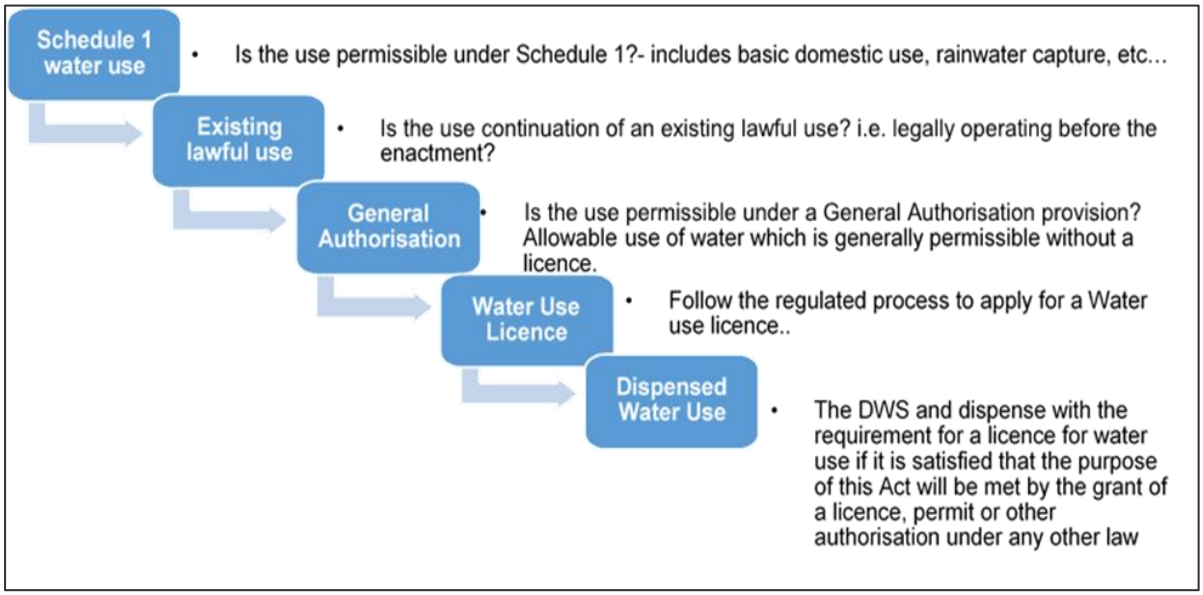


Figure 7: Authorisation processes for new water uses.

The purpose of the NWA is to ensure that the nation's water resources are protected, used, developed, conserved and managed in ways that take into account:

- Meeting basic human needs of present and future generations;
- Promoting equitable access to water;
- Redressing the results of past racial discrimination;
- Promoting the efficient, sustainable and beneficial use of water in the public interest; facilitation social and economic development;
- Providing for the growing demand for water use;
- Protecting aquatic and associated ecosystems and their biological diversity;
- Reducing and preventing pollution and degradation of water resources;
- Meeting international obligations;
- Promoting dam safety; and

- Managing floods and drought.

The NWA defines 11 water uses in Section 21 of the Act. A water use may only be undertaken if authorised by the Department of Water and Sanitation (DWS). The water uses for which an authorisation or licence can be issued include:

a) Taking water from a water resource;

b) Storing water;

c) Impeding or diverting the flow of water in a watercourse;

d) Engaging in a stream flow reduction activity contemplated in section 36;

e) Engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);

f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduits;

g) Disposing of waste in a manner which may detrimentally impact on a water resource;

h) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;

i) Altering the bed, banks, course or characteristics of a watercourse;

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; and

k) Using water for recreational purposes.

The regulated area of a watercourse for section 21 activities of the Act water uses is similarly defined in terms of the Act as follows:

a) The outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;

b) In the absence of a determined 1 in 100-year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or

c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

As part of the NWA, and with specific reference the GNR704 of 1999 has been published. These regulations impose specific restrictions on activities in terms of its locality. One of these restrictions are in terms of Regulation 4(c) saying that no person in control of a mine or activity, may place or dispose of any residue or substance which causes or is likely to cause pollution of water resources, prospecting diggings, pit or any other excavation. If the waste classification results reflect pollution potential, an applicant will therefore have to apply for exemption from GNR704 in order to undertaken concurrent rehabilitation. If no pollution potential is revealed by the classification results, no exemption is required. GNR704 also prescribes the design and construction of pollution control dams. Based on specialist assessments, there may be a need for a General Authorisation (GA) for the drilling wells within the ER which will be based on final drilling location. Therefore, **the applicant must ensure that the final seismic survey transect and/or drilling locations either do not trigger the NWA or an authorisation is obtained prior to undertaking the activities**.

3.6. THE NATIONAL ENVIRONMENTAL MANAGEMENT LAWS AMENDMENT ACT, 2022

The National Environmental Laws Amendment Act, known as 'the NEMLA Bill' or 'NEMLAA4' (Act No. 2 of 2022), finally became an Act on 24 June 2022 and will introduce a major shift in South Africa's environmental legislation on a date to be fixed and proclaimed by the President. Act No. 2 of 2022 – undoubtedly the most significant

piece of environmental legislation that has been published since the implementation of the One Environmental System (OES) in 2014 – has finally been signed into law (the Act). Many of the changes under NEMLA are intended to clean up a range of issues associated with the roll-out of the OES – which overhauled the manner in which environmental issues are regulated on mine sites, among other things. Overall, the changes imposed by the Act aim to deter non-compliance with environmental laws by, among other things, introducing new offences, increasing the quantum of fines and administrative penalties where laws or licenses have been contravened, and extending enforcement powers to enable more widespread enforcement of environmental laws. The applicant must ensure that the activities take into consideration the changes stipulated under NEMLA. A review of NEMLA and its impact on the development may be applicable should the developer fail to comply with the legislation discussed in this report, the EA and/or any other authorizations / licenses applicable to the development. The applicant (Motuoane) may face harsh penalty fines should they fail to comply with NEMA EIA Regulations, 2014 as amended and/or specific conditions which will be stipulated in the Environmental Authorization by the competent authority.

3.7. THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008

On 2 June 2014, the National Environmental Management: Waste Amendment Act came into force. The Waste Act places a general duty on a holder of waste to avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated; reduce, re-use, recycle and recover waste; where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner; manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts; prevent any employee or any person under his or her supervision from contravening the Act; and prevent the waste from being used for an unauthorised purpose. Waste is accordingly no longer governed by the MPRDA but is subject to all the provisions of the National Environmental Management: Waste Act, 2008 (NEMWA).

Section 16 of the NEMWA must also be considered which states as follows:

1. A holder of waste must, within the holder's power, take all reasonable measures to-

    a) "*Avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;*

    b) Reduce, re-use, recycle and recover waste;

    c) Where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;

    d) Manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour, or visual impacts;

    e) Prevent any employee or any person under his or her supervision from contravening the Act; and

    f) *Prevent the waste from being used for unauthorised purposes.*"

These general principles of responsible waste management will be incorporated into the requirements in the EMPr to be implemented for this project. Waste can be defined as either hazardous or general in accordance with Schedule 3 of the NEMWA (2014) as amended. "Schedule 3: Defined Wastes" has been broken down into two categories – Category A being hazardous waste; and Category B being general waste.

In order to attempt to understand the implications of these waste groups, it is important to ensure that the definitions of all the relevant terminologies are defined:

- Hazardous waste: means "*any waste that contains organic or inorganic elements or compounds that may, owning to the inherent physical, chemical or toxicological characteristic of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles*."

- Residue deposits: means "*any residue stockpile remaining at the termination, cancellation or expiry of a prospecting right, mining right, mining permit, exploration right or production right*."
- Residue stockpile: means "*any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, mineral processing plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated within the mining area for potential re-use, or which is disposed of, by the holder of a mining right, mining permit or, production right or an old order right, including historic mines and dumps created before the implementation of this Act*."
- General waste: means "*waste that does not pose an immediate hazard or threat to health or to the environment and includes – domestic waste; building and demolition waste; business waste; inert waste; or any waste classified as non-hazardous waste in terms of the regulations made under Section 69*."

The Waste Classification and Management Regulations (GNR 634) pertain to waste classification and management, including the management and control of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation which is relevant to the proposed project. The purpose of these Regulations is to –

- Regulate the classification and management of waste in a manner which supports and implements the provisions of the Act;
- Establish a mechanism and procedure for the listing of waste management activities that do not require a Waste Management Licence;
- Prescribe requirements for the disposal of waste to landfill;
- Prescribe requirements and timeframes for the management of certain wastes; and
- Prescribe general duties of waste generators, transporters and managers.

Waste classification, as presented in Chapter 4 of these regulations, entails the following:

- Wastes listed in Annexure 1 of these Regulations do not require classification in terms of SANS 10234;
- Subject to sub regulation (1), all waste generators must ensure that the waste they generate is classified in accordance with SANS 10234 within one hundred and eighty (180) days of generation;
- Waste must be kept separate for the purposes of classification in terms of sub regulation (2), and must not be mixed prior to classification;
- Waste-must be re-classified in terms of sub regulation (2) every five (5) years, or within 30 days of modification to the process or activity that generated the waste, changes in raw materials or other inputs, or any other variation of relevant factors;
- Waste that has been subjected to any form of treatment must be re-classified in terms of sub regulation (2), including any waste from the treatment process; and
- If the Minister reasonably believes that a waste has not been classified correctly in terms of sub regulation (2), he or she may require the waste generator to have the classification peer reviewed to confirm the classification.

Furthermore, Chapter 8 of the Regulations stipulates that unless otherwise directed by the Minister to ensure a better environmental outcome, or in response to an emergency so as to protect human health, property or the environment –

- Waste generators must ensure that their waste is assessed in accordance with the Norms and Standards for Assessment of Waste for Landfill Disposal set in terms of section 7(1) of the Act prior to the disposal of the waste to landfill;

- Waste generators must ensure that the disposal of their waste to landfill is done in accordance with the Norms and Standards for Disposal of Waste to Landfill set in terms of section 7(1) of the Act; and
- Waste managers disposing of waste to landfill must only do so in accordance with the Norms and Standards for Disposal of Waste to Landfill set in terms of section 7 (1) of the Act.

The anticipated waste to be generated based on similar adjacent work (Motuoane ER315) includes both general and hazardous waste streams. The waste must be managed accordingly and be disposed by a certified hazardous waste service provider at a registered hazardous landfill site. Although it is not anticipated that hazardous waste will be stored for prolonged periods on site (i.e. over 3 months), should for unforeseen reasons the hazardous waste be stored on site exceeding 3 months, the storage and disposal of the drill waste must be handled accordingly and therefore the relevant waste listed activities for storage must be applied for.

3.8. THE NATIONAL HERITAGE RESOURCES ACT, 1999

The National Heritage Resources Act (Act 25 of 1999 – NHRA) stipulates that cultural heritage resources may not be disturbed without authorisation from the relevant heritage authority. Section 34(1) of the NHRA states that, "*no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…*" The NHRA is utilised as the basis for the identification, evaluation and management of heritage resources and in the case of Cultural Resource Management (CRM) those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through the NEMA, the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA) and the Development Facilitation Act (FDA) legislation. In the latter cases the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorisations are granted for a development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impact Processes required by the NEMA and MPRDA.

The MPRDA defines 'environment' as it is in the NEMA and, therefore, acknowledges cultural resources as part of the environment. Section 39(3)(b) of this Act specifically refers to the evaluation, assessment and identification of impacts on all heritage resources as identified in Section 3(2) of the NHRA that are to be impacted on by activities governed by the MPRDA. Section 40 of the same Act requires the consultation with any State Department administering any law that has relevance on such an application through Section 39 of the MPRDA. This implies the evaluation of Heritage Assessment Reports in Environmental Management Plans or Programmes by the relevant heritage authorities.

A Heritage Impact Assessment for the proposed activities will be undertaken by Dr Lucien James of EIMS and will be discussed in detail in the EIA Phase. Based on the Scoping Phase HIA Report, there are thirty-two (32) heritage features inclusive of structures, buildings, or complexes as well as three grave sites within the ER. It is proposed that buffers be placed around each of these features, with proposed activities not taking place within 30m of the buildings or structures, and 50m of the grave sites. If the buffers are adhered to, these known features will be avoided, and in doing so, there will be little to no impact on the features. A summary of the findings, impacts and mitigation measures is provided in **Sections 4.6 and 7.3** and in detail in the baseline specialist reports (**Appendix F**) and Impact Assessment Matrix (**Appendix G**).

The South African Heritage Resources Agency (SAHRA), the Free State Heritage Resources Authority (FSHRA) and Association of Southern African Professional Archaeologists (ASAPA) will be provided with a copy of the Scoping Report for review and comment.

3.9. THE NATIONAL ENVIRONMENTAL MANAGEMENT AIR QUALITY ACT, 2004

The National Environmental Management: Air Quality Act (Act No. 39 of 2004 as amended – NEMAQA) is the main legislative tool for the management of air pollution and related activities. The Object of the Act is:

To protect the environment by providing reasonable measures for –

i. the protection and enhancement of the quality of air in the republic;

ii. the prevention of air pollution and ecological degradation; and

iii. securing ecologically sustainable development while promoting justifiable economic and social development.

Generally, to give effect to Section 24(b) of the constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of people. The NEMAQA mandates the Minister of Environment to publish a list of activities which result in atmospheric emissions and consequently cause significant detrimental effects on the environment, human health and social welfare. All scheduled processes as previously stipulated under the Air Pollution Prevention Act (APPA) are included as listed activities with additional activities being added to the list. The updated Listed Activities and Minimum National Emission Standards were published on the 22nd of November 2013 (Government Gazette No. 37054).

According to the NEMAQA, air quality management control and enforcement is in the hands of local government with District and Metropolitan Municipalities as the licensing authorities. Provincial government is primarily responsible for ambient monitoring and ensuring municipalities fulfil their legal obligations, with national government primarily as policy maker and co-ordinator. Each sphere of government must appoint an Air Quality Officer responsible for co-ordinating matters pertaining to air quality management. Given that air quality management under the old Act was the sole responsibility of national government, local authorities have in the past only been responsible for smoke and vehicle tailpipe emission control.

Listed Activities and Associated Minimum Emission Standards Identified in terms of Section 21 of the NEMAQA Published under GN 893 in GG 37054 of 22 November 2013 were assessed to determine if the proposed development triggers any of the identified activities. Based on the assessment, the proposed project, the activities do not trigger listed activities under NEMAQA. Subsequently, there is no requirement to apply for an Atmospheric Emission Licences (AEL) for the proposed activities.

The National Pollution Prevention Plans Regulations were published in March 2014 (Government Gazette 37421) and tie in with the National Greenhouse Gas (GHG) Emission Reporting Regulations which took effect on 3 April 2017. In summary, the Regulations aim to prescribe the requirements that pollution prevention plans of greenhouse gases declared as priority air pollutants, need to comply with in terms of the NEMAQA. The Regulations specify who needs to comply, and by when, as well as prescribing the content requirements. Based on the proposed activities (exploration), the applicant does not trigger listed activities and therefore does not need to report GHG Emissions. However, should the activities proceed to production phase, the applicant will be obligated to report on the GHG emissions under these Regulations due to 1b2 listed activities. There will be a requirement to account for the amount of pollutants discharged into the atmosphere (total emissions for one or more specific GHG pollutants) by 31 March each year.

3.10. THE NATIONAL ENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT, 2004

The objective of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) is to provide for the management and conservation of South Africa's biodiversity within the framework of NEMA; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith. The objectives of NEM:BA are within the framework of the National Environmental Management Act, to provide for:

- the management and conservation of biological diversity within the Republic and of the components of such biological diversity;
- the use of indigenous biological resources in a sustainable manner; and
- the fair and equitable sharing among stakeholders of benefits arising from bioprospecting involving indigenous biological resources;

- to give effect to ratified international agreements relating to biodiversity which are binding on the Republic;
- to provide for co-operative governance in biodiversity management and conservation; and
- to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

3.10.1 THREATENED OR PROTECTED SPECIES REGULATIONS, 2015

Chapter 4, Part 2 of NEMBA provides for the listing of Threatened or Protected Species (TOPS). Species listed as such, in terms of the TOPS Regulations (2015) and the TOPS Lists of Species (2015), are further classified as Threatened (Critically Endangered, Endangered and Vulnerable) or Protected. The Act defines these classes as follows:

- Critically Endangered species: any indigenous species facing an extremely high risk of extinction in the wild in the immediate future;
- Endangered species: any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species;
- Vulnerable species: any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species; and
- Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). However, according to the terrestrial biodiversity studies that were undertaken, the project area is not located within any protected areas or formal conservation areas.

The TOPS Regulations (2015) further regulate the permit system set out in NEMBA as it applies to restricted activities involving specimens of listed threatened or protected species, where restricted activities involve those activities that have a direct impact on listed species such as hunting, catching, collecting, picking, chopping off, damaging or destroying, importing and export from Republic, possessing, keeping or exercising physical control over, breeding or propagating, conveying or translocating, selling or buying, receiving or donating or any other prescribed activity involving a TOPS specimen.

According to the Baseline Terrestrial Biodiversity Assessment Report (**Appendix F**), undertaken by The Biodiversity Company (2025), the project area is situated within the Grassland biome. The Grassland biome is centrally located in southern Africa, and adjoins all except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006). Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. The project area overlaps with the Central Free State Grassland (Vulnerable), Highveld Alluvial Vegetation (Least Threatened), Vaal-Vet Sandy Grassland (Endangered) and Winburg Grassy Shrubland (Least Threatened) vegetation units. No sensitive flora species are listed as likely to occur in the ER, however, one (1) reptile species and two (2) mammal species are likely to occur. Twenty-one (21) avifauna species within the ER are threatened. Moreover, two high sensitivity and one medium-high sensitivity species are listed by the DFFE screening tool. According to the list of protected species under Schedule, if any individuals of these plant species are to be disturbed, permits must be obtained from the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs (FSDESTEA).

3.10.2 ALIEN AND INVASIVE SPECIES REGULATIONS, 2014

NEMBA is the most recent legislation pertaining to alien invasive plant (AIP) species. In August 2014, the list of Alien Invasive Species was published in terms of the NEMBA. The Alien and Invasive Species Regulations were published in the Government Gazette No. 44182, 24th of February 2021. The legislation calls for the removal and / or control of AIP species (Category 1 species). In addition, unless authorised thereto in terms of the NWA, no

land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within proximity to a watercourse. Below is a brief explanation of the three categories in terms of the NEMBA:

- Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
- Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
- Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
- Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

Note that according to the Alien and Invasive Species Regulations, a person who has under his or her control a category 1b listed invasive species must immediately:

- Notify the competent authority in writing.
- Take steps to manage the listed invasive species in compliance with:
    - Section 75 of the NEMBA; and
    - The relevant invasive species management programme developed in terms of regulation 4.

An assessment of IAP species within the project area will be assessed as part of the Terrestrial Biodiversity Impact Assessment during the EIA phase. These species (if any) will be listed under the Alien and Invasive Species List 2020, Government Gazette No. GN1003.

3.11. THE MINING AND BIODIVERSITY GUIDELINES

The Mining and Biodiversity Guidelines (2013) was developed by the Department of Mineral Resources, the Chamber of Mines, the SANBI and the South African Mining and Biodiversity Forum, with the intention to find a balance between economic growth and environmental sustainability. The Guideline is envisioned as a tool to "foster a strong relationship between biodiversity and mining, which will eventually translate into best practice within the mining sector. It provides a tool to facilitate the sustainable development of South Africa's mineral resources, in a way that enables regulators, industry and practitioners to minimise the impact of mining on the country's biodiversity and ecosystem services. It provides the mining sector with a practical, user- friendly manual for integrating biodiversity considerations into the planning processes and managing biodiversity during the operational phases of a mine, from exploration through to closure. The Guideline provides explicit direction in terms of where: mining-related impacts are legally prohibited; biodiversity priority areas may present high risks for mining projects; and biodiversity may limit the potential for mining."

In identifying biodiversity priority areas, which have different levels of risk against mining, the Guideline categorises biodiversity priority areas into four categories of biodiversity priority areas in relation to their importance from a biodiversity and ecosystem service point of view as well as the implications for mining in these areas:

A) Legally protected areas, where mining is prohibited;

B) Areas of highest biodiversity importance, which are at the highest risk for mining;

C) Areas of high biodiversity importance, which are at a high risk for mining; and

D) Areas of moderate biodiversity importance, which are at a moderate risk for mining.

The proposed activities are located with Category B (highest risk for mining) but importantly does not fall within Category A and therefore, not prohibited from mining activities (**Figure 8**). The implications for the proposed activity in terms of the risk categories implies that environmental screening, environmental impact assessment (EIA) and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, and to provide site-specific basis on which to apply the mitigation hierarchy to inform regulatory decision-making for mining, water use licenses, and EAs. This assessment should fully consider the environmental sensitivity of the area, the overall environmental and socio-economic costs, and benefits of mining, as well as the potential strategic importance of the minerals to the country. Authorisations may well not be granted. If granted, the authorisation may set limits on allowed activities and impacts and may specify biodiversity offsets that would be written into license agreements and/or authorisations.

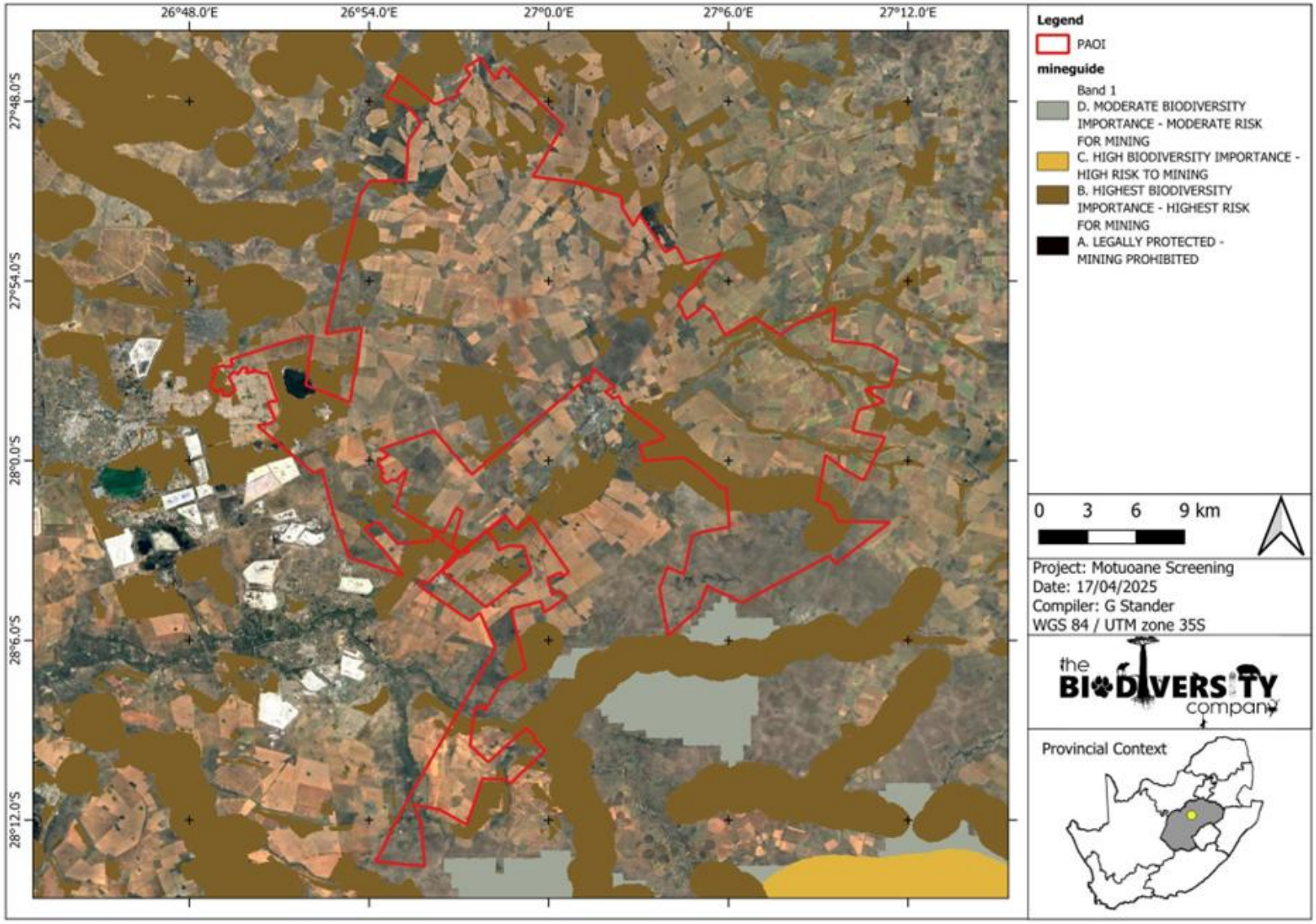


Figure 8: The project area in relation to the Mining and Biodiversity Guidelines (The Biodiversity Company, 2025).

3.12. THE NATIONAL ENVIRONMENTAL MANAGEMENT PROTECTED AREAS ACT, 2003

The National Environmental Management: Protected Areas Act (Act 57 of 2003) serves to: "provide for the protection and conservation of ecologically viable areas representative of South Africa's biological biodiversity and its natural landscapes and seascape; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; for the continued existence, governance and functions of South African National Parks; and for matters in connection therewith.

The objectives of this Act are –

a) to provide, within the framework of the national legislation, including the National Environmental Management Act, for the declaration and management of protected areas;

b) to provide for co-operation governance in the declaration and management of protected areas;

c) to effect a national system of protected areas in South Africa as part of a strategy to manage and conserve its biodiversity;

d) to provide for a diverse and representative network of protected areas on state land, private land, communal land and marine water;

e) to promote sustainable utilisation of protected areas for the benefit of people, in a manner that would preserve the ecological character of such areas;

f) to promote participation of local communities in the management of protected areas, when appropriate; and

g) to provide for the continued existence of South African National Parks

According to the Baseline Terrestrial Biodiversity Assessment undertaken by the Biodiversity Company (**Appendix F**), the project area overlaps with the Thabong Game Reserve and falls within >5 km of Tara Wildlife Safaris, Newlands Game Ranch, De Rust Private Nature Reserve and Goliatskraal Private Nature Reserve. However, it must be noted that the Thabong Game Reserve remains a game reserve only on outdated GIS information. The area earmarked as Thabong Game Reserve is currently known as Harmony Cluster, it is used for mining, residential and grazing activities.

3.13. THE NATIONAL ENERGY ACT, 2008

The National Energy Act (Act 34 of 2008) provides to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors; to provide for energy planning, increased generation and consumption of renewable energies, contingency energy supply, holding of strategic energy feedstock's and carriers, adequate investment in, appropriate upkeep and access to energy infrastructure; to provide measures for the furnishing of certain data and information regarding energy demand, supply and generation; to establish an institution to be responsible for promotion of efficient generation and consumption of energy and energy research; and to provide for all matters connected therewith. Importantly, the Department of Energy (DoE) is mandated to provide for energy planning and measures for the furnishing of certain data and information regarding energy demand, supply and generation. The objectives of this Act are to-

a) ensure uninterrupted supply of energy to the Republic;

b) promote diversity of supply of energy and its sources;

c) facilitate effective management of energy demand and its conservation;

d) promote energy research;

e) promote appropriate standards and specifications for the equipment, systems and processes used for producing, supplying and consuming energy;

f) ensure collection of data and information relating to energy supply, transportation and demand;

g) provide for optimal supply, transformation, transportation, storage and demand of energy that are planned, organised and implemented in accordance with a balanced consideration of security of supply, economics, consumer protection and a sustainable development;

h) provide for certain safety, health and environment matters that pertain to energy;

i) facilitate energy access for improvement of the quality of life of the people of Republic;

j) commercialise energy-related technologies;

k) ensure effective planning for energy supply, transportation and consumption; and

l) contribute to sustainable development of South Africa's economy.

The Act provides for the establishment of the South African National Energy Development Institution (SANEDI), whose functions include:

a) energy efficiency-

i. undertake energy efficiency measures as directed by the Minister;

ii. increase energy efficiency throughout the economy;

iii. increase the gross domestic product per unit of energy consumed; and

iv. optimise the utilisation of finite energy resources;

b) energy research and development-

i. direct, monitor, conduct and implement energy research and technology development in all fields of energy, other than nuclear energy; and

ii. promote energy research and technology innovation;

iii. provide for-

(aa) training and development in the field of energy research and technology development;

(bb) establishment and expansion of industries in the field of energy; and

(cc) commercialisation of energy technologies resulting from energy research and development programmes;

i. register patents and intellectual property in its name resulting from its activities;

ii. issue licences to other persons for the use of its patents and intellectual property;

iii. publish information concerning its objects and functions;

iv. establish facilities for the collection and dissemination of information in connection with research, development and innovation;

v. undertake any other energy technology development related activity as directed by the Minister, with the concurrence of the Minister of Science and Technology;

vi. promote relevant energy research through cooperation with any entity, institution or person equipped with the relevant skills and expertise within and outside the Republic;

vii. make grants to educational and scientific institutions in aid of research by their staff or for the establishment of facilities for such research;

viii. promote the training of research workers by granting bursaries or grants-in-aid for research;

ix. undertake the investigations or research that the Minister, after consultation with the Minister of Science and Technology, may assign to it; and

x. advise the Minister and the Minister of Science and Technology on research in the field of energy technology.

The White Paper on the Energy Policy (1998) is the overarching policy document that guides future policy and planning in the energy sector. It states that the government will, inter alia, "promote the development of South Africa's oil and gas resources…" and "ensure private sector investment and expertise in the exploitation and development of the country's oil and gas resources". The successful exploitation of these natural resources would contribute to the growth of the economy. The applicant is line with the National Development Plan (NDP) and the Draft Integrated Energy Plan (IEP).

3.14. THE MINE HEALTH AND SAFETY ACT, 1996

The Mine Health and Safety Act, 1996 (Act No. 29 of 1996) provides for protection of the health and safety of employees and other persons at mines and, for that purpose-

- to promote a culture of health and safety;
- to provide for the enforcement of health and safety measures;
- to provide for appropriate systems of employee, employer and State participation in health and safety matters;
- to establish representative tripartite institutions to review legislation, promote health and enhance properly targeted research;
- to provide for effective monitoring systems and inspections, investigations and inquiries to improve health and safety;
- to promote training and human resources development;
- to regulate employers' and employees' duties to identify hazards and eliminate, control and minimise the risk to health and safety;
- to entrench the right to refuse to work in dangerous conditions; and
- to give effect to the public international law obligations of the Republic relating to mining health and safety;
- and to provide for matters connected therewith.

With specific reference to the Regulations (GN R93 of 1997) published under this Act, the following has reference to this proposed project:

17(6) The employer must take reasonable measures to ensure that the competent person referred to in regulation 17(2)(a) in writing notifies the employer, which notification must be dated, of any workings being advanced to come within: -

> *(a) a horizontal distance of 100 (one hundred) metres from reserve land, buildings, roads, railways, dams, waste dumps or any other structure whatsoever including structures beyond the mining boundaries, or from any surface, which it may be necessary to protect in order to prevent any significant risk;*
>
> *(b) 50 (fifty) metres from any excavation, workings, restricted area or any other place where there is, or is likely to be a dangerous accumulation of fluid material, noxious or flammable gas. Such notification must include a sketch plan giving the distance to such place from the nearest survey station.*

17(7) The employer must take reasonable measures to ensure that: -

> *(a) no mining operations are carried out within a horizontal distance of 100 (one hundred) metres from reserve land, buildings, roads, railways, dams, waste dumps, or any other structure whatsoever*

including such structures beyond the mining boundaries, or any surface, which it may be necessary to protect in order to prevent any significant risk, unless a lesser distance has been determined safe by risk assessment and all restrictions and conditions determined in terms of the risk assessment are complied with;

(b) workings coming within 50 (fifty) metres, from any other excavation, workings, restricted area or any other place where there is, or is likely to be a dangerous accumulation of fluid material, noxious or flammable gas are mined subject to such restrictions and stopped at such positions as determined by risk assessment.

(c) where ground movement, as a result of mining operations, poses significant risk, an effective ground movement monitoring system is in place.

(d) survey records and plans relating to conditions described in paragraphs (a) and (b) above, are made available to the persons doing the risk assessment.

17(8) No person may erect, establish or construct any buildings, roads, railways, dams, waste dumps, reserve land, excavations or any other structures whatsoever within a horizontal distance of 100 (one hundred) metres from workings, unless a lesser distance has been determined safe:-

(a) in the case of the employer, by risk assessment and all restrictions and conditions determined in terms of the risk assessment are complied with; or

(b) in the case of any other person, by a professional geotechnical specialist and all restrictions and conditions determined by him or her or by the Chief Inspector of Mines are complied with.

The Mine Health and Safety Act and associated Regulations will be applicable to the Motuoane Exploration Rights project.

3.15. THE CONSERVATION OF AGRICULTURAL RESOURCES ACT, 1983

The Conservation of Agricultural Resources (Act 43 of 1983) aims to provide for the conservation of the natural agricultural resources of the Republic by the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants. In order to achieve the objectives of this Act, control measures related to the following may be prescribed to land users to whom they apply:

- The cultivation of virgin soil;
- The utilisation and protection of land which is cultivated;
- The irrigation of land;
- The prevention or control of waterlogging or salination of land;
- The utilisation and protection of vleis, marshes, water sponges, water courses and water sources;
- The regulating of the flow pattern of run-off water;
- The utilisation and protection of the vegetation;
- The grazing capacity of veld, expressed as an area of veld per large stock unit;
- The maximum number and the kind of animals which may be kept on veld;
- The prevention and control of veld fires;
- The utilisation and protection of veld which has burned;
- The control of weeds and invader plants;
- The restoration or reclamation of eroded land or land which is otherwise disturbed or denuded;

- The protection of water sources against pollution on account of farming practices;
- The construction, maintenance, alteration or removal of soil conservation works or other structures on land; and
- Any other matter which the Minister may deem necessary or expedient in order that the objects of this Act may be achieved.

Further, different control measures may be prescribed in respect of different classes of land users or different areas or in such other respects as the Minister may determine. Preliminary impacts on the agriculture and soil, biodiversity and water resources have been identified with regards to this project, and mitigation and management measures recommended.

3.16. THE NATIONAL WEB-BASED ENVIRONMENT SCREENING TOOL, 2019

On the 5th of July 2019, The Department of Forestry, Fisheries and the Environment (DFFE) issued a Notice of the requirement to submit a report generated by the National Web-based Environmental Screening Tool in terms of section 24(5)(h) of the NEMA, 1998 (Act No 107 of 1998) and Regulation 16(1)(b)(v) of the EIA regulations, 2014, as amended. The submission of this report is compulsory when applying for environmental authorisation in terms of Regulation 19 and Regulation 21 of the Environmental Impact Assessment Regulations, 2014 effective from the 4th of October 2019. The DFFE Screening Tool Report was initially generated on the 10th of January 2025 then revised on the 16th of April 2025 due to a slight change in ER footprint. The Screening report is provided in **Appendix D** of this report. The main findings to be discussed from the screening report are listed below.

The following summary of the study area's environmental sensitivities were identified in the Environmental Screening Report. The environmental sensitivities for the proposed development footprint are indicated in **Table 10**.

Table 10: Environmental Sensitivity of Project Area as per the DFFE Screening Tool Report.

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Agriculture Theme	X			
Animal Species Theme		X		
Aquatic Biodiversity Theme	X			
Archaeological and Cultural Heritage Theme	X			
Civil Aviation Theme		X		
Defence Theme				X
Palaeontology Theme	X			
Plant Species Theme				X
Terrestrial Biodiversity Theme	X			

The information collected by the specialists and EAP's assessment may be used to confirm or dispute (as may be applicable) the environmental sensitivity ratings identified by the National Screening Tool. The outcome of the verification process by the specialists' assessments &EAP's site sensitivity verification of the sensitivity ratings identified by the Screening Tool are summarized in **Table 11** below. Pages 36 and 37 on the DFFE Screening Report indicates that certain Specialist Assessments must be undertaken for the proposed development. There is however an allowance of the EAP to motivate for the reasons for not including certain assessments in the assessment report. **Table 12** presents these Specialist Assessments/Studies as well as the motivations behind the EAP's decision of recommending or not recommending the undertaking of certain Specialist Assessments.

Table 11: DFFE's Screening Tool Report Sensitivity Verification by Specialist Assessments.

Assessment Theme	Sensitivity Rating as per Screening Report	Sensitivity Rating (Specialist Verification)	Specialist's Response
Agriculture Theme	High	**Medium**	Relative Agricultural Sensitivity was confirmed to be *Medium* by the Site Sensitivity Verification Report (SSVR) attached as **Appendix E**. The SSVR found that there are numerous agricultural activities within the application area with various agricultural activities being undertake especially in the southern, eastern and northern sections. However, the proposed exploration activities are limited to a maximum footprint of 50m x 50m drill pad and 10m wide transects which will have an acceptable overall impact on the soils and agricultural potential. In addition, post exploration, the disturbed areas will be rehabilitated and will have a final blower (gas emitting well) footprint of 2m x 2m.
Animal Species Theme	High	**High**	According to the SSVR, certain habitats have generally intact vegetation, potential habitats of fauna species. Several fauna species were also noted during the site assessment.
Plant Species Theme	Low	**High**	According to the SSVR, certain habitats are generally intact, and various floral species were noted. The composition, species diversity and number of plant species recorded were noted during the site assessment.
Terrestrial Biodiversity Theme	Very High	**High**	According to the SSVR, certain habitat sensitivities are regarded as high sensitivity due to the role of this intact habitat to biodiversity within an area being more fragmented locally, this is however not for the entire project area.
Aquatic Biodiversity Theme	Very High	**High**	Some Target Areas and Transects were noted to be within / transecting or located within close proximity of watercourses and wetlands from desktop studies and site sensitivity verification. Construction could result in the encroachment into water resources and result in the loss or degradation of these system, most of which are functional and provide ecological services.
Archaeological and Cultural Heritage Theme	Very High	**High**	There are known heritage features including cemeteries and graves with potential HIGH local heritage significance based on the Relative Archaeological and Cultural Heritage sensitivity of the area and previous heritage studies in the region.
Civil Aviation Theme	High	**Low**	Relative Civil Aviation Theme Sensitivity was assessed to be *Low-Sensitive*. The proposed project which entails the establishment of up to eleven (11) new exploration boreholes and ~100km seismic transects do not reflect light which may have an impact on civil aviation. The proposed activities do not interfere with surface and air transmission and therefore, no anticipated impacts on civil aviation emanating from the project. The proposed development does not entail the establishment of high-rise structures, use of aboveground high frequency electromagnetic radiation nor reflecting infrastructure. In addition, the area has low air traffic.
Defence Theme	Very High	**Low**	Relative Defence Theme Sensitivity was assessed to be *Low-Sensitive* as there are no known military bases / facilities present within the vicinity of the project site. The nearest defence facility is the military base in Kroonstad, approximately 30 km northeast of the site and there are no anticipated impacts on defence theme emanating from the proposed activities
Palaeontology Theme	Very High	**Medium**	Based on the site investigation as well as desktop research it is concluded that fossil heritage of scientific and conservational interest in the development footprint is rare. Therefore, there are no foreseen negative impacts on palaeontological features. However, although

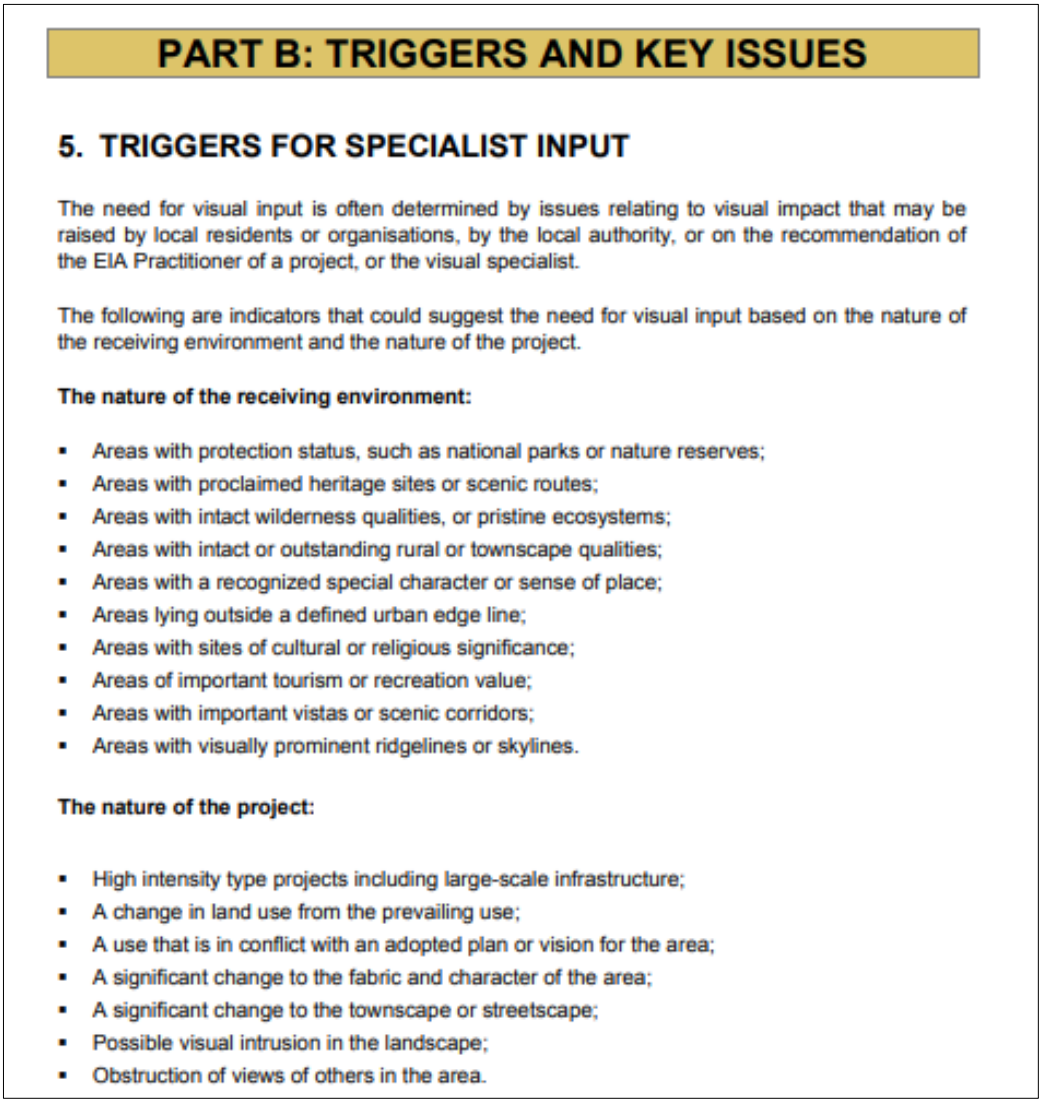
Assessment Theme	Sensitivity Rating as per Screening Report	Sensitivity Rating (Specialist Verification)	Specialist's Response
			no fossiliferous outcrops were noted within the current proposed target areas, due to the extent of the development footprint and the very high palaeo-sensitivity rating, SSVR assessed the Relative Palaeontological Theme Sensitivity to be Medium-Sensitive.

Table 12: Summary of discussions regarding the undertaking of specialist assessments.

Specialist Assessment	Discussion and Motivation
Agricultural Impact Assessment	Although the DFFE Screening tool indicated that the proposed development is located within a *High* Agricultural Sensitivity theme. Relative Agricultural Sensitivity was confirmed to be *Medium* by the SSVR. The SSVR found there are numerous agricultural activities within the application area with various agricultural activities being undertake especially in the southern, eastern and northern sections. However, the proposed exploration activities are limited to a maximum footprint of 50m x 50m drill pad and 10m wide transects which will have an acceptable overall impact on the soils and agricultural potential. In addition, post exploration, the disturbed areas will be rehabilitated and will have a final blower (gas emitting well) footprint of 2m x 2m. **The EAP recommends that an Agricultural Impact Assessment be undertaken for the project**.
Landscape/Visual Impact Assessment	**A Landscape/Visual Impact Assessment is not recommended by the EAP** as the proposed project seismic and drilling activities within the exploration area will have no visual intrusion in the area. The project and its locality do not trigger the need for this specialist study based on the triggers as identified by Oberholzer (2005) and presented in **Figure 9**. Visual sensitivities would arise from receptors living in and visiting the study area and observing changes to the aesthetic baseline, currently rated low within the context of the sub-region.
Archaeological and Cultural Heritage Impact Assessment	The National Web-Based Screening Tool Report found that the Relative Archaeological and Cultural Heritage Theme Sensitivity is *Very High-Sensitive*. The protocols required that a Compliance Statement as a minimum be undertaken to verify the archaeological heritage sensitivity of the area. There are known heritage features including cemeteries and graves with potential HIGH local heritage significance based on the Relative Archaeological and Cultural Heritage sensitivity of the area and previous heritage studies in the region. Therefore, a **Heritage Impact Assessment (HIA) is recommended by the EAP** to identify the heritage features and provide mitigation measures (if any).
Palaeontology Impact Assessment	Based on the 1:250 000 SAHRIS PalaeoMap and the National Web-Based Screening Tool Report, the study area is located within a *Very-High Palaeo-Sensitivity* area. The protocols require that a Compliance Statement as a minimum be undertaken to verify the palaeontological sensitivity of the area. Due to the known cultural heritage features on site and the high possibility of palaeontological finds, a **Palaeontological Impact Assessment is recommended** to identify palaeontological heritage features and provided mitigation measures.
Terrestrial Biodiversity Impact Assessment	The National Web-Based Screening Tool Report found that the Relative Terrestrial Biodiversity Impact Assessment Theme Sensitivity is *Very High-Sensitive*. Based on known occurrence of sensitive terrestrial biodiversity ecosystems from the previous study undertaken during the original EA Application, the **EAP recommended that a Terrestrial Biodiversity Impact Assessment** be undertaken to confirm presence of Flora or Fauna, Avifauna, SCC, or protected species within the development site, verify site terrestrial biodiversity sensitivity and provide necessary mitigation measures.

Specialist Assessment	Discussion and Motivation
Plant Species Assessment	Similarly, to the findings and rationale for Terrestrial Biodiversity Impact Assessment in this table above, this study was recommended by the EAP and forms part of the Terrestrial Biodiversity Impact Assessment.
Animal Species Assessment	Similarly, to the findings and rationale for Terrestrial Biodiversity Impact Assessment in this table above, this study was recommended by the EAP and forms part of the Terrestrial Biodiversity Impact Assessment.
Aquatic Biodiversity Impact Assessment	The Relative Aquatic Biodiversity Theme Sensitivity was assessed to be *Very High-Sensitive* by the National Web-Based Screening Tool Report. Some Target Areas and Transects were noted to be within / transecting or located within close proximity of watercourses and wetlands from desktop studies and site sensitivity verification. There are potential impacts on surface and groundwater through the establishment of exploration boreholes and new seismic transects. The protocols require that a Compliance Statement as a minimum be undertaken to verify the aquatic biodiversity sensitivity of the area. The **EAP recommends that a Full Aquatic Biodiversity Impact Assessment** due to the known aquatic biodiversity sensitivities from the previous assessment.
Hydrology Assessment	In engineering, a hydrological assessment is carried out to quantify the flow or volume of water in a river or stream, over land, in soils, in a pond or in a reservoir. A hydrological study is usually undertaken for projects with potential contamination to groundwater such as mining and surface deposition (Tailings Storage Facilities). The proposed activity will entail the drilling and sampling at depth using a two-string telescopic casing design as outlined in **Section 2.2.2**. Although each borehole will be steel cased and have cement barriers to prevent leaks as well as plugged at the end of exploration to prevent groundwater seepage. It is the **EAPs recommendation that a geohydrological study** be undertaken to establish a site baseline and background hydrological conditions and identify sensitive environmental receptors. This will entail a hydrocensus to cover the target areas, determine the current status quo of the regional groundwater system delineation and vulnerability and qualify the potential impact of the gas extraction as well as simulate potential saline water migration towards the shallow aquifer.
RFI Assessment	The project site falls outside of the Karoo Central Astronomy Advantage Area (KCAAA). AAAs that have been declared to date are: • The Northern Cape Province, excluding Sol Plaatje Municipality; • The Karoo Core AAA (consisting of 13 406 hectares of land owned by the National Research Foundation, 90 km north of Carnarvon); and • The Karoo Central AAAs, as published in the Government Gazette on 12 March 2014. The protocols require that a Site Sensitivity Verification (SSV) Requirements be undertaken where a Specialist Assessment is required, but no specific assessment protocol has been prescribed, gazetted on 20 March 2020. A SSV was undertaken by the EAP in March 2025 and attached as **Appendix E.** Based on the SSVR, the project will have minimal to no impact on astronomy and related scientific endeavours, therefore **an RFI Assessment is not recommended by the EAP**.
Noise Impact Assessment	Noise studies are crucial for exploration activities to assess potential impacts on the environment and communities, identify noise sources, and implement mitigation strategies, ultimately ensuring compliance with regulations and minimizing negative impacts. Noise studies establish baseline noise levels in the area before exploration activities begin, allowing for a comparison of noise levels before and after the start of operations. They help identify potential noise impacts on the environment, including wildlife, ecosystems, and human

Specialist Assessment	Discussion and Motivation
	communities. Therefore, it is a **recommendation by the EAP that a Noise Impact Assessment be undertaken for the project**.
Geotechnical Assessment	When evaluating a site for development, a geotechnical assessment is often needed to identify the type of earth that exists below the ground. The proposed activity is an exploration project which entails the undertaking of seismic surveys with the intention of understanding the geological conditions for hydrocarbons. Therefore, the proposed activity forms part of Geotechnical Assessment. This aspect will form part of the geohydrological study.
Health Impact Assessment	Health impact assessment (HIA) is a tool that can help communities, decision makers, and practitioners make choices that improve public health. HIA can be used to evaluate objectively the potential health effects of a project or policy before it is built or implemented. HIA is usually undertaken for projects which can have health impacts on the surrounding communities. Based on the proposed project description, there are no foreseen associated health impacts. Therefore, **the EAP does not recommend a Health Impact Assessment for the project.**
Ambient Air Quality Impact Assessment	Air Quality Impact Assessment (AQIA) is an evaluation, using approved computer models, of the ambient air quality impacts that the public may be expected to be exposed to due to air pollution emissions from one or more facilities. AQIA is an important technique for determining the relative contribution to ground level pollutant concentrations of specific current or future source emissions at receptor sites. AIQA is usually undertaken is for projects which will potentially emit and/or increase pollutant concentrations during construction and/or operational phases. Based on the project information, the **EAP recommends that an Air Quality Impact Assessment be undertaken for the project** as the project may potentially emit and/or increase pollutant concentrations. The air quality study will help determine the potential impact of exploration activities on the surrounding environment, including air pollution from dust, gases, and other emission.



PART B: TRIGGERS AND KEY ISSUES

5. TRIGGERS FOR SPECIALIST INPUT

The need for visual input is often determined by issues relating to visual impact that may be raised by local residents or organisations, by the local authority, or on the recommendation of the EIA Practitioner of a project, or the visual specialist.

The following are indicators that could suggest the need for visual input based on the nature of the receiving environment and the nature of the project.

The nature of the receiving environment:

- Areas with protection status, such as national parks or nature reserves;
- Areas with proclaimed heritage sites or scenic routes;
- Areas with intact wilderness qualities, or pristine ecosystems;
- Areas with intact or outstanding rural or townscape qualities;
- Areas with a recognized special character or sense of place;
- Areas lying outside a defined urban edge line;
- Areas with sites of cultural or religious significance;
- Areas of important tourism or recreation value;
- Areas with important vistas or scenic corridors;
- Areas with visually prominent ridgelines or skylines.

The nature of the project:

- High intensity type projects including large-scale infrastructure;
- A change in land use from the prevailing use;
- A use that is in conflict with an adopted plan or vision for the area;
- A significant change to the fabric and character of the area;
- A significant change to the townscape or streetscape;
- Possible visual intrusion in the landscape;
- Obstruction of views of others in the area.

Figure 9: Triggers for Visual Impact Assessment (Oberholzer, 2005).

3.17. GAS ACT

The Gas Act (Act 48 of 2001) aims to promote the orderly development of the piped gas industry; to establish a national regulatory framework; to establish a National Gas Regulator as the custodian and enforcer of the national regulatory framework; and to provide for matters connected therewith. The Motuoane Exploration Right and potentially production right in the future will contribute towards the development of the gas industry in South Africa.

3.18. GAS MASTER PLAN AND INTEGRATED RESOURCE PLAN

The SA Government has published a Gas Master Plan in December 2021 for comments from the public. The background to the Master Plan is the following (quoted directly from the plan): "*The National Development Plan (NDP) envisions that by 2030 South Africa will have an energy sector that promotes economic growth and development through adequate investment in energy infrastructure. At just 2.6% of the country's total energy mix, South Africa's natural gas market is small, but with all its inherent benefits, it has the potential to completely change the economy by stimulating economic growth and development, stability, and job creation. The meaningful addition of natural gas to the country's energy mix will rejuvenate an overburdened, out-dated energy infrastructure and reduce cyclical energy shortfalls. Perhaps even more importantly, it will stimulate the*

economy by allowing business and industry to lower their energy and operational spend while also creating significant numbers of new jobs and skills development opportunities. Considering that nearly 90% of South Africa's existing natural gas demand is supplied by a single entity, namely Sasol Gas, the associated economic and employment risks of limited supply options, development and sourcing of alternative natural gas resources are high. It is imperative to ensure economic and employment stability within the natural gas sector by introducing more suppliers. Southern Africa's gas potential has been revealed by major discoveries that, when developed, widen options for greater regional energy trade. South Africa's gas resource potential remains to be quantified but raises the prospect of possible domestic production in the longer term. Globally the natural gas industry has moved into a supply surplus, favouring a larger role for gas as a clean fossil fuel in many countries' energy policies. A challenge in developing the gas sector is to bring gas demand and supply on stream at the same time and spread geographically to stimulate broader localized demand through South Africa. Without such localized gas demand, it is difficult to develop distributed gas supply and without such distributed gas supply it is difficult to develop localized gas demand. One way of breaking this impasse is to create significant "anchor" gas demand through the development of a gas-to-power programme. In pursuit of adding generating capacity, lowering carbon emissions, enhancing energy security and supporting industrial development, South Africa has taken the first steps in a gas-to-power programme to be executed under the Integrated Resource Plan 2019, aiming to increase the national energy mix natural gas contribution from 2.6% to 15.7% by 2030."

3.19. FREE STATE NATURE CONSERVATION ORDINANCE 8 OF 1969

This Ordinance makes provision with respect to the protection and conservation of wildlife in the Free State Province. It makes provision for, among other things, hunting and the protection of wild animals, fishing and the protection of aquatic resources, the protection of indigenous plants and the establishment and management of nature reserves. The Ordinance defines, in Schedule1, protected game and, in Schedule 2, ordinary game and sets out specific rules relating to hunting of each class of game. It also defines prohibited acts in respect of wild or exotic game and rules regarding the importation and exportation of endangered or exotic animals. According to the list of protected species under the Schedule, if any individuals of these plant species are to be disturbed, permits must be obtained from the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs (FSDESTEA). A detailed assessment of floral species within the study area will be undertaken as part of the Terrestrial Biodiversity Assessment during the EIA phase.

3.20. FREE STATE PROVINCIAL SPATIAL DEVELOPMENT PLAN

The Free State Provincial Spatial Development Framework (PSDF) is a policy document that promotes a 'developmental state' in accordance with national and provincial legislation and directives. It aligns with the Free State Provincial Growth and Development Strategy which has committed the Free State to 'building a prosperous, sustainable and growing provincial economy which reduces poverty and improves social development'. The PSDF includes comprehensive plans and strategies that collectively indicate which type of land-use should be promoted in the Free State Province, where such land-use should take place, and how it should be implemented and managed. The proposed exploration activities are within an approved exploration right.

3.21. FREE STATE BIODIVERSITY PLAN, 2015

The development of provincial biodiversity plans is a key component of the systematic biodiversity planning in South Africa and therefore a strong focus of the Biodiversity Planning Forum. Many of the innovative approaches and methodologies have been initiated and established through the development of these provincial biodiversity plans. A key objective of the Provincial Spatial Development Framework (PSDF) is to integrate and standardize planning at all spheres of government in the province with specific reference to amongst others facilitating land-use classification of the entire land surface of the province. To this extent a set of dedicated Spatial Planning Categories (SPCs) were developed which provide a spatial framework to guide decision-making regarding land-use at all levels of planning. The SPCs represent a classification system that indicates the most suitable, or a range of, land use options for a certain piece of land. Associated with each SPC category is land use

guidelines which when implemented ensures a balance between development and conservation. Mainstreaming of the biodiversity plan into spatial planning process will be achieved by aligning the biodiversity plan categories with those of the SPCs so that planning according to SPC will then automatically also adopt the biodiversity plan categories and their associated land use guidelines. Various biodiversity layers were overlaid to the study area and used to determine the sensitivity and/or certain requirements thereof. The results are provided in various sections in this report such as **Sections 3.10**.

3.1 OTHER APPLICABLE ACTS AND GUIDELINES

Other applicable acts and guidelines include the Green House Gases and International Finance Corporation Requirements, and International Agreements.

3.1.1 GHG AND CLIMATE CHANGE

Greenhouse gases (GHG) are "those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the earth's surface, the atmosphere itself, and by clouds. This property causes the GHG effect. Water vapour (H_2O), CO_2, nitrous oxide (N_2O), methane (CH_4) and O_3 are the primary greenhouse gases in the earth's atmosphere. Moreover, there are a number of entirely human-made GHG gases in the atmosphere, such as the halocarbons and other chlorine and bromine containing substances, dealt with under the Montreal Protocol. Beside CO_2, N_2O and CH_4, the Kyoto Protocol deals with the greenhouse gases sulphur hexafluoride (SF6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) (IPCC, 2007). Human activities since the beginning of the Industrial Revolution (taken as the year 1750) have produced a 40% increase in the atmospheric concentration of carbon dioxide, from 280 ppm in 1750 to 406 ppm in early 2017 (NOAA, 2017). This increase has occurred despite the uptake of a large portion of the emissions by various natural "sinks" involved in the carbon cycle (NOAA, 2017). Anthropogenic CO_2 emissions (i.e., emissions produced by human activities) come from combustion of fossil fuels, principally coal, oil, and natural gas, along with deforestation, soil erosion and animal agriculture (IPCC, 2007).

The International Finance Corporation (IFC) lists methods that countries and projects can reduce GHG impacts. These include carbon financing; improvement of energy efficiency; GHG sinks and reservoir protection and improvements; that environmentally friendly agriculture and forestry be encouraged; the increased use of renewable energy methods; implementation of carbon capture and sequestration methods; and improved waste management (recovery and use of methane emissions) as well as reducing GHG emissions from vehicle use and industrial, construction and energy production processes (IFC, 2007). Carbon financing may have much potential in developing countries as well as sustainable agriculture and forestry practices (IFC, 2012), and when supported by governments may be a way of reducing the country's GHG impacts, where projects receive carbon credits and financing for reducing GHG emissions and installing more environmentally friendly alternatives. Because different industries contribute various amounts of GHG emissions, the IFC performance standards suggests that for industrial processes the CO_2-equivalent (CO_2-e) emissions per year do not exceed 100 000 tonnes, this including direct (Scope 1) and indirect (Scope 2) sources (IFC, 2012).

3.1.1.1 INTERNATIONAL AGREEMENTS

In 1992, countries joined an international treaty, the United Nations Framework Convention on Climate Change (UNFCCC) as a framework for international cooperation to combat climate change by limiting average global temperature increases and the resulting climate change, and coping with impacts that were, by then, inevitable.

By 1995, countries launched negotiations to strengthen the global response to climate change, and, two years later, adopted the Kyoto Protocol. The Kyoto Protocol legally binds developed country parties to emission reduction targets. The Protocol's first commitment period started in 2008 and ended in 2012. As agreed in Doha in 2012, the second commitment period began on 1 January 2013 and would end in 2020 (UNFCCC, 2017) but due to lack of ratification has not come into force.

The Paris Agreement was adopted by 196 Parties at Conference of the Parties (COP) 21 in Paris, on 12 December 2015 and commenced 4 November 2016. The Paris Agreement (2016) builds upon the Convention and – for the first time – brings all nations into a common cause to undertake ambitious efforts to combat climate change and

adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort.

The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C. Additionally, the agreement aims to strengthen the ability of countries to deal with the impacts of climate change. To reach these ambitious goals, appropriate financial flows, a new technology framework and an enhanced capacity building framework will be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives.

The Paris Agreement is founded on the idea of countries improving on their climate change strategies in 5-year cycles. The Paris Agreement requires all Parties to put forward their best efforts through "nationally determined contributions" (NDCs) and to strengthen these efforts in the years ahead. This includes requirements that all Parties report regularly on their emissions and on their implementation efforts. The Paris Agreement proposes that Parties submit long-term low greenhouse gas emission development strategies (LT-LEDS) by 2020 but this was not mandatory.

Parties will take stock of the collective efforts in relation to progress towards the goal set in the Paris Agreement and to inform the preparation of NDCs. There will also be a global stocktake every 5 years to assess the collective progress towards achieving the purpose of the Agreement and to inform further individual actions by Parties. Ethiopia submitted their first NDC to the UNFCCC secretariat and ratified the Paris agreement on 9 March 2017. Existing Parties were expected to submit their updated NDC in 2020; and new Parties their original NDCs. Parties are to submit updated NDCs every 5 years. As of May 2021, there are 192 parties that have submitted their NDCs and 8 parties that have submitted their second NDC. There are only 191 Parties to the Paris Agreement; Eritrea has not become a Party to the Paris Agreement but has submitted its first NDC.

Countries as part of the Paris agreement established an enhanced transparency framework (ETF). ETF commenced in 2024, and all countries need to openly report on all activities untaken and progress in climate change mitigation, adaptation measures as well as any support provided or received. ETF also sets out a procedure for reviewing submitted reports. The information provided as part of the ETF will be used as an input for the global stocktake which will assess the collective progress towards the long-term climate goals. South Africa has made strides in implementing the ETF under the Paris Agreement, submitting its first Biennial Transparency Report (BTR1) on December 23, 2024, and is committed to transparently reporting its climate actions.

3.1.1.2 GLOBAL GHG EMISSION INVENTORY

The proposed Motuoane exploration would most likely fall under the category of "energy" for the global GHG inventory. According to the "mitigation of climate change" document as part of the Intergovernmental Panel on Climate Change (IPCC) fifth Assessment Report (AR5) (IPCC, 2014) the 2010 global GHG emissions were 49 (±4.5) Gt CO_2-e, of which 35% (17 Gt CO_2-e) was a result of the energy sector. The World Resources Institute Climate Watch global GHG emissions from the "industrial processes" sector were 2.7711 Gt CO_2-e in 2016 (6% of total anthropogenic GHG emissions).

3.1.1.3 SOUTH AFRICA'S STATUS IN TERMS OF CLIMATE CHANGE AND QUANTIFICATION OF GREENHOUSE GASES

3.1.1.3.1 PARIS AGREEMENT - NATIONALLY DETERMINED CONTRIBUTION

South Africa ratified the UNFCCC in August 1997 and acceded to the Kyoto protocol in 2002, with effect from 2005. However, since South Africa is an Annex 1 country it implies no binding commitment to cap or reduce GHG emissions. The South African Intended Nationally Determined Contribution (INDC) was completed in 2015 and submitted to the UNFCCC on 1 November 2016. This was undertaken to comply with decision 1/CP.19 and 1/CP.20 of the Conference of the Parties to the UNFCC. This document describes South Africa's INDC on adaptation, mitigation and finance and investment necessities to undertake the resolutions.

As part of the adaption portion the following goals have been assembled:

- Goal 1: Development and implementation of a National Adaption Plan. The implementation of this will also result in the implementation of the National Climate Change Response Plan (NCCRP) per the 2011 policy.
- Goal 2: In the development of national, sub-national and sector strategy framework, climate concerns must be taken into consideration.
- Goal 3: An official institutional function for climate change response planning and implementation needs to be assembled.
- Goal 4: The creation of an early warning, vulnerability, and adaptation monitoring system
- Goal 5: Develop policy regarding vulnerability assessment and adaptation needs.
- Goal 6: Disclosure of undertakings and costs with regards to past adaptation strategies.

As part of the mitigation portion the following have been, or can be, implemented at National level:

- The approval of 79 (5 243 MW) renewable energy Independent Power Producer (IPP) projects as part of a Renewable Energy Independent Power Producer Procurement Programme (REI4P). An additional 6 300 MW is being deliberated.
- A "Green Climate Fund" has been created to back green economy initiatives. This fund will be increased in the future to sustain and improve successful initiatives.
- It is intended that by 2050 electricity will be decarbonised.
- Carbon Capture and Sequestration (or Carbon Capture and Storage) (CCS).
- To support the use of electric and hybrid electric vehicles.
- Reduction of emissions can be achieved through the use of energy efficient lighting; variable speed drives and efficient motors; energy efficient appliances; solar water heaters; electric and hybrid electric vehicles; solar photovoltaic; wind power; CCS; and advanced bioenergy.

A draft update of the first NDC was published for public comment on the 30th of March 2021 and the final updated of the first NDC was published and submitted to the UNFCCC on the 27th of September 2021 in preparation for the 26th Conference of the Parties (to held in Glasgow, Scotland in November 2021). The final update of the first NDC South Africa has not submitted its second NDC to UNFCCC. The draft document describes South Africa's NDC on adaptation, mitigation and finance and investment necessities to undertake the resolutions with updated revisions to the adaptation goals and mitigation targets.

As part of the updated adaption portion the following goals have been assembled:

- Goal 1: Enhance climate change adaptation governance and legal framework.
- Goal 2: Develop an understanding of the impacts on South Africa of 1.5 and 2°C global warming and the underlying global emission pathways through geo-spatial mapping of the physical climate hazards, and adaptation needs in the context of strengthening the key sectors of the economy. This will provide the scientific basis for strengthening the national and provincial governments' readiness to respond to climate risk.
- Goal 3: Implementation of National Climate Change Adaptation Strategy (NCCAS) adaptation interventions for the period 2021 to 2030, where priority sectors have been identified as biodiversity and ecosystems; water; health; energy; settlements (coastal, urban, rural); disaster risk reduction, transport infrastructure, mining, fisheries, forestry and agriculture.
- Goal 4: Mobilise funding for adaptation implementation through multilateral funding mechanisms.
- Goal 5: Quantification and acknowledgement of the national adaptation and resilience efforts.

Updated targets based on revised 100-year global warming potential (GWP) factors (published in the Annex to decision 18/CMA.1 of the IPCC 5th assessment report) and based on exclusion of land sector emissions arising

from natural disturbance. The updated NDC mitigation targets, consistent with South Africa's fair share, are presented in **Table 13**.

Table 13: South Africa's NCD mitigation targets.

Year	Target	Corresponding period
2025	South Africa's annual GHG emissions will be in a range between 398 - 510 Mt CO_2-e.	2021-2025
2030	South Africa's annual GHG emissions will be in a range between 398 - 440 Mt CO_2-e.	2026-2030

3.1.1.3.2 NATIONAL CLIMATE CHANGE RESPONSE POLICY

The National Climate Change Response White Paper stated that in responding to climate change, South Africa has two objectives: to manage the inevitable climate change impacts and to contribute to the global effort in stabilising GHG emissions at a level that avoids dangerous anthropogenic interference with the climate system. The White Paper proposes mitigation actions, especially a departure from coal-intensive electricity generation, be implemented in the short- and medium-term to match the GHG trajectory range. Peak GHG emissions are expected between 2020 and 2025 before a decade long plateau period and subsequent reductions in GHG emissions.

The White Paper also highlighted the co-benefit of reducing GHG emissions by improving air quality and reducing respiratory diseases by reducing ambient particulate matter, ozone and SO_2 concentrations to levels in compliance with NAAQS by 2020.

In order to achieve these objectives, the Department of Forestry, Fisheries and the Environment (DFFE) has appointed a service provider to establish a national GHG emissions inventory, which will report through SAAQIS.

South Africa's Climate Change Act 22 of 2024, signed into law in July 2024 and proclaimed into effect on March 17, 2025, establishes a framework for a coordinated national response to climate change, including mitigation and adaptation strategies, and a just transition to a low-carbon economy. The Act is aligned with international policies guidelines and South Africa's Nationally Determined Contribution and aim to reduce GHG emissions as primary driver to anthropogenic climate change. The aim of the Act is to achieve an effective climate change response through a long-term just transition to a low carbon economy that is climate resilient and allows for sustainable development of South Africa. The Act provides for the following:

- Establish provincial and municipal forums on climate change which will be responsible for coordinating climate change response actions in each province.
- Strengthen the establishment of the Presidential Climate Change Coordinating Commission (4PC). Although, the 4PC has already been established and has been working for the Government since December 2020, however, its establishment only carries legal force after the Bill becomes an Act.
- Within one year of the coming into force of the Act, establish a National Adaptation Strategy. This strategy will guide South Africa's adaptation to the impacts of climate change and develop adaptation scenarios which anticipate the likely impacts over the short, medium, and long term.
- Determine a national GHG emissions trajectory, which must be reviewed every five years, and which indicates an emissions reduction objective.
- Put in place a 5-yearly sectoral emission targets for identified sectors and sub-sectors. The sectoral targets must be aligned with the national GHG emissions trajectory and include quantitative and qualitative GHG emission reduction goals.
- Bring into force the carbon budget allocation mechanism, which will replace the current National Pollution Prevention Plan mechanism which is enforced under the National Environmental

Management: Air Quality Act (NEM:AQA). The carbon budget will be linked to the Carbon Tax Act, in relation to carbon tax rates which will be charged on emissions above the carbon budget.

While the Act is now in effect, not all of its provisions have come into operation. A large part of the Act's commencement has been deferred to a later date to allow for the promulgation of necessary regulations. The Act states that the minister will need to develop the following:

- Within one year, sectors and sub-sectors emitting greenhouse gases have published emissions targets;
- Develop sector-specific emissions frameworks and targets in consultation with relevant Ministers;
- Publish a list of greenhouse gases contributing to climate change;
- Assign a carbon budget for a minimum of 15 years to entities involved in emitting listed greenhouse gases.

3.1.1.3.3 GREENHOUSE GAS EMISSIONS REPORTING

Regulations pertaining to GHG reporting using the National Atmospheric Emissions Inventory System (NAEIS) were published in 2017 (Republic of South Africa, 2017) (as amended by GN R994, 11 September 2020). The South African mandatory reporting guidelines focus on the reporting of Scope 1 emissions only.

The South African Greenhouse Gas Emission Reporting System (SAGERS) web-based monitoring and reporting system will be used to collect GHG information in a standard format for comparison and analyses. The system forms part of the national atmospheric emission inventory component of South African Atmospheric Emission Licensing and Inventory Portal (SAAELIP). Motuoane will have to report their GHG emissions to SAGERS since there is no threshold for annual GHG emissions reporting for the Natural Gas producers as per the amended GHG reporting guidelines (GG43712, 7 September 2020).

The DFFE is working together with local sectors to develop country specific emissions factors in certain areas; however, in the interim the IPCC default emission figures may be used to populate the SAAQIS GHG emission factor database. These country specific emission factors will replace some of the default IPCC emission factors. Technical guidelines for GHG emission estimation have been issued.

Also, the Carbon Tax Act (No 15 of 2019) (Republic of South Africa, 2019) includes details on the imposition of a tax on the CO_2-e of GHG emissions. Certain production processes indicated in Annexure A of the Declaration of Greenhouse Gases as Priority Pollutants (Republic of South Africa, 2017) with GHG more than 0.1 mega tonnes (Mt) or million metric tonnes, measured as CO_2-e, are required to submit a pollution prevention plan to the Minister for approval.

3.1.1.3.4 NATIONAL GHG EMISSIONS INVENTORY

South Africa is perceived as a global climate change contributor and is undertaking steps to mitigate and adapt to the changing climate. DFFE is categorised as the lead climate change institution and is required to coordinate and manage climate related information such as development of mitigation, monitoring, adaption, and evaluation strategies (DEA, 2019). This includes the establishment and updating of the National GHG Inventory. The National Greenhouse Gas Improvement Programme (GHGIP) has been initiated; it includes sector specific targets to improve methodology and emission factors used for the different sectors as well as the availability of data.

The 2000 to 2017 National GHG Inventory was prepared using the 2006 IPCC Guidelines (IPCC, 2006) based on updated sector information and emission estimation techniques. According to the 4th Biennial Update Report to the UNFCCC (DFFE, 2021), the total GHG emissions in 2017 were estimated at approximately 512.14 million metric tonnes CO_2-e (excluding Forestry and Other Land Use [FOLU]). This was a 14.2% increase from the 2000 total GHG emissions (excluding FOLU) and 2.8% decrease from the 2015 total GHG emissions (excluding FOLU). FOLU is estimated to be a net carbon sink which reduces the 2017 GHG emissions to 482.02 million metric tonnes CO_2-e. The estimated GHG emissions (excluding FOLU) for 2017 showed the Industrial Processes and Product Use (IPPU) sector contributed 6.3% to the total GHG emissions (excluding FOLU). The estimated CO_2-e emissions (excluding FOLU) for 2017 for the IPPU sector is 32.08 million metric tonnes.

4 ENVIRONMENTAL ATTRIBUTES AND BASELINE ENVIRONMENT

This section of the Scoping Report provides a description of the environment that may be affected by the proposed project. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed development have been described. This information has been sourced from existing information available for the area as well as baseline information received from certain specialists assessments. Please note that detailed specialist assessments are being completed to inform the EIA-phase report. The DFFE screening tool was also used to inform this section, and a copy of the screening report is included in **Appendix D**.

4.1 LOCATION AND LAND USES

The accepted (not yet approved) ER is located over an area of approximately 58 000 hectares (ha) / 580km^2, covering various farms near the towns of Welkom, Virginia, Hennenman and Odendaalsrus, within the Free State Province. The local municipalities in which the proposed exploration area is located are Matjhabeng and Moqhaka Local Municipalities, which are part of the Lejweleputswa and Fezile Dabi District Municipalities respectively. Noticeable boundaries of ER386 are 28°13'28.95"S; 26°55'2.76"E in the South, 27°57'37.57"S; 26°48'49.15"E in the West, 27°59'13.57"S; 27°11'13.06"E in the East and 27°46'34.45"S; 26°57'44.05"E in the North, the central coordinates are approximately 27°58'23.27"S; 26°59'38.94"E. The locality map is included in **Figure 1.**

The study area can be subdivided into four sections namely, the northern section, southern section, western section, and the eastern section (refer to **Figure 1** for the site locality). The northern section is closer to the R34 and located between Odendaalsrus and Kroonstad. There are currently two target areas proposed within this section namely, Target Area 10 (GP B) and Target Area 11 (GP A) and three seismic transect (Transect G1, G2 and G3). This section consists almost entirely of cultivated land with several natural and artificial watercourses. The eastern section is located immediately north of Ventersburg and bounded by the N1 and Phomolong. This section is primarily dominated by cultivated land, open areas and minor game farms. There are distinctive watercourses within this area including the Kromspruit which is immediately to the north of the sole proposed drilling site, Target Area 9 (HF C) 500m assessment area within this section. There are three proposed transects within this section, namely, Transect HF1, HF2 and HF7. Which intersect the Kromspruit, Rietspruit and Slootspruit.

The tip of the southern section is approximately 8.5km south of southern Virginia (Meloding) while the two target areas, Target Area 1 (RSB D) and Target Area 2 (RSB E) are approximately 7km east of southern Virginia. The R73 cuts across this section. Similarly to the northern and eastern sections, the southern section is primarily dominated by cultivated land, open areas and minor game farms, several natural and artificial watercourses. Although there are two target areas within this section, two of the three seismic transects intersect the Sandrivier. There is also a canal that separated the two target areas.

The western section is the section where majority of the exploration activities are being proposed. This section is within a mining area and adjacent to mining towns. The edges of the residential areas of Saaiplaas, Bronville and Thabong form part of the western boundary of this section and ER386. There are six target areas Target Area 3 (ED G), Target Area 4 (ED H), Target Area 5 (ED J), Target Area 6 (ED I), Target Area 7 (ED F) and Target Area 8 (VEG A) as well as seven (7) seismic transects (Transects ED 1-5, VEG 1-2). Although this section also consists largely of cultivated land, open areas and minor game farms, several natural and artificial watercourses, it is the most transformed section within the ER comprising of mining activities, residential areas, road and electrical infrastructure. This section also comprises of several farms earmarked for renewable energy developments. Site conditions are presented in **Figure 10** to **Figure 24** below.

Figure 10: The southern section consists of a mixture of low-lying grassland with shrubs and areas of thick vegetation supporting the various game in the area.

Figure 11: A view of the Sandrivier at a meandering and escarpment section north of Target Area 1 and 2 and where the Transect RSB 1 ends.

Figure 12: Southern view of the southern section showing thick intact vegetation.

Figure 13: Eastern view of the southern section showing a canal supporting the agricultural activities and low laying grasslands and shrubs within agricultural activities further east

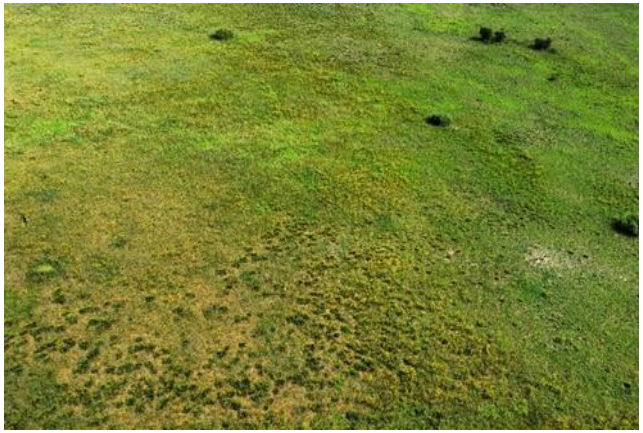


Figure 14: Southern view from the western section showing low-lying disturbed grassland with sparsely distributed shrubs

Figure 15: Northern view from the western section showing low-lying disturbed grassland with sparsely distributed shrubs. Thabong residential area and Doringpan can be seen further north.

Figure 16: Western view of the western section showing uniform vegetation of low-lying grass and sparsely distributed shrubs and Thabong residential area.

Figure 17: A large wetland located on the western edge of the western section, adjacent to a Harmony Tailings Facility.

Figure 18: A view of some of the activities (grazing) located within the western section.

Figure 19: Northern view from the central area of the ER showing low-lying grass within thick vegetation (further north) as some of the game within the area.

Figure 20: The eastern section consists primarily of agricultural and grazing activities. Small dairy farming activities were noted close to Target Area 9 (HF C).

Figure 21: Although the main land use of the northern section is cultivated land and grazing, there are some open spaces within medium-thick vegetation consisting of various floral species.

Figure 22: Some of the infrastructure within the ER include surfaced and gravel roads. The conditions of the roads vary from good, maintained roads to roads which have been severely deteriorated roads in poor condition.

Figure 23: A railway line which appears to be still operational was noted in the western section.

Figure 24: Eskom infrastructure including high voltage powerlines were also noted in the western section of the ER.

4.2 TOPOGRAPHY

Information on the area's topography was obtained from the Baseline Geohydrological Assessment Report undertaken by Gradient Groundwater Consulting in March 2025 (**Appendix F7**). The topography of the greater study area generally has a jagged topography and can be classified as a central interior plain or plateau. Large dolerite intrusions are observed throughout the study area and because of its relative resistance to erosion, the Karoo dolerite sheets generally give rise to very prominent high-standing topographic features (DWAF, 2004). The relief of the area varies between 0 – 130.0m towards the western perimeter and 30 – 210.0m to the south and northern boundaries. Elevations within the study area range between 1 300 and 1 533 meters above mean sea level (mamsl) based on elevations extracted from the Shuttle Radar Topography Mission (SRTM) Digital Elevation Model (DEM) raster interpolation. Elevations generally increase towards the south and east of the study area, with the lowest elevation of 1 300 mamsl in the central-western parts of the study area and the greatest elevation of 1 533 mamsl in the eastern parts of the study area. Based on calculations performed using GIS, the slope of the study area ranges between 0% (indicating water bodies such as wetlands, pans, and dams) and 45.17% (indicating steep hillslopes), while the average slope is calculated as 3.58% with a standard deviation of 2.35%. The greater study flattens out towards the northwest and west which also correlates to the general drainage direction. **Figure 25** shows the regional topographical contours and setting.

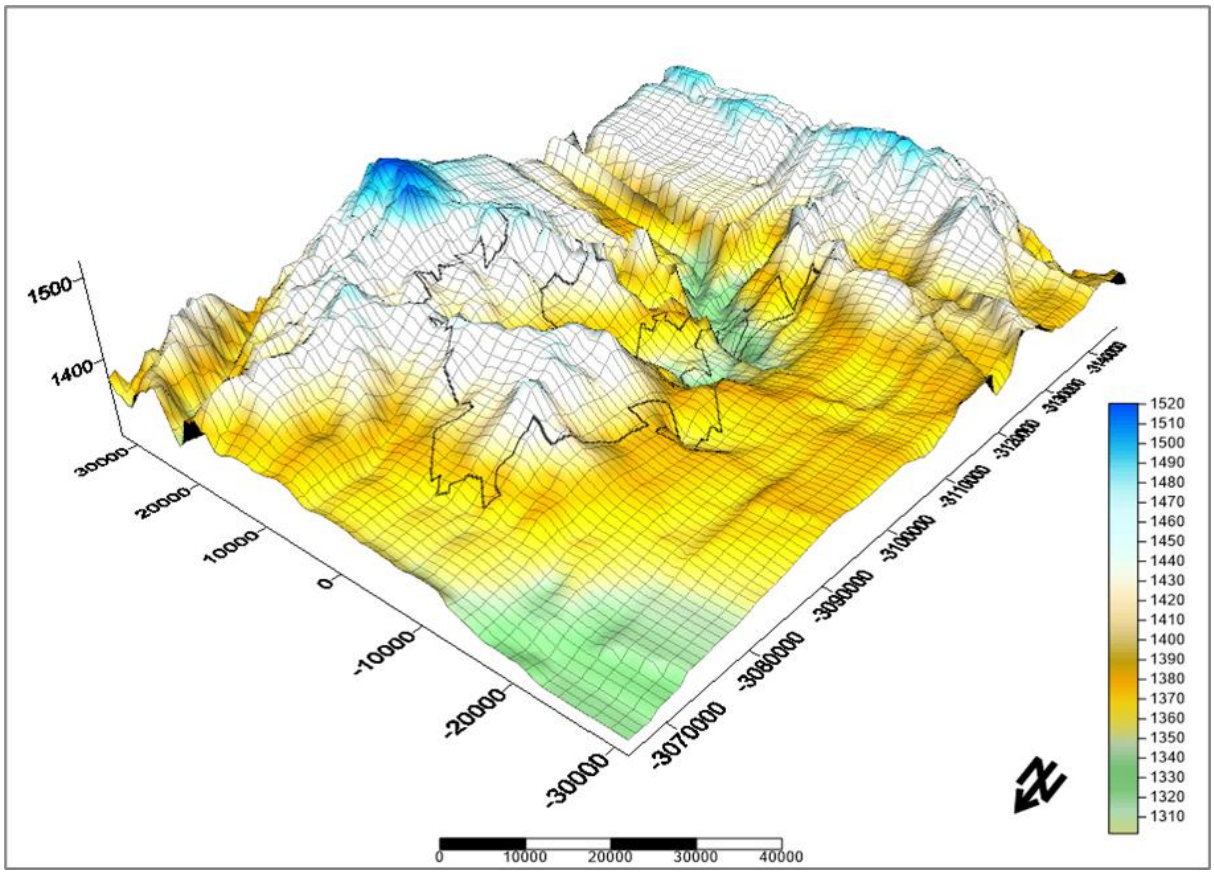


Figure 25: General topography of the study area (Gradient Groundwater Consulting, 2025).

4.3 GEOLOGY

According to information obtained from the Baseline Geohydrological Assessment Report undertaken by Gradient Groundwater Consulting in March 2025 (**Appendix F7**), based on the Council for Geoscience (CGS) 1:250 000 geological maps (Geological Map Sheet 2726 Kroonstad and Geological Map Sheet 2826 Winburg) the surface geology of the study area is characterized by a variety of lithologies, formations, and intrusions. These include geologically recent Quaternary deposits; sediments of the Beaufort and Ecca Groups within the Karoo Supergroup; dolerite dykes, sheets, and sills associated with the Karoo Dolerite Suite; and post-Karoo kimberlite pipes and dykes. **Figure 26** depicts the regional geology and stratigraphy.

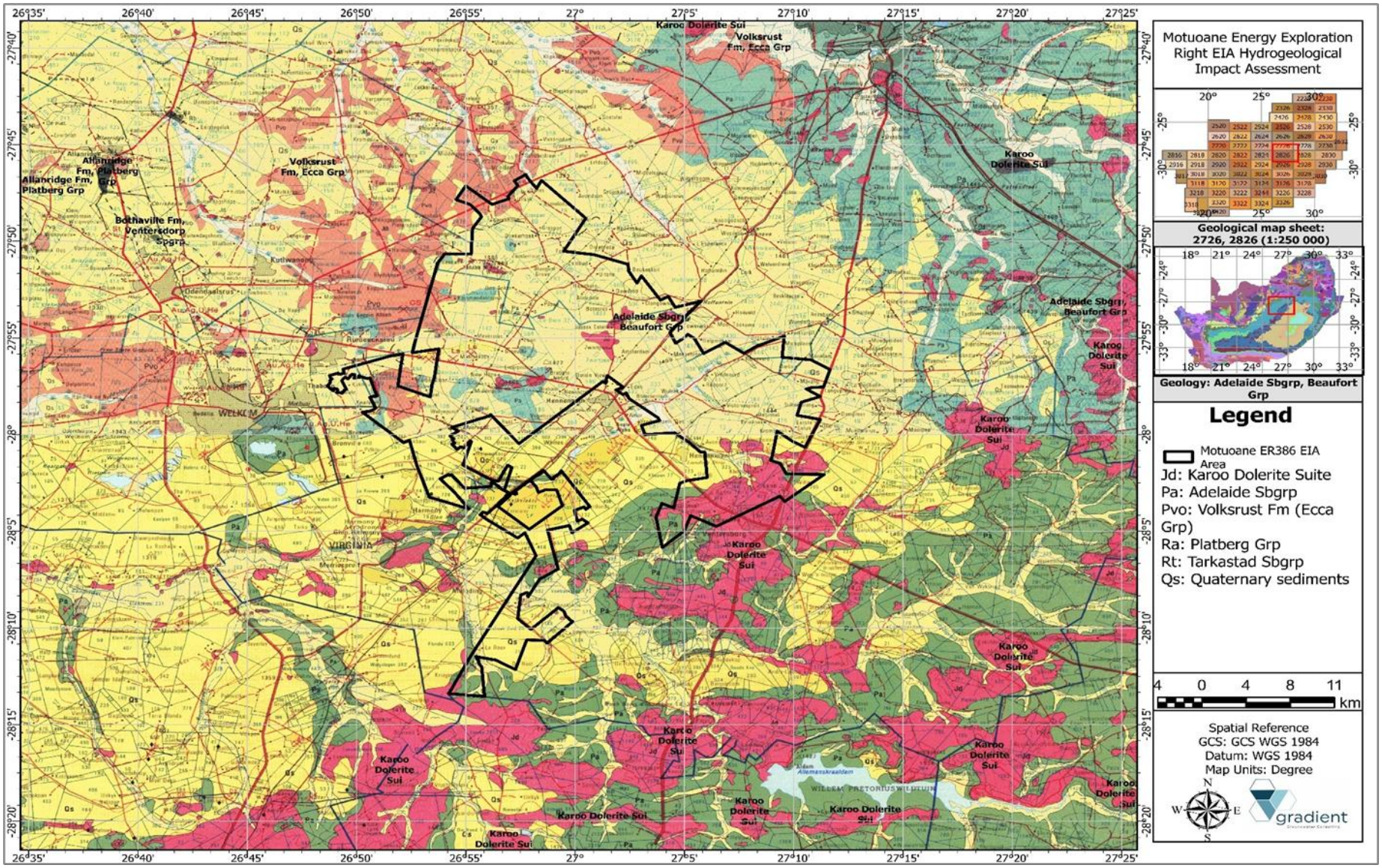


Figure 26: Regional geology and stratigraphy from Geological map sheet 2726: Kroonstad and 2826: Winburg at 1:250 000 scale (Gradient Groundwater Consulting, 2025).

The Quaternary deposits, which were deposited less than 0.01 million years ago (DWA, 2012), cover most of the northern and central parts of the study area, while also being present in the southern parts of the study area. These deposits include aeolian (wind-blown) dune sand in the northern and central parts of the study area; alluvium, including calcified alluvium and river gravel, in the northern, northeastern, central, and southern parts of the study area along the banks and floodplains of surface water drainage features; and patches of calcrete and surface limestone in the western and northwestern parts of the study area.

The sediments of the Beaufort Group, which are primarily of fluvial and deltaic origin (Baran, 2003), were deposited during the late Permian Period between approximately 248 and 239 million years ago and are associated with the orogeny and tectonic paroxysm of the Cape Fold Belt (Woodford and Chevallier, 2002). The Adelaide Subgroup within the Beaufort Group occurs toward the northeastern parts of the study area, while also being present in the central and southern parts of the study area. Specifically, the Normandien Formation within the Adelaide Subgroup occurs towards the northeast of the study area and comprises of greenish grey (bottom of formation) to red (top of formation) mudstone and siltstone, grey shale and rhythmite, and sandstone. The Adelaide Subgroup covering the central and southern parts of the study area is not differentiated into specific formations and comprises of mudstone with subordinate sandstone.

The sediments of the Ecca Group were deposited during the Permian Period between approximately 290 and 248 million years ago (Woodford and Chevallier, 2002). The Volksrust Formation within the Ecca Group occurs toward the northwestern parts of the study area. Fluvial and deltaic sediments were supplied to the Volksrust Formation as a result of continental provenance towards the north and northeast of the Karoo Basin (Woodford and Chevallier, 2002). The Volksrust Formation, which interfingers with the overlying Beaufort Group (Woodford and Chevallier) is a primarily argillaceous formation comprising of mudstone, siltstone, and shale.

A vast network of dolerite dykes, sheets, and sills associated with the Karoo Dolerite Suite occurs throughout the study area and is especially prominent in the southern and central parts of the study area. The Karoo Dolerite Suite intruded into the Karoo Supergroup approximately 180 million years ago during the early stages of the break-up of Gondwanaland (Woodford and Chevallier, 2002). Furthermore, kimberlite and associated alkaline-rich intrusive rocks, including carbonatite and olivine melelitite, intruded into the Karoo Basin between approximately 130 and 70 million years ago (Woodford and Chevallier).

4.4 CLIMATE

According to the Koppen-Geiger climate classification system, the climate of the study area is classified as BSk (Climate Change & Infectious Diseases Group, 2023). This classification indicates that the study area has a cold, semi-arid climate characterized by cold, dry winters and warm summers. The average temperature in the Welkom area ranges between 9.7 °C in the winter (July) and 23.3 °C in the summer (January), while the mean annual temperature is 17.7 °C (Climate-Data, 2021). Refer to **Figure 27** for the Mean Yearly Temperature Distribution of the greater study area. Based on the Baseline Climate Change Assessment by Airshed Planning Professionals in March 2025 (**Appendix F3**),) Baseline annual average temperature was in the range 16.2°C (10^{th} percentile) and 16.31°C (90^{th} percentile) with the number of very hot days varying between 1.68 (10^{th} percentile) and 3.92 (90^{th} percentile) days per year. High inter-annual rainfall variability is noticed (Figure 3-3) as the range between the 10^{th} and 90^{th} percentiles was 1016.84 mm and 1107.52 mm. Extreme rainfall days varied between 12.36 (10^{th} percentile) and 13.48 (90^{th} percentile) days per year.

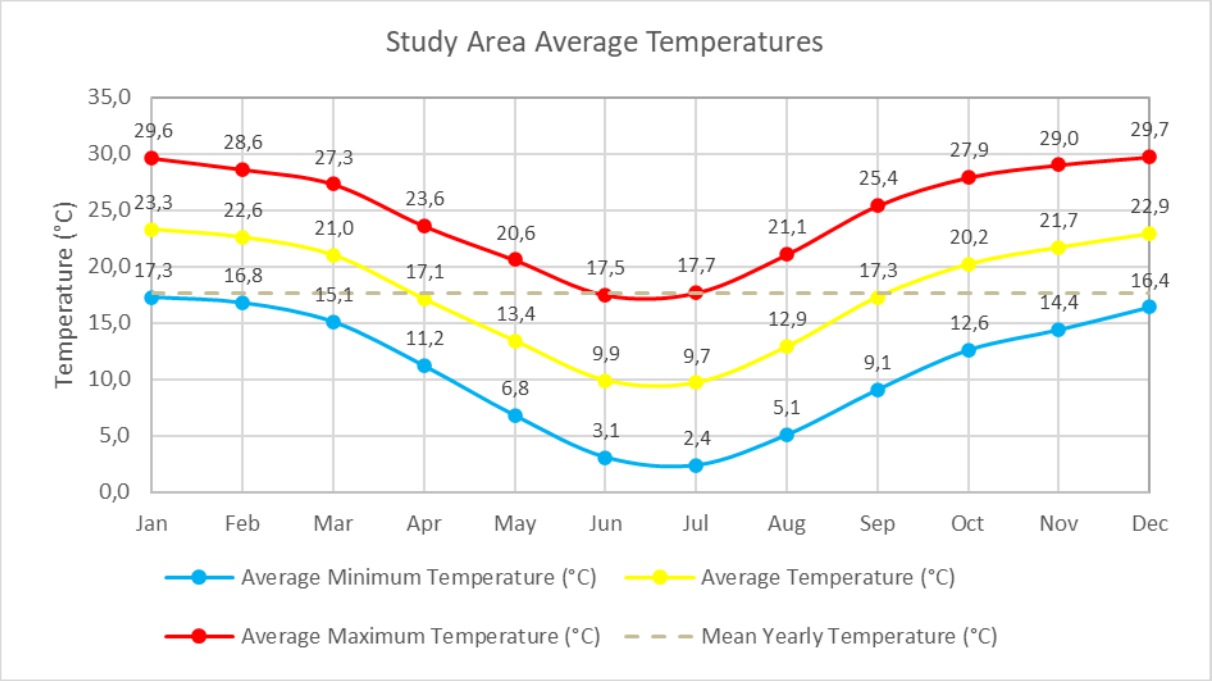
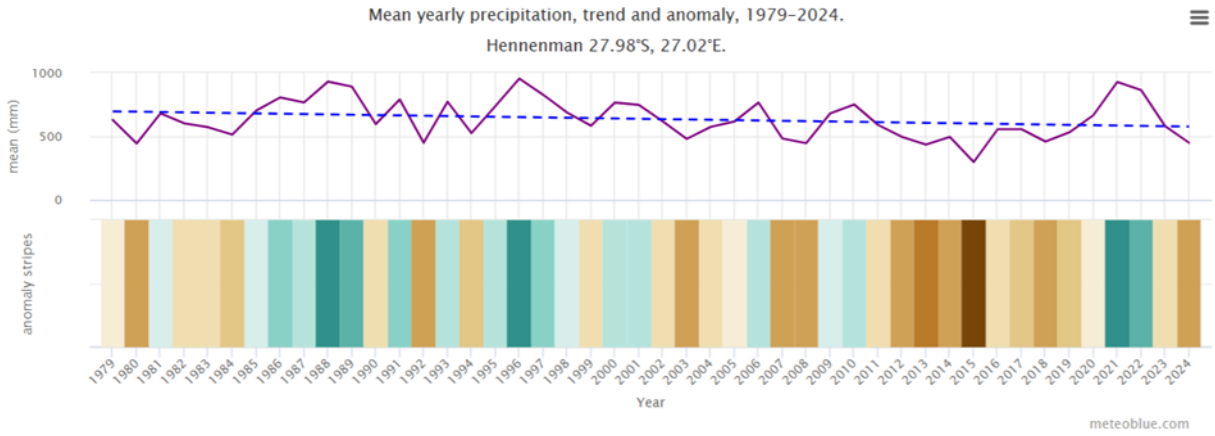


Figure 27: Climate summary Mean Yearly Temperature Distribution of the greater study area, 1991 – 2021 (Climate-Data, 2021).

Recent change in climatic conditions near the project site were accessed from MeteoBlue[1] a weather forecasting platform developed at the University of Basel, Switzerland and based on models of National Oceanic and Atmospheric Administration (NOAA) or National Centres for Environmental Prediction (NCEP). The data sets also include historical climate data tracking changes in climate by referencing ERA5, the fifth generation ECMWF (European Centre for Medium-Range Weather Forecasts) atmospheric reanalysis of the global climate, for the period between 1979 to 2024, with a spatial resolution of 30 km. Based on Hennenman (located within the study area), an increasing trend in the annual average temperatures has been observed with temperatures measuring 16.7°C in 1979 to 18.1°C in 2024 (**Figure 28**– top panel). The lower part the graph shows the so-called warming stripes. Each coloured stripe represents the average temperature for a year - blue for colder and red for warmer years. The change in rainfall over the same period (1979 – 2024) displays a slight decreasing trend (**Figure 28** – bottom panel), where the difference from long-term average for each year in the data set is visualised by the stripes in the lower panel of (**Figure 28** (brown stripes indicate lower than average rainfall and green stripes above average rainfall).



[1] https://www.meteoblue.com

Figure 28: Annual average rainfall (top panel) and rainfall anomaly (lower panel) between 1979 and 2024 (meteoblue AG, 2025).

The mean annual precipitation (MAP) for the study area is estimated at approximately 531.66 mm/a, based on MAP data obtained from Water Resources of South Africa, 2012 study (WRC, 2016). Using patched monthly precipitation data (ranging from 1920 to 2009), obtained from the WR2012 database (WRC, 2016), the MAP for the study area is calculated as 531.81 mm/a. The 5th percentile of the dataset, which approximately represents a 1:20 year drought, is calculated as 345.32 mm/a. The 95th percentile of the dataset, which approximately represents the 1:20 year flood, is calculated as 760.66 mm/a. The results from the analysis of the WR2012 datasets indicate that the study area has a summer rainfall regime, with the majority of the precipitation occurring from October to March (80.02%) as high intensity thunderstorms, while June, July, and August are particularly dry. Refer to **Figure 29** for graphical representations of the monthly precipitation distributions for the study area.

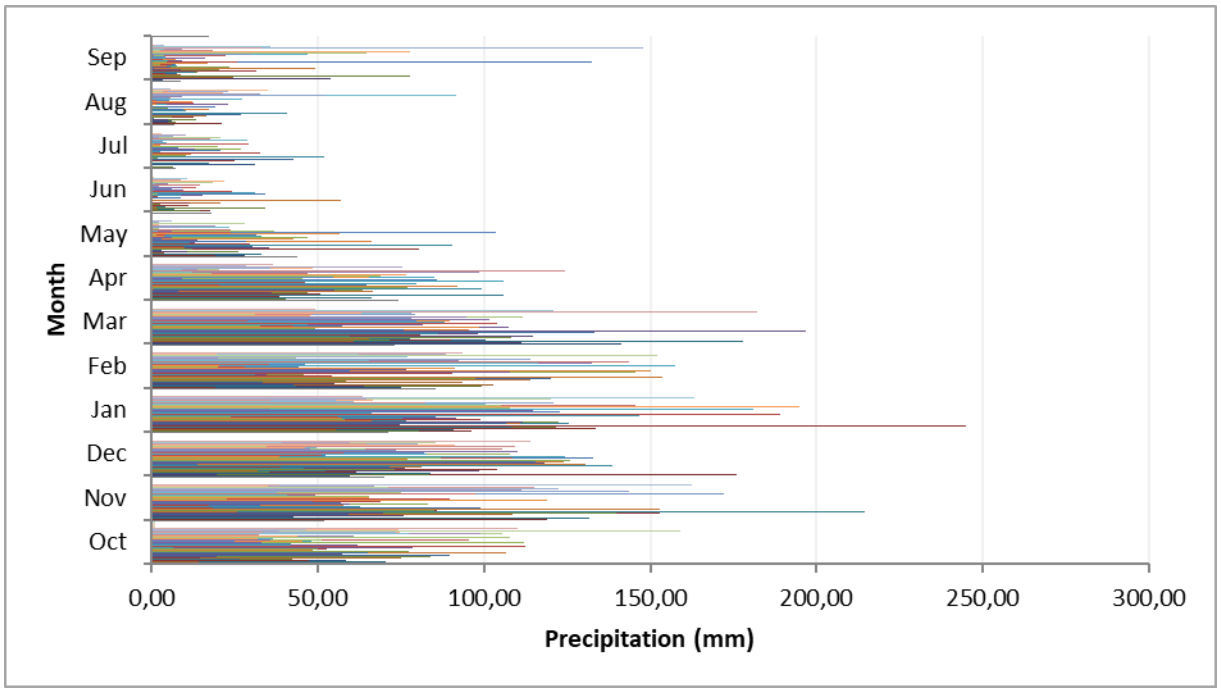


Figure 29: Monthly Precipitation Distribution, 1920 – 2009 (WRC, 2016).

The study area falls within evaporation zones 9A, 11A, and 19C (WRC, 2016). The mean annual evaporation (MAE), measured by Symons Pan, for the study area ranges between 1 540 and 1 750 mm/a (WRC, 2016).

4.5 SOCIO-ECONOMIC

Information on the area's topography was obtained from the Baseline Social Assessment Report undertaken by Equispectives Research and Consulting Services in March 2025 (**Appendix F8**). The proposed project is located in Wards 1, 2, 3, 4, 8, 10, 11, 12, 13,15, 16, 17, 23 and 25 of the Matjhabeng Local Municipality that forms part of the Lejweleputswa District Municipality and Ward 2 in the Moqhaka Local Municipality which falls in Fezile Dabi District the in the Free State Province. The baseline description of the environment will include these areas. **Figure 30** shows the location of the proposed project as well as social and physical infrastructure in the area.

The Free State is a rural province, and its economic activities are dominated by mining, agriculture, and manufacturing. The province is the fifth-largest producer of gold in the world and is also home to Sasol, a large synthetic fuels company. About 90% of the Free State is used for crop production (www.municipalities.co.za). About 34% of the total maize production of South Africa, 37% of wheat, 53% of sorghum, 33% of potatoes, 18% of red meat, 30% of groundnuts and 15% of wool is produced in the Free State.

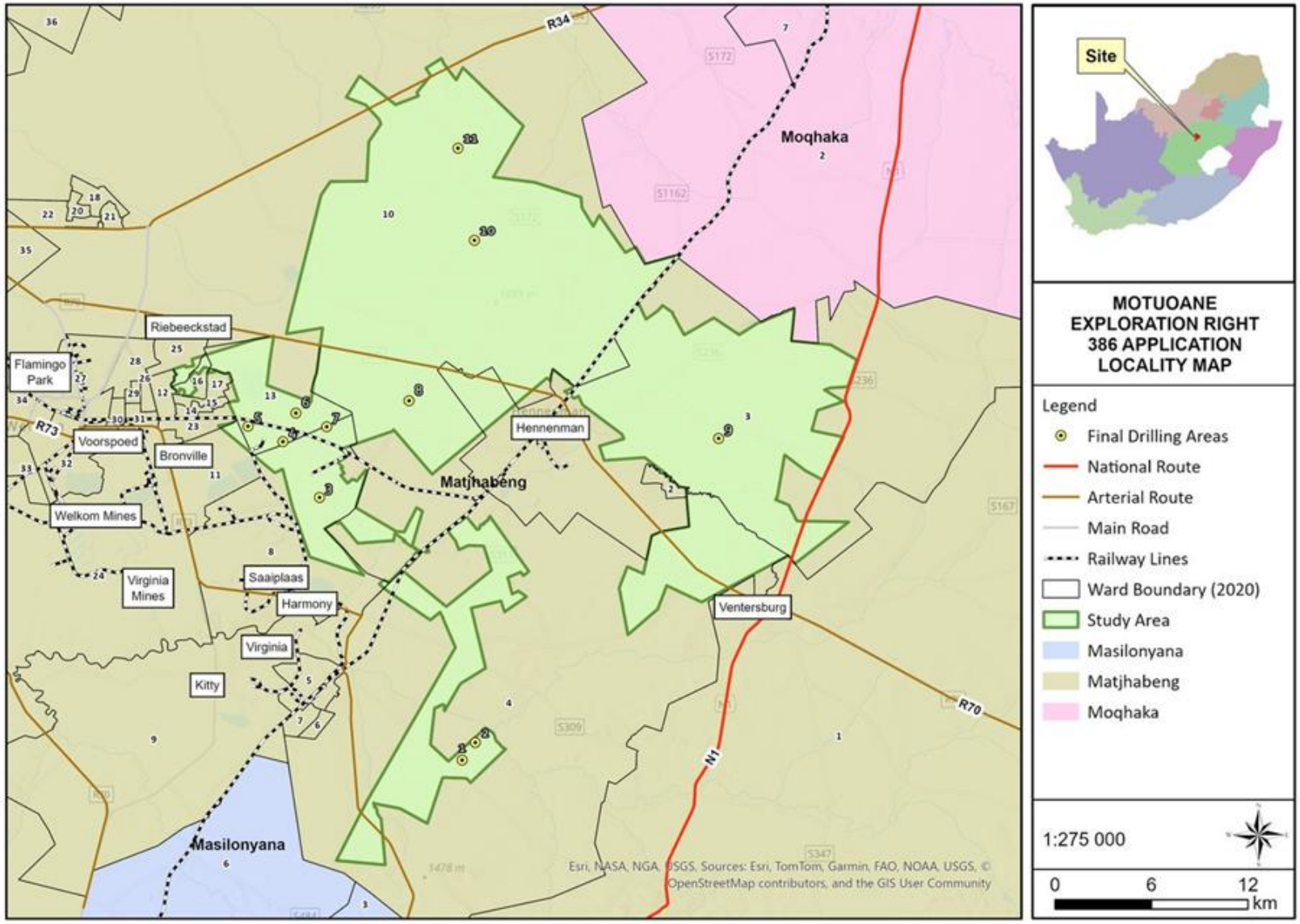


Figure 30: Location of the proposed Motuoane Exploration Right (Equispectives Research and Consulting Services, 2025).

4.5.1 LEJWELEPUTSWA DISTRICT MUNICIPALITY

The Lejweleputswa District Municipality (LDM) is situated in the north western part of the Free State and borders the North West Province to the north; the Fezile Dabi and Thabo Mofutsanyane District Municipalities to the north-east and east respectively; the Xhariep District Municipality and Mangaung Metropolitan Municipality to the south; and the Northern Cape Province to the west. The LDM is accessible from Johannesburg, Cape Town, Klerksdorp and Kimberley through one of South Africa's main national roads, the N1. The district covers an area of 32 286 km^2 and make up almost a third of the Free State province. It consists of the Masilonyana, Matjhabeng, Nala, Tokologo and Tswelopele Local Municipalities (www.lejweleputswa.co.za). The economy of the district relies heavily on the gold mining sector which is dominant in the Matjhabeng and Masilonyana Local Municipalities (Lejweleputswa DM IDP 2021/22). The mining sector is on a downward trend and many businesses that have traditionally depended on the mining sector have either closed down are in the process of closing down. The other municipalities are dominated by agriculture.

4.5.1.1 MATJHABENG LOCAL MUNICIPALITY

The main towns in the Matjhabeng Local Municipality are Welkom, Odendaalsrus, Virginia, Hennenman, Allanridge and Ventersburg (www.matjhabeng.fs.gov.za). The economy of the municipality is centred on mining activities in and around Welkom, Allanridge, Odendaalsrus and Virginia. Manufacturing aimed at the mining sector exists to a limited extent in the above towns, with other activities being limited. Other main economic sectors include manufacturing, tourism, agriculture, gold jewellery, transportation (logistics), and retail (Matjhabeng LM IDP 2022/2023).

4.5.2 FEZILE DABI DISTRICT MUNICIPALITY

The Fezile Dabi District Municipality covers an area of approximately 20,668 km^2. The main towns in the District are Kroonstad, Parys, Sasolburg, Heilbron, Frankfort, Villiers, Deneysville, Oranjeville, Vredefort, Steynsrus, Viljoenskroon, Edenville, Koppies, Tweeling, and Cornelia. These towns are distributed across the four local municipalities within the district, namely the Metsimaholo, Mafube, Moqhaka, and Ngwathe Local Municipalities. The economy of Fezile Dabi District Municipality is diverse, with agriculture (crop farming and livestock) and manufacturing (particularly chemical and petrochemical industries in Sasolburg) serving as primary sectors. Mining contributes to the economy but is less dominant than agriculture and manufacturing. Tourism utilizes natural and cultural attractions to support local businesses and employment. The service sector, including community and social services, plays a crucial role. Trade represents the largest share at 22% of economic activities, while households contribute 13%. Other significant sectors include finance (7%), construction (6%), and transport (5%). This economic profile shows a balanced mix of primary industries, manufacturing, and service sectors with trade being the most significant individual component (Fezile Dabi DM IDP 2022-2027).

4.5.2.1 MOQHAKA LOCAL MUNICIPALITY

The main towns in the Moqhaka Local Municipality are Kroonstad, Viljoenskroon, Steynsrus, Vierfontein, Renovaal. The economy of the Moqhaka Local Municipality is primarily based on agriculture, including crop farming and livestock farming. Other significant sectors include mining, industrial activities, manufacturing, trade, services, and tourism. Public services, such as the Department of Correctional Services and military bases, also contribute to the local economy. There is ongoing local economic development initiatives aimed at promoting economic growth, job creation, and poverty reduction (Moqhaka LM IDP 2022-2027).

4.5.3 DESCRIPTION OF THE POPULATION

The baseline description of the population will take place on three levels, namely provincial, district and local. Impacts can only truly be comprehended by understanding the differences and similarities between the different levels. The baseline description will focus on the Matjhabeng Local Municipality in the Lejweleputswa District Municipality in the Free State Province (referred to in the text as the study area), as these are the areas that will be most affected by the proposed project. Where possible, the data will be reviewed on a ward level. The data used for the socio-economic description was sourced from Census 2022, Community Survey 2016, and Census 2011. Both Census 2022 and Census 2011 were de facto censuses where individuals were counted based on

where they were on the census reference night. For Census 2022 the reference night was the night of 2 February 2022 and for Census 2011 it was the night of 9 October 2011. The results should be viewed as indicative of the population characteristics in the area and should not be interpreted as absolute.

StatsSA released limited data for Census 2022 on 10 October 2023 and will release more detailed data in future following a phased approach. ***The data that was released is only available up to local municipal level, and not on ward level.*** As such the data from Census 2022 will be supplemented by data from Census 2011 and Community Survey 2016. Census 2011 that contains the latest ward level data has been categorised according to the 2016 ward delineations, but not according to the current ward delineations. For this reason, the baseline data according to ward level will be analysed according to the 2016 delineations, which in this instance are the same as the latest ward delineations. Perhaps the most striking feature of Census 2022 is the very high undercount of 31% of people and 30% of households. While census undercounts are the norm rather than the exception (about a 5% undercount is acceptable), the undercount of this census may set a new international record (www.wits.ac.za). At aggregate level Census 2022 is robust, but at sub-national, and especially sub-provincial levels it might be less so.

4.5.3.1 POPULATION AND HOUSEHOLD SIZES

According to the Census 2022, the population of South Africa is approximately 62 million and has shown an increase of about 19.8% since 2011. The household density for the country is estimated on approximately 3.48 people per household, indicating an average household size of 3-4 people for most households, which is down from the 2011 average household size of 3.58 people per household. Smaller household sizes are in general associated with higher levels of urbanisation. The greatest increase in population since 2011 has been on local level (**Table 14**), but still lower than the national average. Population density refers to the number of people per square kilometre and the population density on a national level has increased from 42.4 people per km^2 in 2011 to 50.8 people per km2 in 2022. In the study area the population density has increased since 2011 with the highest density in the Matjabeng LM.

Table 14: Population density and growth estimates (sources: Census 2011, Census 2022).

Area	Size in km2	Population 2011	Population 2022	Population density 2011	Population density 2022	Growth in population (%)
Free State Province	129,825	2,745,590	2,964,412	21.15	22.83	7.97
Lejweleputswa DM	31,930	624,746	679,746	19.35	21.05	8.80
Matjhabeng LM	5,155	407,020	439,034	71.53	77.16	7.87
Fezile Dabi DM	20,674	488,036	509,912	23.61	24.66	4.48
Moqhaka LM	7,925	160,532	155,410	20.26	19.61	-3.19

Poverty is a complex issue that manifests itself in economic, social, and political ways and to define poverty by a unidimensional measure such as income or expenditure would be an oversimplification of the matter. Poor people themselves describe their experience of poverty as multidimensional. The South African Multidimensional Poverty Index (SAMPI) (Statistics South Africa, 2014) assess poverty on the dimensions of health, education, standard of living and economic activity using the indicators child mortality, years of schooling, school attendance, fuel for heating, lighting, and cooking, water access, sanitation, dwelling type, asset ownership and unemployment.

The poverty headcount refers to the proportion of households that can be defined as multi-dimensionally poor by using the SAMPI's poverty cut-offs (Statistics South Africa, 2014). The poverty headcount has increased on all levels since 2011 (**Table 15**), indicating an increase in the number of multi-dimensionally poor households.

The intensity of poverty experienced refers to the average proportion of indicators in which poor households are deprived (Statistics South Africa, 2014). The intensity of poverty has increased slightly on all levels. The intensity of poverty and the poverty headcount is used to calculate the SAMPI score. A higher score indicates a very poor community that is deprived on many indicators. The SAMPI score in the Matjhabeng LM area has decreased between 2011 and 2016, suggesting an improvement in some respects relating to poverty in this area. In the Moqhaka LM the SAMPI score has increased, indicating an increase in poverty in the area. SAMPI scores based on the 2022 Census data is not yet available.

Table 15: Poverty and SAMPI scores (sources: Census 2011 and Community Survey 2016).

Area	Poverty headcount 2011 (%)	Poverty intensity 2011 (%)	SAMPI 2011	Poverty headcount 2016 (%)	Poverty intensity 2016 (%)	SAMPI 2016
Free State Province	5.5	42.2	0.023	5.5	41.7	0.023
Lejweleputswa DM	5.6	42.8	0.024	4.8	42.2	0.020
Matjhabeng LM	5.5	43.0	0.024	4.3	41.8	0.018
Fezile Dabi DM	4.4	42.2	0.019	4.9	41.9	0.021
Moqhaka LM	2.7	41.4	0.011	2.9	42.7	0.012

4.5.3.2 POPULATION COMPOSITION, AGE, GENDER AND HOME LANGUAGE

In all the areas under investigation, the majority of the population belongs to the Black population group except in Ward 11 where almost half of the population belongs to the Coloured population group. The age distribution of the areas under investigation shows that the population on local, district or provincial level tend to be slightly older, with older populations in Wards 3, 8, and 25 of Matjhabeng LM and Ward 2 of Moqhaka LM (**Figure 31**).

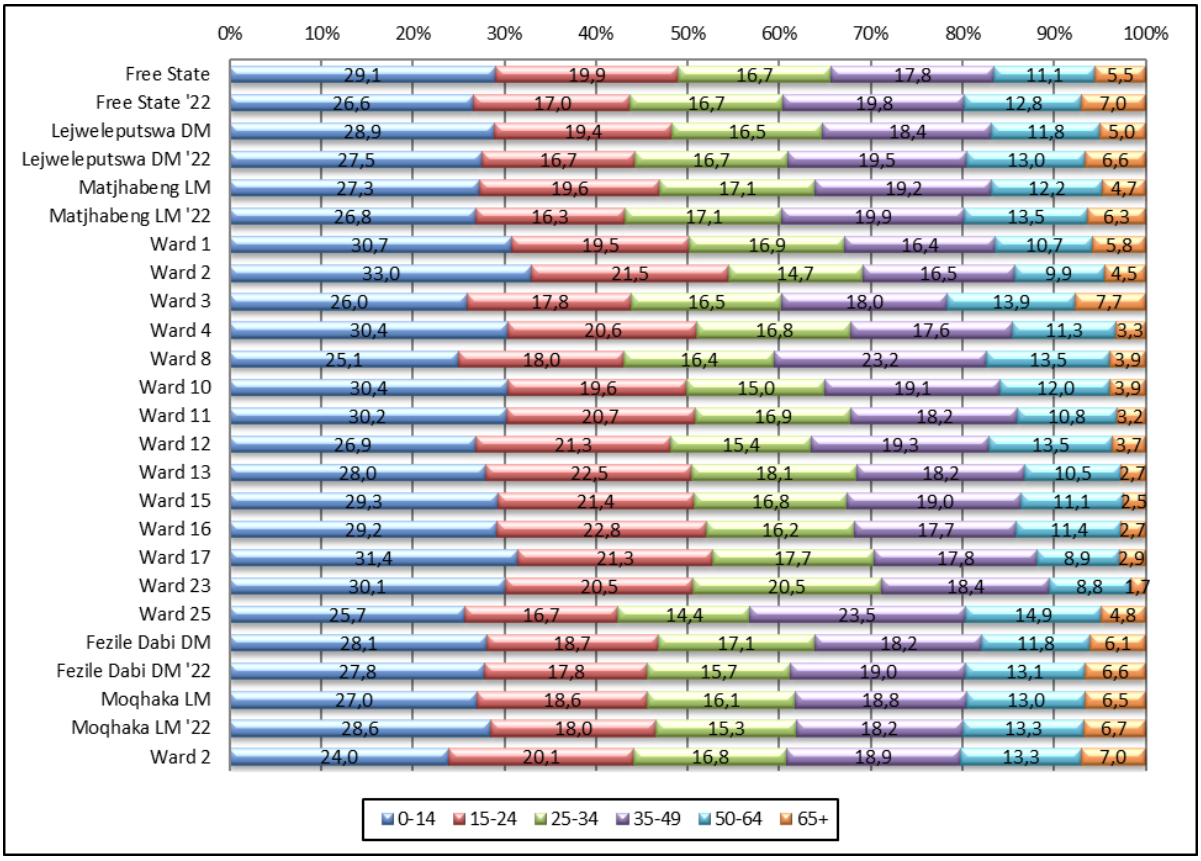


Figure 31: Age distribution (shown in percentage, source: Census 2011), Census 2022.

4.5.3.3 LANGUAGE

The majority of people in the area under investigation have Sesotho as home language, except in Ward 11 where more than half of people have Afrikaans as home language. Wards 3, 8 and 25 also have a relatively high incidence of people with Afrikaans as home language. Home language should be taken into consideration when communicating with the local communities and based on the profile of the area communication should take place in Sesotho, Afrikaans, and English. It must be noted that the public participation process for the project is undertaken in the three main languages spoken in the area namely, Sesotho, Afrikaans, and English (refer to **Appendix C**).

4.5.3.4 ACCESS TO WATER AND SANITATION

Ward 2 of the Moqhaka LM has the lowest incidence of households that access to water from a local or a regional water scheme, but the highest incidence of households that get their water from another source (**Figure 32**). Census 2011 does not specify what the 'other' water sources include. Almost 16% of households in Ward 3 get their water from a borehole. It is therefore important that all drilling sites each borehole shall be steel cased and have cement barriers to prevent leaks as well as plugged at the end of exploration to prevent groundwater seepage as per the proposed drilling procedure.

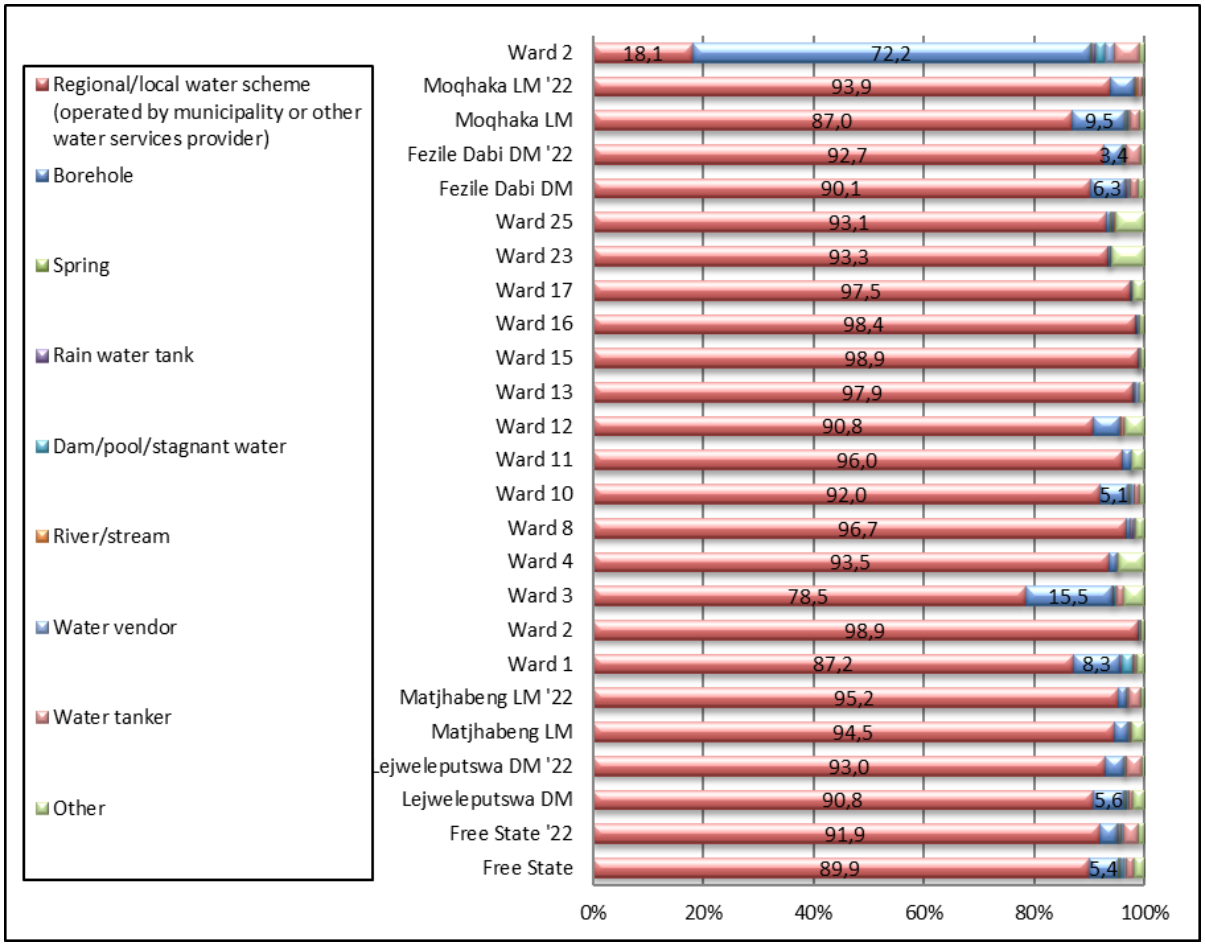


Figure 32: Water source (shown in percentage, source: Census 2011, Census 2022).

Access to piped water, electricity and sanitation relate to the domain of Living Environment Deprivation as identified by Noble et al (2006). Just over three quarters of households in Ward 8 has access to piped water inside the dwelling (**Figure 33**). This is much higher than on local, district and provincial level. The proportion of households in Wards 1, 2, 17, and 23 with access to water inside their dwellings are much lower that on local, district and provincial level.

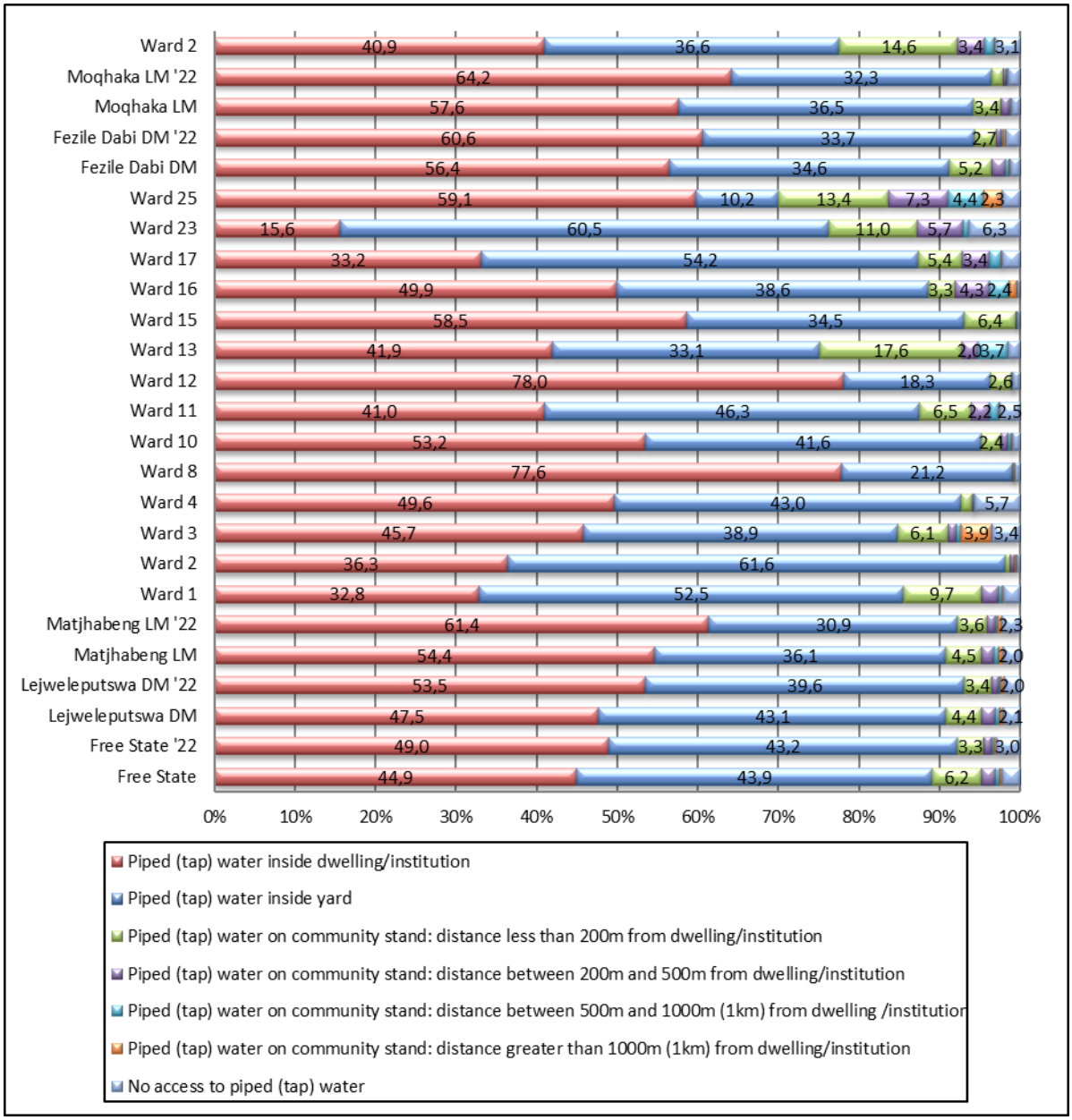


Figure 33: Piped water (shown in percentage, source: Census 2011, Census 2022).

The majority of households in Ward 23 have access to a pit toilet without ventilation (**Figure 34**). The level of access to flush toilets that are connected to a sewerage system varies between the wards.

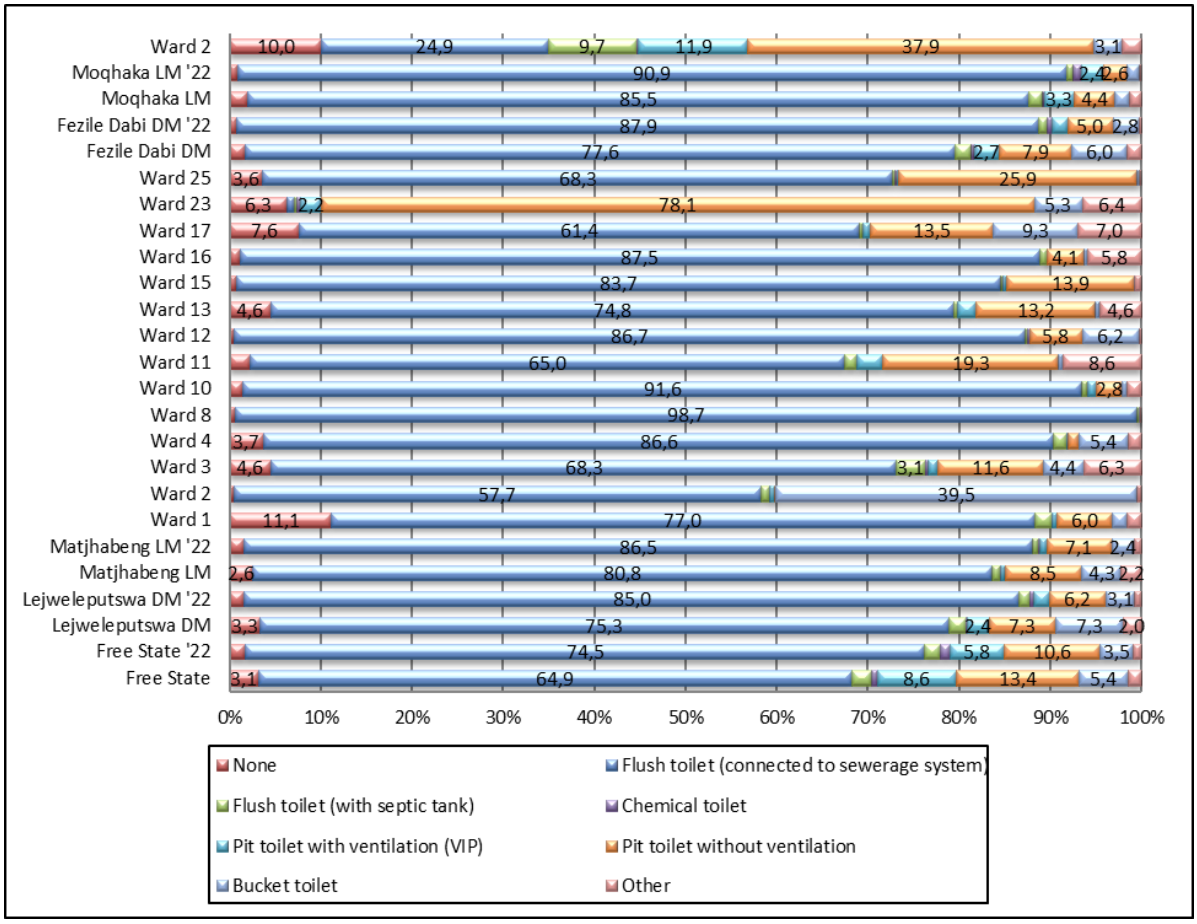


Figure 34: Sanitation (shown in percentage, source: Census 2011).

4.5.3.5 ENERGY

Electricity is seen as the preferred lighting source (Noble *et al.,* 2006) and the lack thereof should thus be considered a deprivation. Even though electricity as an energy source may be available, the choice of energy for cooking may be dependent on other factors such as cost. Wards 13, 23 and 25 of Matjhabeng LM and Ward 2 of the Moqhaka LM have the lowest proportion of households with access to electricity as energy source for lighting (**Figure 35**). It is evident from the energy source usage that gas is underutilized in the area although there is direct evidence includes gas-emitting boreholes, nearby commercial gas production, gas encountered during drilling and underground mining operations in the region.

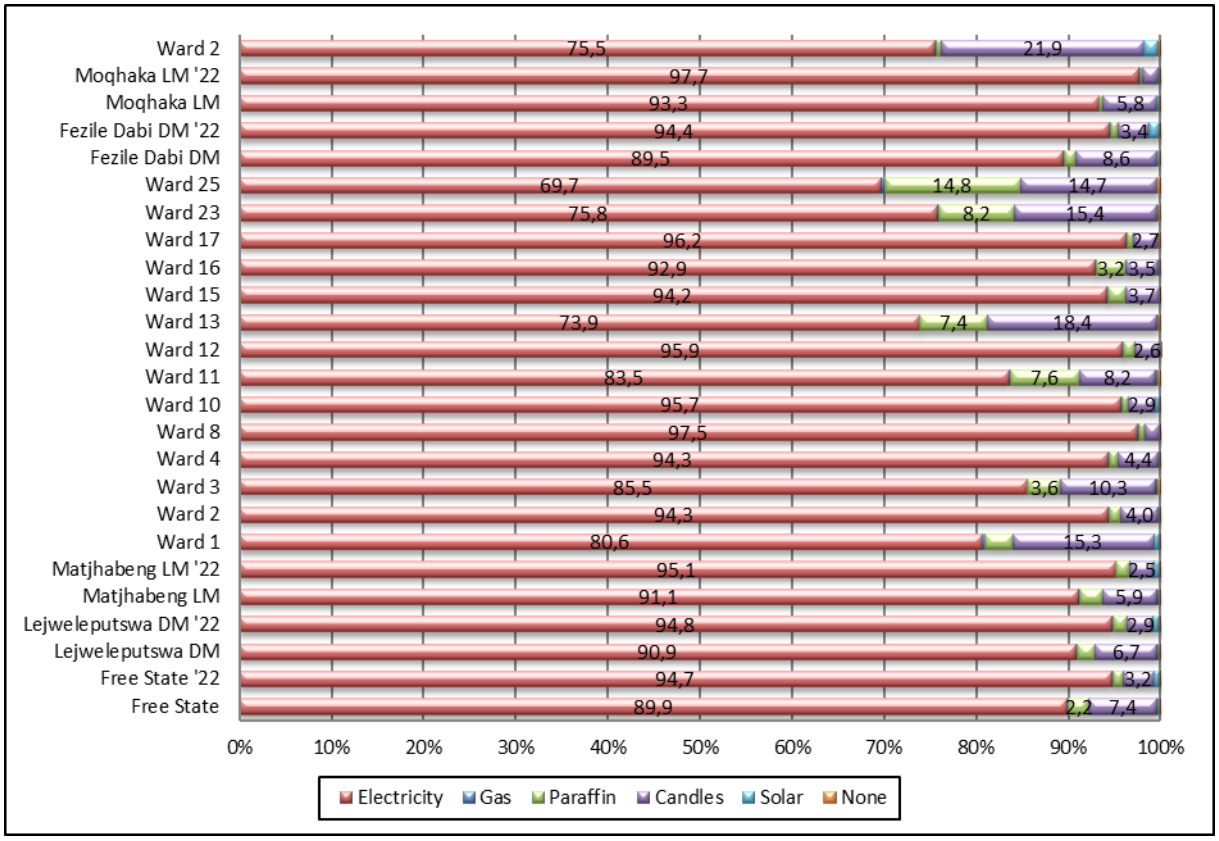


Figure 35: Energy source for lighting (shown in percentage, source: Census 2011, Census 2022).

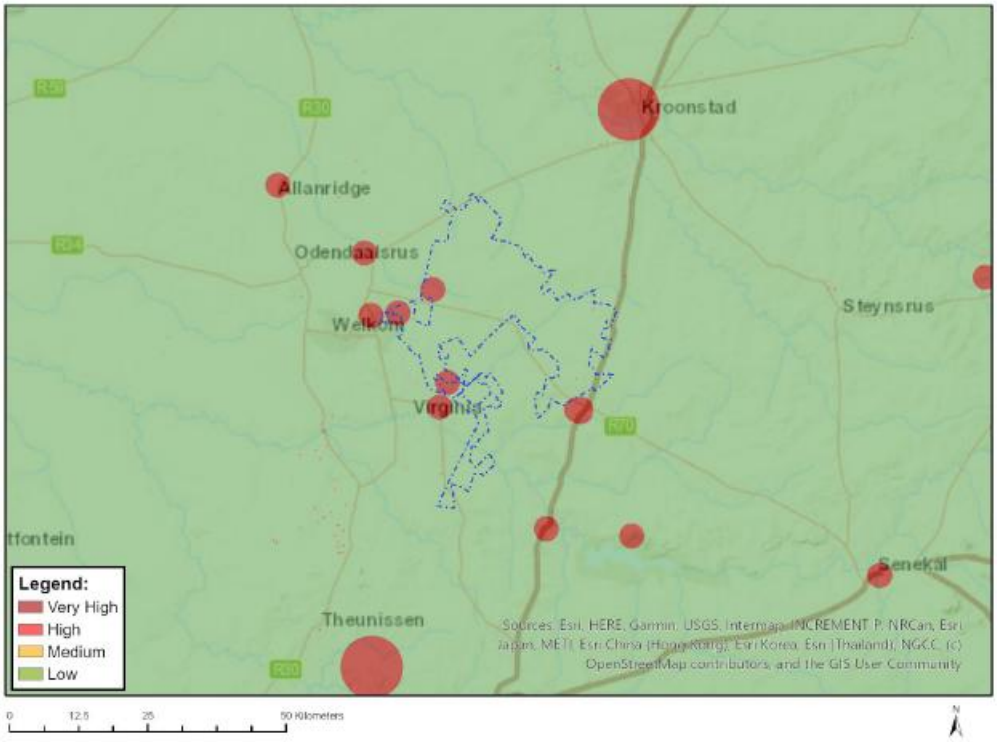
4.6 CULTURAL HERITAGE RESOURCES

The objective of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) is to introduce an integrated system for the management of national heritage resources. The Act defines a 'heritage resource' as any place or object of cultural significance (aesthetic, architectural, historical, scientific, social, spiritual, linguistic, or technological value or significance). The identification, evaluation and assessment of any cultural heritage site, artefact or find in South Africa is required by this Act. This section of the report presents the heritage status of the proposed Motuoane ER386 in Welkom.

According to the Baseline Heritage Impact Assessment Report undertaken by Dr Lucien James (EIMS, 2025), the Free State has a rich archaeological and historical history going back millions of years and includes significant aspects such as Later Stone Age rock art, Battlefields and Iron Age stonewalled enclosures. The general surroundings of the study area became a melting pot of contact and conflict as it represents one of many frontiers where San hunter-gatherers, Nguni and Sotho-Tswana agro-pastoralists, Dutch Voortrekkers and British Colonists all came together. The ravages of war also swept across these plains, and in particular the South African War (1899-1902) as well as the Boer Rebellion (1914-1915).

4.6.1 RELATIVE ARCHAEOLOGICAL AND CULTURAL HERITAGE THEME SENSITIVITY

According to the DFFE Screening Tool Report, the exploration right is located within an area of *low to very high* relative archaeological and cultural heritage theme sensitivity (see **Figure 36**). An assessment of the NHRA and preliminary project information revealed that the proposed development triggers Section 38(1) of the NHRA. Therefore, a Heritage Impact Assessment is required and will be undertaken in the EIA Phase. The South African Heritage Resources Agency (SAHRA), the Free State Heritage Resources Authority (FSPHRA) and Association of Southern African Professional Archaeologists (ASAPA) are I&APs in the project and will be provided with a copy of the report for review and comment.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
High	Within 150m of a Grade IIIa Heritage site
High	Within 100m of a Grade IIIb Heritage site
High	Within 50m of a Grade IIIc Heritage site
Low	Low Sensitivity
Very High	Within 2km of a Grade II Heritage site
Very High	Within 100m of an Ungraded Heritage site

Figure 36: Map of relative archaeological and cultural heritage theme sensitivity (DFFE, 2025).

Based on the Baseline Heritage Impact Assessment Report undertaken by Dr Lucien James (**Appendix F5)**, the ER was assessed using Google Earth as well as available surveys and mapping resources via the CDNGI Geospatial Portal (http://www.cdngiportal.co.za/cdngiportal/). First Edition Topographic maps (2726DD, 2826BB, 2827AA, 2727CC) of the area were analysed. As the maps were drawn between 1945 and 1975, it would include information on observations within the footprint of the development. Altogether, 38 potential heritage features were identified, including, ruins, potential stone wall structures, old farm complexes, and graves or grave sites. The two Grade II provincial heritage features previously identified and discussed are further presented in terms of their location and proximity to proposed activities.

4.6.2 2726DD

The area covered by these topographic maps includes 8 target areas and associated seismic transects. Several observations were made considering topographic maps dated 1945 and 1954. A total of 17 potential heritage features were identified which may be affected by the proposed activities. Many of these features were identified as old structures, or current farm complexes with several ruins or old buildings recognisable through an assessment of Google Earth imagery. Given that these features would be older than 60 years, it is understood that they are protected by the NHRA. The area covered by the maps also includes one of the identified Grade II

sites, that is, the grave of Itumeleng Caswell Mokobo, a political figure. The grave is located in the Phumulani Cemetery of Welkom. Although the further sections of the 2km buffer associated with the feature does intersect with proposed activities' area of interest, it is anticipated that the activities will in no way affect the grave. The feature is almost 1,9 kms from the closest seismic transect. This is further substantiated by the fact that the feature does not stand alone and is located in a cemetery which will not be affected by the proposed activities. Refer to **Figure 37** for one of the extracts of the maps indicating the approximate location of heritage features as identified through Google Earth.

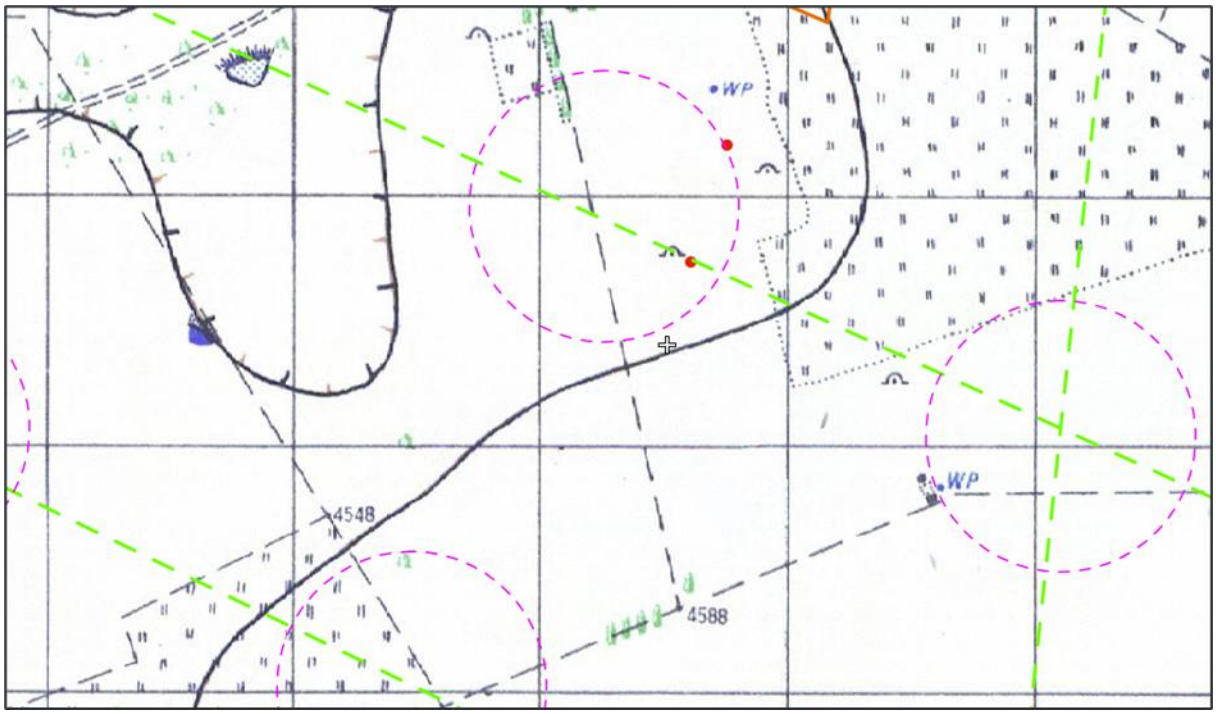


Figure 37: Extract of the 2726DD First Edition Topographic Map dated 1945. Map indicates the approximate location (determined through Google Earth) of a potential heritage feature (red point) within a target area (magenta circle). Seismic transects are represented as green dashed lines (EIMS, 2025).

4.6.3 2826BB

The area covered by these topographic maps includes 3 target areas and associated seismic transects. Several observations were made considering the first edition topographic map dated 1954. A total of 10 potential heritage features were identified which may be affected by the proposed activities. Many of these features were identified as old structures, or current farm complexes with several ruins or old buildings recognisable through an assessment of Google Earth imagery. A potential stone wall structure complex was also identified (MO030). A prospecting borehole was also identified (MO029). Given that these features would be older than 60 years, it is understood that they are protected by the NHRA. The area covered by the maps also includes one of the identified Grade II sites, that is, Ferreirasrust, a farmhouse which was nominated as a provincial heritage site. Similarly to the grave of Itumeleng Caswell Mokobo, the further reaches of the 2km buffer associated with Ferreirasrust intersects with the proposed seismic transects. Activities are expected to take place approximately 1,8 kms from the Grade II heritage feature but will not affect the feature or surrounding sense of place. Refer to **Figure 38** for one of the extracts of the maps indicating the approximate location of heritage features as identified through Google Earth.

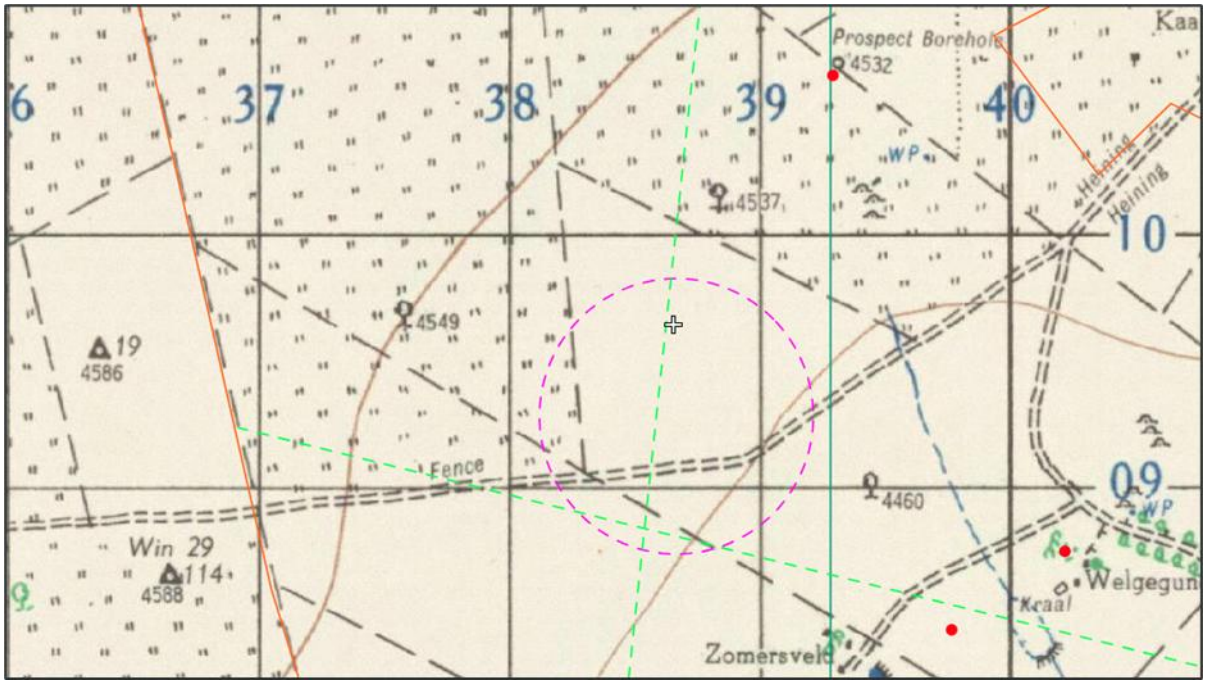


Figure 38: Extract of 2826BB First Edition Topographic Map dated 1954. Features depicted in this extract include a prospecting borehole. The approximate location of this feature (determined through Google Earth) was subsequently plotted (red point) (EIMS, 2025).

4.6.4 2827AA

The area covered by these topographic maps includes no target areas, but a short section of a seismic transect. Several observations were made considering the topographic maps dated 1951 and 1975. A total of 3 potential heritage features were identified which may be affected by the proposed activities. This included a feature marked on the maps as a "shed" (MO020) and a feature marked as a "native hut" (MO021). A grave (MO035) was also identified however; this feature is more than 500m away from the closest seismic transect. Refer to **Figure 39** for extracts of the map indicating the approximate location of heritage features as identified through Google Earth.

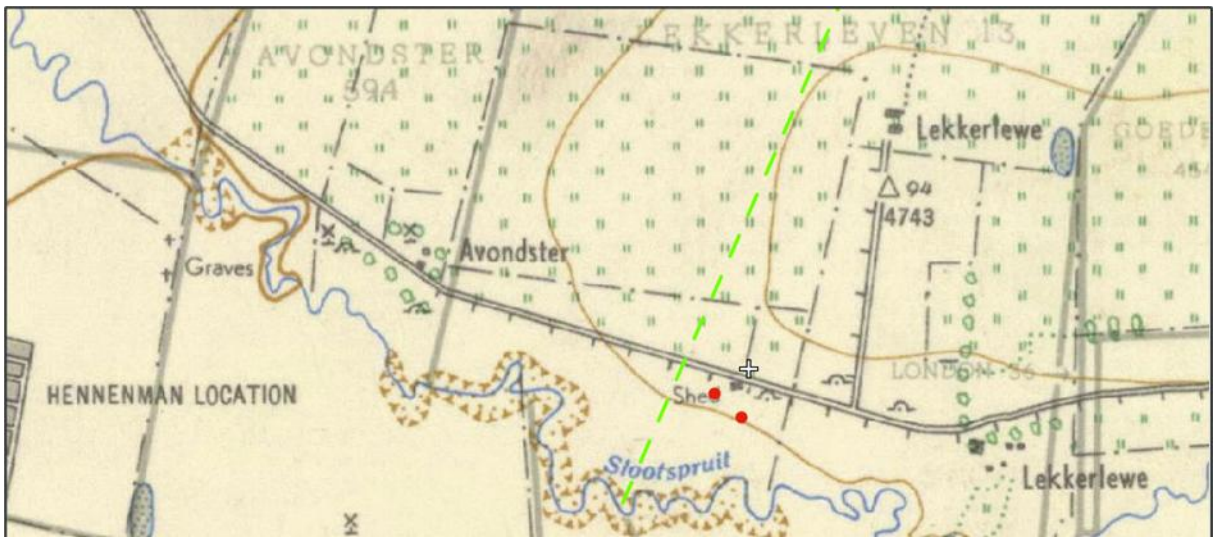


Figure 39: Extract of 2827AA First Edition Topographic Map dated 1951 (top) and a 1975 map (bottom). The approximate location (determined through Google Earth) of features (red points) labelled "Shed" and a nearby structure were identified as structures older than 60 years in proximity of a seismic transect (green dashed lines). A grave (labelled "Graf") on the 1975 map was also identified.

4.6.5 2727CC

The area covered by these topographic maps includes no target areas but does cover an area intersected by several proposed seismic transects. Several observations were made considering the topographic maps dated 1958. A total of 8 potential heritage features were identified which may be affected by the proposed activities. Many of these features were identified as old structures, or current farm complexes with several ruins or old buildings recognisable through an assessment of Google Earth imagery. Given that these features would be older than 60 years, it is understood that they are protected by the NHRA. Further, a cemetery was also identified (MO010), as well as a feature marked as "Graves" (MO023). Refer to **Figure 40** for extracts of the map indicating the approximate location of heritage features as identified through Google Earth.

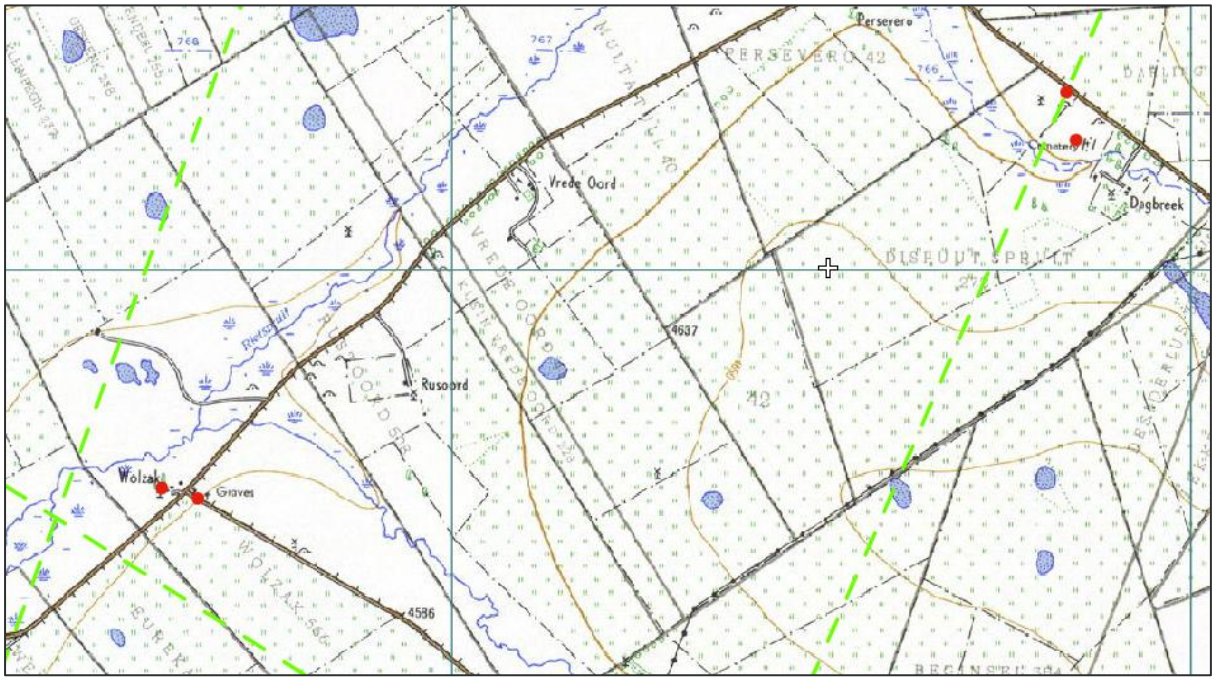


Figure 40: Extract of 2727CC First Edition Topographic Map dated 1958. The approximate location (determined through Google Earth) of graves (bottom left) and a cemetery (top right) along and in proximity to seismic transects (green dashed lines) were plotted (red points).

4.6.6 SUMMARY OF BASELINE HERITAGE FINDINGS

Altogether, besides for Grade II provincial heritage features identified, 31 structures, buildings, or complexes as well as three grave sites were identified as having or potentially having heritage significance. The graves in question are protected by the NHRA and have been provisionally graded as Grade III A or of High significance. All structures, buildings, complexes, or ruins thereof have been provisionally graded as Grade IV A or of Medium significance. This suggests that mitigation must take place should proposed activities have the potential to disturb these features. **Figure 41** present a visual summary of the main findings and their locations. Buffers of the Grade II features are illustrated on the maps. Buffers associated with other sites are too small to be illustrated on the maps. **Table 16** provides a summary of the different features identified, a description of the feature, as well as the coordinates of a relative central point associated with the find.

Table 16: Summary of different finds identified. Grade III A features highlighted in yellow (EIMS, 2025).

Feature No.	Description	Ratings and Significance	Coordinate
MO001	Huts or structures – Although no longer present, site may still hold remains dating 60 years or older.	Grade IV A Medium	28°9'50.73"S, 26°58'51.04"E (approximate location)
MO002	Farm dam – Structure dating 60 years or older.	Grade IV A Medium	28°9'34.51"S, 26°58'42.32"E
MO003	Historical ruin – structure dating 60 years or older.	Grade IV A Medium	28°2'9.46"S, 26°57'23.46"E
MO004	Farm dam – Structure dating 60 years or older.	Grade IV A Medium	28°2'24.61"S, 26°57'12.05"E
MO005	Farm Complex – Structures dating 60 years or older.	Grade IV A Medium	28°2'41.14"S, 26°58'23.09"E
MO006	Ruins of a farm dam – foundation remains dating 60 years or older.	Grade IV A Medium	28°2'42.82"S, 26°58'13.19"E
MO007	Farm Complex – Welgegund. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	28°1'30.53"S, 26°54'31.33"E
MO008	Farm Complex – Roemryk. Farm complex may include structures dating 60 years or older. Also includes a nearby hut.	Grade IV A Medium	27°58'14.81"S, 26°57'0.58"E
MO009	Historical ruins of a settlement area – structure dating 60 years or older.	Grade IV A Medium	27°56'21.84"S, 27°8'29.78"E
MO010	Cemetery – Graves may be 60 years or older.	Grade III A High	27°56'32.13"S, 27°8'32.11"E
MO011	Historical ruin – structure dating 60 years or older.	Grade IV A Medium	27°55'10.98"S, 27°5'29.68"E
MO012	Historical ruins of a settlement area – structure dating 60 years or older.	Grade IV A Medium	27°52'21.61"S, 26°59'12.08"E
MO013	Farm dam – Structure dating 60 years or older.	Grade IV A Medium	27°51'20.91"S, 26°58'37.08"E
MO014	Farm Complex – Bluegum Grove. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	27°51'18.03"S, 26°58'39.63"E

Feature No.	Description	Ratings and Significance	Coordinate
MO015	Historical ruins of a settlement area – structures dating 60 years or older.	Grade IV A Medium	27°51'7.97"S, 26°58'35.34"E
MO016	Farm Complex – Graspan. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	27°49'15.07"S, 26°58'20.42"E
MO017	Ruins of Farm Complex – Donkerhoek. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	27°49'44.18"S, 26°58'9.80"E
MO018	Farm dam and Kraal area - structures dating 60 years or older.	Grade IV A Medium	27°54'8.61"S, 26°59'15.77"E
MO019	Huts or structures – Although no longer present, site may still hold remains dating 60 years or older.	Grade IV A Medium	27°52'26.02"S, 27°0'27.92"E
MO020	Historical ruin – foundation of structure dating 60 years or older.	Grade IV A Medium	28°0'54.37"S, 27°6'20.88"E
MO021	Historical ruins of a settlement area – structures dating 60 years or older.	Grade IV A Medium	28°0'57.06"S, 27°6'24.33"E
MO022	Location of demolished Farm Complex – Wolzak. Site may include heritage finds.	Grade IV A Medium	27°57'46.77"S, 27°4'49.38"E
MO023	Grave site - Graves may be 60 years or older.	Grade III A High	27°57'49.01"S, 27°4'58.16"E
MO024	Historical ruins of a settlement area – structures dating 60 years or older.	Grade IV A Medium	27°57'24.80"S, 26°54'47.82"E
MO025	Farm dam – Structure dating 60 years or older.	Grade IV A Medium	27°56'17.31"S, 26°54'5.26"E
MO026	Farm Complex – Dew Drop. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	27°52'28.35"S, 27°1'40.77"E
MO027	Location of demolished Farm Complex – Uitzicht or Uitkyk. Site may include heritage finds.	Grade IV A Medium	27°50'12.63"S, 26°56'22.40"E
MO028	Location marked as ruins - Site may include heritage finds.	Grade IV A Medium	27°50'43.90"S, 26°55'35.43"E
MO029	Prospecting borehole – feature older than 60 years. Note: if to be used for the exploration activities, Motuoane must consult SAHRA and FSHRA.	Grade IV A Medium	28°0'34.41"S, 26°54'0.32"E

Feature No.	Description	Ratings and Significance	Coordinate
~~MO030~~	Potential Stone Walled Structure – removed from list as observations were not confirmed.	None	28°1'39.78"S, 26°54'16.19"E
MO031	Historical ruin – structure dating 60 years or older.	Grade IV A Medium	27°56'23.30"S, 26°54'11.65"E
MO032	Huts or structures – Although no longer present, site may still hold remains dating 60 years or older.	Grade IV A Medium	27°55'15.93"S, 27°8'58.63"E
MO033	Hut or structure – Site is densely vegetated but may still hold remains dating 60 years or older.	Grade IV A Medium	27°58'31.72"S, 26°53'3.69"E
MO034	Hut or structure – Site is densely vegetated but may still hold remains dating 60 years or older.	Grade IV A Medium	27°58'17.72"S, 26°53'8.61"E
MO035	Cemetery – Graves may be 60 years or older.	Grade III A High	28°0'48.61"S, 27° 5'54.48"E
MO036	Farm Complex – Bothasrus. Farm complex may include structures dating 60 years or older.	Grade IV A Medium	27°49'48.46"S, 26°58'27.12"E

The exploration area is extensive, the site intersects, and is in proximity of several Grade III heritage sites, as well as several Grade II or nominated Provincial heritage sites. This highlighted sensitivity corresponds with Grade II sites, the farmhouse, Ferreirasrust (9/2/318/0001), and several graves of political figures located along the outskirts of Welkom. It was further ascertained that the Very High sensitivity attributed to the site is in relation to Ferreirasrust, and the graves nominated as Grade II provincial sites. Since the ER area is so extensive, sections of the area intersect with the applied buffers of 2km which surrounds these Grade II provincial heritage sites. It is understood that the proposed seismic transects may intersect with the 2km buffers associated with Ferreirasrust and a Grade II grave in Welkom, however, the proposed activities will have no impact on the Provincial heritage features highlighted given their distance from the TAs, and the nature of the proposed seismic survey activities (the impact of this survey is not expected to affect the sense of place which the buffer in place is meant to preserve). Further, the defined 500 m TAs do not fall within any of the buffers associated with these features.

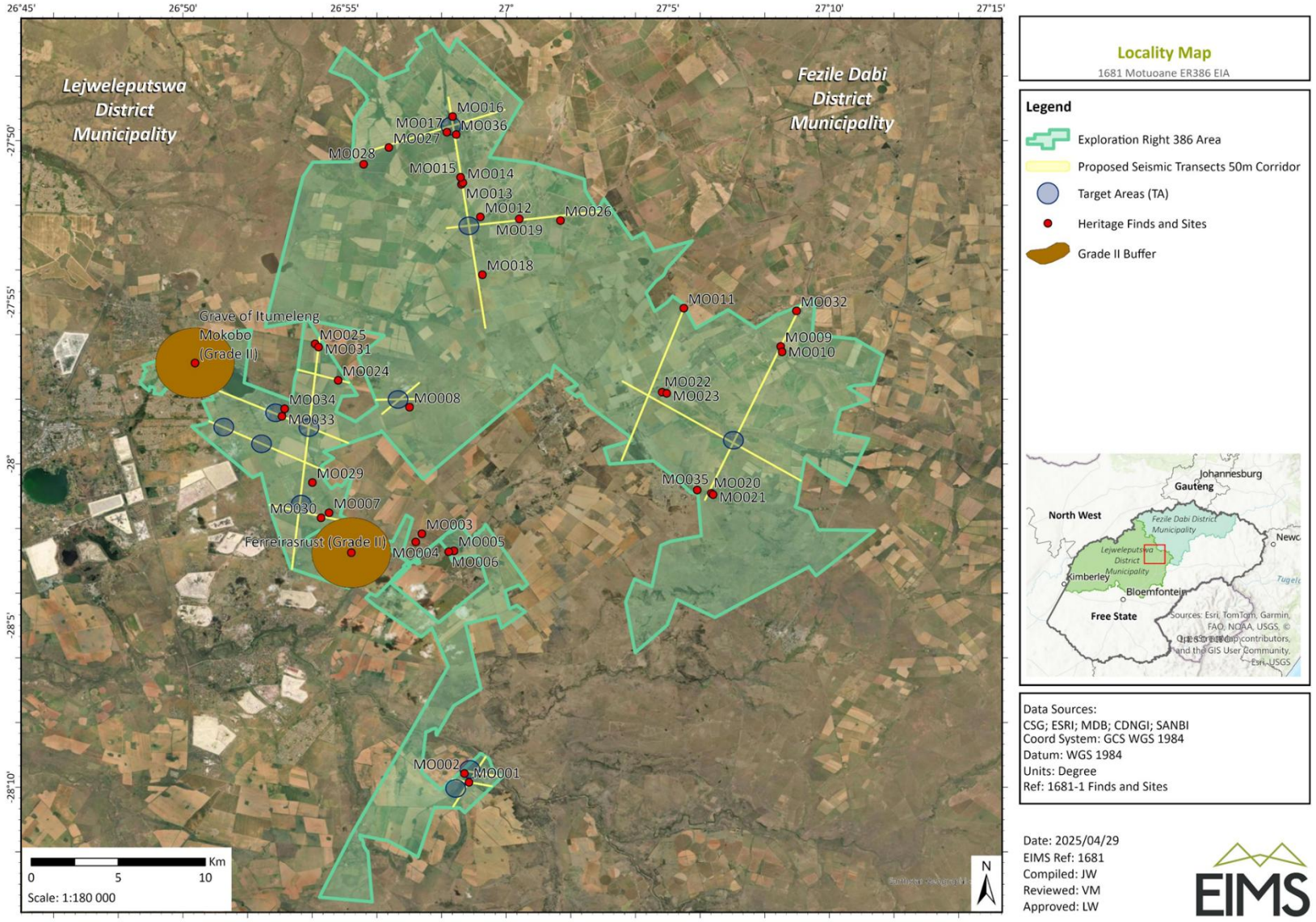
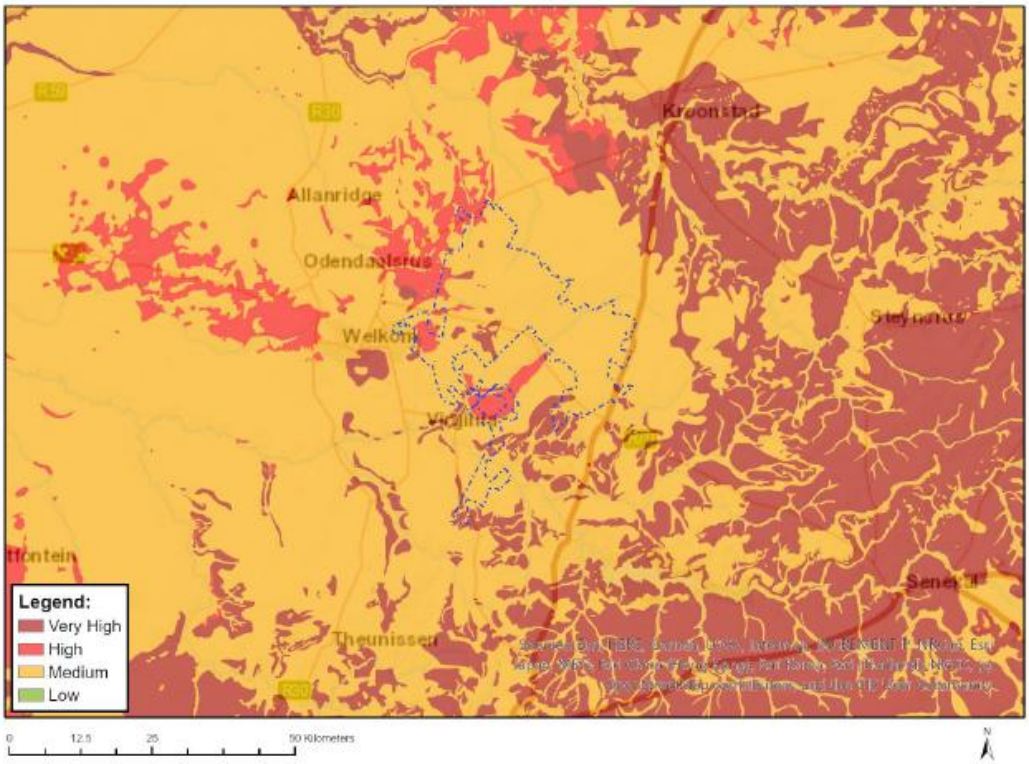


Figure 41: Map of potential heritage features across the ER Area including Grade II site 2km buffers (EIMS, 2025).

4.7 PALAEONTOLOGY

Cultural Heritage in South Africa, including all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include "all objects recovered from the soil or waters of South Africa, including archaeological and **palaeontological objects** and material, meteorites and rare geological specimens". Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources and may not be unearthed, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

Based on the 1:250 000 SAHRIS PalaeoMap and the National Web-Based Screening Tool Report, the study area is located within a *Very High* Palaeo-Sensitivity area (see **Figure 42**). The study area is located on an area which has largely been transformed but the proposed development entails deep excavations (650m boreholes). A Palaeontological Impact Assessment (PIA) will be undertaken for the project to confirm the preliminary findings and/or identify fossil resources and the potential impact by the proposed development as well as mitigation measures. The findings and mitigation measures of the PIA will be discussed in the EIA phase.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
High	Features with a High paleontological sensitivity
Medium	Features with a Medium paleontological sensitivity
Very High	Features with a Very High paleontological sensitivity

Figure 42: Map of relative palaeontology theme sensitivity (DFFE, 2025).

According to the Baseline Palaeontological Impact Assessment Report for the ER (Fourie, 2025), the study area is underlain by Quaternary deposits, while the largest portion of the development is underlain by the Adelaide

Subgroup (Beaufort Group, Karoo Supergroup). The bulk of the site is underlain by the Karoo Supergroup Formations covered by vegetation, grass, trees, roads, and buildings. According to the Council for Geoscience (CGS) 1:250 000 geological maps (Geological Map Sheet 2726 Kroonstad and Geological Map Sheet 2826 Winburg), the surface geology of the study area is characterized by a variety of lithologies, formations, and intrusions. These include geologically recent Quaternary deposits; sediments of the Beaufort and Ecca Groups within the Karoo Supergroup; dolerite dykes, sheets, and sills associated with the Karoo Dolerite Suite; and post-Karoo kimberlite pipes and dykes. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of all Karoo Supergroup geological formations are ranked as VERY LOW to VERY HIGH, and here the impact is potentially VERY HIGH for the Beaufort Group, HIGH for Quaternary (Qs), MODERATE for Ecca rocks and the Qauternary (Qc). A wide range of possible fossil remains occur in the Cenozoic, though these are often sparse, such as: mammalian bones and teeth, tortoise remains, ostrich eggshells, non-marine mollusc shells, ostracods, diatoms, and other micro fossil groups, trace fossils (e.g. calcretised termitaria, rhizoliths, burrows, vertebrate tracks), freshwater stromatolites, plant material such as peats, foliage, wood, pollens, within calc tufa. The Jurassic Dolerite does not contain fossils.

However, it is anticipated that no visible evidence of fossiliferous outcrops will be found in within the target areas and seismic transects during the EIA Phase based on previous studies in the area and thus an overall medium palaeontological significance is likely to be allocated for the project area. It is therefore, currently considered that the proposed development will not lead to detrimental impacts on the palaeontological reserves of the area and construction of the development may be authorised in its whole extent. The ECO for this project must be informed that the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) has a Very High Palaeontological Sensitivity. If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation (recording and collection) can be carried out.

Figure 43: Extract of the SAHRIS PalaeoMap map (Dr Fourie, 2025).

A site-specific palaeontological study will be undertaken in the EIA phase.

4.8 SOILS AND AGRICULTURAL POTENTIAL

As part of the Baseline Soils, Agriculture, Freshwater and Terrestrial Biodiversity Assessment (The Biodiversity Company, 2025), baseline soil information was obtained using published South African Land Type Data. Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 - 2006). The land type data is presented at a scale of 1:250 000 and comprises of the division of land into land types. In addition, a Digital Elevation Model (DEM) as well as the slope percentage of the area was calculated by means of the NASA Shuttle Radar Topography Mission Global 1 arc second digital elevation data by means of QGIS and SAGA software.

The land capability was determined by using the guidelines described in "The farming handbook" (Smith, 2006) which the DAFF land capabilities were further developed from. Accordingly, the identified soil forms associated with the ER are restricted to land capability 2 and 3, categorised between land capability 6-8 (Pinedene, Westleigh, Augrabies, Swartland and Glen soils) and land capability 8 (Witbank soil), categorised between land capability 1-5. The baseline soil land capability was compared to the National Land Capability data (DAFF, 2017). The land potential classes are further determined by combining the land capability results and the climate capability of a region. The final land potential results are then described in **Table 17**.

Table 17: Summary of different finds identified. Grade III A features highlighted in yellow (EIMS, 2025).

Land potential	Description of land potential class
L1	Very high potential: No limitations. Appropriate contour protection must be implemented and inspected.
L2	High potential: Very infrequent and/or minor limitations due to soil, slope, temperatures, or rainfall. Appropriate contour protection must be implemented and inspected.
L3	Good potential: Infrequent and/or moderate limitations due to soil, slope, temperatures, or rainfall. Appropriate contour protection must be implemented and inspected.
L4	Moderate potential: Moderately regular and/or severe to moderate limitations due to soil, slope, temperatures, or rainfall. Appropriate permission is required before ploughing virgin land.
L5	Restricted potential: Regular and/or severe to moderate limitations due to soil, slope, temperatures, or rainfall.
L6	Very restricted potential: Regular and/or severe limitations due to soil, slope, temperatures, or rainfall. Non-arable
L7	Low potential: Severe limitations due to soil, slope, temperatures, or rainfall. Non-arable
L8	Very low potential: Very severe limitations due to soil, slope, temperatures, or rainfall. Non-arable

According to the land type database (Land Type Survey Staff, 1972 – 2006), the ER is characterized by the Bb1, Dc12, Dc8, Bd19, Bd21, Bd20, Ea40, Dc9 land types. Figure 44 illustrates the respective terrain units relative to the most prevalent land use type. The associated land capability ranges from Very Low-Low (02) to Moderate-High (10). Refer to **Figure 45** and **Figure 46** for the land types and land capabilities within the ER.

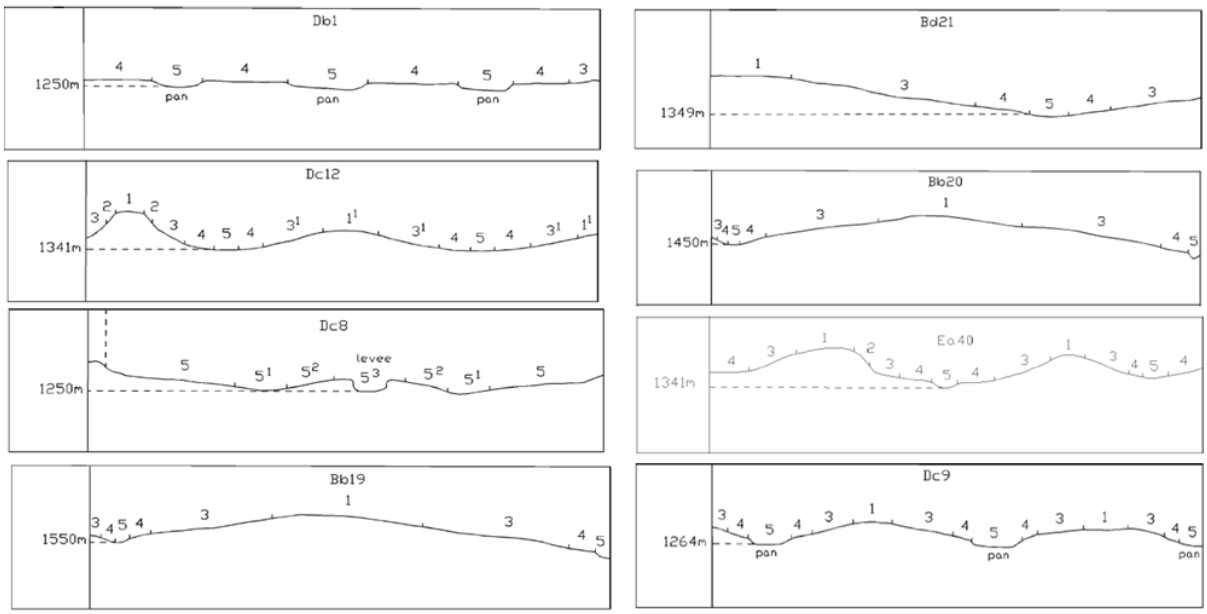


Figure 44: Illustration of Bb1, Dc12, Dc8, Bd19, Bd21, Bd20, Ea40, Dc9 and type terrain units (Land Type Survey Staff, 1972 – 2006) (The Biodiversity Company, 2025).

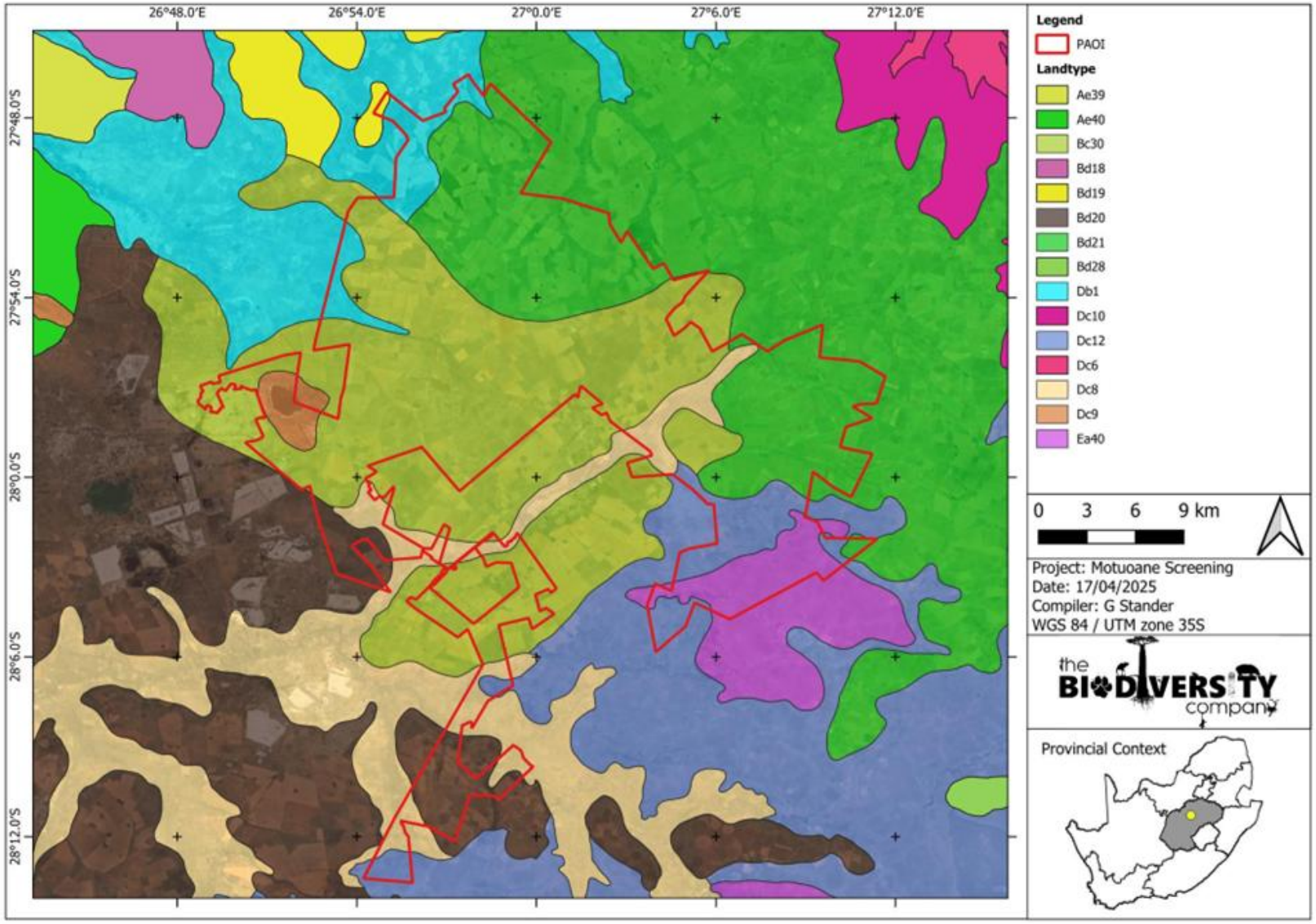


Figure 45: The land type associated with the exploration right (The Biodiversity Company, 2025).

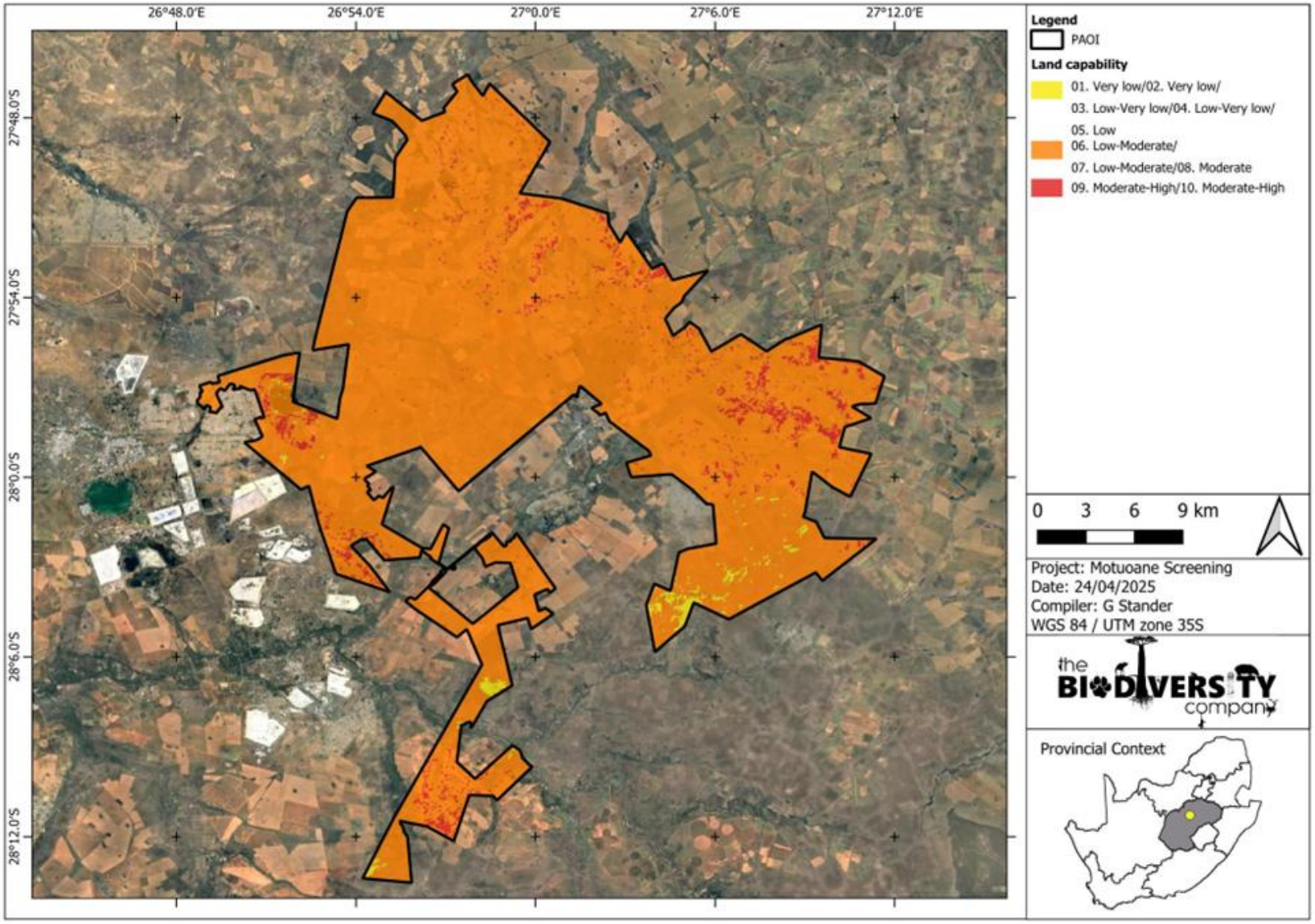


Figure 46: The land capability associated with the exploration right (The Biodiversity Company, 2025).

4.9 TERRESTRIAL BIODIVERSITY AND VEGETATION

Terrestrial biodiversity is the variety of life forms on the land surface of the Earth. High biodiversity is an indicator of a healthy ecosystem, which is directly linked to human health. Animals and plants are responsible for many vital services our lives depend on, including: oxygen production; water regulation; soil retaining; and providing flood protection.

Biodiversity is both a part of nature and affected by it. Some biodiversity loss is because of events such as seasonal changes or ecological disturbances (wildfires, floods, etc.), but these effects are usually temporary, and ecosystems have managed to adapt to these threats. Human-driven biodiversity loss, in contrast, tends to be more severe and long-lasting. The human-made climate crisis is leading to environmental destruction, habitat loss, and species extinction. Terrestrial biodiversity is decreasing rapidly through habitat loss: a process where a natural habitat becomes incapable of supporting its native species, which are consequently displaced or killed. In the recent past, there have Increased efforts implemented to prevent further loss of terrestrial biodiversity and the ecosystem services they provide. The characteristics and implications of the terrestrial biodiversity within the Motuoane ER386 site are discussed below.

4.9.1 ECOLOGICALLY IMPORTANT LANDSCAPE FEATURES

The following features describe the general area and habitat, this assessment is based on spatial data that are provided by various sources such as the provincial environmental authority and the South African National Biodiversity Institute (SANBI).

Table 18: Desktop and background spatial features examined (The Biodiversity Company, 2025).

Desktop Information Considered	Relevant/Irrelevant
Ecosystem Threat Status (RLE 2021)	Relevant. Overlaps with 'Endangered (EN) and 'Least Concern (LC)' ecosystems.
Ecosystem Protection Level	Relevant. Overlaps with 'Not Protected (NP)' and 'Poorly Protected (PP)' ecosystems.
Provincial Conservation Plan	Relevant. Overlaps with Other Natural Areas (ONAs), Ecological Support Areas 1 & 2 (ESAs 1 & 2), Degraded Areas (DAs) as well as Critical Biodiversity Areas 1 & 2 (CBAs 1 & 2).
South Africa Protected Areas Database - SAPAD and South Africa Conservation Areas Database - SACAD	Relevant. Overlaps with the Thabong Game Range and falls within >5 km of Tara Wildlife Safaris, Newlands Game Ranch, De Rust Private Nature Reserve and Goliatskraal Private Nature Reserve.
National Protected Areas Expansion Strategy (NPAES)	Relevant. The ER overlaps with NPAES Priority Focus Areas.
Key Biodiversity Areas (KBA)	Irrelevant. The nearest KBA is situated over 30 km from the ER.
South African Inventory of Inland Aquatic Ecosystems (SAIIAE)	Relevant. The ER overlaps with 'Least Concern' (LC) and 'Critically Endangered' (CR) wetlands.
National Freshwater Priority Area	Relevant. The ER overlaps with non-priority and priority FEPA wetlands.
Mining and Biodiversity Guidelines	Relevant. The ER overlaps with an area of Highest Biodiversity Importance.
Strategic Water Source Areas (SWSA)	Irrelevant. The ER does not overlap with any SWSA.

Coordinated Avifaunal Roadcount (CAR)	Irrelevant. Three CAR routes are located within the Project Area. FW19, FW20, FW49.
Coordinated Waterbird Counts (CWAC)	Relevant. A CWAC location, Toronto Pan, is located approximately 11 km from the Project Area.

4.9.2 PROTECTED AREAS

The DFFE maintains a spatial database on Protected Areas and Conservation Areas. Protected Areas and Conservation Areas (PACA) Database scheme that used for classifying protected areas (South Africa Protected Areas Database-SAPAD) and conservation areas (South Africa Conservation Areas Database-SACAD) into types and sub-types in South Africa. The ER overlaps with the Thabong Game Reserve and more than 5 km of Tara Wildlife Safaris, Newlands Game Ranch, De Rust Private Nature Reserve and Goliatskraal Private Nature Reserve (**Figure 47**). Although according to SAPAD, the ER overlaps with the Thabong Game Reserve, it must be noted that the Thabong Game Reserve remains a game reserve only on outdated GIS information. The area earmarked as Thabong Game Reserve is currently known as Harmony Cluster, it is used for mining, residential and grazing activities (refer to **Figure 15** to **Figure 18** in **Section 4.1**).

4.9.3 NATIONAL PROTECTED AREA EXPANSION STRATEGY

The National Protected Area Expansion Strategy 2010 (NPAES) was identified through a systematic biodiversity planning process. They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with strong emphasis on climate change resilience and requirements for protecting freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine scale planning which may identify a range of different priority sites based on local requirements, constraints and opportunities (NPAES, 2010). Portions of the southern sections of the ER overlaps with NPAES Priority Focus Areas (**Figure 48**).

4.9.4 FREE STATE BIODIVERSITY PLAN

Bioregional plans are one of a range of decision support tools provided for in the Biodiversity Act that can be used to enable biodiversity conservation in priority areas. The purpose of a bioregional plan is to inform land-use planning, environmental assessment and authorisations, and natural resource management, by a range of sectors whose policies and decisions impact on biodiversity (Desmet *et al.*, 2013). The purpose of the conservation plans is to inform land-use planning and development on a provincial scale and to aid in natural resource management, with one of the outputs being a map of Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). These are classified into different categories, namely Protected Areas, CBA1 areas, CBA2 areas, ESA1 areas, ESA2 areas, Other Natural Areas (ONAs) and areas with No Natural Habitat Remaining (NNR) based on biodiversity characteristics, spatial configuration and requirements for meeting targets for both biodiversity patterns and ecological processes.

Critical Biodiversity Areas (CBAs) – Areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and the functionality of ecosystems. Ecological Support Areas (ESAs) - Areas are required to support and sustain the ecological functioning of Critical Biodiversity Areas (CBAs). For terrestrial and aquatic environments, these areas are functional but are not necessarily pristine natural areas. They are however required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the CBAs, and which also contributes significantly to the maintenance of Ecological Infrastructure.

The Free State Department of Environment and Nature Conservation has developed a Free State Biodiversity Sector Plan, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). These biodiversity priority areas, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of the landscape. The identification of Critical Biodiversity Areas for the Free State was undertaken using a Systematic Conservation Planning approach. Available data on biodiversity features (incorporating both pattern and process, and covering terrestrial and inland aquatic realms), their condition, current Protected Areas and Conservation Areas, and

opportunities and constraints for effective conservation were collated. Based on the Free State Biodiversity Sector Plan, the proposed study area overlaps ESAs 1 & 2, CBAs 1 & 2, DAs, as well as ONAs (**Figure 49**).

It must be noted that the majority of the proposed Motuoane ER386 target areas and seismic transects is situated in within an area consisting mainly of mining activities, crop farming and grazing and naturally occurring pans. Residential areas, waterbodies, wetlands, mines and quarries and forested land are also located in the extended surrounding areas. The larger area surrounding the proposed ER is classified as agricultural and mining in nature. A terrestrial biodiversity impact assessment will be undertaken to the presence, type, implications and/or mitigation measures of biodiversity species within the study area. The findings will be presented and discussed in the EIA Report. The approach that will be adopted for the fauna and flora assessment will take cognisance of the recently published Government Notice 320 in terms of NEMA dated 20 March 2020: "Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation".

4.9.5 THE NATIONAL VEGETATION MAP 2018

The Vegetation Map of South Africa, Lesotho and Swaziland is a fundamental data set that is updated periodically. The National Biodiversity Assessment (NBA) 2018 process provided an opportunity for a more comprehensive revision of the NVM and better alignment between the terrestrial, marine and estuarine ecosystem maps. Based on the NVM, the ER is located within a Grassland Biome. Grassland Biome is centrally located in southern Africa, and adjoins all except the desert, fynbos, and succulent Karoo biomes (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the grassland biome include: Seasonal precipitation; and the minimum temperatures in winter (Mucina & Rutherford, 2006). The grassland biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. The topography is mainly flat and rolling but includes the escarpment itself. Altitude varies from near sea level to 2 850 m above sea level. Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often abundant. Frosts, fire, and grazing maintain the grass dominance and prevent the establishment of trees. The ER overlaps with the Vaal-Vet Sandy Grassland, Central Free State Grassland, Highveld Alluvia Vegetation and the Winburg Grassy Shrubland vegetation types (**Figure 50**).

4.9.5.1 VAAL-VET SANDY GRASSLAND

The Vaal-Vet Sandy Grassland occurs in North-West and Free State Provinces from its northern distribution, in an area south of Lichtenburg and Ventersdorp, stretching to Klerksdorp, Leeudoringstad, Bothaville and Brandfort in the south. is situated in the summer rainfall region with a mean annual precipitation of 530 m, where summers are mild to hot and winters very cold with frequent frost. Aeolian and colluvial sand overlay sandstone, shale, and mudstone of the Karoo Supergroup (mostly Ecca Group) as well as older Ventersdorp Supergroup Andesite and basement gneiss in the north. Soil forms are mostly Avalon, Westleigh, and Clovelly (Mucina and Rutherford, 2010).

The landscape is dominated by plains with some scattered, slightly irregular undulating plains and hills. Low-tussock grasslands with strong karroid elements and the relative dominance of the grass species *Themeda triandra* are important features of Vaal-Vet Sandy Grassland. Dominant and other significantly occurring grasses are *Anthephora pubescens, Aristida congesta, Brachiaria serrata, Chloris virgata, Cymbopogon caesius, C. pospischilii, Cynodon dactylon, Digitaria argyrograpta, D. eriantha, Elionurus muticus, Eragrostis curvula, E. chloromelas, E. lehmanniana, E. plana, E. obtusa, E. racemosa, E. superba, E. trichophora, Heteropogon contortus, Panicum coloratum, P. gilvum, Pogonarthria squarrosa, Setaria sphacelata, Themeda triandra Trichoneura grandiglumis, Triraphis andropogonoides and Tragus berteronianus.* Dominant and characteristic herbs and low shrubs generally include *Anthospermum rigidum, Berkheya onopordifolia, Bulbine narcissifolia, Euphorbia inaequilatera, Felicia muricata, Geigeria aspera, Helichrysum caespititium, H. dregeanum, H. paronychioides, Hermannia depressa, Hibiscus pusillus, Ledebouria marginata, Monsonia burkeana, Pentzia globosa, Rhynchosia adenodes, Selago densiflora, Tripteris aghillana, Vernonia oligocephala and Ziziphus zeyheriana*.

This vegetation type is described as endangered because approximately 63% of it has been transformed for commercial crop cultivation and grazing pressure from cattle and sheep. Only 0.3% of this vegetation type is statutorily conserved in Bloemhof Dam, Schoonspruit, Sandveld, Faan Meintjies, Wolwespruit and Soetdoring Nature Reserves (Mucina and Rutherford, 2010). Vaal-Vet Sandy Grassland is comparable with Dry Cymbopogon-Themeda Veld (VT 50) (Acocks, 1953) and Dry Sandy Highveld Grassland (LR 37) (Low and Rebelo, 1996).

4.9.5.2 CENTRAL FREE STATE GRASSLAND

The Central Free State Grassland mostly occurs in the Free State Province and marginally into Gauteng Province in a broad zone from around Sasolburg in the north to Dewetsdorp in the south, also including towns such as Kroonstad, Ventersburg, Steynsrus, Lindley, Winburg and Edenvale in its distribution area. It is situated in the summer rainfall region of South Africa with a mean annual precipitation of 560 mm. Summers are generally mild and frost occurs frequently during winter months. The geology of this vegetation type is generally dominated by sedimentary mudstones and sandstone of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) as well as those of the Ecca Group (Karoo Supergroup). These rock formations give rise to vertic, melanic and red soils, typically of the Arcadia, Bonheim, Kroonstad, Valsrivier and Rensburg soil forms (Mucina and Rutherford, 2010).

The landscape is charactersed by undulating plains supporting short grassland. Under natural conditions it is dominated by Themeda triandra but is dominated by *Eragrostis curvula* and *E. chloromelas* in disturbed habitats. Dwarf Karoo-shrubs establish in severely degraded clayey bottomlands, and overgrazed and trampled low-lying areas are prone to Vachellia karroo encroachment. Dominant and other characteristic plant species include the grasses *Aristida adscensionis, A. congesta, A. bipartite, A. canescens, Andropogon appendiculatus, Agrostis lachnantha, Cynodon dactylon, C. transvaalensis, Cymbopogon pospischilii, Digitaria argyrograpta, Eragrostis curvula, E. chloromelas, E. lehmanniana, E. micrantha, E. plana, E. obtusa, E. racemosa, E. trichophora, Elionurus muticus, Heteropogon contortus, Microchloa caffra, Panicum coloratum, Setaria sphacelata, S. incrassata, Sporobolus discosporus, Themeda triandra and Tragus koelerioides.* Also, the herbs and low shrubs *Anthospermum rigidum, Berkheya onopordifolia, Conyza pinnata, Crabbea acaulis, Euphorbia inaequilatera, Felicia muricata, Geigeria aspera, Helichrysum dregeanum, Hermannia depressa, Hibiscus pusillus, Melolobium candicans, Oxalis depressa, Pentzia globosa, Pseudognaphalium luteo-album, Raphionacme dyeri and Tripteris aghillana* (Mucina and Rutherford, 2010).

Central Free State Grassland is compared to Acocks' (1953) Dry Cymbopogon-Themeda Veld (VT 50) and also to Low and Rebelo's (1996) Dry Sandy Highveld Grassland (LR 37). From a conservation point of view, this unit is described as vulnerable due to almost a quarter of the area of it being transformed for crop cultivation and building of large dams such as Allemanskraal, Erfenis, Groothoek, Koppies, Weltevrede and Kroonstad Dams. Small portions are conserved in the Willem Pretorius, Rustfontein and Koppies Dam Nature Reserves as well as in some private nature reserves (Mucina and Rutherford, 2010).

4.9.5.3 HIGHVELD ALLUVIAL VEGETATION

The Highveld Alluvial Vegetation occurs in the Free State, North-West, Mpumalanga and Gauteng Provinces, and also in Lesotho and Swaziland and are associated with alluvial drainage lines and floodplains along rivers embedded in the Grassland Biome, and marginally along eastern Kalahari rivers in the Savanna Biome. Important rivers that fall in this unit are the Riet, Harts, Vals, Vet, Wilge, Mooi, Sand, middle and upper Vaal, upper Modder and upper Caledon Rivers as well as their many tributaries. Climatically this unit is situated in the summer rainfall region of southern Africa with MAP over the distribution range of the unit at about 500 mm. Summers are generally hot and winters are cold with frequent frost. Deep sandy to clayey alluvial soils, which developed over Quaternary alluvial sediments, with Oakleaf, Dundee, Shortlands, Glenrosa and Mispah soil forms, generally dominate this unit. The topography is generally flat and the river banks support riparian thickets accompanied by seasonally flooded grasslands and disturbed herblands, often dominated by alien flora. The rivers in this unit are perennial, often flooding in the high rainfall summer months and erosion of river banks and the deposition of fine soil on alluvium is a general phenomenon (Mucina and Rutherford, 2010).

Important plant species in riparian thickets are the trees and woody shrubs *Celtis africana, Diospyros lycioides, Ehretia rigida, Grewia flava, Gymnosporia buxifolia, Lycium hirsutum, Searsia lancea, S. pyroides, Salix*

mucronata, Vachellia karroo and *Ziziphus mucronata*, the herbs and herbaceous shrubs *Asparagus laricinus, A. suaveolens, Clematis brachiata, Pollichia campestris and the grasses Panicum maximum* and *Setaria verticillata*. Reed beds are dominated by Phragmites australis and flooded herb- and grasslands by the graminoids *Agrostis lachnantha, Andropogon appendiculatus, A. eucomus, Brachiaria marlothii, Chloris virgata, Cynodon dactylon, Cyperus denudatus, C. longus, Echinochloa holubii, Eragrostis obtusa, E. plana, E. porosa, Fimbristylis ferruginea, Hemarthria altissima, Imperata cylindrica, Ischaemum fasciculatum, Miscanthus junceus, Panicum coloratum, Paspalum distichum, Pycreus mundii, Sporobolus africanus, S. fimbriatus, Themeda triandra* and *Urochloa panicoides*, as well as the herbs and herbaceous shrubs *Alternanthera sessilis, Barleria macrostegia, Corchorus asplenifolius, Crinum bulbispermum, Equisetum ramosissimum, Felicia muricata, Galium capense, Gomphocarpus fruticosus, Haplocarpha lyrata, Hibiscus pusillus, Lobelia angolensis, Myriophyllum spicatum, Nidorella residifolia, Persicaria amphibia, P. lapathifolia, P. hystricula, Pseudognaphalium oligandrum, Pulicaria scabra, Rorippa fluviatilis, Senecio inoratus, Stachys hyssopoides* and *Vahlia capensis* (Mucina and Rutherford, 2010).

From a conservation point of view Highveld Alluvial Vegetation is not threatened and about 10% of the unit is statutorily conserved in Baberspan (a Ramsar site), Bloemhof Dam, Christiana, Faan Meintjies, Soetdoring, Sandveld and Schoonspruit Nature Reserves. More than 25% has been transformed by crop cultivation and the building of the Bloemhof, Erfenis, Krugersdrif, Mockes and Vaalharts Dams (Mucina and Rutherford, 2010). The unit is prone to invasion by a number of alien weeds and invaders such as the trees and woody shrubs *Celtis sinensis, Melia azedarach, Morus alba, Salix babylonica, Schinus molle, Nicotiana glauca, N. longiflora* and *Populus x canescens*, and also the herbs *Argemone ochroleuca, Chenopodium strictum, Conyza canadensis, Datura stramonium, Melilotus alba, Oenothera indecora, Tagetes minuta, Verbena bonariensis, Xanthium strumarium, Zinnia peruviana, and the grasses Paspalum dilatatum , P. urvillei* and *Pennisetum clandestinum*.

4.9.5.4 WINBURG GRASSY SHRUBLAND

The Windburg Grassy Shrubland is located primarily in the Free State Province. There are a series of larger patches between Trompsburg through Bloemfontein and Winburg to Ventersburg. The altitude ranges from 1,300 to 1,660 meters, predominantly between 1,360 and 1,440 meters. The landscape features solitary hills, slopes and escarpments of mesas creating a mosaic of habitats ranging from open grassland to shrubland (Mucina & Rutherford, 2006).

Important Plant Taxa includes graminoids: *Aristida adscensionis (d), A. congesta (d), A. diffusa (d), Cymbopogon pospischilii (d), Cynodon dactylon (d), C. incompletus (d), Eragrostis chloromelas (d), E. lehmanniana (d), E. micrantha (d), E. obtusa (d), E. trichophora (d), Eustachys paspaloides (d), Heteropogon contortus (d), Panicum stapfianum (d), Setaria lindenbergiana (d), S. sphacelata (d), Sporobolus fimbriatus (d), Themeda triandra (d), Tragus koelerioides (d), Digitaria argyrograpta, Elionurus muticus, Enneapogon scoparius, Eragrostis plana, E. superba, Tragus berteronianus, T. racemosus, Triraphis andropogonoides.* Small Trees: *Vachellia karroo, Celtis africana, Cussonia paniculata, Pittosporum viridiflorum,Searsia lancea, Scolopia zeyheri, Ziziphus mucronata.* Tall Shrubs: *Buddleja saligna (d), Euclea crispa subsp. ovata (d), Gymnosporia polyacantha (d), Olea europaea subsp. africana (d), Rhus burchellii (d), R. erosa (d), Diospyros lycioides subsp. lycioides, Grewia occidentalis, Gymnosporia buxifolia, Tarchonanthus camphoratus.* Herbs: *Berkheya onopordifolia var. onopordifolia, Hermannia coccocarpa, Indigofera alternans, Mohria caffrorum, Pupalia lappacea, Salvia repens.* Low Shrubs: *Helichrysum dregeanum (d), Pentzia globosa (d), Anthospermum rigidum subsp. pumilum, Asparagus cooperi, A. laricinus, Berkheya annectens, Chrysocoma ciliata, Clutia pulchella, Euryops empetrifolius, Felicia filifolia subsp. filifolia, F. muricata, Nenax microphylla, Osyris lanceolata, Rosenia humilis, Selago saxatilis, Solanum tomentosum var. coccineum.*

From a conservation point of view, the Winburg Grassy Shrubland is classified as Least Threatened, with a national conservation target of 28%. A small extent is conserved in statutory areas such as the Willem Pretorius Nature Reserve. Around 10% of this vegetation type has been transformed due to urban expansion and cultivation (Mucina & Rutherford, 2006).

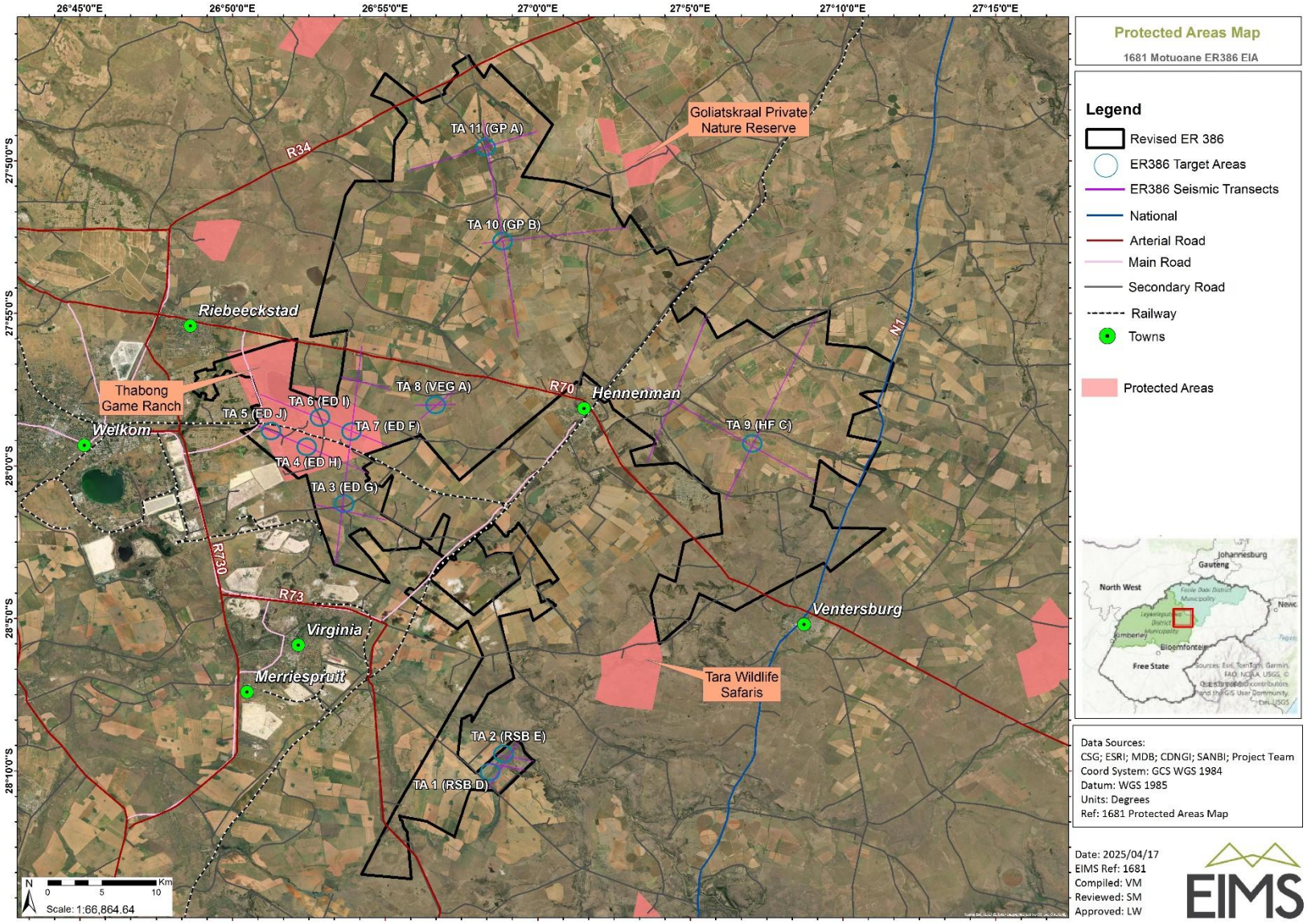


Figure 47: Map illustrating the ER in relation to the SAPAD areas.

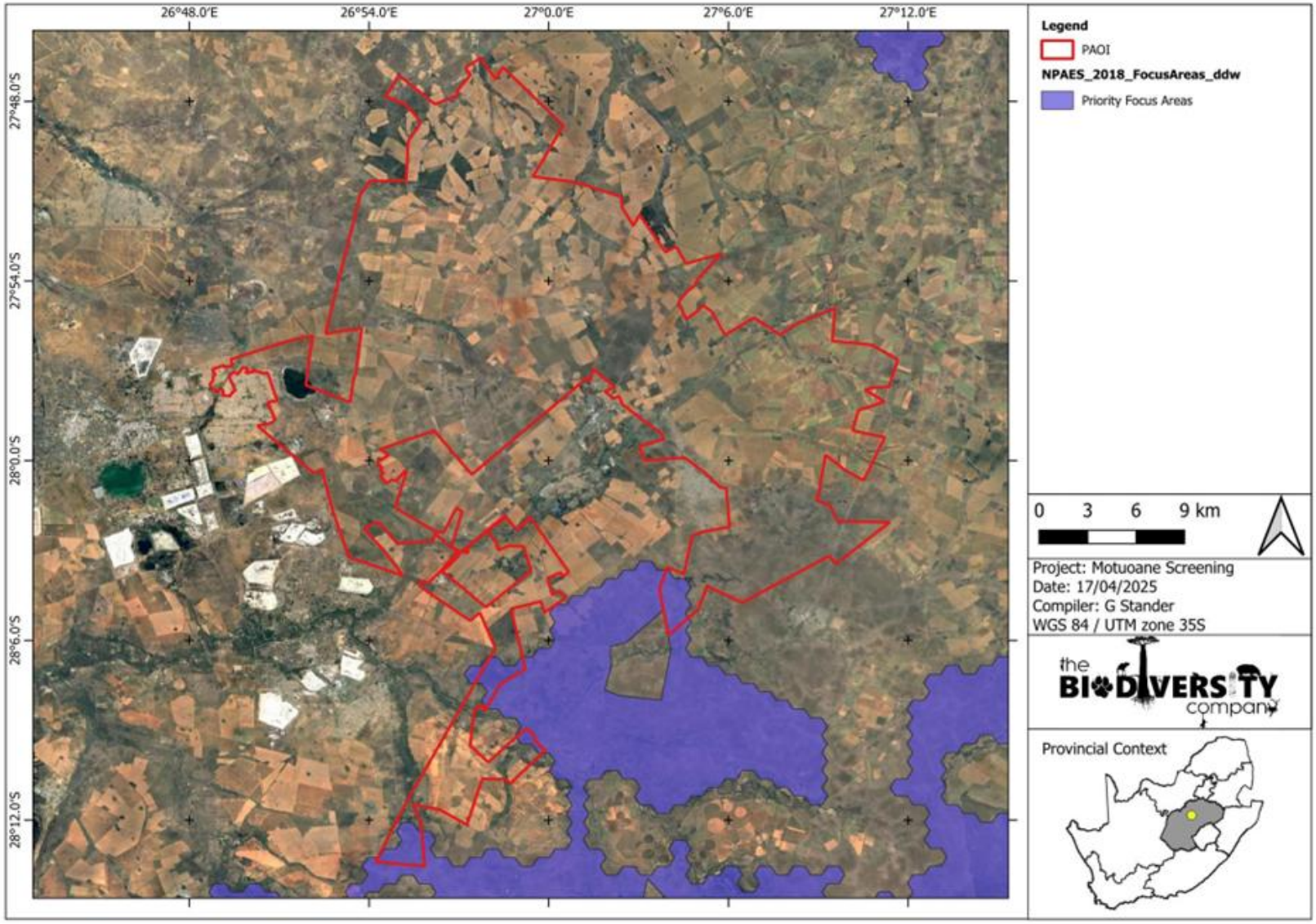


Figure 48: Map illustrating the ER in relation to the NPAES areas (The Biodiversity Company, 2025).

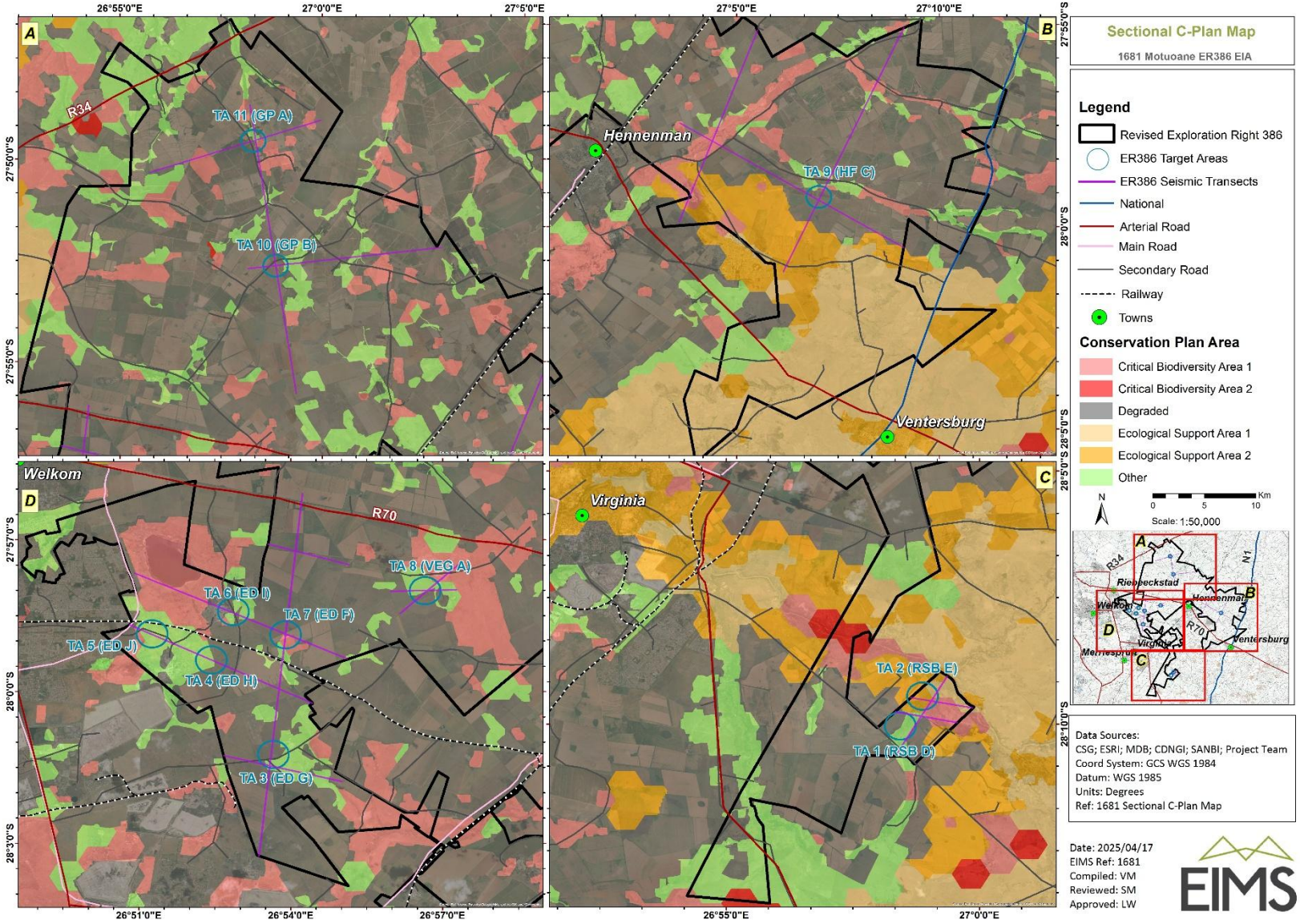


Figure 49: Map illustrating the ER in relation to the provincial conservation plan.

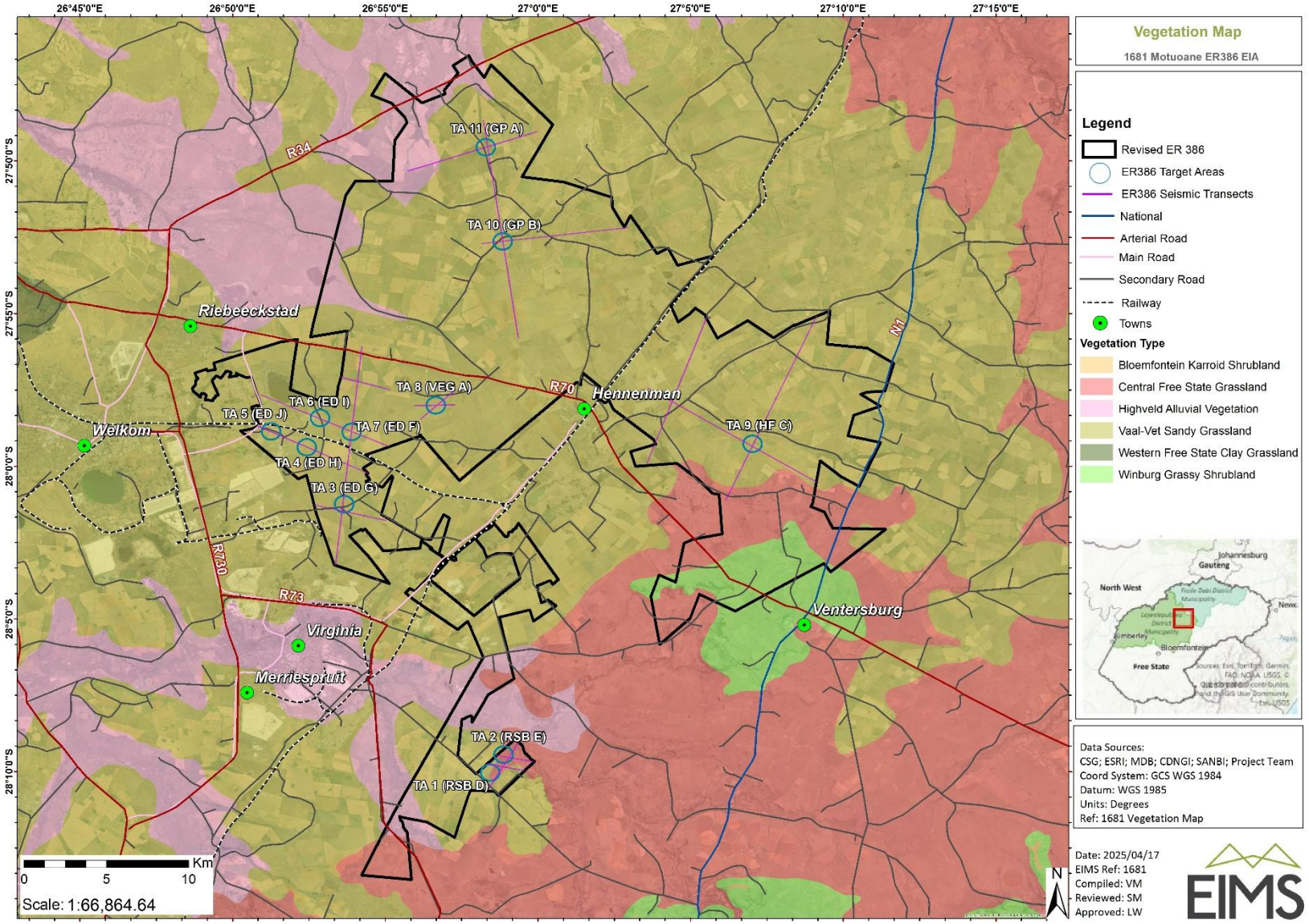


Figure 50: Vegetation types associated with the ER.

4.9.6 THE NATIONAL BIODIVERSITY ASSESSMENT

The National Biodiversity Assessment (NBA) was completed as a collaboration between the SANBI, the DFFE and other stakeholders, including scientists and biodiversity management experts throughout the country over a three-year period. The purpose of the NBA is to assess the state of South Africa's biodiversity with a view to understanding trends over time and informing policy and decision-making across a range of sectors.

The two headline indicators assessed in the NBA are Ecosystem Threat Status and Ecosystem Protection Level (Skowno *et al.,* 2019).

4.9.6.1 ECOSYSTEM THREAT STATUS

Ecosystem Threat Status (ETS) outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function, and composition, on which their ability to provide ecosystem services ultimately depends. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Least Concern (LC) or Protected, based on the proportion of each ecosystem type that remains in a good or healthy ecological condition (Skowno et al., 2019). CR, EN, VU or Protected ecosystem types are collectively referred to as threatened ecosystems. Critically Endangered (CR) ecosystems experiencing severe ecological degradation due to human intervention and facing an extremely high risk of irreversible transformation. Endangered (EN) ecosystems that have undergone degradation but are not critically endangered, meaning they have a high risk of further decline. Vulnerable (VU) ecosystems at a high risk of significant degradation, although not currently endangered or critically endangered. Protected ecosystems of high conservation value or national/provincial importance, regardless of whether they are critically endangered, endangered, or vulnerable. According to the spatial dataset, the ER overlaps with EN and LC ecosystems (**Figure 51**).

4.9.6.2 ECOSYSTEM PROTECTION LEVEL

Ecosystem Protection level (EPL) informs on whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Not Protected (NP), Poorly Protected (PP), Moderately Protected (MP) or Well Protected (WP), based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Skowno et al., 2019). NP, PP or MP ecosystem types are collectively referred to as under-protected ecosystems. In South Africa, approximately 33% of ecosystem types are considered well protected, while 59% are not protected. The country aims for at least 17% of terrestrial ecosystems to be conserved through protected areas, but currently only has 8.37%. Ecosystems like estuaries and wetlands are among the most threatened and least protected, and freshwater fish are the most threatened species group.

Ecosystem protection level based on the target achievement (%) of each vegetation type by type 1 protected areas. Well-protected (WP) ecosystems are defined as vegetation types with 100% of their target area conserved; similarly, MP ecosystems, PP, and NP ecosystems have at least 50%, 25%, and 5% of their target areas conserved, respectively. According to the National Vegetation Data (2018) obtained from SANBI, the ER overlaps with NP and PP ecosystems (**Figure 52**).

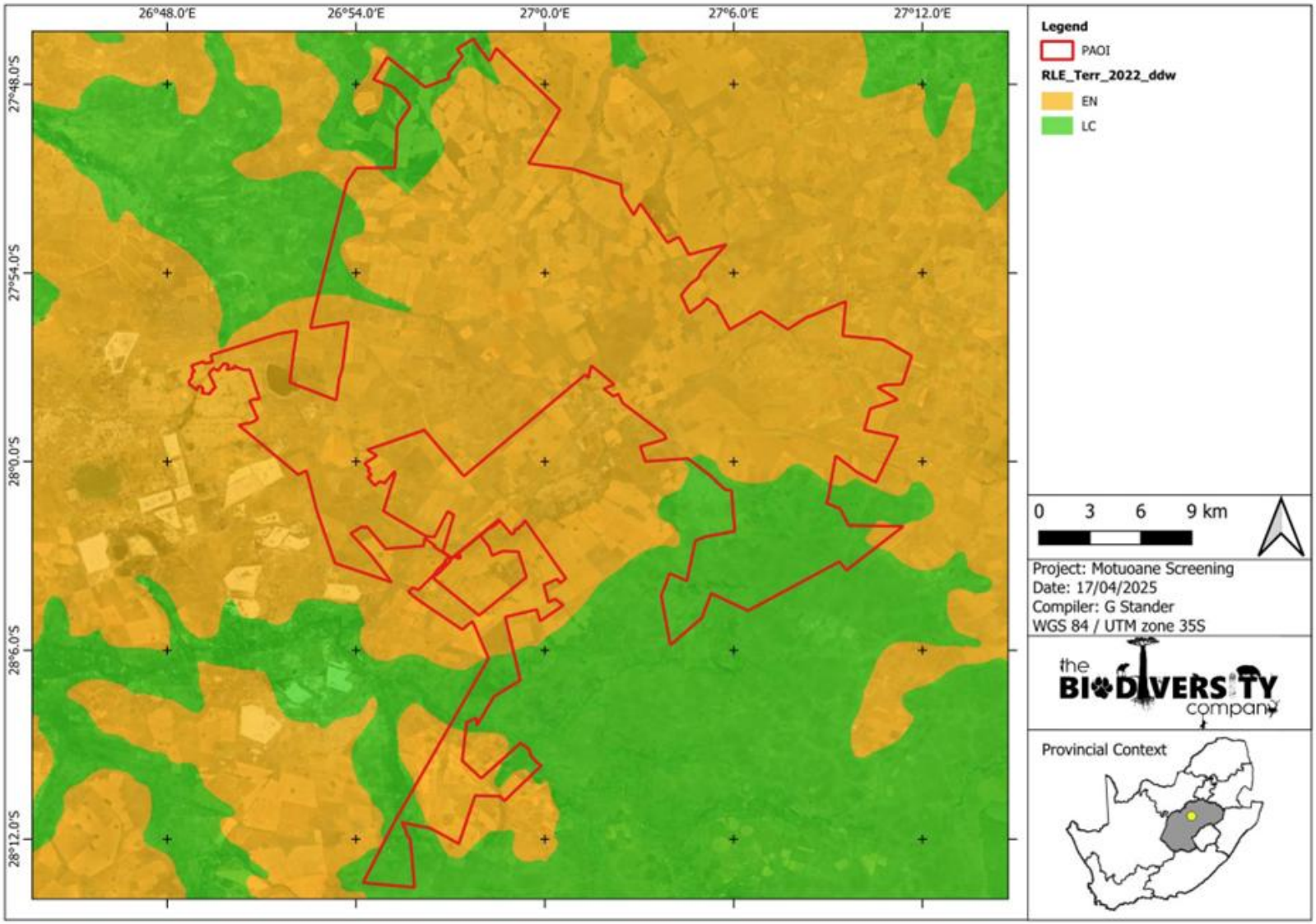


Figure 51: Map illustrating the ecosystem threat status associated with the ER (The Biodiversity Company, 2025).

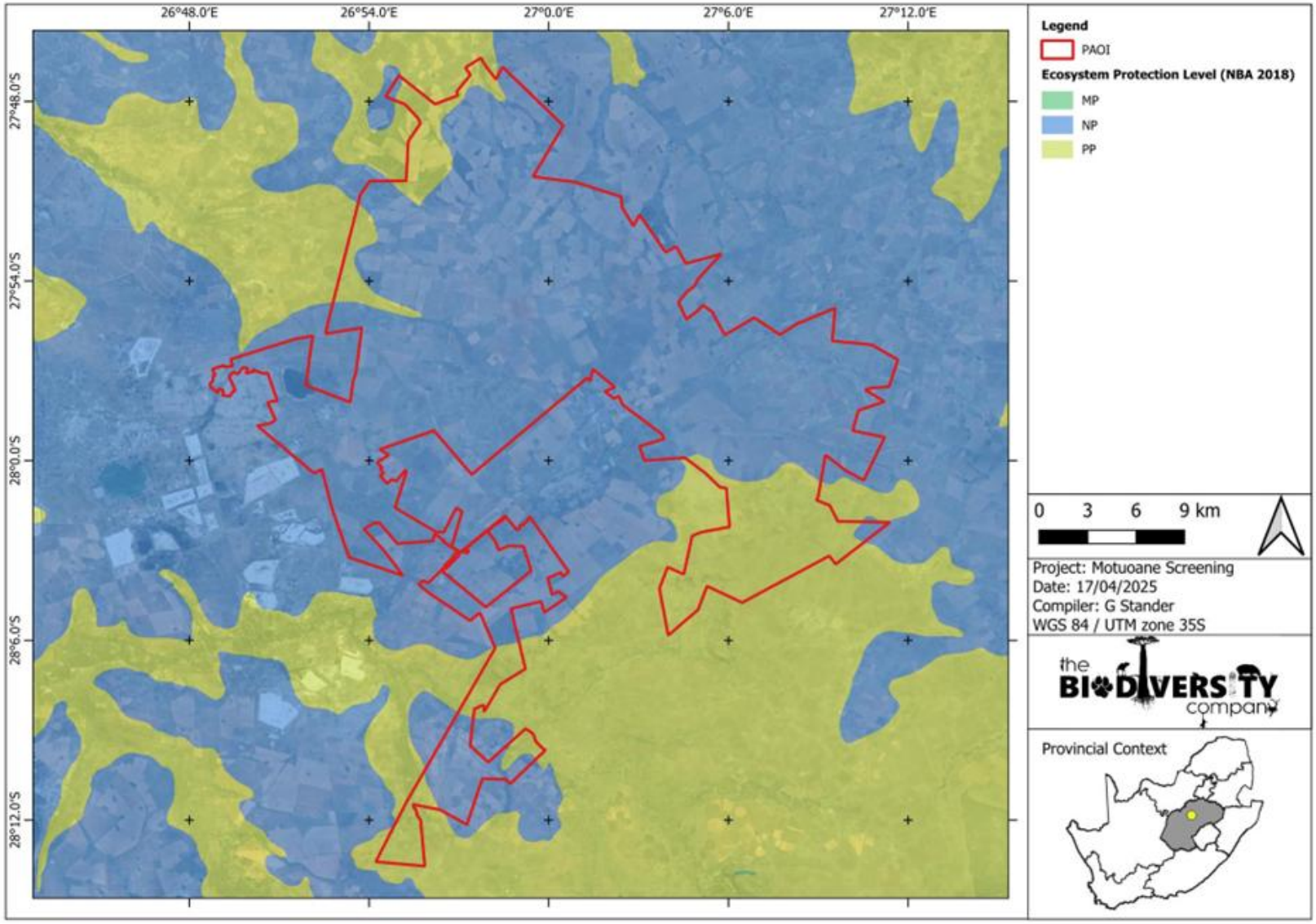


Figure 52: Map illustrating the ecosystem protection level associated with the ER (The Biodiversity Company, 2025).

4.9.6.3 FLORA

According to the Baseline Terrestrial Biodiversity Assessment undertaken by the Biodiversity Company (2025), the Plants of southern Africa (POSA) database indicates that 243 species of plants are expected to occur within the ER, of which 215 are indigenous. The full list of species will be provided in the final report. The POSA database does not indicate the likely presence of any Species of Conservation Concern (SCC), similarly, the DFFE Screening Tool does not list any extra SCC.

4.9.6.4 FAUNA

4.9.6.4.1 AMPHIBIANS

Based on the iNaturalist database five (5) amphibian species have the potential to occur in the ER. One (1) of the expected species is an SCC (**Table 19**). No additional amphibian SCC were listed by the screening tool.

4.9.6.4.2 REPTILES

Based on the iNaturalist database, fourteen (14) reptile species are expected to occur within the area, none of which are classified as SCC. The DFFE screening tool lists one (1) sensitive species which is described in **Table 19**.

Please note that the Screening Tool report includes lists of bird, mammal, reptile, amphibian, butterfly, and plant species of conservation concern known or expected to occur on the proposed development footprint. Some of these SCC are sensitive to illegal harvesting. Such species have had their names obscured and are listed as sensitive plant unique number / sensitive animal unique number. As per the best practise guideline that accompanies the protocol and screening tool, please, the name of the sensitive species may not appear in the final EIA report nor any of the specialist reports released into the public domain. It should be referred to as *sensitive plant* or *sensitive animal* and its threat status may be included, e.g. *critically endangered sensitive plant* or *endangered sensitive animal.*

4.9.6.4.3 MAMMALS

The iNaturalist database lists eleven (11) mammal species that could be expected to occur within the area. Excluding large mammal species that are normally restricted to protected areas, one (1) SCC is likely to occur in the ER. One (1) additional species (two in total) is listed as sensitive according to the DFFE screening tool (**Table 19**).

Table 19: Threatened fauna species that are expected to occur within the ER (The Biodiversity Company, 2025).

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional	Global	
Threatened amphibian species that are expected to occur within the ER				
Pyxicephalus adspersus	Giant Bullfrog	NT	LC	Moderate
Mammal species of conservation concern that may occur within the ER				
Sensitive Species 15	-	VU	VU	High
Threatened mammal species that are expected to occur within the ER				
Aonyx capensis	Cape clawless otter	NT	NT	Medium
Hydrictis maculicollis	Spotted-necked Otter	VU	NT	Medium

Note: LC = Least Concern, NT = Near Threatened, VU = Vulnerable.

Aonyx capensis (Cape clawless otter) are predominantly aquatic and seldom found far from water. Freshwater is an essential habitat requirement, and they only occur in marine habitats where there is access to fresh water (IUCN, 2017). Based on the Red List of Mammals of South Africa, Lesotho and Swaziland (2016), *A. capensis* populations are decreasing due to the threats of habitat loss, domestic and urban wastewater pollution as well as illegal hunting. Although the species is cryptic and therefore not often seen, there is suitable habitat in the ER and therefore the likelihood of occurrence is rated as medium.

Hydrictis maculicollis (Spotted-necked Otter) inhabits freshwater habitats where water is un-silted, unpolluted, and rich in small to medium sized fishes (IUCN, 2017). Suitable habitat may be available in river and wetland areas within the ER; however, these resources have likely been modified to some extent, resulting in a moderate likelihood of occurrence.

4.9.6.4.4 AVIFAUNA

Southern African Bird Atlas Project 2 (SABAP2) data indicate that 298 avifauna species are expected for the ER and surrounding areas. Of these 298 avifauna species, 21 are considered SCC (**Table 20**). The likelihood of occurrence within the ER are included in the table. The DFFE screening tool lists three (3) high sensitivity species and one (1) medium sensitivity species. Several bird species were noted by the EAP during the Site Sensitivity Verification. However, the bird species could not be identified. The bird species and likelihood of occurrence of these species will be determined by the ecologist following the site visit.

Table 20: List of bird species of conservation importance expected to occur within the ER (The Biodiversity Company, 2025).

Species	Common Name	Conservation Status		Screening Tool Sensitivity	Likelihood of occurrence
		Regional	Global		
Sagittarius serpentarius	Secretarybird	VU	EN	High	High
Oxyura maccoa	Maccoa Duck	NT	EN	-	Low
Polemaetus bellicosus	Martial Eagle	EN	EN	-	Low
Aquila rapax	Tawny Eagle	EN	VU	-	Low
Falco biarmicus	Lanner Falcon	VU	LC	-	High
Falco vespertinus	Red-footed Falcon	NT	VU	-	Low
Phoenicopterus roseus	Greater Flamingo	NT	LC	-	High
Phoeniconaias minor	Lesser Flamingo	NT	NT	-	High
Circus ranivorus	African Marsh Harrier	EN	LC	-	Moderate
Geronticus calvus	Southern Bald Ibis	VU	VU	-	Low
Eupodotis caerulescens	Blue Korhaan	LC	NT	-	High
Rostratula benghalensis	Greater Painted-snipe	NT	LC	-	Moderate
Charadrius pallidus	Chestnut-banded Plover	NT	LC	-	Low
Glareola nordmanni	Black-winged Pratincole	NT	NT	-	Moderate
Coracias garrulus	European Roller	NT	LC	-	High
Calidris ferruginea	Curlew Sandpiper	LC	NT	-	Moderate
Ciconia abdimii	Abdim's Stork	NT	LC	-	Low
Ciconia nigra	Black Stork	VU	LC	-	Low
Mycteria ibis	Yellow-billed Stork	EN	LC	High	Low
Hydropogne caspia	Caspian Tern	VU	LC	Medium-High	Low
Gyps africanus	White-backed Vulture	CR	CR	-	Low

Note: LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered

Circus ranivorus (African Marsh Harrier) is listed as EN in South Africa (ESKOM, 2014). This species has an extremely large distributional range in sub-equatorial Africa. South African populations of this species are declining due to the degradation of wetland habitats, loss of habitat through over-grazing and human disturbance and possibly, poisoning owing to over-use of pesticides (IUCN, 2017). This species breeds in wetlands and forages primarily over reeds which may be present surrounding water resources within the ER.

Glareola nordmanni (Black-winged Pratincole) is a migratory species which is listed as NT both globally and regionally. This species has a very large range, breeding mostly in Europe and Russia, before migrating to southern Africa. Overall population declines of approximately 20% for this species are suspected (IUCN, 2017). This species generally occurs near water and damp meadows, or marshes overgrown with dense grass, which may be present within the ER. Due to it's migratory nature, this species will only be present in South Africa for a few months during the year and will not breed locally.

Eupodotis caerulescens (Blue Korhaan) is endemic to South Africa and Lesotho and occurs in grassveld usually over 1 500 m above sea level, preferring open, fairly short grassland and a mixture of grassland and karoo dwarf-shrubland within 1 km of water, with termite mounds and few or no trees (BirdLife International, 2017). The total global population is estimated to number between 12 000-15 000 individuals, equivalent to 8 000-10 000 mature individuals, with a decreasing population trend. The main threat is intensive agriculture, especially within the east of its range. The grasslands present within the ER may be suitable for this species to occur in.

Calidris ferruginea (Curlew Sandpiper) is migratory species which breeds on slightly elevated areas in the lowlands of the high Arctic, and may be seen in parts of South Africa during winter. During winter, the species occurs at the coast, but also inland on the muddy edges of marshes, large rivers and lakes (both saline and freshwater), irrigated land, flooded areas, dams and saltpans (IUCN, 2017). The marshes and wetlands within the ER may be suitable for this species.

Coracias garrulous (European Roller) is a winter migrant from most of South-central Europe and Asia occurring throughout sub-Saharan Africa (IUCN, 2017). The European Roller has a preference for bushy plains and dry savannah areas, but the grasslands within the ER may also be suitable for this species (IUCN, 2017).

Phoenicopterus roseus (Greater Flamingo) is widely distributed throughout sub-Saharan Africa and inhabits shallow eutrophic waterbodies such as saline lagoons, saltpans and large saline or alkaline lakes (BirdLife International, 2019b). Juveniles, and to a lesser extent adults undertake irregular nomadic or partially migratory movements throughout the species' range in response to water-level changes. In sub-Saharan Africa, the species may also join large flocks of non-breeding *Phoeniconaias minor* (Lesser Flamingo). The sub-Saharan African populations numbers between 100 000 and 120 000 mature individuals. The species suffers from low reproductive success if exposed to disturbance at breeding colonies, or if water-levels surrounding nest-sites lower resulting in increased predation from ground predators. Further threats include effluents mining, pollution from sewage and heavy metal effluents from industries and collisions with powerlines (BirdLife International, 2019b). Larger and smaller water resources in and around the ER were found on a desktop basis and may be suitable for this species.

Rostratula benghalensis (Greater Painted-snipe) shows a preference for recently flooded areas in shallow lowland freshwater temporary or permanent wetland, it has a wide range of these freshwater habitats which they occur in, such as, sewage pools, reservoirs, mudflats overgrown with marsh grass (IUCN, 2017). The wetlands in the ER may be deemed suitable for this species.

Falco biarmicus (Lanner Falcon) is native to South Africa and inhabits a wide variety of habitats, from lowland deserts to forested mountains (IUCN, 2017). Global population estimates are more than 30000 breeding pairs, in South Africa it is estimated to be 1400 pairs. They may occur in groups up to 20 individuals but have also been observed solitary. They are partial and facultative migrants, that breeds from May to early September. Nests are mostly found on cliff ledges, and they may alternate between more than one nest. Their diet is mainly composed of small birds such as pigeons and francolins. Anecdotal evidence suggest these species are susceptible to agrochemicals, another threat to their population is the clearing of grassland habitats (Roberts *et al.,* 2023). The grasslands and agricultural fields within the ER may be suitable foraging grounds for this SCC.

Phoeniconaias minor (Lesser Flamingo) is widely distributed throughout sub-Saharan Africa but mainly breeds in the Rift Valley Lakes in East Africa, with smaller breeding congregations in West Africa and southern Africa. This species is nomadic and makes extensive movements in response to environmental conditions and southern African populations are partially migratory, with many making regular movements from their breeding sites inland to coastal wetlands when not breeding (BirdLife International, 2018). The species is an obligate filter feeder and feeds during the night and early morning when the surface of the water is calm, primarily by

swimming and filtering the algae near the surface. The global population has been estimated at between 2 220 000-3 240 000 individuals, with a declining population trend. The main threat is breeding habitat loss due to mining and hydro-electric power (BirdLife International, 2018). Further threats include effluents mining, pollution from sewage and heavy metal effluents from industries and collisions with powerlines. Larger and smaller water resources in and around the ER may be suitable for this species.

Sagittarius serpentarius (Secretarybird) is listed as EN on a global scale (BirdLife International, 2020). The species has a wide distribution across sub-Saharan Africa, but surveyed densities suggest that the total population size does not exceed a five-figure number. Ad-hoc records, localised surveys and anecdotal observations indicate apparent declines in many parts of the species' range, especially in South Africa where reporting rates decreased by at least 60% of quarter degree grid cells used in Southern African Bird Atlas Projects. Threats include excessive burning of grasslands that may suppress populations of prey species, whilst the intensive grazing of livestock is also probably degrading otherwise suitable habitat. Disturbance by humans is likely to negatively affect breeding. The species is captured and traded; however, it is unknown how many deaths occur in captivity and transit. Direct hunting and nest-raiding for other uses and indiscriminate poisoning at waterholes are also further threats. A proposed conservation action is that landowners of suitable properties should join biodiversity stewardship initiatives and to manage their properties in a sustainable way for the species' populations. The grasslands and agricultural fields within the ER may be suitable foraging grounds for this SCC.

4.10 FRESHWATER ECOLOGY - SURFACE WATER AND WETLAND

4.10.1 DRAINAGE AND CATCHMENT

This section provides an overview of the regional hydrological (surface water) environment across the extent of the project area. Information in this section has been sourced from the Baseline Geohydrological Assessment undertaken by Gradient Groundwater Consulting (**Appendix F7**) and the Baseline Soils, Agriculture, Freshwater and Terrestrial Biodiversity Assessment undertaken by the Biodiversity Company (**Appendix F1**).

South Africa is divided into nineteen (19) Water Management Areas (WMAs). The delegation of water resource management from central government to catchment level is achieved by establishing Catchment Management Agencies (CMAs) at WMA level. Each CMA progressively develops a Catchment Management Strategy (CMS) for the protection, use, development, conservation, management and control of water resources within its WMA. This is to ensure that on a regional scale, water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all persons. The main instrument that guides and governs the activities of a WMA is the CMS which, while conforming to relevant legislation and national strategies, provides detailed arrangements for the protection, use, development, conservation, management and control of the region's water resources. The greater study is situated in primary catchment (C) of the Vaal River drainage system which covers a total area of approximately 580.0km^2. The resource management falls under the Vaal Water Management Area (WMA5) (previously Middle Vaal WMA[2]) which spans portions of the North West Province, northern Free State as well northern sections of the Northern Cape. The study area encompasses several quaternary catchments of the Vaal WMA. These include Quaternary Catchments C25B, C42H, C42J and C60H. The main watercourses within the Middle Vaal WMA are the Mooi, Vet, and Vaal Rivers (WRC, 2016). The Vaal River is a major tributary of the Orange River, which generally drains in an eastern direction towards the Atlantic Ocean. The primary rivers in and around the study area include the Vals River towards the northeast of the study area, the Sand River in the central parts of the study area, and the Vet River towards the southwest of the study area (WRC, 2016).

The perennial Vals River, a major tributary of the Vaal River, flows across the northeastern extremity of the study area, where it is dammed by the Serfontein Dam, and drains in a northwestern direction. The Serfontein Dam has a surface area of approximately 1.09 km^2. Minor tributaries of the Vals River located within the study area include Blomspruit and Enslinspruit toward the northeast of the study area, Middelspruit and Otterspruit toward

[2] It should be noted that the Department of Water Affairs (DWA), now the Department of Water and Sanitation (DWS), replaced the original 19 WMAs established in 2004 by 9 new WMAs as defined in Government Gazette No. 35517, July 2012. This resulted in the grouping of the Upper, Middle, and Lower Vaal WMAs into the single Vaal WMA.

the north of the study area, and Sandspruit towards the northwest of the study area. Blomspruit, Middelspruit and Sand Spruit drain in a northwestern direction toward the Vals River, while Enslinspruit and Otterspruit drain toward the north.

The perennial Sand River, a tributary of the Vet River, flows across the central parts of the study area and drains in a western direction. The Sand River is dammed by the Allemanskraal Dam southeast of the study area. The Allemanskraal Dam has a surface area of approximately 28.64 km^2. Minor tributaries of the Sand River located within the study area include Koolspruit, Erasmusspruit, and Rietspruit north of the Sand River and Maselspruit, Merriespruit, and the Doring River south of the Sand River. Koolspruit, Erasmusspruit, and Rietspruit drain in a southwestern direction toward the Sand River, Maselspruit and Merriespruit drain in a northern direction toward the Sand River, and the Doring River drains in a northwest direction toward the Sand River.

The perennial Vet River, a major tributary of the Vaal River, is located towards the southwest of the study area and drains in a northwestern direction. The Vet River is dammed by the Erfenis Dam towards the south of the study area. The Erfenis Dam has a surface area of approximately 32.40 km^2. Minor tributaries of the Vet River located within the study area include Soutspruit and Kromspruit north of the Vet River. Soutspruit drains is a southern direction towards the Vet River, while Kromspruit drains towards the southwest. Surface water drainage overall occurs in a western to northwestern direction within the study area. The mean annual runoff (MAR) for the study area is estimated at approximately 13.16 Mm^3/a, based on MAR data obtained from WR2012 (WRC, 2016). **Table 21** provides a summary of relevant climatological and hydrogeological information for the relevant quaternary catchments. Refer to **Figure 53** and **Figure 54** for the hydrological conditions.

Table 21: Study Area Catchment and Hydrological Properties (Gradient Groundwater Consulting, 2025).

Quaternary Catchment	Area (km^2)	% Covered by Study Area	MAP (mm/a)	MAE (mm/a)	MAR (Mm^3/a)	Rainfall Zone	Evaporation Zone
C25B	1 887.67	1.91	509.21	1 750	7.23	C2H	9A
C42H	445.00	9.83	540.00	1 590	10.16	C4C	19C
C42J	1 013.93	26.69	529.79	1 600	21.26	C4C	19C
C60H	1 232.02	19.39	512.75	1 650	2.64	C6B	11A

4.10.2 SOUTH AFRICAN INVENTORY OF INLAND AQUATIC ECOSYSTEMS

The South African Inventory of Inland Aquatic Ecosystems spatial dataset is part of the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) which was released as part of the National Biodiversity Assessment (NBA 2018). National Wetland Map 5 includes inland wetlands and estuaries, associated with river line data and many other data sets within the South African Inventory of Inland Aquatic Ecosystems (SAIIAE, 2018). Ecosystem threat status (ETS) of river and wetland ecosystem types are based on the extent to which each river ecosystem type had been altered from its natural condition. Ecosystem types are categorised as CR, EN, VU or LT, with CR, EN and VU ecosystem types collectively referred to as 'threatened' (Van Deventer *et al.,* 2019; Skowno *et al.,* 2019). The ER overlaps with a CR and LC wetlands (**Figure 55**).

4.10.3 NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREA STATUS

To better conserve aquatic ecosystems, South Africa has categorised its river systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver *et al.,* 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's (NEM:BA) biodiversity goals (Nel *et al.,* 2011). **Figure 56** shows that the ER overlaps with non-priority and priority FEPA wetlands.

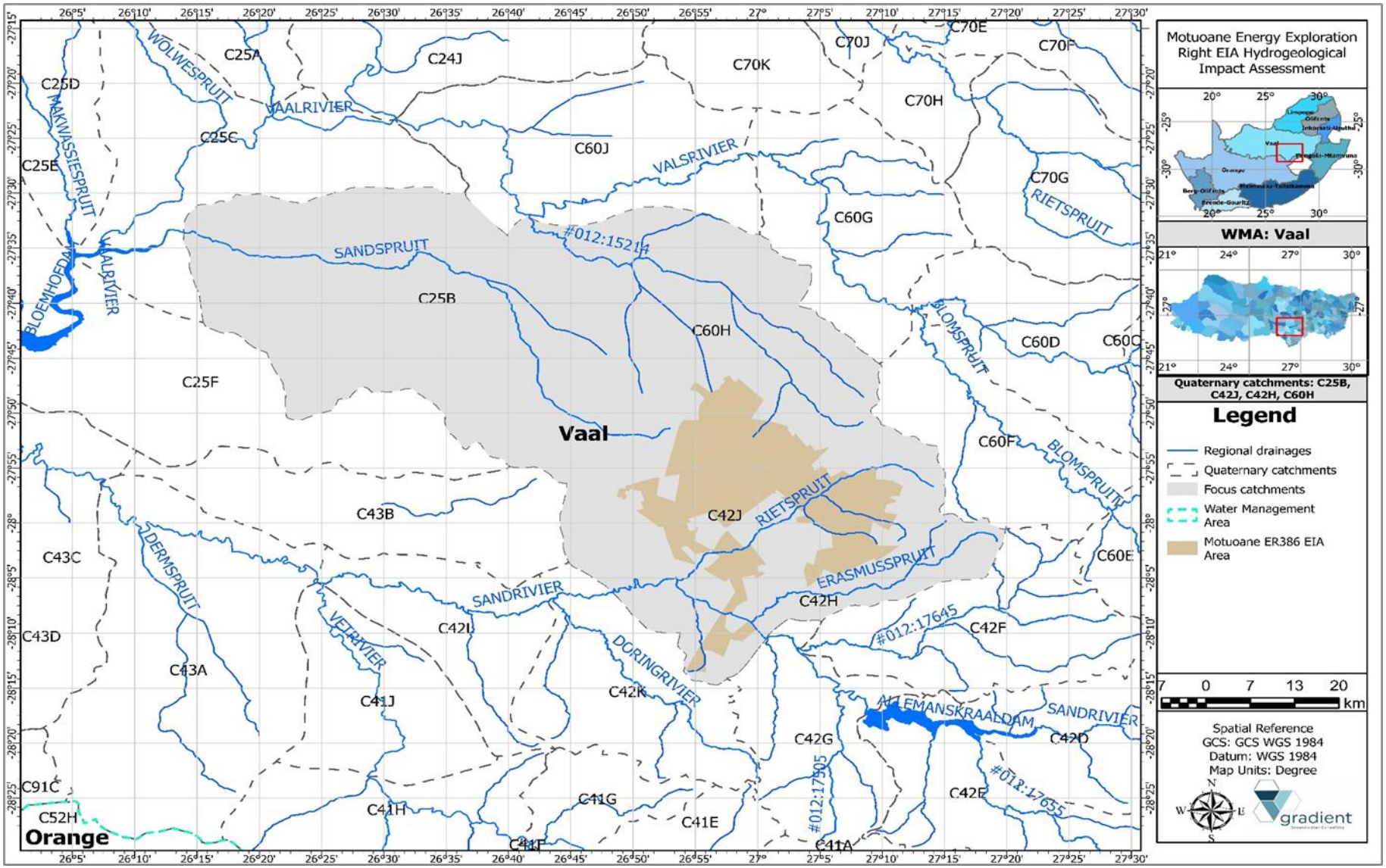


Figure 53: Quaternary catchments and water management area (Gradient Groundwater Consulting, 2025).

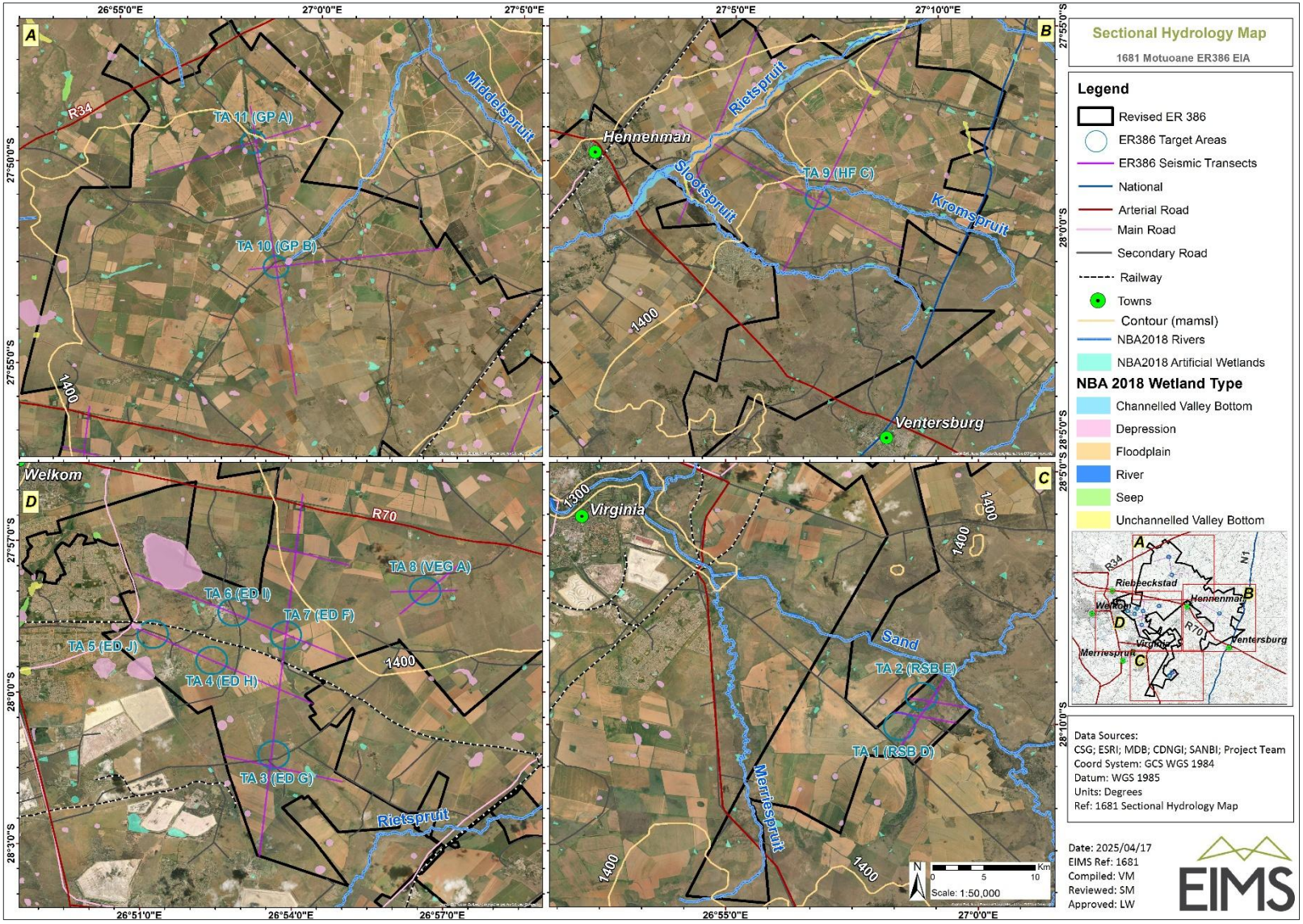


Figure 54: Site Hydrological Map.

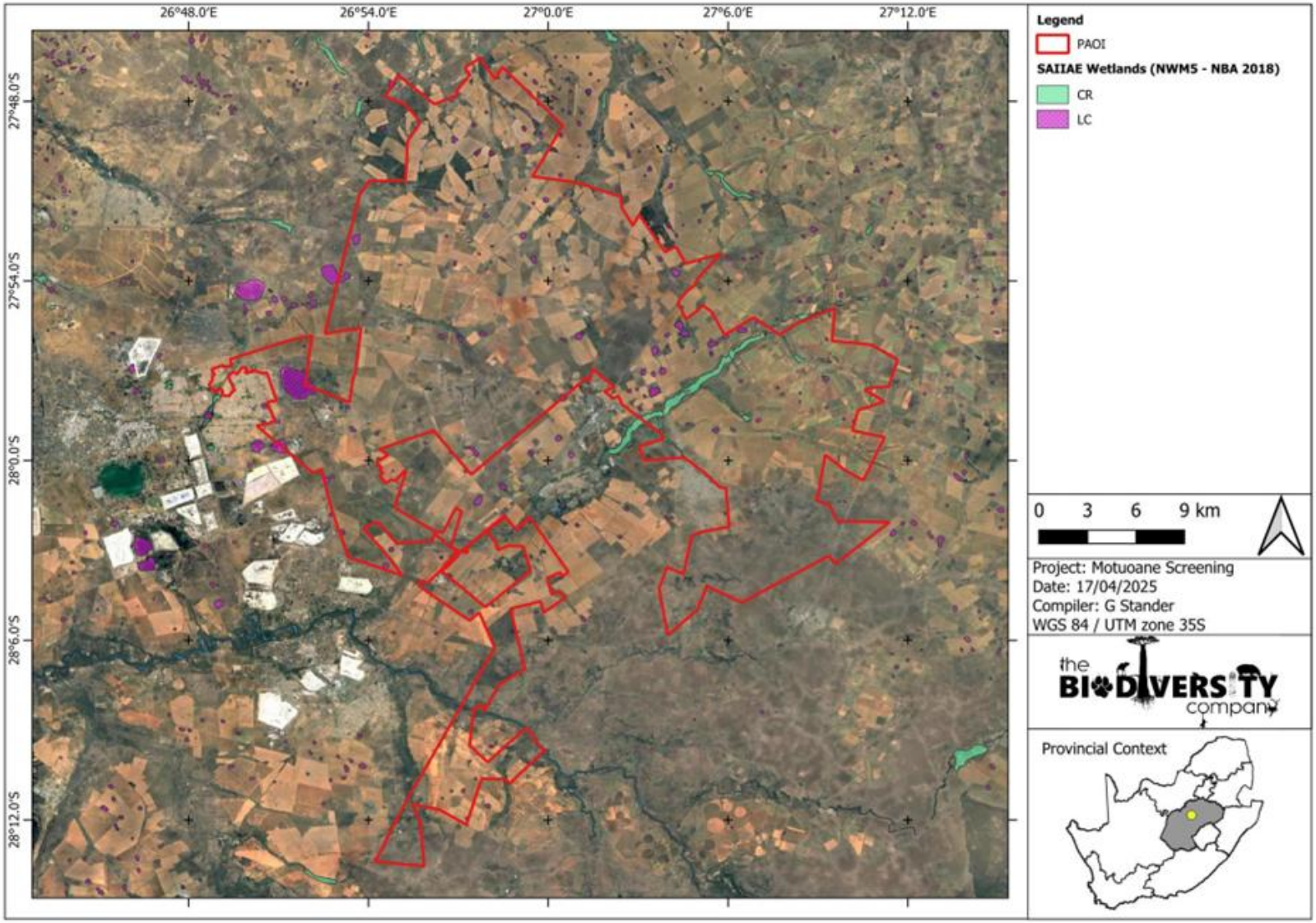


Figure 55: Map illustrating ecosystem threat status of rivers and wetlands in the ER (The Biodiversity Company, 2025).

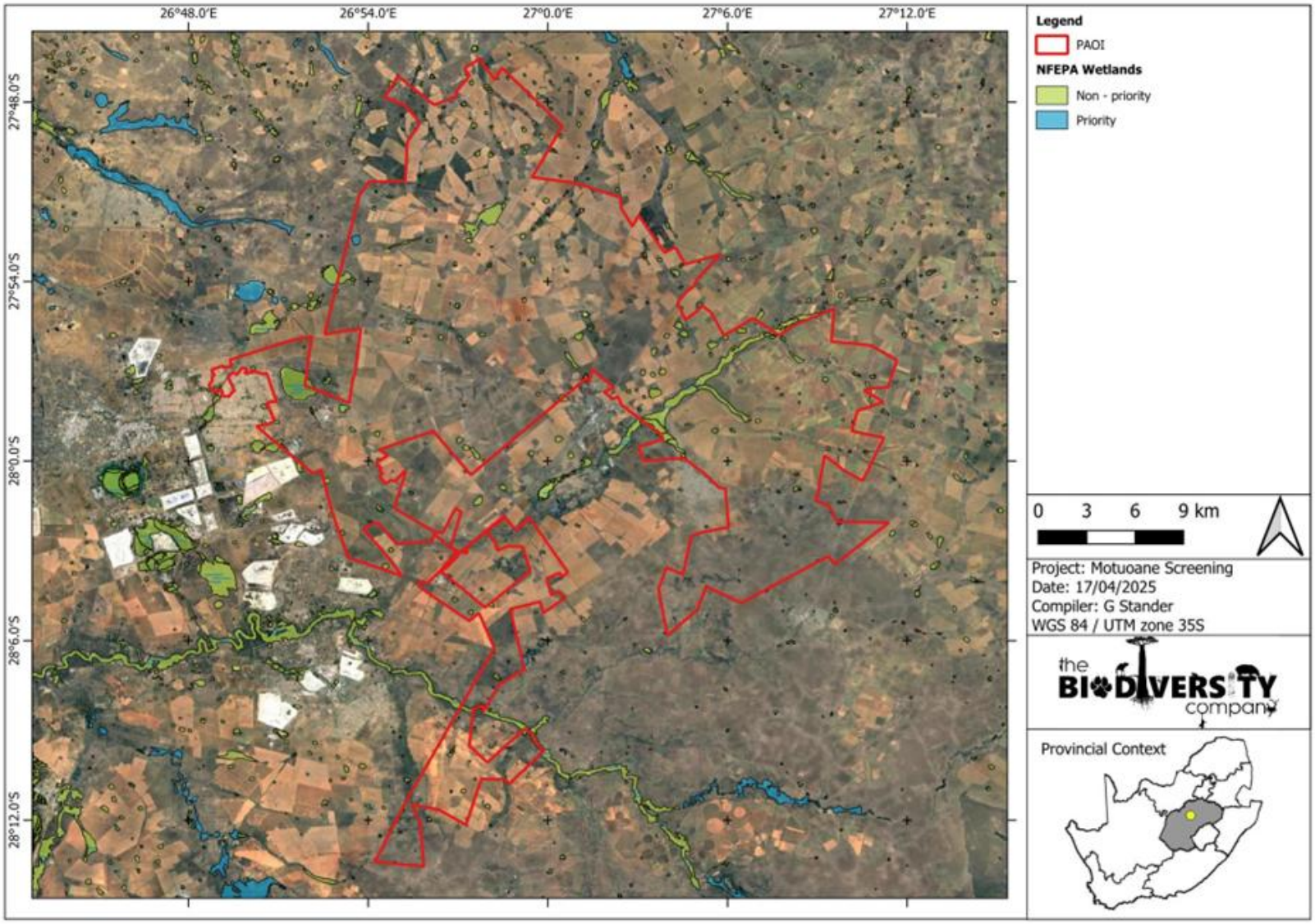


Figure 56: The ER in relation to the National Freshwater Ecosystem Priority Areas (The Biodiversity Company, 2025).

4.11 HYDROGEOLOGY - GROUNDWATER

This section summarises the regional and site-specific hydrogeology as obtained from the Baseline Geohydrological Assessment by Gradient Groundwater Consulting (2025) attached as **Appendix F7**. A detailed geohydrological specialist study will be conducted as part of this EIA and included in the EIA phase report. The geohydrological setting and conceptual model of the study area is described according to the following criteria:

- Regional hydrogeology information;
- Local hydrostratigraphic units;
- Unsaturated zone;
- Groundwater-surface water interaction;
- Hydraulic parameters;
- Aquifer classification; and
- Hydrogeological conceptual model.

4.11.1 REGIONAL HYDROGEOLOGY INFORMATION

The Department have characterised South African aquifers based on host-rock formations in which it occurs together with its capacity to transmit water to boreholes drilled into relative formations. The water bearing properties of respective formations can be classified into four aquifer classes defined below. Each of these classes is further subdivided into groups relating to the capacity of an aquifer to transmit water to boreholes, typically measured in Litres per second (L/s). The groups therefore represent various ranges of borehole yields:

a. **Class A:** Intergranular Aquifers associated either with loose and unconsolidated formations such as sands and gravels or with rock that has weathered to only partially consolidated material.

b. **Class B:** Fractured Aquifers associated with hard and compact rock formations in which fractures, fissures and/or joints occur that are capable of both storing and transmitting water in useful quantities.

c. **Class C:** Karst Aquifers associated with carbonate rocks such as limestone and dolomite in which groundwater is predominantly stored in and transmitted through cavities that can develop in these rocks.

d. **Class D:** Intergranular and fractured Aquifers that represent a combination of Class A and B aquifer types. This is a common characteristic of South African aquifers. Substantial quantities of water are stored in the intergranular voids of weathered rock but can only be tapped via fractures penetrated by boreholes drilled into it.

According to the DWS Hydrogeological map (DWS Hydrogeological map series 2726 Kroonstad) the study area is predominantly underlain by a Class d2 intergranular and fractured aquifer (typically associated with median borehole yields ranging between 0.1 and 0.5 L/s), while small portions towards the northwest of the study area are underlain by a Class d3 intergranular and fractured aquifer (typically associated with median borehole yields ranging between 0.5 and 2.0 L/s). Both the Class d2 and Class d3 aquifers consist of primarily argillaceous (clay-containing) rocks, including shale, mudstone, and subordinate siltstone. Most hard-rock aquifers are secondary in nature with groundwater associated with fracturing, fault zones as well as contact zones of the dolerite intrusions. Aquifer hosts in the Beaufort Group comprise of mudstone and sandstone intruded by dolerite dykes and sheets, however, will not only be multi-layered, but also multi-porous with variable thicknesses. The contact plane between two different sedimentary layers will cause a discontinuity in the hydraulic properties of the composite aquifer. The Ecca Group aquifers consist mainly of shales and sandstones that are very dense with permeability usually very low due to poorly sorted matrices. Accordingly, it can be assumed that the aquifer has a low development potential, it should however be noted that higher yielding boreholes (>5.0l/s) may occur along intruding dyke contact zones and other structural features i.e., fault zones etc. (Barnard, 2000).

According to Vegter's groundwater regions delineated (2000) the study area can be classified as falling under the Northeastern Upper Karoo Region (Region 30) towards the central, eastern and southern areas whereas the northern and northwestern section forming part of the Northeastern Pan Belt Region (Region 33). Groundwater Region 33 comprises of mudstone and sandstone (with dolerite dyke and sill intrusions) of the Adelaide and Tarkastad Subgroups within the Beaufort Group of the Karoo Supergroup (WRC, 2016). The maximum aquifer thickness i.e., shallow, intergranular aquifer system within the Northeastern Pan Belt Region is <20m while the maximum aquifer thickness within the Northeastern Upper Karoo Region is slightly thicker at 20 – 30m with water stored mainly in decomposed/partly decomposed rock and water bearing fractures principally restricted to a shallow zone below the static groundwater level.The average groundwater level within Groundwater Region 33 is 14.90 mbgl, while the average saturated thickness of the weathered (shallow) and fractured (deeper) zones are 22.60 m and 75.00 m, respectively (WRC, 2016). Groundwater Region 30 comprises of compact, dominantly argillaceous strata of the Ecca Group within the Karoo Supergroup (WRC, 2016). The average groundwater level within Groundwater Region 30 is 18.20 mbgl, while the average saturated thickness of the weathered (shallow) and fractured (deeper) zones are 9.30 m and 185.00 m, respectively (WRC, 2016). Refer to **Figure 58** for a map illustrating the typical groundwater occurrence for the greater study area while **Figure 59** depicts the hydrogeological map of the greater study area.

4.11.2 LOCAL HYDROSTRATIGRAPHIC UNITS

For the purposes of this investigation, three main hydrostratigraphic units/aquifer systems can be inferred in the saturated zone[3]:

i. A **shallow Quaternary (perched and unconfined) aquifer**: These aquifers consist of recent types of sediments and are characteristically primary porosity aquifers, such that groundwater flow occurs in the pore spaces between soil and sediment particles. These aquifers are formed by alluvial material along the riparian zone of local drainages and are limited to a zone of variable width and depth. Clay lenses in the soil and unsaturated zones may cause local, perched water tables which occur above the regional water table.

ii. A **shallow, intergranular and fractured aquifer within the Beaufort Group**: These aquifers occur in the transitional soil and weathered bedrock formations underlain by more consolidated bedrock. Groundwater flow patterns usually follow the topography, discharging as natural springs at topographic low-lying areas. Usually, these aquifers can be classified as a secondary porosity aquifer and is generally unconfined with phreatic water levels. In secondary porosity aquifers, groundwater flow occurs along fractures, while water is stored within the rock matrix. Due to higher effective porosity (n) this aquifer is more susceptible to impacts from contaminant sources compared to confined aquifers.

iii. A **deeper, fractured aquifer within the Ecca Group and pre-Karoo rocks**: In fractured aquifers, pores are well-cemented and do not allow any significant flow of water. Groundwater flow is dictated by transmissive secondary porosity structures such as bedding planes fractures, faults and contact zones fracture zones that occur in the relatively competent host rock. Fractured mudstone, sandstone, shales sequences as well as dolerite dykes and sills are considered as fractured rock aquifers holding water in storage in both pore spaces and fractures. Groundwater yields, although more heterogeneous, can be expected to be higher than the weathered zone (shallow) aquifer. This aquifer system usually displays semi-confined or confined characteristics with potentiometric heads often significantly higher than the water-bearing fracture position.

4.11.3 UNSATURATED ZONE

The unsaturated (vadose) zone is defined as the subsurface zone between the ground surface and the main water table where pores are filled with both air and water as depicted in **Figure 57** (Fetter and Kreamer, 2023). According to WR2012 (WRC, 2016), the average thickness of the unsaturated zones of Groundwater Region 30 and 33 are 18.20 m and 14.90 m, respectively. According to the 1.0×1.0 km groundwater level grid obtained

[3] Refer to project assumptions and limitations, it should be noted that no site characterisation boreholes have been drilled to confirm this statement.

from WR2012 (WRC, 2016), the thickness of the unsaturated zone ranges between 15.98 to 56.82 m, with an average thickness of 29.48 m.

4.11.4 GROUNDWATER-SURFACE WATER INTERACTION

Groundwater and surface water interaction is an essential component of the hydrological cycle. The hyporheic zone (stream bed) is the zone of most interaction (Adams *et. al*.,2012). According to records documented by Van Tonder and Dennis (2003), under natural conditions this area exhibits certain regions where there is pronounced interaction between surface and groundwater. The two regimes are therefore well-linked and should be integrated to manage any water-related issues in these catchments. Regional drainages can be generally classified as influent or gaining stream systems as the groundwater head elevation of the water table in the vicinity of the stream is higher than the altitude of the stream bed and, accordingly, there definitely exists groundwater discharge as baseflow to local drainages. The alluvial associated with the floodplains within the greater study area forms a primary aquifer and may potentially be directly connected with surface water resources, especially during high flow conditions.

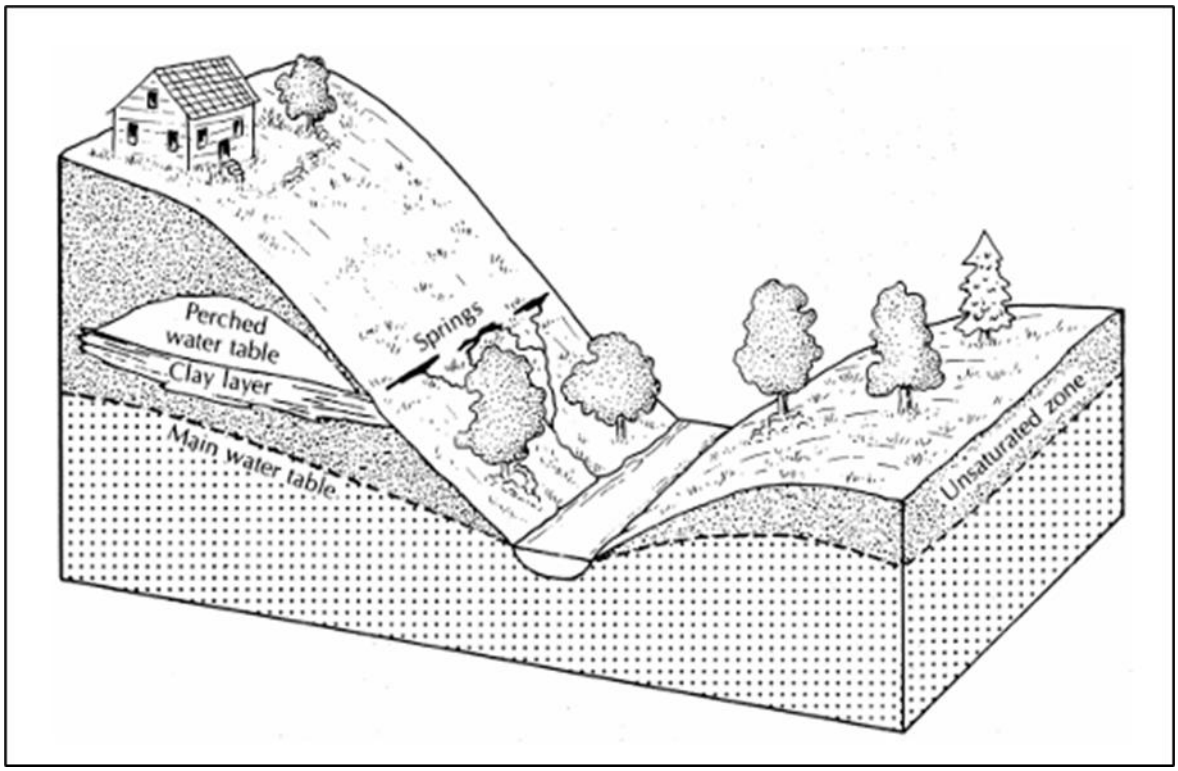


Figure 57: Illustration of the Unsaturated Zone (Fetter and Kreamer, 2023).

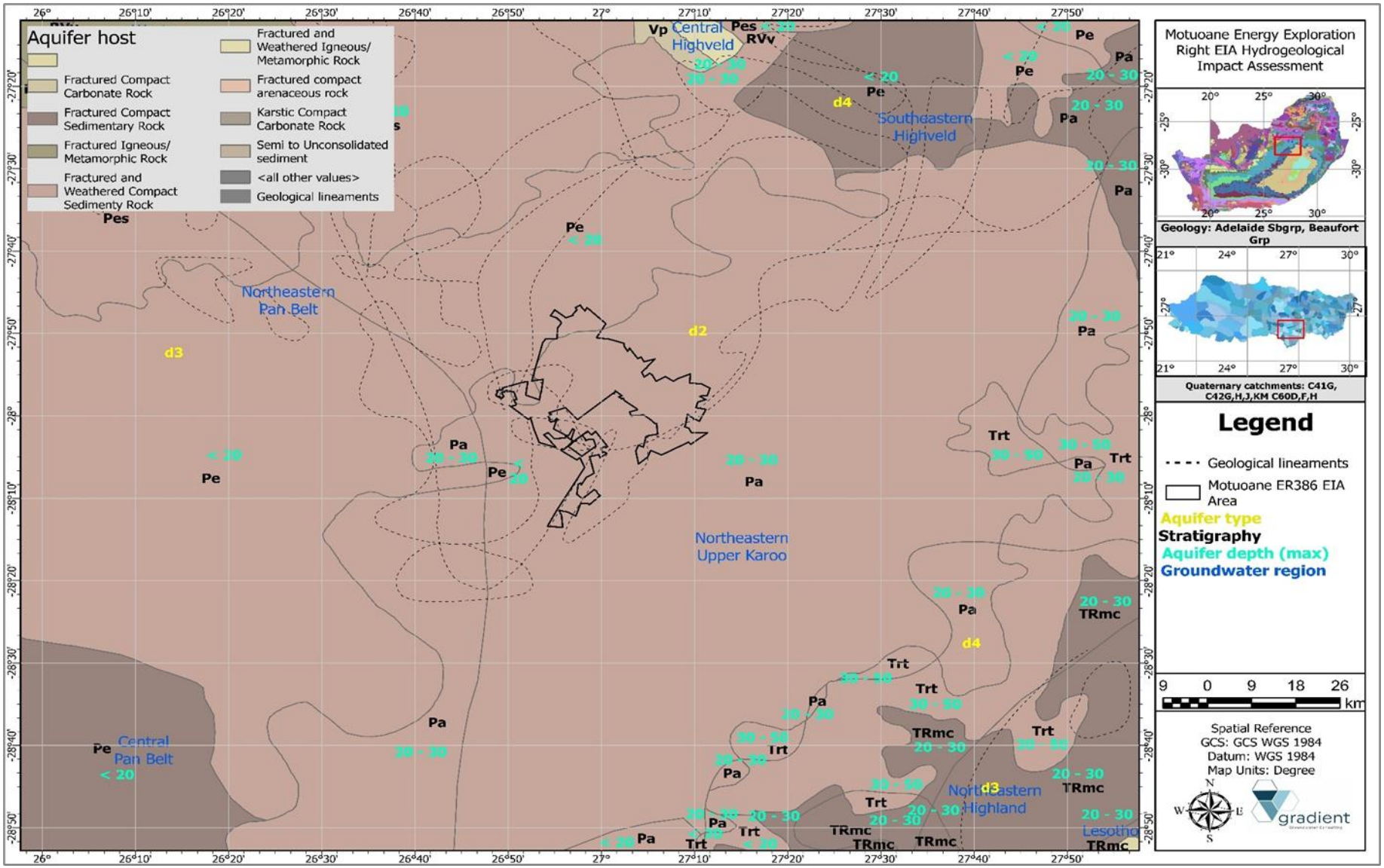


Figure 58: Typical aquifer hosts and groundwater occurrence for the study region (Gradient Groundwater Consulting, 2025).

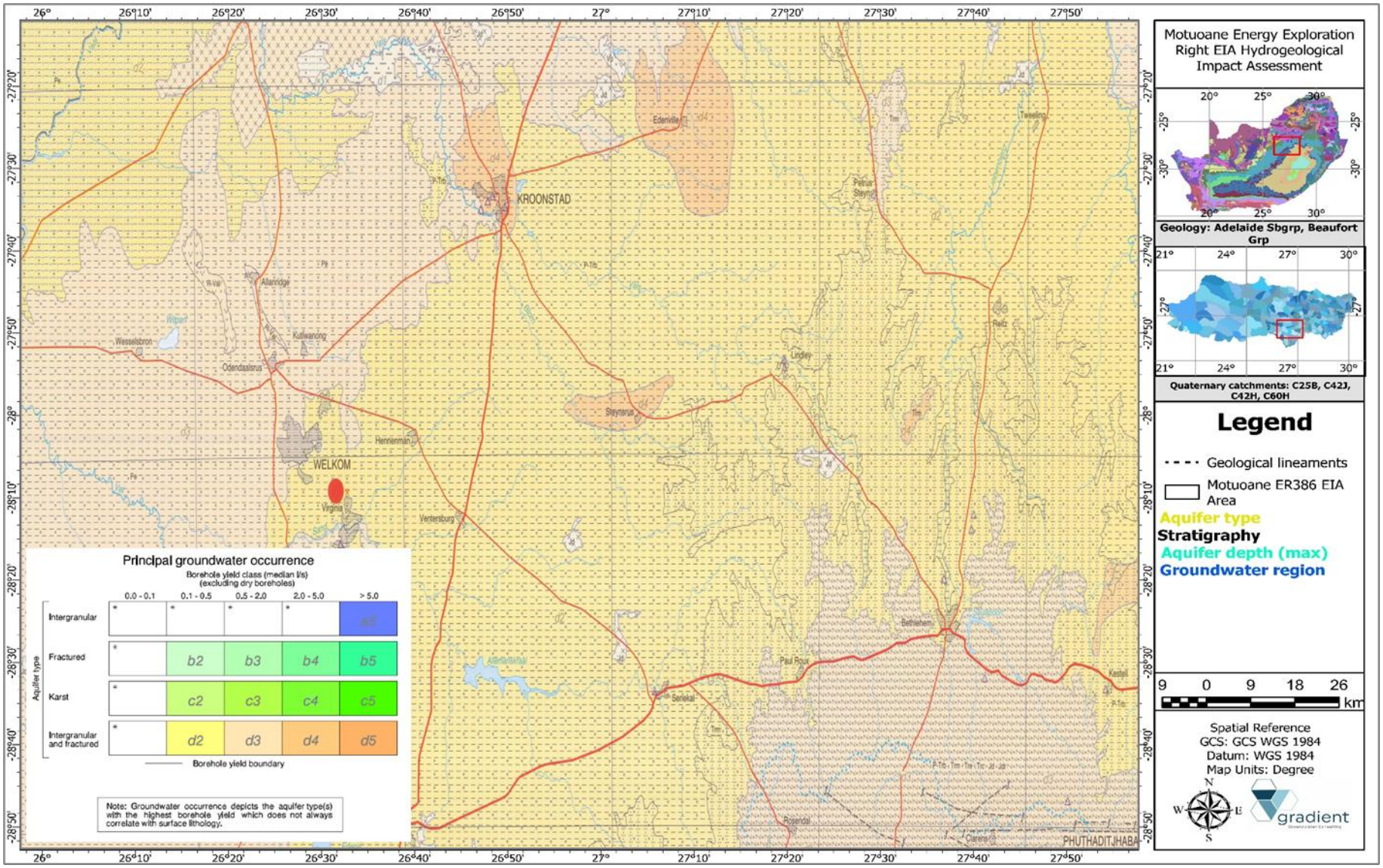


Figure 59: Hydrogeological map of the greater study region (Gradient Groundwater Consulting, 2025).

4.11.5 HYDRAULIC PARAMETERS

This section provides a brief overview of aquifer hydraulic parameters based on published literature for similar hydrogeological conditions as well as historical reports.

4.11.5.1 HYDRAULIC CONDUCTIVITY AND TRANSMISSIVITY

Hydraulic conductivity is the constant of proportionality in Darcy's Law which states that the rate of flow through a porous medium is proportional to the loss of head, and inversely proportional to the length of the flow path as indicated in the following equation for Hydraulic Conductivity (Darcy's Law)**:**

$$K = \frac{Q}{A\left(\frac{dh}{dl}\right)}$$

where:

K = Hydraulic Conductivity (m/d).

Q = Flow of water per unit of time (m^3/d).

dh/dl = Hydraulic gradient.

A = is the cross-sectional area, at a right angle to the flow direction, through which the flow occurs (m^2)

The hydraulic conductivity of sedimentary formations such as evident on site can range from $10E^{-6}$ – $10E^{-2}$ m/d. The hydraulic conductivity of fractured igneous rocks (i.e. dolerite) varies between $10E^{-6}$ – $10E^{-1}$ m/d, while conductivity values for un-fractured igneous rocks (i.e. fresh dolerite sill) ranges between $10E^{-9}$ – $10E^{-6}$ m/d. The hydraulic conductivity of quaternary deposits and alluvial pockets associated with the drainage system i.e., riverbed aquifers can be orders higher and can vary between $10E^{-2}$ – $10E^{1}$ m/d (Freeze and Cherry, 1979). Refer to **Figure 60** for the typical hydraulic conductivity values for on-site hydrostratigraphical units.

Transmissivity can be expressed as the product of the average hydraulic conductivity (K) and thickness (b) of the saturated portion of an aquifer and expressed by:

$$T = Kb$$

where:

T = Transmissivity (m^2/d).

K = Hydraulic Conductivity (m/d).

b = Saturated aquifer thickness.

According to the transmissivity GIS data provided by WR2012 (WRC, 2016), the entire study area is underlain by a Class d2 intergranular and fractured aquifer with an average transmissivity of 17.5 m^2/day (WRC, 2016)[4].

[4] It should be noted that no aquifer tests were conducted to support site representative hydraulic parameters.

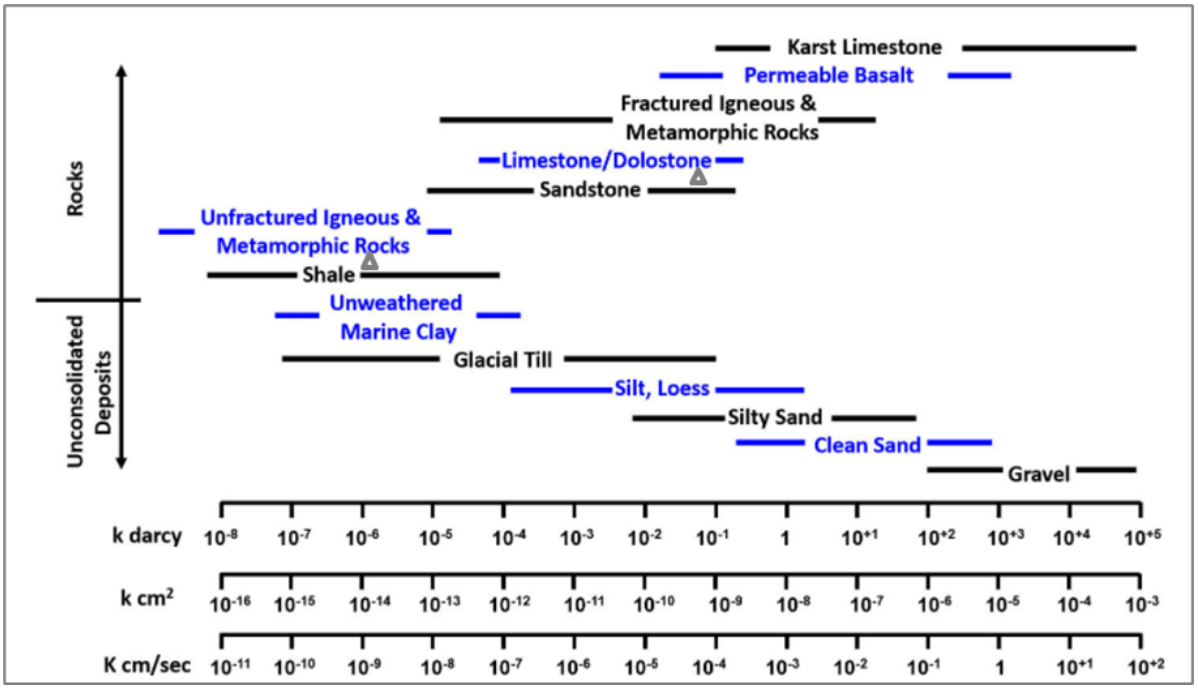


Figure 60: Typical hydraulic conductivity values for on-site hydrostratigraphical units (Gradient Groundwater Consulting, 2025).

4.11.5.2 STORATIVITY

Storativity refers to the volume of water per volume of aquifer released as a result of a change in head. For a confined aquifer, the storage coefficient is equal to the product of the specific storage and aquifer thickness. Typical storativity values for fractured rock systems is in the order of $10E^{-5}$ – $10E^{-3}$ (Freeze and Cherry, 1979). Storativity values of the shallow, weathered aquifer will be slightly higher i.e., $10E^{-2}$.

4.11.5.3 POROSITY

Porosity is an intrinsic value of seepage velocity and hence contamination migration. The porosity of fractured sedimentary formations ranges between 3% – 10%, while porosity of weathered formations can range between 10% to 15% depending on the nature and state of weathering. The intrinsic porosity of primary aquifers i.e., alluvial deposits can be as high as 20% depending on the nature of sorting (Freeze and Cherry, 1979).

4.11.5.4 RECHARGE

An approximation of recharge for the study area is estimated at ~3.50% of MAP i.e. ~19.48 mm/a as summarised in **Table 22**. According to the 1 × 1 km recharge grid obtained from WR2012, the average recharge in the greater study area ranges is approximately 9.11 mm/a (WRC, 2016). Groundwater recharge was calculated using the RECHARGE Program1 (van Tonder and Xu, 2000), which includes using qualified guesses as guided by various schematic maps. The following methods/sources were used to estimate the recharge: (i) Geology (ii) Vegter Groundwater Recharge Map (**Figure 61**) (iii) Harvest Potential (**Figure 62**) (iv) Baseflow as a minimum of recharge (v) Qualified opinion and, (vi) Literature review.

Table 22: Recharge estimation (after van Tonder and Xu, 2000) (Gradient Groundwater Consulting, 2025).

Recharge method/ Reference	Recharge (mm/a)	Recharge (% of MAP)	Weighted Average (High = 5; Low = 1)
Geology	21.60	4.06	2.00
Vegter	25.00	4.70	1.00

Recharge method/ Reference	Recharge (mm/a)	Recharge (% of MAP)	Weighted Average (High = 5; Low = 1)
Harvest Potential	20.00	3.76	2.00
Baseflow	15.00	2.82	2.00
Qualified Opinion	17.50	3.29	4.00
Literature	17.80	3.35	4.00
Weighted average	**19.48**	**3.50**	**15.00**
Notes: Recharge per annum were calculated using a MAP of 532.0 mm/a.			

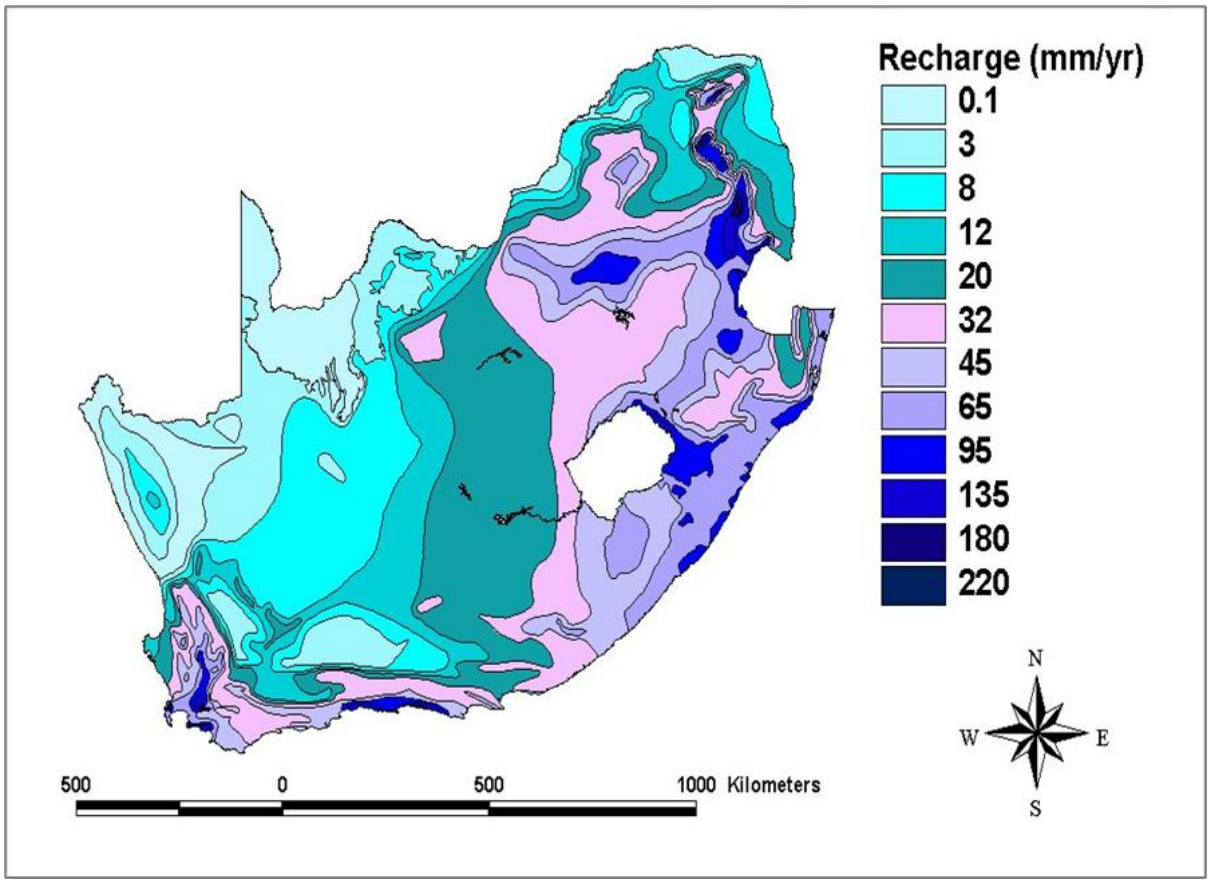


Figure 61: Groundwater recharge distribution in South Africa (After Vegter, 1995).

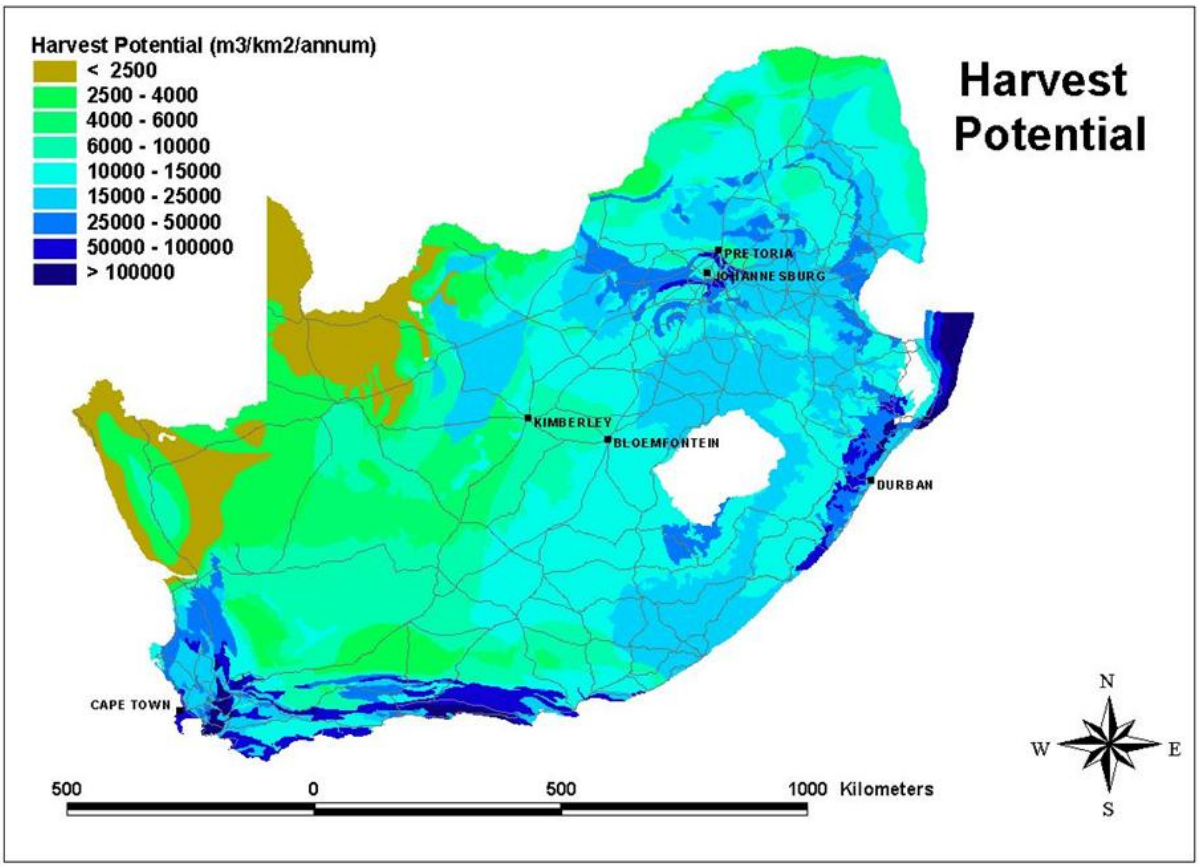


Figure 62: Harvest potential distribution in South Africa (DWS, 2013).

4.11.6 AQUIFER CLASSIFICATION AND GROUNDWATER MANAGEMENT INDEX

The most widely accepted definition of groundwater contamination is defined as the introduction into water of any substance in undesirable concentration not normally present in water e.g. microorganisms, chemicals, waste or sewerage, which renders the water unfit for its intended use (UNESCO, 1992). The objective is to formulate a risk-based framework from geological and hydrogeological information obtained as part of this investigation. Two approaches were followed in an estimation of the risk of groundwater contamination as discussed below. As part of the aquifer classification, a Groundwater Quality Management (GQM) Index is used to define the level of groundwater protection required. The GQM Index is obtained by multiplying the rating of the aquifer system management and the aquifer vulnerability. A **GQM Index = 4** was calculated for the local aquifer system and according to this estimate, a "**Medium**" level groundwater protection is required for this aquifer system.

$$\textit{GQM Index} = \textit{Aquifer system management x Aquifer vulnerability}$$

4.11.6.1 AQUIFER CLASSIFICATION

An aquifer classification system provides a framework and objective basis for identifying and setting appropriate levels of groundwater resource protection. This would facilitate the adoption of a policy of differentiated groundwater protection. The aquifer classification system used to classify the aquifers is the proposed National Aquifer Classification System of Parsons (1995). This system has a certain amount of flexibility and can be linked to second classifications such as a vulnerability or usage classification. Parsons suggests that aquifer classification forms a very useful planning tool that can be used to guide the management of groundwater issues. Parsons also suggests that some level of flexibility should be incorporated when using such a classification system.

The South African Aquifer System Management Classification is presented by five major classes:

- Sole Source Aquifer System;

- Major Aquifer System;
- Minor Aquifer System;
- Non-Aquifer System; and
- Special Aquifer System.

The following definitions apply to the aquifer classification system:

- Sole source aquifer system: “An aquifer that is used to supply 50 % or more of domestic water for a given area, and for which there are no reasonable alternative sources should the aquifer become depleted or impacted upon. Aquifer yields and natural water quality are immaterial”.
- Major aquifer system: “Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good”.
- Minor aquifer system: “These can be fractured or potentially fractured rocks that do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although this aquifer seldom produces large quantities of water, they are both important for local supplies and in supplying base flow for rivers”.
- Non-aquifer system: “These are formations with negligible permeability that are generally regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks does occur, although imperceptible, and needs to be considered when assessing risk associated with persistent pollutants”.
- Special aquifer system: “An aquifer designated as such by the Minister of Water Affairs, after due process”.

According to the aquifer classification map of South Africa the project area is underlain by a “**Minor aquifer**”.

4.11.6.2 AQUIFER VULNERABILITY

Aquifer vulnerability can be defined as the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer. According to the aquifer vulnerability map of South Africa the project area is underlain by an aquifer system with a “**Moderate**” vulnerability rating.

4.11.6.3 AQUIFER SUSCEPTIBILITY

Aquifer susceptibility is a qualitative measure of relative ease with which a groundwater body can be potentially contaminated by anthropogenic activities. According to the Aquifer susceptibility map of South Africa the project area is underlain by an aquifer system with a “Medium” susceptibility rating. Refer to **Table 23**.

Table 23: Groundwater Quality Management Index (Gradient Groundwater Consulting, 2025).

Aquifer system		**Aquifer vulnerability**	
Management qualification		**Classification**	
Class	**Points**	**Class**	**Points**
Sole Source Aquifer System	6	High	3
Major Aquifer System	4	**Moderate**	**2**
Minor Aquifer System	**2**	Low	1
Non-Aquifer System	0		

Aquifer system		Aquifer vulnerability	
Management qualification		**Classification**	
Special Aquifer System	0-6		
GQM INDEX	**Level of protection**		
<1	Limited Protection		
1 to 3	Low Level Protection		
3 to 6	**Medium Level Protection**		
6 to 10	High Level Protection		
>10	Strictly Non- Degradation		
		GQM Index:	**4**

4.11.6.4 SOURCE-PATHWAY-RECEPTOR EVALUATION

In order to evaluate the risk of groundwater contamination, potential sources of contamination should be identified, as well as potential pathways and receptors. The pollution linkage concept relies on the identification of a potential pollutant (i.e. source) on-site which is likely to have the potential to cause harm to a receptor by means of a pathway by which the receptor may be exposed to the contaminant (**Figure 63**).

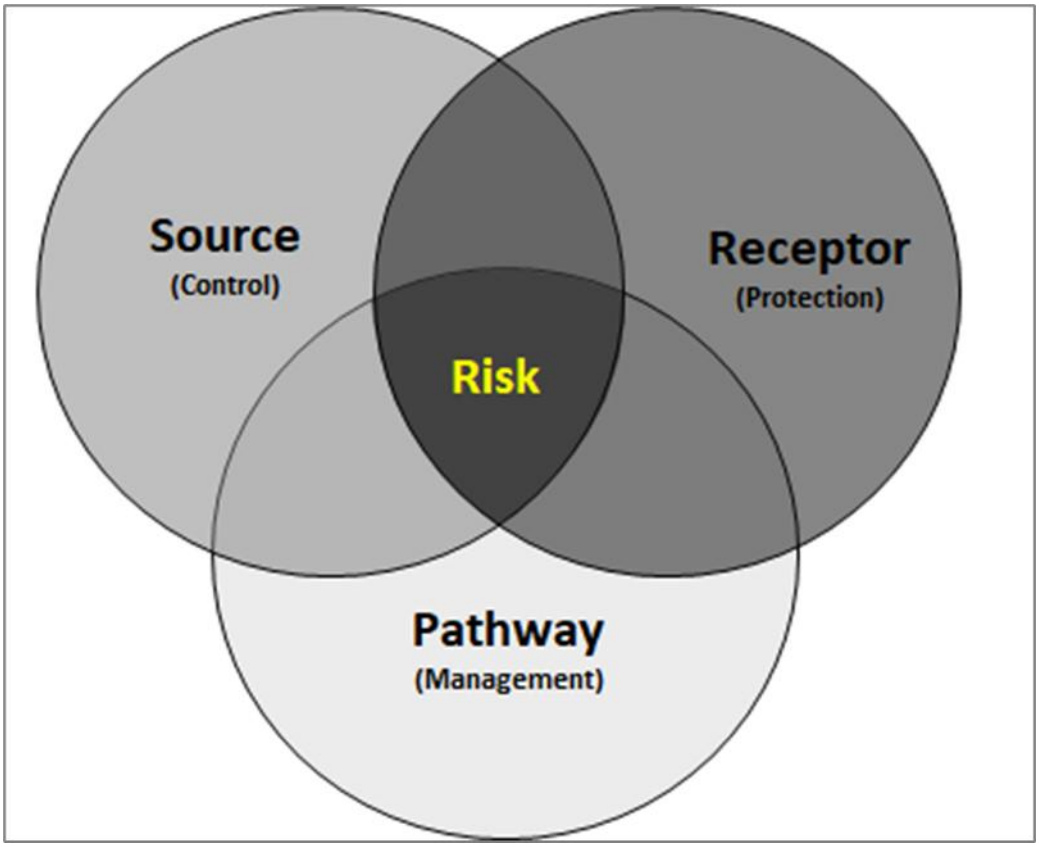


Figure 63: Source pathway receptor principle (Gradient Groundwater Consulting, 2025).

4.11.6.4.1 POTENTIAL SOURCES

The following potential sources have been identified:

i. Migration of saline groundwater from the deep, fractured aquifer to the overlying, potable aquifer(s) during the gas exploration phase.

ii. Migration of stray gas from the deep, fractured aquifer to the overlying, potable aquifer(s) during the gas exploration phase.

iii. Migration of contaminants from the plant footprint as well as associated waste facilities and infrastructure into local water resources and host aquifers.

iv. Mobilisation and maintenance of heavy vehicles and machinery on-site may cause hydrocarbon contamination of groundwater resources.

4.11.6.4.2 POTENTIAL PATHWAYS

The following aquifer pathways have been identified:

i. Vertical flow through the unsaturated/vadose zone as well as saturated zone to the underlying intergranular and fractured rock aquifers. The rate at which seepage will take place is governed by the permeability of sub-surface soil layers and host-rock formations.

ii. Preferential flow-paths include the contact between the depth of weathering and fresh un-weathered rock, fractures, faults, joints and bedding planes. Secondary fractures may also potentially act as transport mechanisms.

iii. If not adequately sealed and suitably mitigated, gas exploration and exploration wells will form preferential flow paths and serve as a direct connection between the deeper, fractured aquifer and shallow, potable aquifer unit(s)

4.11.6.4.3 POTENTIAL RECEPTORS

The following receptors were identified:

i. Shallow, inter-granular as well as the intermediate, fractured aquifer units situated within the plume migration footprint(s). The riparian zone aquifer associated with drainage patterns throughout the greater study area can also be viewed as a sensitive groundwater receptor.

ii. Down-gradient drainages and streams including associated riparian zone aquifer system(s) and baseflow contribution.

iii. Private or neighbouring boreholes associated with relevant fracture zones and/or structures(s)if intercepted by the pollution plume migration footprint.

4.11.7 HYDROGEOLOGICAL CONCEPTUAL MODEL

The hydrogeological conceptual model consists of a set of assumptions, which will aid in reducing the problem statement to a simplified and acceptable version. Data gathered during the desk study and site investigation has been incorporated to develop a conceptual understanding of the regional hydrogeological system. **Figure 64** depicts a generalised hydrogeological conceptual model for similar environments and illustrates the concept of primary porous media aquifers and secondary fractured rock media aquifers. In porous aquifers, flow occurs through voids between unconsolidated rock particles whereas in double porosity aquifers, the host rock is partially consolidated, and flow occurs through the pores as well as fractures in the rock. In secondary aquifers the host rock is consolidated, and porosity is generally restricted to fractures that have formed after consolidation of the rock.

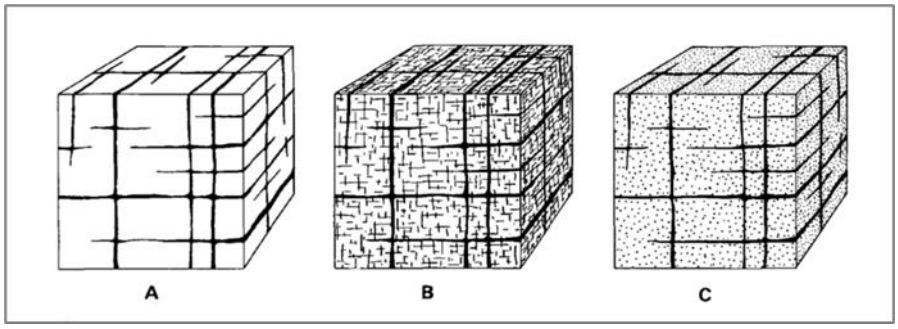


Figure 64: Generalised conceptual hydrogeological model (after Kruseman and de Ridder, 1994).

4.12 AIR QUALITY

The information presented in this section was obtained from the Baseline Air Quality Assessment Report undertaken by Airshed Planning Professionals (**Appendix F3**). Air quality sensitive receptors (AQSRs) refer to places where humans reside. Ambient air quality guidelines and standards, as discussed under **Section 3.9**, have been developed to protect human health. Ambient air quality, in contrast to occupation exposure, pertains to areas outside of an industrial site or boundary where the public has access to and according to the Air Quality Act, excludes air regulated by the Occupational Health and Safety Act (Act No 85 of 1993). Potential sensitive receptors within the project area, include individual households and residential areas (i.e., Welkom, Hennenman, Virginia and Ventersburg).

4.12.1 CLIMATE AND ATMOSPHERIC DISPERSION POTENTIAL

Meteorological mechanisms direct the dispersion, transformation and eventual removal of pollutants from the atmosphere. The extent to which pollution will accumulate or disperse in the atmosphere is dependent on the degree of thermal and mechanical turbulence within the earth's boundary layer. This dispersion comprises vertical and horizontal components of motion. The stability of the atmosphere and the depth of the surface-mixing layer define the vertical component. The horizontal dispersion of pollution in the boundary layer is primarily a function of the wind field. The wind speed determines both the distance of downwind transport and the rate of dilution as a result of plume 'stretching'. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. The wind direction, and the variability in wind direction, determines the general path pollutants will follow, and the extent of crosswind spreading. The pollution concentration levels therefore fluctuate in response to changes in atmospheric stability, to concurrent variations in the mixing depth, and to shifts in the wind field (Tiwary and Colls, 2010).

The spatial variations, and diurnal and seasonal changes, in the wind field and stability regime are functions of atmospheric processes operating at various temporal and spatial scales (Goldreich and Tyson, 1988). The atmospheric processes at macro- and meso-scales need therefore be taken into account in order to accurately parameterise the atmospheric dispersion potential of a particular area. A qualitative description of the synoptic systems determining the macro-ventilation potential of the region may be provided based on the review of pertinent literature. These meso-scale systems may be investigated through the analysis of meteorological data observed for the region.

For the purpose of the scoping assessment, surface and profile weather data for the period January 2019 to December 2021 was obtained from the South African Weather Service (SAWS) station at Welkom. **Updated meteorological data for the period 2022 – 2024 will be used for the AQIA.**

4.12.2 LOCAL WIND FIELD

The vertical dispersion of pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness (Tiwary and Colls, 2010).

Period and diurnal wind roses drawn from the Welkom SAWS station shown in **Figure 65**. During the period 2019 to 2021, the wind field was dominated by winds from the northeastern sector. Calm conditions occurred for 3.5% of the time. Wind speeds decreased during night-time conditions with an increase in calms to 4.65%.

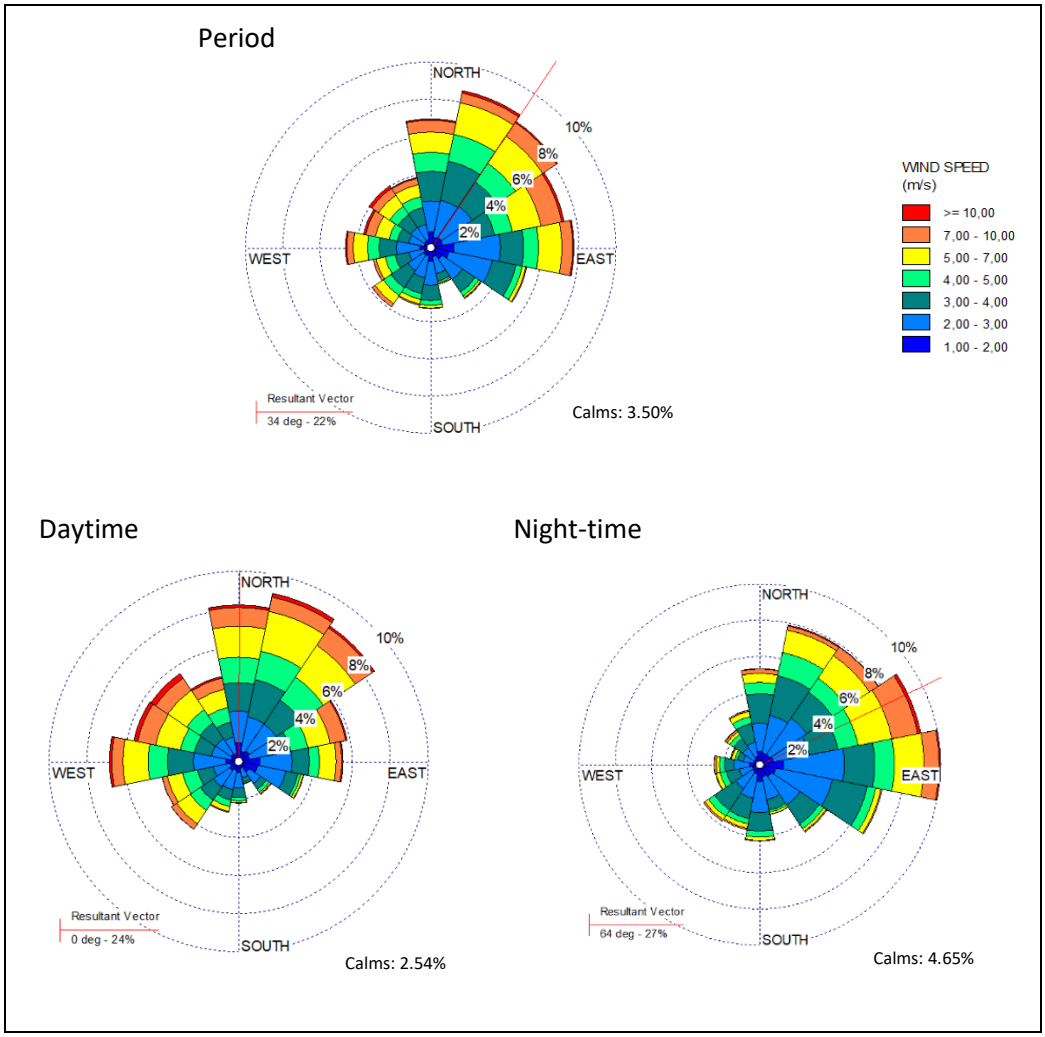


Figure 65: Period average, daytime and night-time wind roses measured data; January 2019 to December 2021 from SAWS Welkom monitoring station (Airshed Planning Professionals, 2025)

4.12.3 ATMOSPHERIC STABILITY AND MIXING DEPTH

The new generation air dispersion models differ from the models traditionally used in a number of aspects, the most important of which are the description of atmospheric stability as a continuum rather than discrete classes. The atmospheric boundary layer properties are therefore described by two parameters: the boundary layer depth and the Monin-Obukhov length, rather than in terms of the single parameter Pasquill Class. The Monin-Obukhov length (LMo) provides a measure of the importance of buoyancy generated by the heating of the ground and mechanical mixing generated by the frictional effect of the earth's surface. Physically, it can be thought of as representing the depth of the boundary layer within which mechanical mixing is the dominant form of turbulence generation (CERC, 2004). The atmospheric boundary layer constitutes the first few hundred metres of the atmosphere. During the daytime, the atmospheric boundary layer is characterised by thermal turbulence due to the heating of the earth's surface. Night times are characterised by weak vertical mixing and the predominance of a stable layer. These conditions are normally associated with low wind speeds and less dilution potential. During windy and/or cloudy conditions, the atmosphere is normally neutral. For low level releases, the highest ground level concentrations would occur during weak wind speeds and stable (night-time) atmospheric conditions.

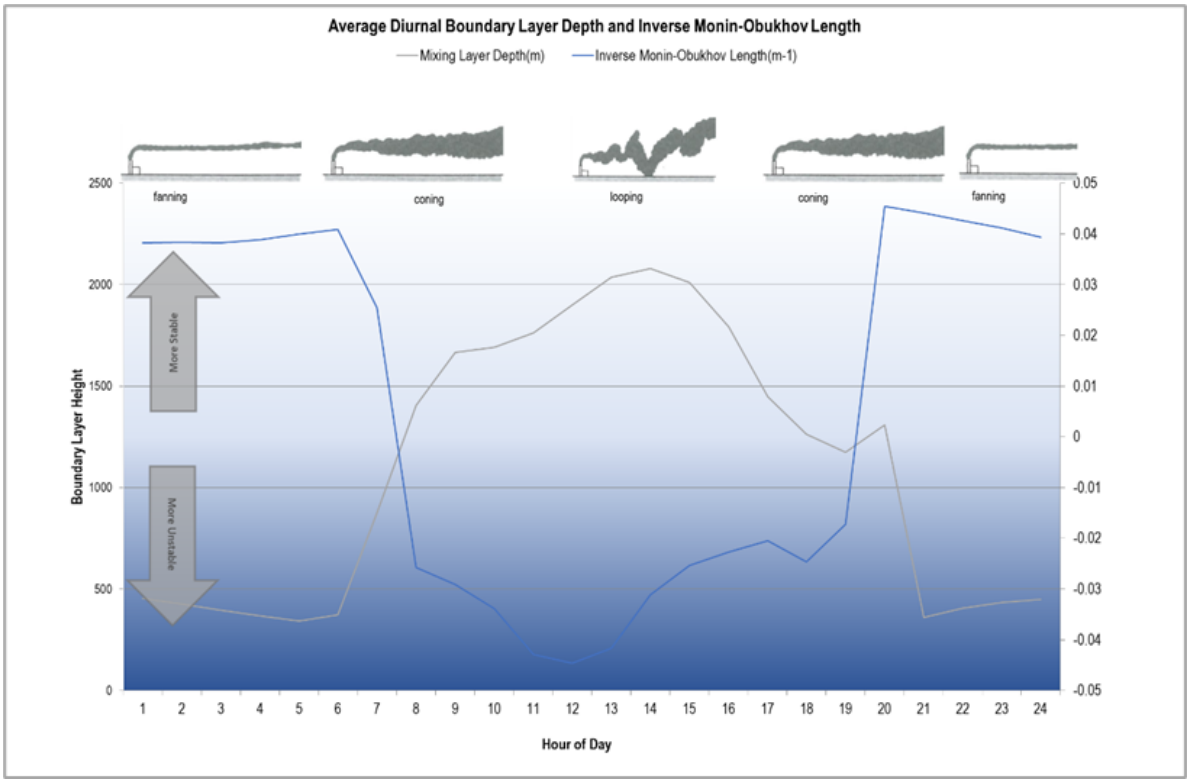


Figure 66: Diurnal atmospheric stability as described by the inverse of the measured Monin-Obukhov length (SAWS Welkom Data: 2019 to 2021)

4.12.4 AMBIENT AIR QUALITY WITHIN THE REGION

4.12.4.1 SOURCES OF POLLUTION IN THE REGION

Neighbouring land-use in the surrounding of the proposed project comprises predominantly of agriculture activities. These land-uses contribute to baseline pollutant concentrations via fugitive and process emissions, vehicle tailpipe emissions, household fuel combustion, biomass burning and windblown dust from exposed areas.

4.12.4.1.1 AGRICULTURE

Agriculture is a major land-use activity within and beyond the Project boundary. These activities include crop farming such as maize, and livestock farming. Particulate matter is the main pollutant of concern from agricultural activities as particulate emissions are derived from windblown dust, burning crop residue, and dust entrainment as a result of vehicles travelling along dirt roads. In addition, pollen grains, mould spores and plant and insect parts from agricultural activities all contribute to the particulate load. Should chemicals be used for crop spraying, they would typically result in odiferous emissions. Crop residue burning is also an additional source of particulate emissions and other toxins.

Livestock farms, especially cattle, are also significant sources of fugitive dust especially when feedlots are used and the cattle trample in confined areas. Pollutants associated with dairy production for instance include ammonia (NH_3), hydrogen sulfide (H_2S), methane (CH_4), carbon dioxide (CO_2), oxides of nitrogen (NOx) and odour related trace gasses. According to the US-EPA, cattle emit methane through a digestive process that is unique to ruminant animals called enteric fermentation. The calf-cow sector of the beef industry was found to be the largest emitter of methane emissions. Where animals are densely confined the main pollutants of concern include dust from the animal movements, their feed and their manure, NH_3 from the animal urine and manure, and H_2S from manure pits.

Organic dust includes dandruff, dried manure, urine, feed, mould, fungi, bacteria and endotoxins (produced by bacteria, and viruses). Inorganic dust is composed of numerous aerosols from building, materials and the environment. Since the dust is biological it may react with the defence system of the respiratory tract. Odours

and VOCs associated with animal manure is also a concern when cattle are kept in feedlots. The main impact from methane is on the dietary energy due to the reduction of carbon from the rumen. Dust and gasses levels are higher in winter or whenever animals are fed, handled or moved.

4.12.4.1.2 MINING SOURCES

Particulates represent the main pollutant of concern at mining operations, whether it is underground or opencast. The amount of dust emitted by these activities depends on the physical characteristics of the material, the way in which the material is handled and the weather conditions (e.g. high wind speeds, rainfall, etc.). Mining of gold, including ore extraction, processing plants, waste rock dumps and tailings storage facilities are all commercial activities situated in the region of the project.

4.12.4.1.3 DOMESTIC FUEL COMBUSTION

Domestic households are known to have the potential to be one the most significant sources that contribute to poor air quality within residential areas. Individual households are low volume emitters, but their cumulative impact is significant. It is likely that households within the local communities or settlements utilize coal, paraffin and/or wood for cooking and/or space heating (mainly during winter) purposes. Pollutants arising from the combustion of wood include respirable particulates, CO and SO_2 with trace amounts of polycyclic aromatic hydrocarbons (PAHs), in particular benzo(a)pyrene and formaldehyde. Particulate emissions from wood burning have been found to contain about 50% elemental carbon and about 50% condensed hydrocarbons.

Coal is relatively inexpensive in the region and is easily accessible due to the proximity of the region to coal mines and the well-developed coal merchant industry. Coal burning emits a large amount of gaseous and particulate pollutants including SO_2, heavy metals, PM including heavy metals and inorganic ash, CO, PAHs (recognized carcinogens), NO2 and various toxins. The main pollutants emitted from the combustion of paraffin are NO_2, particulates, CO and PAHs.

4.12.4.1.4 BIOMASS BURNING

Biomass burning includes the burning of evergreen and deciduous forests, woodlands, grasslands, and agricultural lands. Within the project vicinity, crop-residue burning and wildfires (locally known as veld fires) may represent significant sources of combustion-related emissions. The frequency of wildfires in the grasslands varies between annual and triennial. Biomass burning is an incomplete combustion process (Cachier, 1992), with carbon monoxide, methane and nitrogen dioxide gases being emitted. Approximately 40% of the nitrogen in biomass is emitted as nitrogen, 10% is left in the ashes, and it may be assumed that 20% of the nitrogen is emitted as higher molecular weight nitrogen compounds (Held, *et al.,* 1996). The visibility of the smoke plumes is attributed to the aerosol (particulate matter) content. In addition to the impact of biomass burning within the vicinity of the project activity, long-range transported emissions from this source can be expected to impact on the air quality between the months of August to October. It is impossible to control this source of atmospheric pollution loading; however, it should be noted as part of the background or baseline condition before considering the impacts of other local sources.

4.12.4.1.5 FUGITIVE DUST SOURCES

These sources are termed fugitive because they are not discharged to the atmosphere in a confined flow stream. Sources of fugitive dust identified in the study area include paved and unpaved roads and wind erosion of sparsely vegetated surfaces.

4.12.4.1.6 UNPAVED AND PAVED ROADS

Emissions from unpaved roads constitute a major source of emissions to the atmosphere in the South African context. When a vehicle travels on an unpaved road the force of the wheels on the road surface causes pulverization of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong turbulent air shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed. Dust emissions from unpaved roads vary in relation to the vehicle traffic and the silt loading on the roads. Unpaved roads in the region are mainly haul and access roads.

Emissions from paved roads are significantly less than those originating from unpaved roads, however they do contribute to the particulate load of the atmosphere. Particulate emissions occur whenever vehicles travel over a paved surface. The fugitive dust emissions are due to the re-suspension of loose material on the road surface. Paved roads in the region include the N1, R70, R73 and the R34.

4.12.4.1.7 WIND EROSION OF OPEN AREAS

Windblown dust generates from natural and anthropogenic sources. For wind erosion to occur, the wind speed needs to exceed a certain threshold, called the threshold velocity. This relates to gravity and the inter-particle cohesion that resists removal. Surface properties such as soil texture, soil moisture and vegetation cover influence the removal potential. Conversely, the friction velocity or wind shear at the surface is related to atmospheric flow conditions and surface aerodynamic properties. Thus, for particles to become airborne, its erosion potential has to be restored; that is, the wind shear at the surface must exceed the gravitational and cohesive forces acting upon them, called the threshold friction velocity. Every time a surface is disturbed, its erosion potential is restored (US EPA, 2006). Erodible surfaces may occur as a result of agriculture and/or grazing activities.

4.12.4.1.8 VEHICLE TAILPIPE EMISSIONS

Emissions resulting from motor vehicles can be grouped into primary and secondary pollutants. While primary pollutants are emitted directly into the atmosphere, secondary pollutants form in the atmosphere as a result of chemical reactions. Significant primary pollutants emitted combustion engines include CO_2, carbon (C), SO_2, oxides of nitrogen (mainly NO), particulates and lead. Secondary pollutants include NO_2, photochemical oxidants such as ozone, sulfur acid, sulphates, nitric acid, and nitrate aerosols (particulate matter). Vehicle type (i.e. model-year, fuel delivery system), fuel (i.e. oxygen content), operating (i.e. vehicle speed, load) and environmental parameters (i.e. altitude, humidity) influence vehicle emission rates.

4.12.4.2 AIR QUALITY SAMPLING RESULTS

There are no publicly accessible ambient measurements in the vicinity of the project.

5 PROJECT ALTERNATIVES

In terms of the EIA Regulations published in Government Notice (GN) R982 of 2014, as amended, feasible and reasonable alternatives must be identified and considered within the environmental assessment process. An alternative is defined as "…in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to the:

(a) property on which or location where it is proposed to undertake the activity;

(b) type of activity to be undertaken;

(c) design or layout of the activity;

(d) technology to be used in the activity;

(e) operational aspects of the activity; and

(f) Includes the option of not implementing the activity."

In terms of Section 24 of NEMA, the proponent is required to demonstrate that alternatives have been described and investigated in sufficient detail during the EIA process. It is important to highlight that alternatives must be practical, feasible, reasonable and viable to cater for an unbiased approach to the project and in turn to ensure environmental protection. In order to ensure full disclosure of alternative activities, it is important that various role players contribute to their identification and evaluation. Stakeholders have an important contribution to make during the EIA Process and each role is detailed as follows:

The role of the environmental assessment practitioner is to:

- encourage the proponent to consider all feasible alternatives;
- identify reasonable alternatives;
- provide opportunities for stakeholder input to the identification and evaluation of alternatives;
- document the process of identification and selection of alternatives;
- provide a comprehensive consideration of the impacts of each of the alternatives; and
- document the process of evaluation of alternatives.

The role of the proponent is to:

- assist in the identification of alternatives, particularly where these may be of a technical nature;
- disclose all information relevant to the identification and evaluation of alternatives;
- be open to the consideration of all reasonable alternatives; and
- be prepared for possible modifications to the project proposal before settling on a preferred option.

The role of the public is to:

- assist in the identification of alternatives, particularly where local knowledge is required;
- be open to the consideration of all reasonable alternatives; and
- recognise that there is rarely one favoured alternative that suits all stakeholders and that alternatives will be evaluated across a broad range of criteria, including environmental, social and economic aspects.

Table 24 outlines the various alternative types that must be considered for each development. The extent of the applicability of each of these is further presented. It must be highlighted that the alternatives presented in the table are derived from both the EIA Regulations (2014) as amended as well as the Department of Environmental Affairs and Tourism's (now Department of Environmental, Fisheries and Forestry) 2004 Integrated Environmental Information Series on the Criteria for determining alternatives in EIA. Where the alternative is applicable to the project, it will be further discussed in this Scoping Report. The alternatives discussed further in this Scoping Report are as follows:

- The No-Go Option;
- Location / property alternatives;
- Process alternatives;
- Scale alternatives; and
- Design alternatives.

Table 24: Project alternatives as per NEMA EIA Regulations, 2014 as amended.

ALTERNATIVE	COMMENT / MOTIVATION
No-go Option	The 'no-go' alternative is sometimes referred to as the 'no-action' alternative (Glasson *et al.,* 1999) and at other times the 'zero-alternative'. It assumes that the activity does not go ahead, implying a continuation of the current situation or the status quo. This alternative must be discussed on all projects as it allows for an assessment of impacts should the activity not be undertaken. It is the Department's requirement that this alternative be assessed for all EA applications. Subsequently, **this alternative is discussed in this report.**
Activity alternatives	These are sometimes referred to as project alternatives, although the term activity can be used in a broad sense to embrace policies, plans and programmes as well as projects. Consideration of such alternatives requires a change in the nature of the proposed activity. This would entail a process where a different project is proposed instead of the Motuoane ER386. **Based on project information, Motuoane only proposes to undertake exploration activities for hydrocarbons. Therefore, this alternative is not considered feasible and will not be discussed further.**
Location / property alternatives	Location alternatives could be considered for the entire proposal or for a component of a proposal, for example the location of a processing plant within the property boundary. The latter is sometimes considered under site layout alternatives. A distinction should also be drawn between alternative locations that are geographically quite separate, and alternative locations that are in proximity. In the case of the latter, alternative locations in the same geographic area are often referred to as alternative sites. There are up to 11 proposed drilling sites and 16 seismic transects within the extended exploration right. Therefore, based on the project description, there are proposed exploration sites (target areas) and areas outside of the preliminary target areas. Subsequently, **the location/property alternatives are considered feasible and applicable to this project.**
Technology alternatives	Various terms are used for this category, including technological alternative and equipment alternative. The purpose of considering such alternatives is to include the option of achieving the same goal by using a different method or process. An

ALTERNATIVE	COMMENT / MOTIVATION
	industrial process could be changed, or an alternative technology could be used. These are also known as technological and equipment alternative and will be discussed as they are feasible and applicable to the Motuoane ER386. **These will be discussed in this report.**
Demand alternatives	Demand alternatives arise when a demand for a certain product or service can be met by some alternative means. This is applicable to the demand for a product or service. An example of this would be where there is a need to provide housing units. Examples of alternatives can be through managing demand through various methods or providing additional housing through either single dwelling residential units or mixed-use developments. Specific to the proposed project, **alternatives regarding the demand are considered not feasible for the Motuoane ER386 project and will not be discussed further.**
Scheduling alternatives	These are sometimes known as sequencing or phasing alternatives. In this case an activity may comprise several components, which can be scheduled in a different order or at different times and as such produce different impacts. As indicated in Section 2, the proposed activities have to be undertaken in sequence, one phase (non-invasive exploration) informs the other phase (invasive exploration). First there are Non-Invasive Exploration activities which involve the seismic surveys to determine the areas of interest for the drilling team. Only once the seismics are completed, can a 2-D sub-surface geological network be generated and analysed to identify areas of interest for further exploration. The outcome of the seismic survey will be used to inform preferable drilling locations for the Invasive Exploration phase. Considering that the seismic activities will largely be undertaken on existing gravel roads, there will be minimal difference of impacts based on seasonal scheduling of the activities. Therefore, **scheduling alternatives are considered not feasible for the Motuoane ER386 project and will not be discussed further.**
Input alternatives	By their nature, input alternatives are most applicable to industrial applications that may use different raw materials or energy sources in their processes. Considering that the proposed development is an exploration project which does not involve the conversion of raw materials into finished products, **input alternatives are considered not feasible for the Motuoane ER386 project and will not be discussed further.**
Routing alternatives	Consideration of alternative routes generally applies to linear developments such as power lines, transport, and pipeline routes. Although the proposed Motuoane ER386 exploration activities involve a linear aspect, seismic transect, routing alternatives are not feasible as seismic transects are strategic and follow a linear path because they facilitate the creation of clear, two-dimensional subsurface cross-sections, which are easier to interpret and analyse. **Therefore, routing alternatives are considered not feasible and will not be discussed further.**
Scale alternatives	In some cases, activities that can be broken down into smaller units can be undertaken on different scales. For example, a housing development within an overall mixed-used development could have the option of 1 000, 2 000 or 4 000 housing units. Each of these scale alternatives may have different impacts. Similarly, the exploration footprint is extensive and as such, there are two options, limiting exploration activities to a specific number (smaller scale) or undertaking unlimited

ALTERNATIVE	COMMENT / MOTIVATION
	exploration activities within the exploration right. **For this reason, scale alternatives will be discussed in this report.**
Design or Site layout alternatives	This entails the consideration of different site layouts or designs for aesthetic purposes or different construction materials to optimise local benefits and sustainability would constitute design alternatives. Site layout alternatives permit consideration of different spatial configurations of an activity on a particular site. This may include particular components of a proposed development or may include the entire activity. Generally, the design alternatives could be incorporated into the project proposal and so be part of the project description and need not be evaluated as separate alternatives. There are two options for containment sumps during the drilling phase, ground containment sumps (sump pit) or above ground steel or plastic sumps and location thereof which have different designs and different impacts. **Based on this, design or layout alternatives will be considered and discussed in this report**.
Operational alternatives	The Operational Alternative is where you can specify controls on the operational aspects of the project such as pressure pipes, pumps, as well as valves. In the case of the proposed Motouane exploration activities, **feasible operational alternatives were not identified and are not discussed in this report.**

Feasible and/or reasonable alternatives that can be considered are described and motivated below.

5.1 LOCATION / PROPERTY ALTERNATIVES

The proposed exploration activities entail the undertaking of up to eleven (11) drilling sites and up to sixteen (16) seismic surveys within the exploration right footprint. For purposes of this report, location alternatives will be in reference to preliminary identified target exploration locations which are assessed in detail and preliminary general exploration footprint which is only assessed on desktop level. Detailed of the preliminary identified target exploration locations are indicated in **Section 2** (**Table 6**) while the preliminary identified target exploration locations and the general exploration footprint indicated in **Figure 1** and **Figure 2**.

5.1.1 EXPLORATION ACTIVITIES WITHIN PRELIMINARY IDENTIFIED TARGET EXPLORATION LOCATIONS

Undertaking the activities within preliminary identified target exploration locations would entail a process where these exploration activities are restricted to within 500m of preliminary well location and/or within 25m of the preliminary seismic transects. This would entail undertaking the exploration activities within areas assessed in detail, with known sensitivities to be avoided and processes in place to be followed to ensure activities are undertaken in an environmentally friendly and sustainable manner.

5.1.2 EXPLORATION ACTIVITIES OUTSIDE PRELIMINARY EXPLORATION TARGET AREAS

Undertaking the activities within the preliminary general exploration footprint areas would entail a process where the proposed exploration activities are undertaken outside of the assessed 500m of preliminary well location and/or outside of the 25m of the preliminary seismic transects. This would entail undertaking the exploration activities on areas only assessed in desktop level with little known site-specific environmental sensitivities.

5.1.3 ADVANTAGES AND DISADVANTAGES OF LOCATION ALTERNATIVES

Preliminary advantages and disadvantages of undertaking the activities within preliminary identified target exploration locations which are assessed in detail compared to undertaking the exploration activities within preliminary general exploration footprint which is only assessed on desktop level are indicated in **Table 25**.

Table 25: Advantages and disadvantages of undertaking activities within different location alternatives.

ADVANTAGE	DISADVANTAGE
Undertaking the activities within preliminary identified target exploration locations	
Activities will be on known site-specific environmental sensitivities and controls in place.	Final drilling site/s may fall outside of the assessed area which would limit effective assessment of the gas resource.
Site-specific controls would be in place for the activities in these areas.	Additional specialist studies, applications or approvals may still be required depending on the final location.
Restricting exploration activities and subsequent disturbance / impacts to specific locations within the ER.	
Undertaking the activities outside preliminary exploration target areas	
Final drilling site/s may fall outside of the assessed area based on the outcome of the seismic surveys. Strict measures to be included in the EMPr will allow activities to proceed in these areas. It must be noted that there may be a requirement to undertake additional site-specific environmental sensitivities and specify additional controls.	Activities will be located on areas with little knowledge of specific environmental sensitivities.
	Minimal site-specific controls would be in place for the activities in these areas.
	This would open up the entire exploration footprint for exploration activities and potential disturbance / impacts.
	Additional specialist studies, applications or approvals may be required to allow for activities to be undertaken in these areas.

Based on the advantages and disadvantages indicated in **Table 25** above, it is recommended that the proposed activities be ideally undertaken within the preliminary identified target exploration locations and areas outside of the target areas be the last resort. However, the nature of the exploration activities is such that the target sites are somewhat adjustable. This provides the operator with flexibility to move the sites for on-the-ground-activities to avoid local sensitivities that must be avoided (e.g. residence, wetlands and watercourse, etc.) buffers where required provided that the relevant processes to be outlined in the Environmental Management Programme (EMPr) which will be compiled in the EIA Phase are followed. The specific locality of the exact drilling location can only be identified once the initial phases have been undertaken, environmental sensitivities identified and faults / fractures within the target rocks identified. This will be further assessed during the EIA phase. **It is therefore recommended that, both areas inside the target areas and outside the target areas be considered for approval provided that relevant processes / measures are in place**.

5.2 TECHNOLOGY OR PROCESS ALTERNATIVES

5.2.1 EXPLORATION DRILLING ALTERNATIVES

Drilling penetration into rock becomes more difficult with increasing hole diameters and rock compressive strength. In piling applications, hard rock formations have to be cut and excavated prior to the installation of the foundation piles and/or piled retaining walls. Commonly, conventional rotary drill tools are used for bored piles in medium to very high strength rocks. For harder rock formations different methods have to be adopted as much larger cutting energy and force input are normally required to break the material at the rock tool interface. Different drilling methods include rotary, percussion, rotary-percussion drilling and core drilling techniques, each utilizing distinct techniques to penetrate various soil and rock conditions, with rotary drilling using a rotating drill bit and percussion drilling using a hammering action.

5.2.1.1 ROTARY DRILLING METHOD

Rotary drilling uses a rotating drill bit to create boreholes by cutting or grinding through materials, and it is a versatile technique used in various applications, including well drilling, soil sampling, and geotechnical investigations. Rotary drilling is a method of creating boreholes in the ground using a spinning drill bit. This technique utilises a rotary drilling rig, which applies downward pressure and rotational force to the drill string, effectively cutting through soil and rock layers. As the drill bit advances, it grinds and chips away at the subsurface material, creating a cylindrical hole. The process uses a special fluid, often called drilling mud, which flows through the drill and out of small openings in the drill bit (refer to **Figure 67**). This fluid has several important jobs:

- Cooling the drill bit to prevent overheating;
- Lubricating the drilling components;
- Carrying cuttings from the borehole to the surface; and
- Stabilising the borehole walls to prevent collapse.

Rotary drilling rigs come in various sizes and configurations, including compact, rubber-tracked units designed for accessing confined spaces to large truck-mounted rigs capable of drilling deep boreholes in challenging conditions. Common uses of rotary drilling are deep water well drilling, geothermal wells, and oil & gas drilling.

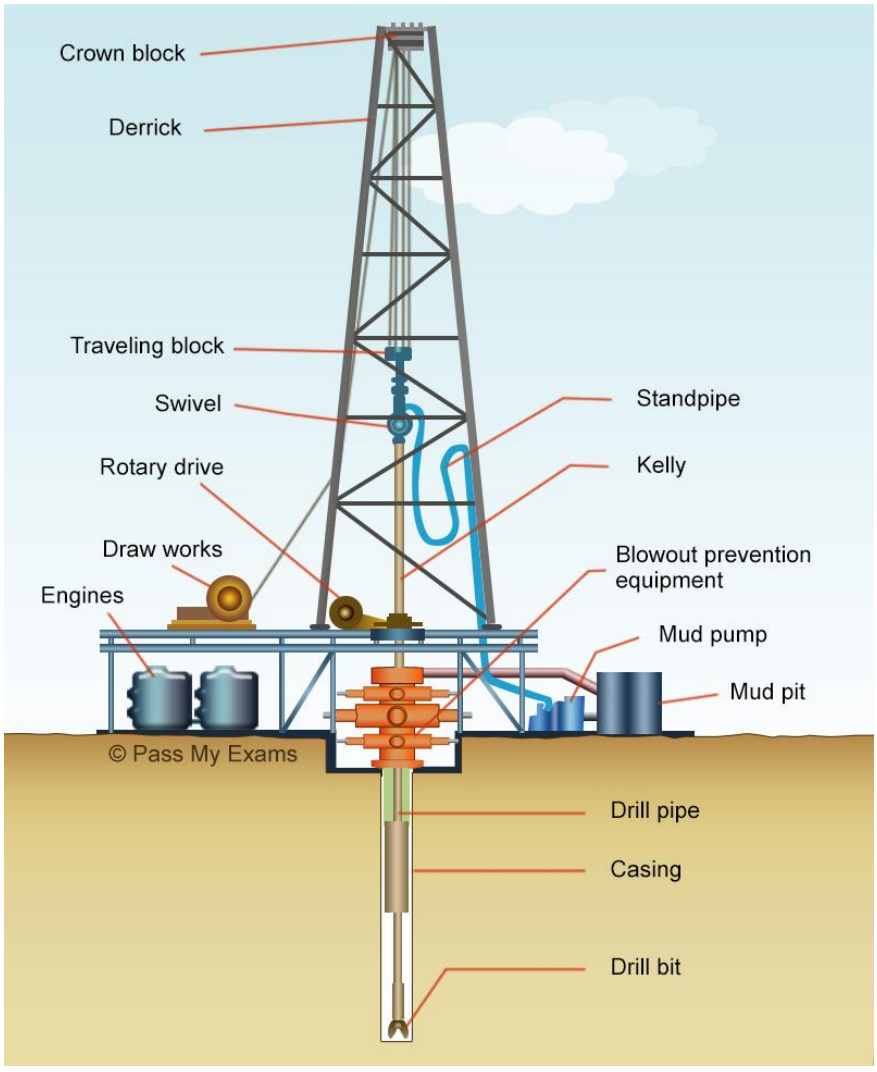


Figure 67: Fully cased drilling with rotary drive (https://www.passmyexams.co.uk/GCSE/chemistry/drilling-crude-oil-1.html).

5.2.1.2 PERCUSSION DRILLING METHOD

Percussion drilling is a technique where a hammering bit is attached to a long cable that is then lowered into a wide-open hole. As such, it is also called cable drilling, wherein the driller uses a tripod to support the tools. By going back and forth with the bit, the action loosens the soil in the borehole, which is then extracted with the help of a bailer. At intervals, the bit is removed while the cuttings are suspended in water, which is then removed by pumping to the surface. The percussion or churn drill digs a vertical hole. It employs the principle of freely falling chisel bit hung on a cable to which percussive motion is imparted by one of the various types of power units. The power units are manual lift and drop, compressed air, and electrically driven winches. The tungsten carbide bit fitted in a hammer is lifted few meters and allowed to drop (**Figure 68**) to hit the bottom of the hole. The process continues in succession. The churning motion of the bit crushes and scraps the ground, and so a hole is dug. The cutting of rocks thus produces mud or slurry by lowering water. The crushed material is removed from the bottom of the hole at a regular interval to make a sample. Churn drilling is suitable for soft and medium formation. In harder formation resharpening of cutting bit is required frequently resulting in lowering of progress. The capacity of the churn drill in its original form is limited to relatively short holes, under 40 m. Unless the formation is consolidated, a steel casing is necessary to prevent the collapse of the hole. Similarly, the casing may have to be cemented/isolated in order to protect the hole from contamination or prevent the hole from being a vehicle to bring various layers in communication (triggering environmental concerns). Only an uncemented casing can be used temporarily after permanent screen or casing is installed.

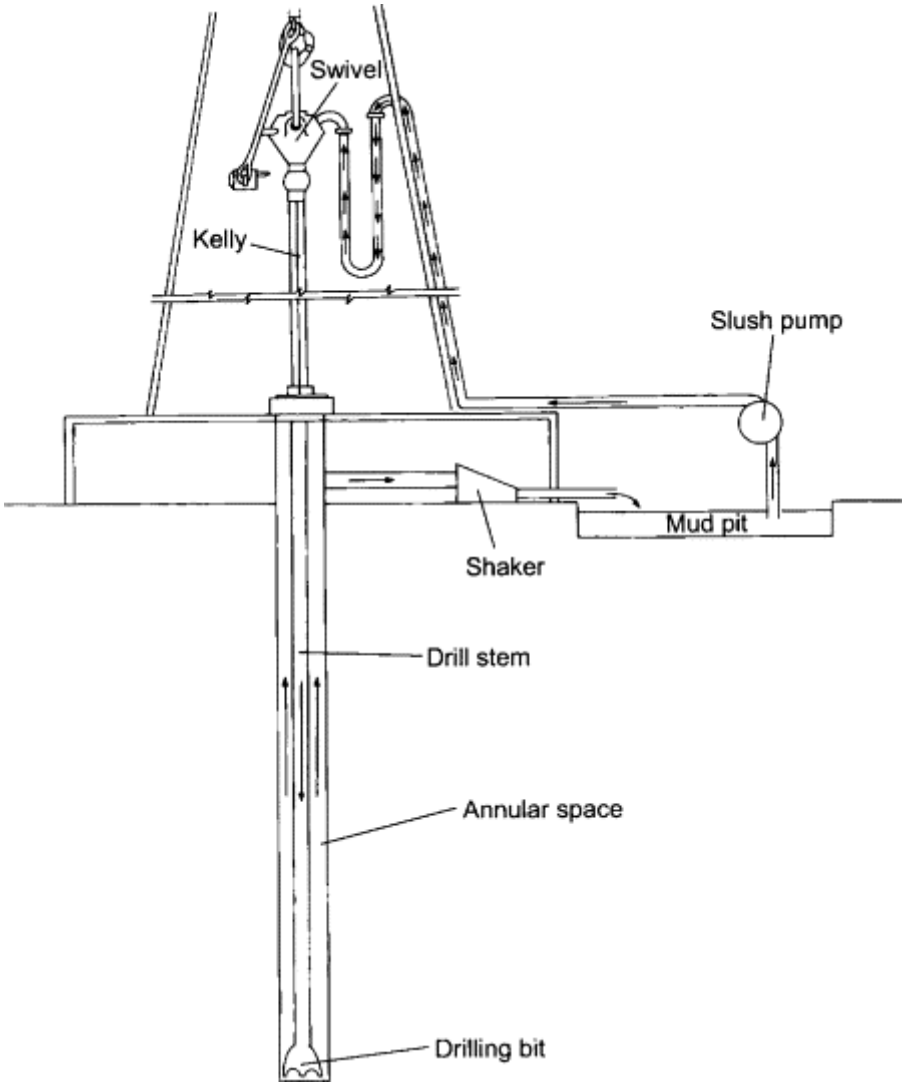


Figure 68: Typical example of percussion drilling technique (https://www.sciencedirect.com/topics/engineering/percussion-drilling).

5.2.1.3 ROTARY-PERCUSSION DRILLING METHOD

Rotary-percussion drilling, also known as down-the-hole hammer drilling, combines rotary and percussive drilling techniques to penetrate various soil and rock conditions efficiently, using a hammer tool to produce percussion while rotating the drill bit. A hammer drill (located directly in the borehole) delivers blows to a drill bit, breaking up the material. The drill pipes are rotated, and a flushing medium (like compressed air or water) is used to remove debris. The hammer drill is connected to the drill pipes, and the drill bit is forced through the drill pipes, hammer drill, and borehole. Refer to **Figure 69** for the excavation processes of the rotary-percussion composite excavation method: (**A**) excavating the shaft with rotary drilling; (**B**) completing the rotary drilling segment; (**C**) excavating the shaft with percussion drilling; (**D**) completing the percussion drilling segment

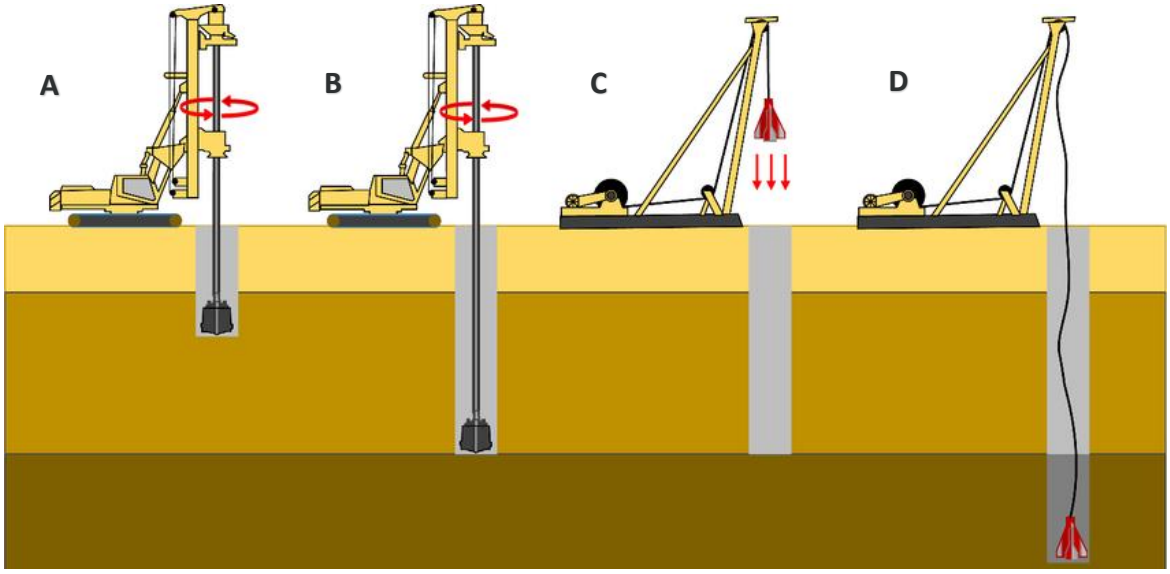


Figure 69: Typical example of rotary-percussion drilling technique (Hu *et al.,* 2023).

5.2.1.4 DIAMOND CORE DRILLING METHOD

Diamond drilling is a type of rotary drilling that uses a diamond studded drill bit (**Figure 70A**) to drill through and collect samples of sub-surface rock. The drill bit is attached to a core barrel which consists of an inner and outer barrel and a core lifter. The core barrel is then attached to a 6m drill rod (together called the “drill string”) which is connected to a rotary / diamond drill rig (**Figure 70A**). During drilling, the inner barrel remains stationary while the outer barrel rotates with the drill bit. Water and other drilling fluids are injected into the drill string to prevent overheating. The drill bit cuts through the rock as it rotates and the opening at the end of the drill bit allows a solid column of rock (known as “drill core”) to move up into the core barrel. When 6m has been drilled, a steel cable is used to latch the inner barrel and winch the drill core to the surface. The core lifter prevents the drill core from slipping out through the opening at the end of the drill bit while this is happening. Once at the surface, the drill core is removed from the inner barrel, washed, cracked into shorter lengths and placed in a core tray with markers inserted to track depth. Another 6m drill rod is attached to the top of the drill string and it is lowered back into the drill hole to continue drilling until the desired depth is reached. At least once a shift, core trays are transported to a separate core processing area to be marked up, photographed and logged by a qualified geologist. Once the geologist has finished with the drill core, it is cut in half longitudinally, so that half can be sent to a laboratory for analysis and half stored for future reference / use. Upon completion of drilling, it is a requirement that rehabilitation is undertaken to ensure that all areas impacted by drilling are restored to the condition that existed prior to undertaking the drilling, and no hazards are left behind that would impact the surrounding environment or land use.

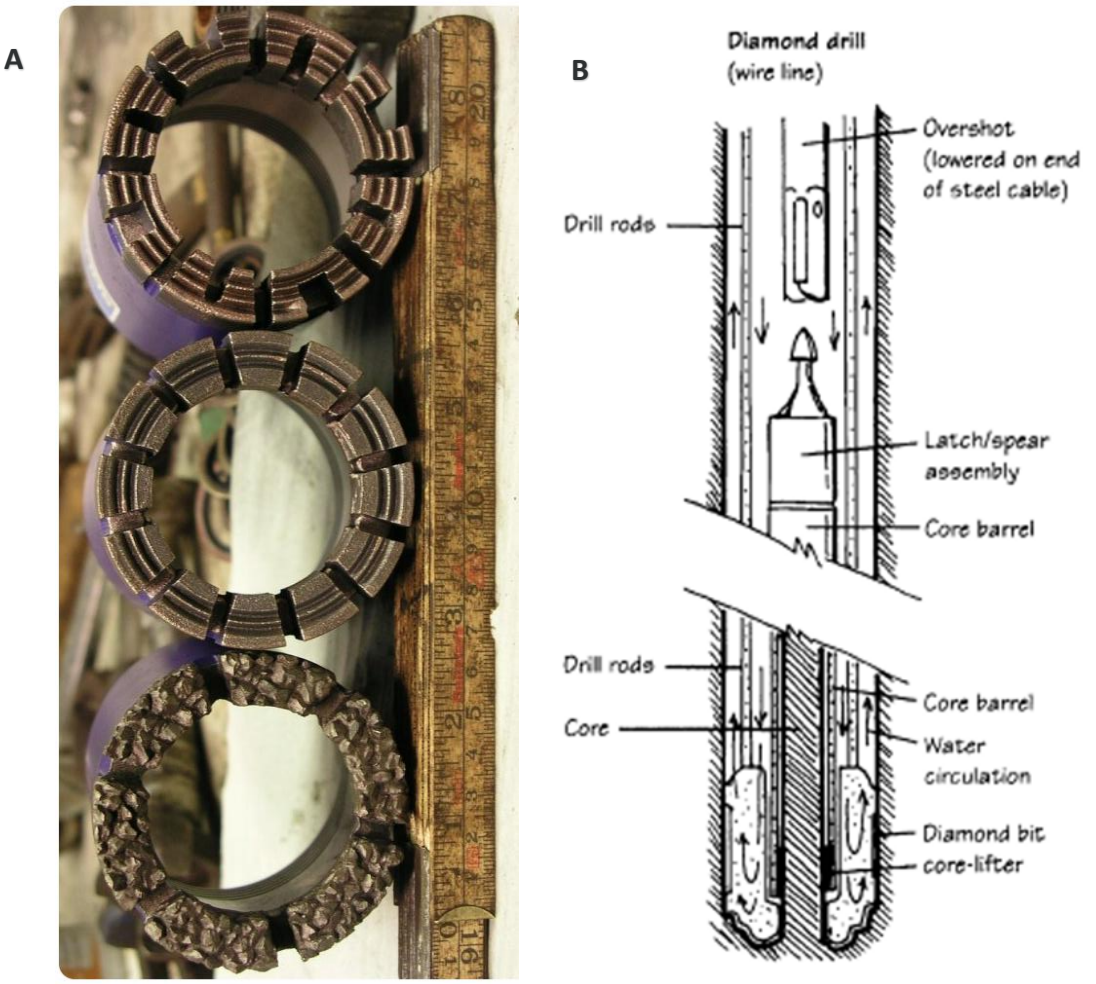


Figure 70: Diamon core drilling technique (Wai: https://www.precisiondrillingaustralia.com.au and Igo: ttps://www.igo.com.au)

5.2.1.5 ADVANTAGES AND DISADVANTAGES OF DIFFERENT EXPLORATION DRILLING METHODS

Table 26: Advantages and disadvantages of different exploration drilling alternatives.

METHOD	ADVANTAGE	DISADVANTAGE
Rotary Drilling	Versatile, efficient, good for various formations	Rotary drilling equipment and operations can be more expensive than percussive drilling
	Faster drilling speeds due to continuous rotation	The machinery used in rotary drilling can generate significant noise and vibration, which can be disruptive, especially in residential areas.
	Enhanced safety as fewer manual connections are required	Can be slower and more challenging than percussive methods in extremely hard rock.

METHOD	ADVANTAGE	DISADVANTAGE
	Ideal for deep boreholes and oil & gas applications	Disposal of drilling waste, including large volumes of water if drilling below the water table, can be costly.
	Reduced risk of borehole collapse.	Can cause environmental impacts including noise and vibration pollution, air pollution from exhaust emissions, and potential soil and water contamination from drilling fluids.
	High penetration rate in hard rock, durable	Expensive, requires specialized equipment
Percussion Drilling	In general, percussion drilling is relatively fast and efficient.	Percussion drilling cause noise pollution, potential for soil disturbance and contamination, and the need for proper waste disposal
	Percussion drilling is a cost-effective method.	Percussion drilling can cause significant damage to the rock formation being drilled, making it unsuitable for some geological projects.
	Can be used in a variety of geological formations, including hard rock, soft rock, and unconsolidated formations.	The equipment can be very heavy and relatively expensive.
	It is a straightforward method to operate and maintain, making it accessible for a range of projects and drilling environments.	Especially in harder rock, the method is slower than rotary-percussion and/or core methods.
Rotary-percussion Drilling	Can drill in consolidated or broken formations, as well as transitional hard or soft formation changes.	Generally slower than pure rotary drilling, especially in softer materials or for deep boreholes.
	Can increase rate of penetration (ROP) and drilled meters per shift.	Can be prone to hole deviation in certain conditions, especially in hard or unstable formations.
	Can be more cost-effective than other drilling methods, especially for deep drilling.	May require more specialized equipment and expertise compared to simpler drilling methods.
	Allows for the collection of continuous core samples, which is useful for detailed geological analysis.	Some rotary-percussion drilling techniques have limitations on the maximum drilling depth
	Causes less surface disruption compared to some other drilling	Depending on the specific method and fluids used, there can be

METHOD	ADVANTAGE	DISADVANTAGE
	methods, making it suitable for urban or residential areas.	environmental concerns related to drilling fluids and waste disposal.
Diamond Core Drilling	Diamond core drilling is more precise than its offshoots of earth burying. Diamond core drilling produces clean, accurate holes with minimal vibration or damage to surrounding materials.	Diamond drilling can be noisy and create vibrations, which can be unpleasant for workers and nearby residents.
	Where the rotary and percussion drill mechanisms chip or crush the earth beneath tools, the core drill type is able to pull a slither of rock delicately from the earth.	Diamond drilling can lead to soil and water contamination if not managed properly. The drilling process can introduce harmful substances into the ground, affecting both soil quality and nearby water sources.
	Has the drill to power through the hardest of rock materials.	Local ecosystems, including plants and animals, are often more disrupted by diamond drilling activities
	Diamond core drilling is important for geological analysis. By examining the extracted core a geologist can determine the relationship between the rock layers and examine the earth's condition in fault zones.	Diamond drilling equipment and diamond bits are expensive, and require regular maintenance, making the process costly.
	Diamond drilling is usually faster and more effective than conventional drilling methods.	Compared to other drilling methods, diamond core drilling can be slower, especially in hard rock formations.
	Diamond core drilling produces minimal dust and debris, which reduces cleanup time and environmental impact.	There's a risk of losing or damaging the core sample during the drilling process, which can hinder geological analysis.
	While the initial investment may be higher, diamond drills are durable and can last longer than other types of drills, which can lead to cost savings in the long run.	Diamond drilling equipment can be prone to failure, especially in harsh conditions, leading to downtime and increased costs.

In general, percussion drilling is a versatile and cost-effective method of geological exploration that is widely used in the exploration industry. While it has some drawbacks, such as its limited depth capabilities and potential for rock damage, it remains a popular choice for many exploration projects. As with any drilling method, it is important to weigh the pros and cons carefully before deciding whether to use percussion drilling for a specific geological exploration task. Based on the advantages and disadvantages indicated in **Table 26** above, each method has its own pros and cons, the seismic surveys will inform the type of drilling technique required but from an environmental point, percussion drilling has the least impacts while diamond core drilling has the most environmental impacts..

5.2.2 SEISMIC SURVEYS ALTERNATIVES

A seismic survey is a method used to investigate the subsurface structure, primarily for oil and gas exploration, by sending sound waves into the ground and analysing the reflected signals. Offshore surveys use airguns to create low-frequency sound waves that travel through the water and reflect off the seafloor, allowing geophysicists to map geological features and potential hydrocarbon deposits. While onshore seismic surveys are used to investigate the subsurface structure of land areas, commonly for exploring hydrocarbon reservoirs, mineral deposits, and natural gas, by using sound waves and the principles of reflection seismology. The proposed activities are onshore seismic surveys and thus, this report will only focus on onshore seismic surveys. Onshore seismic surveys utilize sound waves, which are generated and then reflected off subsurface layers. By analysing the reflected waves, geoscientists can create images of the subsurface structure. The design of a seismic survey depends on the specific objectives, the geological setting, and the availability of historical data. Factors to consider include the size of the survey area, the spacing of seismic lines, and the type of seismic acquisition techniques used. For purposes of this report, the types of seismic surveys techniques used will be based on three common methods used for oil and gas explorations namely, Vibroseis technique, Accelerated Weight Drop (AWD) and Magnetotelluric Survey (MT) (refer to **Section 2.1.4** for detailed information).

5.2.2.1 VIBROSEIS TECHNIQUE

Vibroseis seismic surveys use vehicles to generate artificial seismic waves through mechanical vibration, offering a low-impact method for gathering data to interpret geological features beneath the earth's surface, similar to how sound waves are used in an ultrasound. Vibroseis trucks travel slowly, stopping at intervals to send seismic waves into the earth using vibrators mounted on the trucks. These waves travel through the earth and are reflected (echoed) off rock formations. Sensitive microphones on the surface, called geophones, record these reflected waves. Geoscientists analyse the recorded data to build knowledge of the underlying geology.

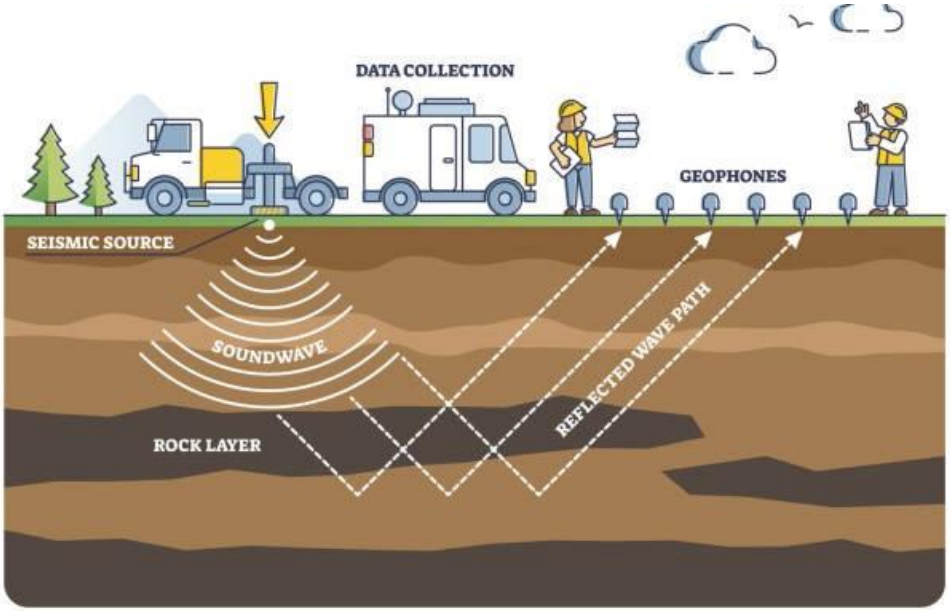


Figure 71: Illustration of Vibroseis technique (Bhardwaj, 2024).

5.2.2.2 ACCELERATED WEIGHT DROP TECHNIQUE

An accelerated weight drop (AWD) seismic survey uses a heavy weight that is accelerated and dropped onto a base plate, generating seismic waves to image the subsurface. An AWD seismic source is a type of surface impact source that uses a weight striking a base plate coupled to the ground. The falling weight strikes the base plate, transmitting kinetic energy to the ground, which creates seismic waves that travel through the subsurface. These seismic waves are then recorded by geophones or other sensors, and the data is used to create images of the subsurface, which is useful for various applications, such as oil and gas exploration, groundwater studies, and engineering investigations (see **Figure 72**).

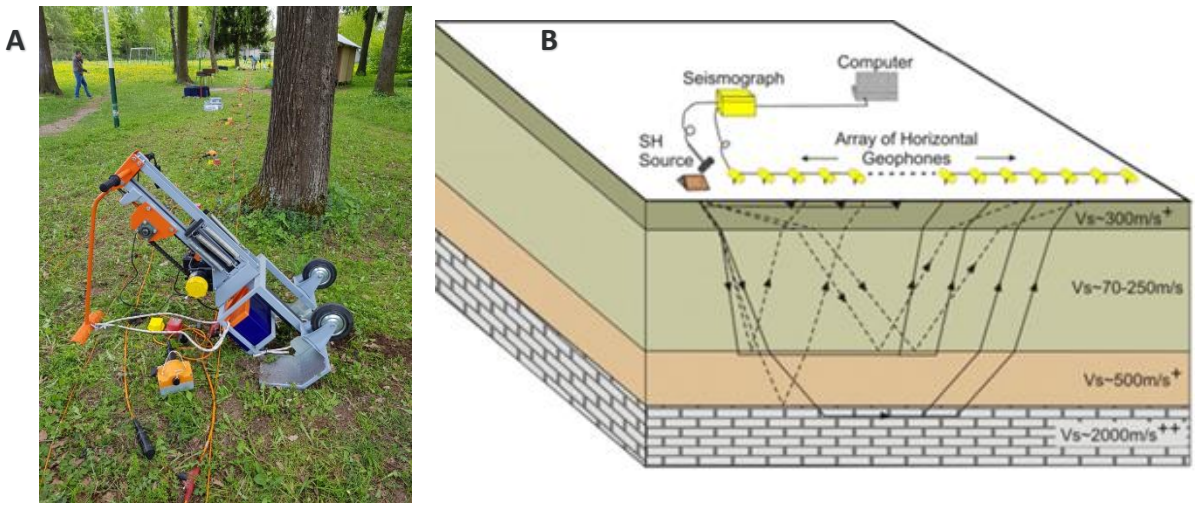


Figure 72: Illustration of AWD technique after Stephenson *et al.,* 2022. (A) AWD on site and (B) illustration of the process.

5.2.2.3 MAGNETOTELLURIC SURVEY

Magnetotellurics (MT) are electro-magnetic survey and imaging techniques that use naturally-occurring ionospheric current sheets and lightning storms — passive energy sources — to map geologic structures to depths of 500 meters or more. The MT geophysical survey method combines measurements of the earth's electric field and magnetic field over a wide band of frequencies. Low frequencies sample deep into the earth and high frequencies correspond to shallow samples. For hydrocarbon exploration, MT is mainly used as a complement to the primary technique of reflection seismology exploration. While seismic imaging is able to image subsurface structure, it cannot detect the changes in resistivity associated with hydrocarbons and hydrocarbon-bearing formations. MT does detect resistivity variations in subsurface structures, which can differentiate between structures bearing hydrocarbons and those that do not.

At a basic level of interpretation, resistivity is correlated with different rock types. High-velocity layers are typically highly resistive, whereas sediments – porous and permeable – are typically much less resistive. While high-velocity layers are an acoustic barrier and make seismic ineffective, their electrical resistivity means the magnetic signal passes through almost unimpeded. This allows MT to see deep beneath these acoustic barrier layers, complementing the seismic data and assisting interpretation ().

A

B

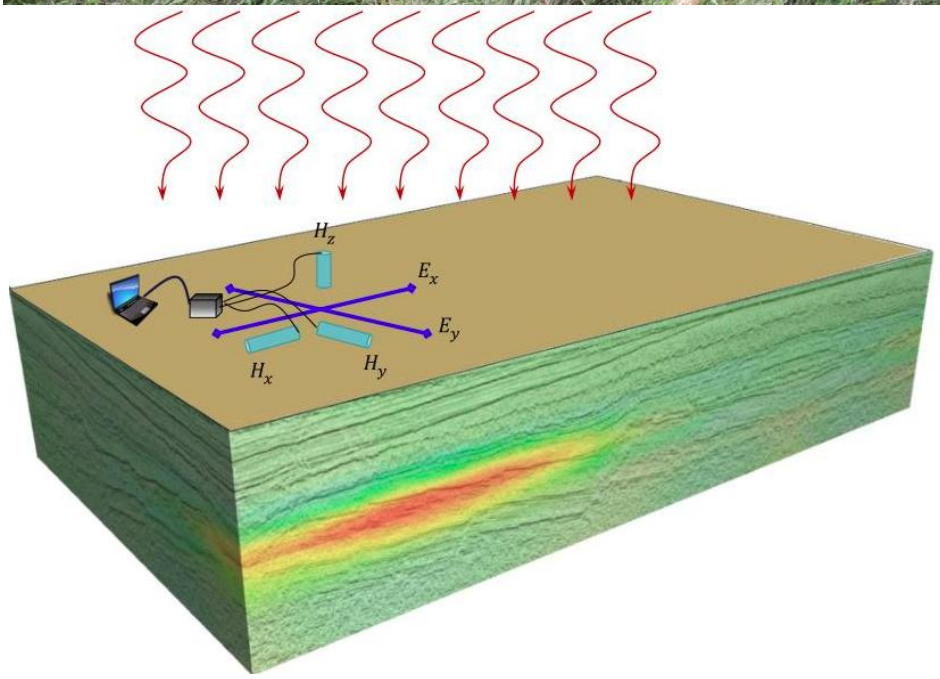


Figure 73: Illustration of MT survey (geopartner: https://geopartner.pl). (A) MT setup on site and (B) illustration of the MT process.

5.2.2.4 ADVANTAGES AND DISADVANTAGES OF DIFFERENT SEISMIC SURVEYS ALTERNATIVES

Preliminary advantages and disadvantages of different seismic survey techniques are indicated in **Table 27**.

Table 27: Advantages and disadvantages of different seismic survey alternatives.

TECHNIQUE	ADVANTAGE	DISADVANTAGE
Vibroseis Survey	Vibroseis allows for precise control over the frequencies and energy of the generated seismic waves, which is beneficial for tailoring the survey to specific geological targets.	Although Vibroseis surveys are generally quicker, they can be affected by weather and terrain conditions resulting in longer survey periods.
	Vibroseis sweeps can be repeated easily, allowing for high-quality data acquisition.	Vibroseis trucks may have difficulty navigating rugged or steep terrain.
	Vibroseis surveys are generally quicker.	Can be more expensive than some other geophysical methods
Accelerated Weight Drop Surveys	AWD surveys can be significantly faster than Vibroseis surveys	Repeated thumping can cause soil disturbance, potentially leading to long-lasting effects
	AWD systems can be mounted on crawlers or other vehicles, allowing them to operate in more varied terrain.	Depending on local regulations, AWD surveys may require more permits than vibroseis surveys.
	AWD can produce more energy than vibroseis, potentially allowing for deeper penetration.	May not be as effective as other seismic methods in deeper areas
	AWD surveys can be used in areas where explosives or vibroseis are not practical or safe.	AWD methods are primarily designed for shallow subsurface investigations, making them less suitable for exploring deeper geological structures
Magnetotelluric Surveys	MT relies on naturally occurring electromagnetic fields, reducing the need for active sources and equipment, making it a cost-effective and environmentally friendly method.	Cannot provide the resolution of seismic surveys and may not be suitable for all geological environments.
	MT surveys can provide information about the subsurface at great depths, and can be used in areas where seismic data collection is difficult or impractical.	MT surveys can be more complex and time-consuming than other geophysical methods.
	MT can map large areas and provide a regional perspective on subsurface resistivity variations.	MT surveys can be expensive, particularly for large-scale projects or surveys in challenging terrains.
	MT surveys do not require drilling or ground disturbance, minimizing environmental impact.	MT surveys may have limited resolution, particularly for shallow subsurface structures.

Based on the advantages and disadvantages indicated in **Table 27** above, it can be seen that the suitability for each is based on the nature of the exploration project and the environmental conditions. It can also be seen that

where one technique lacks, the other can abounds. Therefore, it is **recommended that a multi-survey technique be used based on the environmental conditions of the final survey location.**

5.3 SCALE ALTERNATIVES

5.3.1 UNDERTAKING LIMITED DRILLING AND SEISMIC ACTIVITIES

In this alternative, the exploration activities within the ER would be limited to the proposed number of a maximum of eleven (11) drilling activities and sixteen (16) seismic transects. No additional exploration activities would be allowed through the current application. Should future additional exploration activities be required beyond the current proposed figures, then an amendment application with site specific specialist assessments (in new areas) or compliance studies (in current areas) would be required to support such an application.

5.3.2 UNDERTAKING UNLIMITED DRILLING AND SEISMIC ACTIVITIES

In this alternative, there would be no limit to the number of exploration activities within the ER. This would entail a scenario where more than eleven (11) drilling activities and sixteen (16) seismic transects are undertaken, provided they are within the approved ER. Such additional exploration activities would only need to follow the process to be specified in the EMPr which will be compiled during the EIA Phase.

5.3.3 ADVANTAGES AND DISADVANTAGES OF DIFFERENT SCALE ALTERNATIVES

Preliminary advantages and disadvantages of undertaking limited / defined number compared to undertaking unlimited / undefined number of exploration activities within exploration area are indicated in **Table 28**.

Table 28: Advantages and disadvantages of different scale alternatives.

ADVANTAGE	DISADVANTAGE
Undertaking Limited Drilling and Seismic Activities within the ER	
Limited allowance of exploration activities would result in lesser environmental impacts.	The specified number of exploration activities may possibly be not enough for effective resource quantity and quality analysis. Additional activities would then require assessments, authorisations / approvals which can be time consuming and expensive.
Limited allowance of exploration activities would ideally result in activities being undertaken primarily on the target areas which will be assessed in detail and will have adequate control measures in place.	
There would be less or more control impacts on the surrounding land uses, thus less impacts on the economic activities of the area.	
Undertaking Unlimited Drilling and Seismic Activities within the ER	
The specified number of exploration activities may possibly be not enough for effective resource quantity and quality analysis. Additional activities would then be undertaken without additional authorisations / approvals which can save time and money.	This process would result in significant cumulative environmental impacts. Can lead to significant habitat loss, pollution, and resource depletion.
	This could result in more exploration activities being undertaken outside of the target areas provided they are in *less sensitive environments* only based on desktop information which could be outdated information.
	The area is known for agricultural and game farming as well as an area earmarked for renewable energy developments, unlimited exploration activities could

ADVANTAGE	DISADVANTAGE
	significantly affect the land uses and the economic functions of the area.

Based on the advantages and disadvantages indicated in **Table 28** above, it is **recommended that the proposed activities ideally be limited to the proposed 11 drilling and 16 seismic exploration activities**.

5.4 DESIGN OR LAYOUT ALTERNATIVES

Design alternatives are the consideration of different designs for technical efficiency, aesthetic purposes or different construction materials in an attempt to optimise local benefits and sustainability. It must be noted that there are two types of drilling pit sumps, aboveground sumps and underground sumps. Underground sumps are used in underground mining operations to collect and pump water from working and therefore, not feasible nor applicable for the proposed exploration project. Subsequently, for purposes of this report, design or layout alternatives are based on the two options for aboveground drill sumps, namely the traditional plastic lined pond (sump pit) or above ground sumps with secondary steel or plastic containment.

In exploration drilling, a sump pit (or sump) is a contained area used to collect drill cuttings and manage drilling fluids, allowing for water recycling and efficient solids settling. Sumps are typically constructed as pits or basins, often made of steel or plastic tanks. They can be portable, allowing for easy transport and setup at different drill sites. Sumps are designed to prevent the escape of drilling fluids and cuttings into the environment. Ramps are often included in sump design to allow wildlife to escape if they enter the sump. Proper planning and construction of sumps are crucial for minimizing environmental impact and ensuring a safe drilling operation. It is important to note that the type of drilling method used will influence the size and design of the sump required.

5.4.1 TRADITIONAL LINED POND (DRILL SUMP PITS)

In this alternative, a sump pit is used to collect drill cuttings and manage drilling fluids, allowing for water recycling and efficient solids settling. The drilling team will excavate a hole depending on the drilling method, then line the top portion (typically 0.5 meters) with materials and fenced to ensure joints are sealed for support and preventing water and animals from entering. The typical lining material used are high density polyethylene sheets (refer to **Figure 74**). After drilling operations are completed, the sump pit and the surrounding area must be rehabilitated to restore the site to its original condition. This may involve removing the accumulated solids, cleaning the pit, and restoring the vegetation.

Figure 74: Typical traditional sump pit used for one of the approved Motuoane drilling sites in the region.

5.4.2 ABOVEGROUND SUMPS WITH SECONDARY CONTAINMENT

Above-ground sumps with secondary containment are designed to capture and contain spills or leaks from fuel tanks or other storage containers, acting as a secondary barrier to prevent environmental contamination. Secondary containment is a system designed to prevent the release of hazardous materials into the environment in case of a spill or leak from a primary storage container (like a tank). It is a crucial safety measure, especially for above-ground storage tanks (ASTs) that hold flammable or hazardous liquids. Common methods include containment sumps, bunds (earthen dykes), spill pallets, or double-walled tanks. Aboveground sumps are often made of materials that are impervious to the stored liquid, such as steel, concrete, asphalt, clay, or plastic. In exploration drilling, feasible material includes steel or plastic (**Figure 75**). The sumps are either emptied or disposed by a hazardous waste service provider at a hazardous waste facility.

Figure 75: Examples of aboveground sumps with secondary containment (Ultratech International Inc: https://spillcontainment.com/ultratech-university/spill-containment/).

5.4.3 ADVANTAGES AND DISADVANTAGES OF DIFFERENT DRILL CONTAINMENT SUMPS

Based on the analysis of the different feasible aboveground drill sumps proposed for the project, the advantages and disadvantages are provided in **Table 29**.

Table 29: Advantages and disadvantages different aboveground drill sumps.

ADVANTAGE	DISADVANTAGE
Traditional lined pond (drill sump pits)	
Lined ponds prevent water seepage into the soil, conserving water resources, especially important in areas with intermittent water availability.	Requires dredging causing disturbance to soil.
For drilling activities, it is a cost-effective method compared to aboveground sumps with secondary containment	Waste material can settle and rot on the bottom, leading to ammonia buildup, which is toxic to aquatic life.
Liners prevent soil particles from dissolving into the water, maintaining water clarity and chemistry, which is beneficial for aquaculture and other water-based activities.	Requires constant monitoring to ensure there's no seepage.
	Animals can easily be trapped by the fence and/or fall into the pit.

ADVANTAGE	DISADVANTAGE
Appropriate liners for the specific activity and site are highly resistant to UV damage, chemicals, and punctures, ensuring long-term durability.	Lined ponds can suffer from leaks, liner damage, and require sump pumps. Punctures and tears are common, and repairs can be difficult and costly.
	Damage to liner results in immediate contamination and may affect groundwater and/or nearby aquatic systems.
	Requires backfilling and rehabilitation.
Aboveground sumps with secondary containment	
Above-ground sumps are easier to install and are accessible for repairs and troubleshooting.	Secondary containment systems can be expensive to install and maintain and requires constant monitoring and maintenance.
Above-ground sumps can be designed to fit various spaces and needs, offering design flexibility.	Sediment can settle in the sump, reducing its capacity and requiring more frequent pumping.
Have a longer lifespan, leading to lower long-term costs.	Above-ground sumps can be unsightly and may not blend in with the surrounding landscape.
They are more effective in containing spills from primary container which can be easily identified and addressed compared to lined sumps.	Above-ground sumps can be expensive to install, especially if they are large or complex.
Above-ground sumps are prone to solids buildup and potential maintenance issues.	Secondary containment systems, like bunds or containment berms, require additional space around the primary tank or sump, increasing the overall area needed for storage
	Vehicles can back into them, vandals can deface or damage them, and trespassers can steal their contents. Exposure also increases the chance of leaks.
	Regular inspections and maintenance are crucial to ensure the integrity of both the primary and secondary containment systems.
	If the secondary containment fails, the spilled material can contaminate the surrounding soil and water.

Based on the advantages and disadvantages indicated in **Table 29** above, it is the **EAPs opinion that aboveground sumps with secondary containment be used for the exploration activities**.

5.5 NO GO ALTERNATIVE

The no go alternative would imply that the explorations activities do not proceed. This would result in the status quo of the environment remaining in its current condition. Potential impacts such as some direct / indirect loss of habitats, direct / indirect mortalities, and displacement of fauna including SCC and Protected species would not occur. There would also be no potential for contamination of water resources (including surface water resources) associated with the exploration activities. In addition, the clearing of vegetation for the proposed activities which could expose, disturb and displace archaeological sites / material would be avoided. However,

the approval of the proposed activities would allow the applicant to improve the accuracy of their exploration for an economically viable resource (natural gas including Helium) available in the area. It is important to note that the exploration right will not provide the required authorisation for production activities to be undertaken. As such, any future intention to undertake production of hydrocarbons within the exploration right area would require a further application, investigation and public consultation process.

Exploration for additional domestic hydrocarbon reserves is considered important and any discoveries would be well received by the local market. The Department of Energy's Integrated Resource Plan (2010-2030) supports this view, stating that regional and domestic gas options should be pursued. The government's official position is that exploration and development of oil and gas fields should be encouraged. The identification of potential geological structures or "prospects" within the proposed exploration licence area for future exploration and possible well-drilling provides an opportunity to develop a South African oil and gas industry resulting in long-term benefits consisting of access to new energy sources, improved security of supply, major in-country investments in a development project and reduced dependence on the importation of hydrocarbons. There is also potential in the long-term for local economic stimulation through direct employment, future business opportunities, royalties and tax revenues. In addition, there are known mitigation measure to avoid and/or reduce potential impacts mentioned above as per the various specialist studies and knowledge from past exploration activities. As such, **the no go alternative is <u>not</u> considered feasible or reasonable for this application**, also refer to the detailed need and desirability of the project indicated in **Section 2.6**.

6 STAKEHOLDER ENGAGEMENT

The Public Participation Process (PPP) is a requirement of several pieces of South African legislation and aims to ensure that all relevant Interested and Affected Parties (I&APs) are consulted, involved and their comments are considered, and a record included in the reports submitted to the Authorities. The process ensures that all stakeholders are provided this opportunity as part of a transparent process which allows for a robust and comprehensive environmental study. The PPP for the proposed project needs to be managed sensitively and according to best practises to ensure and promote:

- Compliance with international best practice options;
- Compliance with national legislation;
- Establishment and management of relationships with key stakeholder groups; and
- Involvement and participation in the environmental study and authorisation/approval process.

As such, the purpose of the PPP and stakeholder engagement process is to:

- Introduce the proposed project;
- Explain the authorisations required;
- Explain the environmental studies already completed and yet to be undertaken (where applicable);
- Solicit and record any issues, concerns, suggestions, and objections to the project;
- Provide opportunity for input and gathering of local knowledge;
- Establish and formalise lines of communication between the I&APs and the project team;
- Identify all significant issues for the project; and
- Identify possible mitigation measures or environmental management plans to minimise and/or prevent negative environmental impacts and maximize and/or promote positive environmental impacts associated with the project.

6.1 LEGAL COMPLIANCE

The PPP must comply with several important sets of legislation that require public participation as part of an application for authorisation or approval, namely:

- The Mineral and Petroleum Resources Development Act (Act No. 28 of 2002 – MPRDA); and
- The National Environmental Management Act (Act No. 107 of 1998 – NEMA).

Adherence to the requirements of the above-mentioned Acts will allow for an Integrated PPP to be conducted, and in so doing, satisfy the requirement for public participation referenced in the Acts. The details of the Integrated PPP followed for the project are provided below.

6.2 PRE-CONSULTATION WITH THE COMPETENT AUTHORITY

A pre-application meeting with the Petroleum Agency of South Africa (PASA) was held on the 29th of January 2025. The objective of the meeting was to present the project, confirm identified triggered and applicable listed activities and the applicable application process to be followed as well as the identified applicable specialist studies. The pre-application meeting was also used to confirm the current application form and submission methods.

6.3 GENERAL APPROACH TO SCOPING AND PUBLIC PARTICIPATION

The PPP for the proposed project has been undertaken in accordance with the requirements of the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA) and National Environmental Management Act

(NEMA) Environmental Impact Assessment (EIA) Regulations (2014), and in line with the principles of Integrated Environmental Management (IEM). IEM implies an open and transparent participatory process, whereby stakeholders and other I&APs are afforded an opportunity to comment on the project and have their views considered and included as part of project planning.

6.3.1 IDENTIFICATION OF INTERESTED AND AFFECTED PARTIES

An initial I&AP database has been compiled based on known key I&AP's, Windeed searches, and stakeholders as well as trust information obtained from the regional deeds office (Bloemfontein Justice Department). The I&AP database includes amongst others, landowners, communities, farming groups, regulatory authorities and other special interest groups. Additional I&APs will be identified during the public review and comment period of the Scoping Report. The I&APs database will continuously be updated throughout the duration of the application process. A full list of I&APs is attached in **Appendix C**.

6.3.2 LIST OF PRE-IDENTIFIED ORGANS OF STATE/ KEY STAKEHOLDERS IDENTIFIED AND NOTIFIED

Government Authorities were notified of the proposed project and include:

Table 30: List of key organs of state and I&APs identified and notified.

ORGANS OF STATE	KEY I&APS
• Council for Scientific and Industrial Research (CSIR) • Department of Mineral Resources and Energy: Free State • Fezile Dabi District Municipality • Free State Department of Agriculture & Rural Development • Free State Department of Cooperative Governance and Traditional Affairs • Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs • Free State Department of Mineral Resources and Energy • Free State Department of Police, Roads and Transport • Free State Department of Public Works and Infrastructure • Free State Department of Water and Sanitation • Free State Development Corporation • Free State Heritage Resources Authority • Free State Provincial Shared Services Centre (PSSC) Offices • Lejweleputswa Development Agency • Lejweleputswa District Municipality	• Affected Landowners • Afgri • Afgri Agri Services • African Conservation Trust • African Carbon Energy • AfriForum • Agri Free State • Agri SA • Agri South Africa • Air Traffic and Navigation Services (ATNS) • Birdlife South Africa • Botanical Society • Centre for Environmental Rights • Conservation South Africa (CSA) • Council of Geoscience • Earth Life Africa • Endangered Wildlife Trust • Federation for a Sustainable Environment • FrackFree South Africa • Free State Wetland Forum • GroundWork SA • GUBICO

• Matjhabeng Local Municipality • National Department of Agriculture, Land Reform and Rural Development (DALRRD) • National Department of Forestry, Fisheries and Environment (DFFE) • National Department of Transport • National Department of Water and Sanitation (DWS) • National Energy Regulator of South Africa (NERSA) • National House of Traditional Leaders • Petroleum Agency SA • PetroSA • Sedibeng Water • South African Civil Aviation Authority (SACAA) • South African Defence Force (SANDF) • South African Heritage Resources Agency (SAHRA) • South African National Biodiversity Institute • South African National Roads Agency Ltd (SANRAL) • South African Radio Astronomy Observatory • Telkom SA SOC LTD • Transnet SOC LTD • Vaal Central Water	• Harmony Gold • Hennenman Farming Forum? • Lebone Solar Farm (PTY) LTD • Matjhabeng Ratepayers Association • Mining and Environmental Justice Community Network of South Africa (MEJCON-SA) • Mining Affected Communities United in Action (MACUA) • Mulilo Energy Holdings (PTY) LTD • Natural Justice • Savannah Environmental (PTY) LTD • Tara Wildlife SA • Vaal Environmental Justice Alliance (VEJA) • Vrystaat Landbou/ Free State Agriculture • Warburtons Attorneys • WESSA • WILD TRUST

6.3.3 PROJECT NOTIFICATION AND REQUEST FOR INITIAL COMMENTS

The PPP commenced on the 14th of March 2024 with an initial notification and call to register. The notification was given in the following manner:

6.3.3.1 REGISTERED LETTERS, FAXES AND EMAILS

Notification letters in English, Afrikaans and Sesotho, faxes, and emails were distributed to all pre-identified key I&APs including government organisations, NGOs, relevant municipalities, ward councillors, landowners and other organisations that might be affected. Background Information Document in English, Afrikaans and Sesotho was compiled and uploaded to the EIMS website.

The notification letters included the following information to I&APs:

- The purpose of the proposed project;
- High level list of anticipated activities to be authorised;
- Scale and extent of activities to be authorised;
- Information on the intended exploration activities to enable I&APs to assess/surmise what impact the activities will have on them or on the use of their land;

- Map showing affected properties;
- Summary of the relevant legislation pertaining to the application process;
- Initial registration period timeframes; and
- Contact details of the EAP.

6.3.3.2 NEWSPAPER ADVERTISEMENTS / GOVERNMENT GAZETTE

Advertisements describing the proposed project and EIA process were placed in the local newspaper with circulation in the vicinity of the study area. The initial advertisement was placed in the Vista Newspaper (in English, Afrikaans and Sesotho) on the 20th of March 2025. Gazette Notice was published in the National Gazette on the 11th of April 2025. The newspaper advert and the Gazette included the following information:

- Project name;
- Applicant name;
- Project location;
- Nature of the activity and application;
- Availability of Scoping Report; and
- Relevant EIMS contact person for the project.

6.3.3.3 SITE NOTICE PLACEMENT

A1 correx site notices in English, Afrikaans and Sesotho were placed at 99 locations within the local project area between the 17th and 20th of March 2025. Fifty (50) A1 correx board site notices will be replaced with the revised version of the map at 50 locations within the proposed project study area The on-site notices included the following information:

- Project name;
- Applicant name;
- Project location;
- Map of proposed project area;
- Project description;
- Legislative requirements; and
- Relevant EIMS contact person for the project.

Proof of revised site notices will be provided in the Final Scoping Report to be submitted to the authorities and also in the Draft EIR Phase which will be made available to I&APs.

6.3.3.4 POSTER PLACEMENT

Eight (8) A3 posters in English, Afrikaans and Sesotho were placed at local public gathering places in Virginia, Welkom, Thabong, Bronville and Saaiplaas.

The notices and written notification afforded all pre-identified I&APs the opportunity to register for the project as well as to submit their comments of the Scoping Report and indicate the contact details of any other potential I&APs that they feel should be contacted. The contact person at EIMS, contact number, email and faxes were stated on the posters. Comments/concerns and queries were encouraged to be submitted in either of the following manners:

- Electronically (fax, email);
- Telephonically; and/or

- Written letters.

6.3.4 AVAILABILITY OF SCOPING REPORT

Notification regarding the availability of this Scoping Report for public review was given in one or more of the following manner to all registered I&APs (which includes key stakeholders and landowners):

- Facsimile notifications with information similar to that in the registered letter described above;
- Email notifications with a letter attachment containing the information; and/or
- SMS notifications with the relevant information.

The scoping report has been made available for public review and comment from the **15th of May 2025 to the 18th of June 2025** for a period of 30 days.

6.4 COMMENTS AND RESPONSES REPORTING

Issues raised have been addressed in a transparent manner and the full details (such as the comment received, the name of the I&AP who commented, the issue raised and the main aspect of the raised issue, as well as the response provided to the I&AP) included in the Public Participation Report (**Appendix C**). The Public Participation Report and the comments and responses has continuously been updated throughout the public participation phase as and when new comments were received. A summary of comments received is as follows:

- South African Heritage Resources Agency request for an application to made.
- AgriSA request to redirect the initial notification to the relevant person.
- I&APs requesting to register for the project.
- South African National Roads Agency (SANRAL) request to redirect the initial notification to the relevant region/department.
- I&APs requesting to register for the project.
- I&APs requesting to register for the project.
- Request for shapefiles, maps, and KMZ files for the proposed project.
- Transnet wayleave application outcome - Transnet Pipelines not affected by the proposed project.
- Request for information on the impact of the proposed project on specific farm portions.
- Goldfields Community Forum request to engage directly with Motuoane Community Liaison Officer.
- Moolman, Nel & Pienaar request to be removed from the I&AP database.
- South African Civil Aviation Authority (SACAA) request to redirect the initial notification to the relevant region/department.
- Wesboerdery (Pty) Ltd request for information with regards to proposed project and how their farms may be impacted.

All comments that will be received during the review of the Scoping Report will be captured and responded to through a Table of Correspondence that will be included in the final report. Comments received to date have been included in this report. All I&APs registered on the Project database will be informed of the availability of the Scoping Report for public review. I&APs will be provided with another opportunity to submit their comments during the Environmental Impact Assessment (EIA) Phase of the project. Refer to see **Appendix C** for all Public Participation related documents.

6.5 REVIEW OF THE SCOPING REPORT BY COMPETENT AUTHORITIES

It must be noted that PASA is the Administrative Authority (assessor) of the petroleum related applications but is not the decision maker. The Competent Authority for making the final decision is still the Department of

Mineral Resources and Energy (DMRE). Both PASA as the assessor and DMRE as the Competent Authority have been provided with a copy of this Scoping Report for review and commenting as well as the application form. Comments received from PASA and DMRE will be captured and responded to on the Table of Correspondence for the project which will be made available in the EIA Phase. The authorities will also be afforded another opportunity to review and comment on the EIA Report during the EIA Phase.

DMRE as the competent Authority for the listed activity must, within 43 days of receipt of the Final Scoping Report that has been subjected to 30 days of public review as a Draft Report, accept the Final Scoping Report and Plan of Study for EIA in writing should no amendments be required, or shortcomings be identified therein. Upon acceptance of the Scoping Report, the Environmental Assessment Practitioner (EAP) may then proceed with the tasks contemplated in the Plan of Study for EIA.

The authority can also reject the Scoping Report for not following legislative procedure if any of the required steps were not undertaken. In terms of Regulation 22 (b) of Government Notice R. 982, the Scoping Report may be amended and resubmitted by the EAP should it be rejected. On receipt of the amended Scoping Report and Plan of Study for EIA, the Competent Authority will then reconsider the application. Should the Scoping Report be approved, the amended Scoping Report will then be made available for public review and comment prior to submission to the Competent Authority.

The authority may also advise the EAP of matters that may hinder the success of the EIA application or matters that may prejudice the success of the application.

6.6 PUBLIC PARTICIPATION PROCESS FOR EIA PHASE

The Public Participation Process (PPP) will be documented and included in the Environmental Impact Report (EIR). The PPP will be undertaken in accordance with the Plan of Study for EIA. The project I&APs will be updated on all project developments throughout the EIA Phase. A summary of comments received from the registered I&APs, the date of their receipt and responses of the EAP to those comments will be provided in the Comments and Response Report that will be updated during all project phases. All copies of any representations, objections and comments received will also be submitted to the competent authority together with the EIR. Refer to **Section 9.7 for** the proposed public participation process for the EIA Phase.

6.7 APPEAL PERIOD

After a decision has been reached by DMRE, Chapter 2 of the National Appeal Regulations 2025 makes provision for any affected person to appeal against the decision. Within 20 calendar days from the date that the decision is sent by the decision-maker, or, where applicable, by the applicant to registered interested and affected parties; or within 30 calendar days from the date that the decision is received, where the appeal is submitted in terms of section 43(8) of the Act, the appellant must submit the appeal to the appeal administrator. The applicant, where applicable, the decision-maker and any other person contemplated in regulation 4 of the National Appeal Regulations may, within 20 calendar days from the date of receipt of the appeal, submit, in the form obtainable from the website of the relevant appeal authority a statement responding to an appeal, to the appeal administrator and to the appellant. The appeal administrator may request additional information from any person or affected organ of state for purposes of the appeal. An appeal panel may be appointed at the discretion of the delegated or organ of state to handle the case and it would then submit its recommendations to that organ of state for a final decision on the appeal to be reached. The appeal authority must decide an appeal, and notify the appellant, applicant, and, where applicable, any registered interested and affected party and affected organs of state of the decision within 50 calendar days of the expiry of the time period in regulation 5 of the National Appeals Regulations.

It must however be noted that, a municipal council may extend or condone a failure by a person to comply with the timeframes in regulations 4(1) and 5. In addition, despite regulation 7(1), the appeal authority may decide

an appeal within (a) 70 calendar days of the expiry of the time period in regulation 5 or (b) 50 calendar days of the appeal administrator receiving the appeal panel or expert's recommendations, where an appeal is complex. An appeal is complex where it requires:

a) the appointment of an advisory appeal panel or an expert to assist the appeal authority to decide an appeal;
b) the appeal administrator to undertake a site inspection to properly advise the appeal authority; or
c) more than one appeal administrator to process the appeal due to the volume of its documents or the technical nature of its subject matter.

EIMS will communicate the decision of the Competent Authority and the way appeals should be submitted to the Minister and to all I&APs as soon as reasonably possible after the final decision has been received.

7 ENVIRONMENTAL IMPACT ASSESSMENT

This section aims to identify and do a preliminary assessment on the potential environmental impacts associated with the proposed Motuoane ER386. This impact assessment will be used to guide the identification and selection of preferred alternatives, and management and mitigation measures, applicable to the proposed activities. The preliminary assessment will also serve to focus the subsequent EIA phase on the key issues and impacts.

7.1 IMPACT ASSESSMENT METHODOLOGY

The impact significance rating methodology, as presented herein and utilised for all EIMS Impact Assessment Projects, is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The approach may be altered or substituted on a case by case basis if the specific aspect being assessed requires such- such instances require prior EIMS Project Manager approval. The broad approach to the significance rating methodology is to determine the significance (S) of an environmental risk or impact by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relating this to the probability/ likelihood (P) of the impact occurring. The S is determined for the pre- and post-mitigation scenario. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the S to determine the overall final significance rating (FS). The impact assessment will be applied to all identified alternatives.

7.1.1 DETERMINATION OF SIGNIFICANCE

The final significance (FS) of an impact or risk is determined by applying a prioritisation factor (PF) to the post-mitigation environmental significance. The significance is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and Reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$\boldsymbol{C = \frac{(E + D + M + R) * N}{4}}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in **Table 31** below.

Table 31: Criteria for Determining Impact Consequence.

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. Highly localised, limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property or site boundary, or the area within a few hundred meters of the site)
	3	Local (i.e. beyond the site boundary within the Local administrative boundary (e.g. Local Municipality) or within consistent local geographical features, or the area within 5 km of the site)
	4	Regional (i.e. Far beyond the site boundary, beyond the Local administrative boundaries within the Regional administrative boundaries (e.g. District Municipality), or extends into different distinct geographical features, or extends between 5 and 50 km from the site).

	5	Provincial / National / International (i.e. extends into numerous distinct geographical features, or extends beyond 50 km from the site).
Duration	1	Immediate (<1 year, quickly reversible)
	2	Short term (1-5 years, less than project lifespan)
	3	Medium term (6-15 years)
	4	Long term (15-65 years, the impact will cease after the operational life span of the project)
	5	Permanent (>65 years, no mitigation measure of natural process will reduce the impact after construction/ operation/ decommissioning).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected)
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected, or affected environmental components are already degraded)
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; moderate improvement for +ve impacts; or where change affects area of potential conservation or other value, or use of resources).
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease; high improvement for +ve impacts; or where change affects high conservation value areas or species of conservation concern)
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease, substantial improvement for +ve impacts; or disturbance to pristine areas of critical conservation value or critically endangered species)
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring very high time and cost.
	5	Irreversible Impact.

Once the C has been determined, the significance is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/ scored as per **Table 32**.

It is noted that both environmental risks as well as environmental impacts should be identified and assessed. Environmental Risk can be regarded as the potential for something harmful to happen to the environment, and in many instances is not regarded as something that is expected to occur during normal operations or events (e.g. unplanned fuel or oil spills at a construction site). Probability and likelihood are key determinants or variables of environmental risk. Environmental Impact can be regarded as the actual effect or change that happens to the environment because of an activity and is typically an effect that is expected from normal operations or events (e.g. vegetation clearance from site development results in loss of species of concern).

Typically, the probability of an unmitigated environmental impact is regarded as highly likely or certain (management and mitigation measures would ideally aim to reduce this likelihood where possible). In summary, environmental risk is about what could happen, while environmental impact is about what does happen.

Table 32: Probability/ Likelihood Scoring

Probability		
	2	Low probability (Unlikely, impact could occur but not realistically expected; >5% and <20% chance).
	3	Medium probability (Possible, the impact may occur; >20% and <50% chance).
	4	High probability (Likely, it is most probable that the impact will occur- > 50 and <90% chance).
	5	Definite (Almost certain, the impact is expected to, or will, occur, >90% chance).

The result is a qualitative representation of relative significance associated with the impact. Significance is therefore calculated as follows:

$$\boldsymbol{S = C\,x\,P}$$

Table 33: Determination of Significance

Consequence	5- Very High[5]	5	10	15	20	25
	4- High	4	8	12	16	20
	3- Medium	3	6	9	12	15
	2- Low	2	4	6	8	10
	1- Very low	1	2	3	4	5
		1- Improbable	2- Low	3- Medium/ Possible	4- High/ Probable	5- Highly likely/ Definite
	Probability					

The outcome of the significance assessment will result in a range of scores, ranging from 1 through to 25. These significance scores are then grouped into respective classes as described in **Table 34**.

Table 34: Significance Scores

S Score	Description
≤4.25	Low (i.e. where this impact is unlikely to be a significant environmental risk/ reward).
>4,25, ≤8.5	Low-Medium (i.e. where the impact could have a significant environmental risk/ reward).
>8.5, ≤13.75	High-Medium (i.e. where the impact could have a significant environmental risk/ reward).

[5] In the event that an impact or risk has very high or catastrophic consequences, but the likelihood/ probability is low, then the resultant significance would be Low-medium. This does in certain instances detract from the relative important of this impact or risk and must consequently be flagged for further specific consideration, management, mitigation, or contingency planning.

S Score	Description
>13.75	High (i.e. where the impact will have a significant environmental risk/ reward).

The impact significance will be determined for each impact without relevant management and mitigation measures (pre-mitigation significance), as well as post implementation of relevant management and mitigation measures (post-mitigation significance). This allows for a prediction in the degree to which the impact can be managed/mitigated.

7.1.2 IMPACT PRIORITIZATION

Further to the assessment criteria presented in the section above, it is necessary to consider each potentially significant impact in terms of:

1. Cumulative impacts; and

2. The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impacts' post-mitigation significance (post-mitigation). This prioritisation factor does not aim to detract from the significance ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the post-mitigation significance based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 35: Criteria for Determining Prioritisation

Cumulative Impact (CI)	**Low (1)**	**Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.**
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in **Table 36**. The impact priority is therefore determined as follows:

$$\boldsymbol{Priority = CI + LR}$$

The result is a priority score which ranges from 2 to 6 and a consequent PF ranging from 1 to 1.5 (Refer to **Table 36**).

Table 36: Determination of Prioritisation Factor

Priority	Prioritisation Factor
2	1
3	1.125
4	1.25
5	1.375
6	1.5

In order to determine the final impact significance (FS), the PF is multiplied by the post-mitigation significance scoring. The ultimate aim of the PF is an attempt to increase the post mitigation environmental risk rating by a factor of 0.5, if all the priority attributes are high (i.e. if an impact comes out with a high medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a higher significance).

Table 37: Final Environmental Significance Rating

Significance Rating	Description
<-25	**Very High (Impacts in this class are extremely significant and pose a very high environmental risk. In certain instances these may represent a fatal flaw. They are likely to have a major influence on the decision and may be difficult or impossible to mitigate. Offset's may be necessary.**
<-13.75 to -25	High negative (These impacts are significant and must be carefully considered in the decision-making process. They have a high environmental risk or impact and require extensive mitigation measures).
-8.5 to -13.75	Medium-High negative (i.e. Impacts in this class are more substantial and could have a significant environmental risk. They may influence the decision to develop in the area and require more robust mitigation measures).
<-4.25 to <-8.5	Medium- Low negative (i.e. These impacts are slightly more significant than low impacts but still do not pose a major environmental risk. They might require some mitigation measures but are generally manageable).
-1 to -4.25	Low negative (i.e. Impacts in this class are minor and unlikely to have a significant environmental risk. They do not influence the decision to develop in the area and are typically easily mitigated.
0	No impact
1 to 4.25	Low positive
>4.25 to <8.5	Medium-Low positive
8.5 to 13.75	Medium-High positive

Significance Rating	Description
>13.75	High positive

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

7.2 IMPACTS IDENTIFIED

This Section presents the potential impacts that have been identified during the scoping phase assessment. It should be noted that this report has been made available to I&AP's for review and comment and their comments and concerns will be addressed in the final Scoping report submitted to the CA for adjudication. The results of the public consultation will be used to update the identified potential impacts which will be further refined during the course of the EIA assessment and consultation process.

Potential environmental impacts identified during the scoping process were identified by the EAP, the appointed specialists, as well as the public. **Table 38** provides the list of potential impacts identified.

Without proper mitigation measures and continual environmental management, most of the identified impacts may potentially become cumulative, affecting areas outside of their originally identified zone of impact. The potential cumulative impacts have been identified, evaluated, and mitigation measures suggested which will be updated during the detailed EIA level investigation.

When considering cumulative impacts, it is important to bear in mind the scale at which different impacts occur. There is potential for a cumulative effect at a broad scale, such as regional deterioration of air quality, as well as finer scale effects occurring in the area surrounding the activity. The main impacts which have a cumulative effect on a regional scale are related to the transportation vectors that they act upon. For example, air movement patterns result in localised air quality impacts having a cumulative effect on air quality in the region. Similarly, water acts as a vector for distribution of impacts such as contamination across a much wider area than the localised extent of the impacts source. At a finer scale, there are also impacts that have the potential to result in a cumulative effect, although due to the smaller scale at which these operate, the significance of the cumulative impact is lower in the broader context.

Table 38: Identified environmental impacts.

Main Activity / Action / Process	Ancillary Activity	Geo-physical (geology, topography, air, water)	Biological	Socio-economic	Heritage and cultural
Site preparation (Planning: pre-construction)	Removing vegetation, trees, and shrubs to create a clear drilling / exploration area Ensuring access to power and water sources if needed Installing warning signs and fencing to protect the area and prevent unauthorized access		○ Loss/ destruction of natural habitat ○ Introduction/ Invasion by Alien Species ○ Loss of floral species. ○ Displacement of faunal species	○ Visual impact and impact on sense of place ○ Perceptions and expectations Employment opportunities	○ Disturbance of archaeological sites or historic structures (if any)
Human resources management (Planning: pre-construction	Employment/recruitment I&AP consultations Integration with Municipalities' strategic long-term planning Comprehensive safety and environmental awareness training for all personnel Developing emergency plans to address potential accidents or incidents, such as drilling equipment failures or spills Developing emergency plans to address potential accidents or incidents, such as drilling equipment failures or spills Establishing and maintaining effective communication/grievance systems between the exploration crew, landowners and community members			○ Employment opportunities. ○ Improving the knowledge of local team through training and awareness.	
Earthworks (Construction)	Stripping and stockpiling of soils Levelling, grubbing and bulldozing Removing vegetation, trees, and shrubs to create a clear drilling / exploration area Preparing trenches and foundations	○ Erosion due to storm water runoff ○ Impact due to topsoil stripping ○ Surface water contamination	○ Loss/ destruction of natural habitat ○ Introduction/ Invasion by Alien Species ○ Displacement of faunal species	○ Visual impact and impact on sense of place ○ Nuisance and impact on sense of place (i.e., noise, dust, etc.).	○ Disturbance/ destruction of archaeological sites or historic structures ○ Disturbance/ destruction of fossils

Main Activity / Action / Process	Ancillary Activity	Geo-physical (geology, topography, air, water)	Biological	Socio-economic	Heritage and cultural
	Establishment of drilling pads to provide a stable base for the drill rig Constructing or improving roads to allow for the transportation of equipment and personnel to the drilling site Setting up site camps for drilling and seismic team and vehicles Setting up systems for managing drilling fluids, which may include containment sumps	○ Loss of fertility ○ Loss of flow paths ○ Emissions and dust ○ Impacts on wetlands		○ Safety and security (i.e., access to properties, theft, fire hazards, etc.). ○ Impact on existing infrastructure (i.e., roads, fences, etc.) ○ Perceptions and expectations ○ Employment opportunities	
Exploration (Construction)	Drilling and seismic surveys Collecting, storing, and transporting drill core samples Collecting, storing, and disposing of drilling waste, including cuttings, fluids, and debris Surface and groundwater water management	○ Erosion due to storm water runoff ○ Impact due to topsoil stripping ○ Surface water contamination ○ Groundwater contamination ○ Loss of fertility ○ Loss of flow paths ○ Emissions and dust ○ Impacts on wetlands	○ Loss/ destruction of natural habitat ○ Introduction/ Invasion by Alien Species ○ Displacement of faunal species	○ Visual impact and impact on sense of place ○ Nuisance and impact on sense of place (i.e., noise, dust, etc.). ○ Safety and security (i.e., access to properties, theft, fire hazards, etc.). ○ Impact on existing infrastructure (i.e., roads, fences, etc.) ○ Perceptions and expectations of employment opportunities	○ Disturbance/ destruction of archaeological sites or historic structures ○ Disturbance/ destruction of fossils
Post Construction Rehabilitation (Decommissioning of drilling and seismic surveys)	Revegetation Soil / slope stabilisation Backfilling (if necessary) Erosion control	○ Emissions and dust	○ Alien and invasive species	○ Safety and security (i.e., access to properties, theft, fire hazards, etc.). ○ Perceptions and expectations ○ Visual and dust	
Gas Analysis and Maintenance (Post construction)	Continuous analysis of gas quantity and quality Initiate maintenance and aftercare program Environmental aspect monitoring	○ Surface and groundwater quality	○ Alien and invasive species	○ Visual ○ Site security and access control	
Final Rehabilitation, Decommissioning and Closure	Plugging of boreholes Revegetation Soil / slope stabilisation Backfilling (if necessary)	○ Emissions and dust	○ Alien and invasive species	○ Safety and security (i.e., access to properties, theft, fire hazards, etc.).	

Main Activity / Action / Process	Ancillary Activity	Geo-physical (geology, topography, air, water)	Biological	Socio-economic	Heritage and cultural
	Erosion control			○ Perceptions and expectations ○ Visual and dust	
Monitoring, Maintenance and Relinquishment	Groundwater monitoring Floral monitoring Gas emissions monitoring	○ Emissions ○ Emissions and dust	○ Alien and invasive species	○ Safety and security (i.e., access to properties, theft, fire hazards, etc.) ○ Perceptions and expectations	

7.3 DESCRIPTION AND PRELIMINARY ASSESSMENT OF IMPACTS

The following potential impacts were identified during the scoping phase assessment and were assessed in terms of nature, significance, consequence, extent, duration and probability. These preliminary impact calculations will be subject to amendment based on the EIA phase assessment and the results of public consultation undertaken during the Scoping as well as EIA phases. **Table 39** provides a description of each impact with preliminary mitigation measures and an indication of which impacts are to be assessed in greater detail in the EIA phase assessment. Preliminary mitigation / management measures to minimise potential negative impacts or enhance potential benefits are put forward in this Scoping Report and will be adjusted where relevant during the EIA phase once detailed specialist assessments are concluded and input from the public has been considered.

Table 39: Preliminary impact assessment based on normal operations or events (refer to **Appendix G** to for detailed assessment).

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
1	Interference with Existing Land Uses (Damage / Disruption of activities / services / infrastructure)	Planning (pre-	Medium to high -	Low -	Medium to low -	The drill rig and supporting machinery may require temporary gravel access roads and the establishment of drilling pads within largely farming areas which may cause an interference with the existing land uses. In addition, although exploration drilling plays a crucial role in the mining industry as it helps identify and assess potential mineral deposits, it can also come with its own set of challenges on existing mining operations. The drilling activity can penetrate a mine shaft destabilizing the shaft and/or affect mining operations. The Vibroseis truck may need access across boundary fences used for grazing or game which may be affected if access gates are left open. The seismic transects may also overlap with farming grounds which may result in temporary loss and/impact on agricultural fields and production. In addition, as indicated in **Section 1**, there are least 14 approved renewable energy projects from various applicants located within ER386. Motuoane and the renewable energy applicants will need to discuss the way forward and/or make necessary arrangements to coexist especially for TA 3 (EDG) and Transects EDG1 and EDG2 as the renewable energy projects overlap with the target areas. The proposed activities are not intensive in nature and do not require a large footprint and are of short duration. The seismic surveys are expected to last for a couple of weeks and the drilling activities to be completed within months, therefore the period of activities is also reduced. It must also be noted that in the event that a Vibroseis truck is used, it will be equipped with very wide, low-pressure tires and will not leave ruts. There is also a chance of using an alternative method of a portable weight drop method, which is much smaller than the Vibroseis truck and has lesser impacts. In addition, the activities are largely located on low-laying grassland. However, there are several target areas (TA 3 to TA 7) located within the Harmony Gold area where drilling activities if not planned properly may intercept a mine shaft, or otherwise disrupt mining activities, and therefore pose high risks to mining activities. Therefore, the cumulative impact of proposed activities on existing land uses is medium-high negative without mitigation and medium-low negative with mitigation. Preliminary mitigation measures include: • Prior to accessing and commencement of exploration activities on any portion of land, the Applicant must enter into formal written agreement with the affected landowner;	An asset and services baseline of services that may be affected within 50 m of the exploration area must be compiled before the project commences
		Construction / Operational (Drilling)	Medium to high -	Medium to low -	Medium to low -		
		Construction / Operational	Medium to low -	Low -	Low -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
		Closure & Rehab	Medium to low -	Low -	Medium to low -	• Before the project commences, an asset and services baseline of services that may be affected within 50 m of the affected exploration area must be compiled. A copy of the baseline records should be given to each landowner/ service provider, and a master document kept by the applicant; • Underground mining companies (if any) within the identified drilling locations must be engaged during the planning phase to ensure the drilling activities do not interfere with underground mining activities; • If any damage occurs to services / infrastructure, the applicant will be liable to fix it to its original state; and • A services impact and interruption plan must be developed for sites which intersect existing services in order to minimise and manage potential interruptions should they occur due to an incident.	
2	Soils and Agricultural Activities	Planning (pre-construction)	Medium to low -	Low -	Low -	Existing land uses may be affected by the proposed activities and in particular during the drilling of the wells. The drill rig and supporting machinery may require new access roads and the establishment of drilling pads within largely farming areas which may affect the soils and agricultural activities. The geochemical and soil sampling activities are anticipated to have a low impact on existing soils and agricultural activities. Existing land uses may be affected by the proposed exploration activities and in particular during the seismic surveys. The seismic transects may overlap with farming grounds which may result in temporary loss and/impact on soils agricultural fields and production. The seismic activities will have a short duration, use existing gravel roads as far as possible and are therefore anticipated to have a low impact on existing soils and agricultural activities. It is anticipated that there will be minimal impact on soil and agricultural potential. Considering the small extent of the proposed activities compared to the large extent the agricultural land, the proposed activities and associated infrastructure will not result in the segregation or fragmentation of any high production agricultural land. Therefore, the cumulative impact on soil and agricultural potential is low subject to adherence of the mitigation measures. Preliminary mitigation measures include: • As far as possible interference with existing land uses/livelihoods should be avoided. If any interference or disruption takes place, the landowner should be fairly compensated for their losses; • The duration of the construction should be minimized to as short term as possible, to reduce the period of disturbance on soils and agricultural activities; • Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities; • Soils and agricultural fields outside the direct project footprint, should under no circumstances be disturbed; and • Landowner engagement must be undertaken during the project phases to investigate possible scenarios for appropriate compensation of landowners for loss / disturbance of high land capability and/or grazing areas where necessary.	Soils and Agricultural Impact Assessment & EIA Phase impact assessment
		Construction / Operational	Medium to high -	Medium to low -	Medium to low -		
		Construction / Operational	Medium to low -	Low -	Low -		
		Closure & Rehab	Medium to low -	Low -	Low -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
3	Soil erosion and sedimentation	Planning (pre-	Medium to low -	Low -	Low -	Clearing of vegetation for the drilling activities such as vehicular movement of drill rig and supporting vehicles will result in compaction of soils which will impact the soils and increase the rate of erosion, especially on sloping terrain. Clearing of vegetation for the seismic activities such as vehicular movement of Vibroseis truck and supporting vehicles will result in compaction of soils which will impact the soils and increase the rate of erosion, especially on sloping terrain. The proposed activities and associated infrastructure will result in compaction and increased soil erosion during the construction / exploration phase and accumulatively increase the erosion rate in the area through the removal of the vegetation soil disturbance from vehicular movement and drilling. However, considering that no seismic activities nor drilling activities are permitted on or near to watercourses, the risk of sedimentation of watercourses is considered very low. Through the implementation of the proposed mitigation measures, this impact is considered to have an overall low negative cumulative impact significance subject to adherence of the mitigation measures as the area has small soil erosion surfaces (i.e. drainage lines) and the activities will not be permitted on the erosion surfaces to further enlarge them. Preliminary mitigation measures include: • The duration of the construction should be minimized to as short term as possible, to reduce the period of disturbance on soils; • Best known techniques of soil erosion and management should be adopted for the project if necessary; • Construction / exploration impacts associated with the proposed project must be contained within the footprint of the assessed areas; • Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey; and • No seismic activities nor drilling activities are to be permitted within wetlands or watercourses (32m prelitigation and a 15m post-mitigation buffer).	Soils and Agricultural Impact Assessment and Soils and Agricultural Impact Assessment & EIA Phase impact assessment
		Construction / Operational (Drilling)	Medium to high -	Medium to low -	Medium to low -		
		Construction / Operational	Medium to low -	Low -	Low -		
		Closure & Rehab	Medium to low -	Low -	Low -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
4	Landownership and displacement of landowners and livestock	Planning (pre-construction)	Medium to low -	Low -	Medium to low -	The proposed exploration activities are located across various farms owned by different landowners. There may be a need to temporary disrupt the current farming activities so that the proposed exploration activities may be undertaken especially for seismic surveys which traverses various farm properties. The temporary disruption of the current farming activities so that the proposed exploration activities may be undertaken may result in agricultural land lost and/or reduced livestock production which may affect the farming community's enablement to sustain themselves. Negotiations with affected landowners are currently ongoing and will be undertaken in detail before activities are undertaken. Measures will be in place to prevent displacement landowners and livestock. Therefore, the cumulative impact is considered low negative overall subject to adherence of the mitigation measures. Preliminary mitigation measures include: • Ensure that all affected landowners are identified, and relevant information is provided to the landowners during the application phase; • Prior to accessing any portion of land, the Applicant must enter into formal written agreements with the affected landowner. This formal agreement should additionally stipulate landowner's special conditions which would form a legally binding agreement; and • Negotiations with affected landowners must be undertaken and any loss of revenue caused by the exploration works must be reasonably compensated.	EIA Phase impact assessment
		Construction /	Medium to low -	Low -	Low -		
		Construction / Operational	Medium to low -	Low -	Low -		
		Closure & Rehab	Medium to low -	Low -	Low -		
5	Air quality / greenhouse gas emissions	Planning (pre-construction)	Medium to low -	Low -	Low -	Different types of gases can be encountered while drilling, depending on the geology and depth of the well being drilled. Some common gases encountered during drilling operations include Hydrocarbons Gases, Oil and condensate gases, Carbon dioxide (CO_2), Helium (He), etc. OGas exploration may release amounts of methane, a potent greenhouse gas, either by accident or design. Equipment and operational techniques can be applied across exploration and production chains to significantly reduce these emissions, and because methane (natural gas) is a valuable commodity, this can often be done at no cost or even at a profit. In addition, the risk of significant release of methane is mainly during the production phase, while the current project is only exploration. Therefore, the potential short-term releases of greenhouse gasses from drilling activities arising from the	Climate Change and Air Quality Impact Assessment & EIA Phase impact assessment

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
		Construction / Operational	Medium to high -	Medium to low -	Medium to low -	drill rig, support machinery and vehicles are not anticipated to significantly impact on the regional or global greenhouse gas emissions and as such this impact is rated to have a low negative significance with mitigation. Hydrocarbon exploration and production activities, including seismic operations, emit greenhouse gases. However, GHG emission from seismic surveys are mainly offshore seismics from the large vessel and supporting vessel operations over a period of several months. While onshore seismic surveys have a short duration (weeks) and GHG are limited to the operation of the exploration plant (i.e., Vibroseis truck). Therefore, the potential short-term releases of greenhouse gasses are not anticipated to significantly impact on the regional or global greenhouse gas emissions and as such this impact is rated to have a low negative significance with mitigation The area is known to have good hydrocarbon reserves which the current project aims to identify and quantify. There are also several existing gas emitting wells in the area and the proposed activities will result in an increase of gas emitting wells substantially. Based on the GHG emissions report for similar project in the region, the most substantial emission source is expected to be the testing of the wells and gas released during the drilling phase. Collectively, these wells would increase gas emissions if they were leaking, however as indicated in Section 2.2.2, depending on the results of the sampling, each borehole will either be plugged entirely or left as is for future analysis. Regardless of which of these options is chosen, the borehole will be capped with a steel cap that is engraved with the borehole number according to industry specifications and have pressure readings to identify potential leaks. Therefore, the addition of up to 11 drilling wells will likely have low negative to insignificant cumulative impact on air quality and greenhouse gas emissions considering that the mitigation measures are implemented. Preliminary mitigation measures include: • Limit air emissions as far as practically possible through best practice design and implementation; • Reduce to nuisance factor of dust to neighbouring residents; • All drilling sites must be properly sealed to trap all gases from escaping; • Implement dust suppression measures in all areas that will be affected by construction activities and where dust will be generated. Dust suppression must also be undertaken during windy and dry weather conditions; and • Speed restriction of no more than 20 km/h must be implemented for all construction vehicles within the construction site.	
		Construction / Operational	Medium to low -	Low -	Low -		
		Closure & Rehab	Medium to low -	Low -	Medium to low -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
6	Safety and security (Health and Safety of the Community)	Planning (pre-construction)	Medium to low -	Low -	Low -	The exploration activities (drilling and seismic) may have health and safety implications for the personnel that will be working on the project. Required access to the property for exploration activities may result in a risk to the safety and security of landowners, lawful occupiers, and community members due to the increase in number of unfamiliar people in the area. Property gates may also be left open resulting in the robbery, loss or theft of livestock. The drilling activities may also expose gases which may ignite during the project causing fire that may result in loss of fauna and flora, livestock and/or human life. Based on information obtained from the herders during the site inspection, there is crime in the area but relatively low. There have not been unnatural and/or uncontrollable events incidents such as fire in a long time. Therefore, with the proposed mitigations, it is anticipated there will low negative cumulative Safety and security impacts as there will be an implementation of security as well as fire control during the activities. Preliminary mitigation measures include: • All farm gates must be closed immediately upon entry/exit; • Fencing of all drill sites with security access control and warning signs; • All drilling sites must be properly sealed to trap gases from escaping. Wells should be plugged to prevent crossflow of gas into aquifers and isolate all potential hydrocarbon / water bearing formations by utilizing placed cement plugs extending at least 30m above and below the reservoir; • There must be access control to the entry / exit points of the exploration sites; • Vehicles should be clearly marked as construction vehicles; and • An emergency response plan should be complied and all workers on site must be trained to respond to known emergencies associated with hydrocarbon exploration.	EIA Phase impact assessment
		Construction / Operational	Medium to high -	Medium to low -	Medium to low -		
		Construction / Operational	Medium to low -	Low -	Low -		
		Closure & Rehab	Medium to low -	Low -	Low -		
7	Noise Impacts	Planning (pre-construction)	Medium to low -	Low -	Low -	Construction sites are synonymous with noise impacts. High noise levels such as blasting, drilling and excavating can have an adverse impact on the farming community, adjacent landowners and fauna. Construction activities and traffic during the drilling phase are anticipated to produce minimal noise. The onsite drilling activities will pose the potential for noisy conditions due to machinery and vehicles. Construction activities and traffic during the seismic survey phase are anticipated to produce minimal noise. The onsite seismic activities will pose the potential for noisy conditions due to Vibroseis truck, machinery and supporting vehicles.	Noise Impact Assessment & EIA Phase impact assessment

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
		Construction / Operational	Medium to high -	Low -	Low -	The noise associated with the proposed activities are not expected to be excessive in nature relative to the surrounding agricultural / rural area extent. However, the Harmony cluster is relatively close to residential and businesses which are high noise pollution receptors. The small number of vehicles and temporary exploration works are anticipated to general minimal noise. Considering that excessive noise impacts (if any) will be limited to the site and the area and will be short-term, the cumulative impact on noise pollution due to the proposed activity is anticipated to be low negative. Preliminary mitigation measures include: • The working hours stipulated in the Construction permit, where applicable, must be adhered to. Where this is not applicable, the following working hours must be adhered to: Monday to Friday from sunrise to sunset and where applicable on a Saturday which must be agreed upon between the affected parties and the Contractor; • The contractor must attempt to restrict noisy activities as far as possible to times and locations whereby the potential for noise nuisance is reduced; and • All construction plant and other equipment must be in a good working order to reduce possible noise pollution.	
		Constructio n /	Medium to low -	Low -	Low -		
		Closure & Rehab	Medium to low -	Low -	Low -		
8	Nuisance and Impact on Sense of Place	Planning (pre-construction)	Medium to low -	Low -	Low -	The proposed drilling activities will temporarily impact on the established sense of place of a particular property. The character of the area would change due to the drilling activities being undertaken on that particular place. Additional vehicles, increased noise and dust, the removal of vegetation for drilling well site/s, and potential influx of workers will all contribute to the alteration of the sense of place. The proposed seismic activities will temporarily impact on the established sense of place of a particular property. The character of the area would change due to the seismic activities being undertaken on that particular place. Additional vehicles including Vibroseis truck, increased noise and dust, the potential removal of vegetation along the seismic transect, and potential influx of workers will all contribute to the alteration of the sense of place. The study area is generally a rural area in nature. It can be described as an open swath of land that has few homes or other buildings, and not very many people with very low population density. The area consists of minimal activities that are nuisance and have an impact on sense place. With the proposed exploration activities, minimal changes to the current sense of place is anticipated and low cumulative impact is expected.	Various Specialist Assessments & EIA Phase impact assessment
		Construction / Operational (Drilling)	Medium to high -	Low -	Low -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
		Construction / Operational (Survey)	Medium to low -	Low -	Low -	Preliminary mitigation measures include: • Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities; • All construction/operational and access must make use of the existing roads; • Noise producing activities should be limited to day-time after 07h00 and 17h00 on weekdays; • Adequate dust suppression measures should be utilized to minimize dust production; • The duration of the construction should be minimized to as short term as possible, to reduce the period of disturbance on the area; and • Areas outside the direct project footprint, should under no circumstances be disturbed	
		Closure & Rehab	Medium to low -	Low -	Low -		
9	Impact on Groundwater Quality and Quantity	Planning (pre-construction)	Medium to low -	Low -	Low -	A major concern associated with onshore hydrocarbon exploration is the potential for the exploratory drilling to have an adverse impact on groundwater quality and quantities. Existing stressors that affect ground water condition include application of pesticides and fertilizers to the land, waste from livestock and other animals, landfills, mining operations, and unintentional releases such as chemical spills or leaks from hydrocarbon tanks. There is always a risk of potential spills from a leaking drilling rig, drilling fluid, drilling sump, Vibroseis truck, chemical toilets etc. occurring during the construction / exploration. The spill can then infiltrate into the groundwater and contaminate the water resource. There is also a potential of incorrect handling of waste such as the drilling mud and cuttings which may impact the water resource. Potential formation water (water found within geological formations, particularly in oil and gas reservoirs, that has the potential to be produced during extraction) coexists with oil and gas and can contain various dissolved substances which may contaminate the water resource. Exploration drilling activities require water which will be sourced from existing license holders. The utilisation of groundwater for drilling and other associated activities may result in the alteration/ reduction of groundwater levels on site thereby affecting local users. Potential contamination of groundwater through drilling activities is a risk without proper mitigation measures in place. All alternative drilling methods may potentially result in contamination a water resource if strict measures are not in place and/or adhered to.	Hydrogeological Impact Assessment & EIA Phase impact assessment

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
		Construction / Operational (Drilling)	Medium to high -	Medium to low -	Medium to low -	Although during the exploration activities, there is potential for alteration of the hydraulic regimes (head). However, the small scale of the impacts that would be perceived would not significantly alter the water table and/or groundwater flow patterns over a large area and if perceived would be of short duration. This will likely be limited to the site and surrounding areas. Considering that the Mining Best Practice Guidelines (MBPG) and that mining activities must comply with the National Water Act (NWA), which includes regulations related to water use and pollution, Motuoane will insert casing in the underground aquifer zones as per the project description indicated in **Section 2.2.2** which will ensure compliance with the MBPG and NWA and subsequently preventing any adverse impacts on groundwater quantity and quality for surrounding groundwater users. Furthermore, a monitoring programme is proposed in the EMPr for the continued monitoring of surface and groundwater quantity and quality. As such, this impact is anticipated to have a low negative cumulative significance through the implementation of these mitigation measures. The potential risk to groundwater from the seismic activities is in relation to the potential of spills from leaking Vibroseis truck, supporting plant or from the site camp facilities (i.e. chemical toilets) occurring during the seismic survey. The spill can then infiltrate into the groundwater and contaminate the water resource. Preliminary mitigation measures include: • Ensure that detailed baseline water quality and quantity samples are obtained and analysed for reference purposes; • Ensure that all mitigation measures as stipulated in the EMPr relating to the drilling (specifically technical specifications) as well as the MPRDA regulations are adhered to;	
		Construction / Operational (Survey)	Medium to low -	Low -	Low -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
		Closure & Rehab	Medium to low -	Low -	Low	• The best drilling fluid option should be selected during construction towards minimising the potential for groundwater contamination and the exploration wells should be constructed such no gas or oil leakage occurs during the operational phase; • The correct type of fluids should be used during the construction phase and the boreholes should be correctly constructed so that no gas leakage occurs during the construction or operational phases. Biodegradable drilling fluids should be used wherever possible; • Excavations should be open for as short period as practically possible and drilling circulation fluid sumps be cleaned out and rehabilitated; • Construction vehicles and machines must be maintained properly to ensure that oil spillages are kept at a minimum; • Spill trays must be provided if refuelling of drilling rig and vehicles are done on site; • Chemical sanitary facilities should be provided for drilling crew. Construction workers should only be allowed to use temporary chemical toilets on the site. Chemical toilets shall not be within close proximity of the drainage system. Frequent maintenance should include the removal without spillages; • Adequate fuel containment facilities to be used during exploration phase; • The use of all materials, fuels and chemicals which could potentially leach into the environment must be controlled; • All materials, fuels and chemicals must be stored in a specific and secured area to prevent pollution from spillages and leakages; • No potential formation water must be discharge into the environment, it was be manged as a hazardous waste and disposed at a registered hazardous waste disposal facility; • No uncontrolled discharges from the drilling pad or site shall be permitted; and • Any spills that occur during the exploration phase must immediately be cleaned up and the contaminated soils, etc. suitably disposed of at a registered waste disposal facility; and • Sound groundwater management measures need to be developed based on the results of the impact assessment.	

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
10	Impact on Surface water Quality and Quantity	Planning (pre-construction)	Medium to low -	Low -	Low -	When surface water becomes polluted by contaminants, it puts strains on local and regional drinking water supplies and aquatic ecosystems that rely on surface water environments. Because of their geographical location, surface waters easily become polluted, and some leading causes of water pollution come from contaminated rainwater runoff, from fertilizers and other harmful chemicals that are used on farms, in homes, industries, and on infrastructure such as roads. Surface water pollution can also come from sewage leaks and waste products that leach into the environment. Surface water may be impacted through the clearing of vegetation close to the water resource habitat, introduction of pollutants onto the water resource (i.e. leak from chemical toilets) and/or hydrocarbon spills from drill rig or supporting plant. This disturbance may also result in the proliferation of alien and invasive species within the surrounding watercourses. Surface water may be impacted through the clearing of vegetation close to the water resource habitat, introduction of pollutants onto the water resource (i.e. leak from chemical toilets) and/or hydrocarbon spills from Vibroseis truck and/or supporting plant. This disturbance may also result in the proliferation of alien and invasive species within the surrounding watercourses. There are concerns surrounding the potential for contamination of water resources (including surface water resources). In terms of the relevant legislation, no drilling may take place on or near to surface water features and furthermore, mitigation measures have been put forward to prevent pollution on or near to the drill sites which will prevent contaminated surface water runoff from entering water resources. There is also a potential of incorrect handling of waste such as the drilling mud and cuttings which may impact the water resource. Potential formation water (water found within geological formations, particularly in oil and gas reservoirs, that has the potential to be produced during extraction) coexists with oil and gas and can contain various dissolved substances which may contaminate the water resource if improperly handled or discharged. However, mitigation measures have been put in place to ensure proper handling of hazardous waste including drilling fluid, sumps and potential water formation. The accumulative surface water impact associated with the proposed development is low and this impact has been rated with a low negative significance. Preliminary mitigation measures include: • Ensure that detailed baseline water quality and quantity samples are obtained and analysed for reference purposes; • Construction/drilling should preferably not be conducted during rainy days. If drilling is to be undertaken during rainy days, additional precautionary measures in consultation with the ECO must be implemented to prevent contamination on surface water; • Excavations should be open for as short period as practically possible and drilling circulation fluid sumps be cleaned out and rehabilitated; • Construction vehicles and machines must be maintained properly to ensure that oil spillages are kept at a minimum; • Spill trays must be provided if refuelling of drilling rig and vehicles are done on site;	Freshwater and Wetlands Impact Assessment & EIA Phase impact assessment
		Construction / Operational (Drilling)	Medium to high -	Low -	Medium to low -		
		Construction /	Medium to low -	Low -	Low -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
		Closure & Rehab	Medium to low -	Low -	Low -	• Chemical sanitary facilities should be provided for drilling crew. Construction workers should only be allowed to use temporary chemical toilets on the site. Chemical toilets shall not be within close proximity of the drainage system. Frequent maintenance should include the removal without spillages; • Adequate fuel containment facilities to be used during exploration phase; • The use of all materials, fuels and chemicals which could potentially leach into the environment must be controlled; • All materials, fuels and chemicals must be stored in a specific and secured area to prevent pollution from spillages and leakages; • No potential formation water must be discharge into the environment, it was be manged as a hazardous waste and disposed at a registered hazardous waste disposal facility; • No uncontrolled discharges from the drilling pad or site shall be permitted; • Any spills that occur during the exploration phase must immediately be cleaned up and the contaminated soils, etc. suitably disposed of at a registered waste disposal facility; and • No seismic activities nor drilling activities are to be permitted within wetlands or watercourses (32m prelitigation and a 15m post-mitigation buffer).	
11	Impacts on natural habitat	Planning (pre-construction)	Medium to high -	Medium to low -	Medium to high -	The proposed drilling activities on site will lead to localised disturbance to an area approximately 50 x 50 m per well with a total of 11 exploration wells across the entire study area. There will possibly also be damage to habitats associated with travelling from existing access routes to sites selected for wells. The activities will fragment these habitat units regarded as important, not only within the within the local landscape, but also regionally as they are used for habitat, foraging and movement corridors for fauna within a landscape fragmented by agriculture and mining to more natural areas where they may reproduce. Although the proposed activities on site will lead to localised disturbance of approximately 100 km seismic transects across the entire study area, the actual impact will be 4ha within the 58 000ha ER, less than 1% of the ER area. Impacts will possibly result from damage to habitats associated with travelling from existing access routes to areas with no current access routes which will require temporary gravel access roads and/or clearance of vegetation. The activities will fragment these habitat units regarded as important, not only within the local landscape, but also regionally as they are used for habitat, foraging and movement corridors for fauna within a landscape fragmented by agriculture and mining to more natural areas where they may reproduce. The activities will result in a loss of natural habitat units, not only within the within the local landscape, but also regionally as they are used for habitat, foraging and movement corridors for fauna within a landscape fragmented by agriculture and mining to more natural areas where they may reproduce. However, due to the small scale of clearing required for the proposed	Terrestrial Biodiversity Impact Assessment & EIA Phase impact assessment
		Construction / Operational (Drilling)	Medium to low -	Low -	Medium to low -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
		Construction / Operational (Survey)	Medium to low -	Low -	Medium to low -	activities limited to 50m x 50m for each drilling site while the seismic activities will largely be undertaken on existing gravel roads, the short duration thereof and the rehabilitation that will occur, this impact is anticipated to have a low negative cumulative impact on natural habitats upon implementation of the mitigation measures. Preliminary mitigation measures include: • Minimise vegetation clearance. • Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities; • An Invasive Species Management Plan must be compiled and implemented during the lifecycle of the project; All construction/exploration and access must make use of the existing roads as far as possible; • A suitable qualified Environmental Officer (EO) or Environmental Compliance Officer (ECO) must be appointed prior to the construction / exploration phase. If the final seismic transect route and/or the drilling location changes from the currently proposed areas, but within the assessed footprint and is situated within the high sensitive area, the EO / ECO must undertake final walkdown along the specific final planned transect route/s and drilling location/s in order to ensure that no sensitive vegetation or floral SCC are to be impacted; • Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further; • Areas rated as High sensitivity outside of the direct development areas should be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent development access to these areas from construction workers and machinery; and • All laydown, chemical toilets etc. should be restricted to low / medium sensitivity areas. Any materials may not be stored for extended periods of time and must be removed from the project area once the construction/exploration phase has been concluded.	
		Closure & Rehab	Medium to low -	Low -	Low -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
12	Impacts on Microorganisms	Planning (pre-construction)	Medium to high -	Medium to low -	Medium to high -	A microorganism, or microbe, is an organism of microscopic size, which may exist in its single-celled form or as a colony of cells. The movement of drill rigs and supporting vehicles as well as the establishment of 50 x 50 m drill pads will directly impact on microorganisms within that particular site. One of the main impacts of seismic surveys is impacts on microorganisms through the use of Vibroseis technology. As explained in detail in **Section 2.1.4**, seismic surveying along the transects is proposed to be undertaken through a Vibroseis technique by deploying an array of energy sources from a small-sized Seismic Vibrator and an array of sensors or receivers (geophones) on the identified area of interest. A single Seismic Vibrator consisting of a vibrating baseplate that is connected to the ground will be used. The vibrating plate will emit a low frequency signal (4-80 Hz) into the ground, called a sweep. The vibrator vehicle will move slowly along the pre-determined lines (transects) using GPS for navigation. It will stop, emit a signal 8-20 seconds long, moves approximately 10 meters ahead, stops, emits a signal and so on until all the transects have been traversed. In addition to the vehicular movements, site establishments and vegetation clearance, in total, it is anticipated that there will be 2 500 sweeps which will impact on the microorganisms. Without mitigation, there will be substantially impacts on microorganisms from the proposed activities which will result in less presence of microbes in the area. However, with the implementation of the mitigation measures such as the uses of frequency signal (4-80 Hz), existing gravel roads and reducing the period of exploration, there will be acceptable impacts on the microorganisms. It must also be noted that in the event that a Vibroseis truck is used, it will be equipped with very wide, low-pressure tires and will not leave ruts. There is also a chance of using an alternative method of the AWD or MT Survey methods, which are much smaller than the Vibroseis truck and have lesser impacts. In addition, microorganisms are mobile and likely to temporary migrate nearby where they may not be directed impacted. Furthermore, the activities are limited to specific areas and over a short period of time. Therefore, the overall cumulative impact on microorganisms is anticipated to be low negative with mitigations. Preliminary mitigation measures include: • Minimise vegetation clearance. • The duration of the exploration should be minimized to as short term as possible. This will reduce the period of disturbance on microorganisms; • All construction/exploration activities and access must make use of the existing roads as far as possible; and • Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities. This will allow for microorganism to reestablish / recover.	Terrestrial Biodiversity Impact Assessment & EIA Phase impact assessment
		Construction / Operational	Medium to low -	Medium to low -	Medium to low -		
		Construction / Operational	Medium to high -	Medium to low -	Medium to low -		
		Closure & Rehab	Medium to low -	Low -	Low -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
13	Impacts on Vegetation and Flora species	Planning (pre-construction)	Medium to high -	Medium to high -	Medium to high -	The clearance of vegetation is required in order to prepare the drill site and may be required for new access roads. An area of approximately 50 x 50 m will be impacted upon for the drilling site and potential new temporary access roads. No clearance of vegetation is required for the geochemical and soil sampling activity. The clearance of vegetation may be required for the seismic activities. Approximately 100 km of seismic transects will be undertaken along existing gravel and potential new temporary access roads which may require clearance of vegetation. Localised loss of floral habitat and diversity may occur within areas of increased ecological sensitivity, such as the rocky grassland and water resource habitat. Due to the clearance of indigenous vegetation for new temporary access roads and drilling pads, drilling activities and vehicular movement and Vibroseis, disturbance and mortalities of flora species is anticipated. Clearing of vegetation for construction purposes as well as compaction of soils due to vehicular movement will result in reduced floral habitat availability and re-establishment success post exploration phase. Disturbances to soil and vegetation on site will also favour alien plants in places. Minimise vegetation clearance. Existing gravel roads must be used as far as possible, and the closest disturbed areas must be considered for drill pads. Clearance of vegetation must be kept to the required footprint (i.e. 50 x 50 m drill pad). Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed. A vegetation clearance management plan should be compiled prior commencement of activities which at minimum should state how the minimisation with be managed based on the affected environmental aspect or phase of the exploration. The proposed activities will result in a loss of vegetation supporting the floral and fauna. However, due to the small scale of clearing required for the proposed activities, the short duration thereof and the rehabilitation that will occur, this impact has a low negative significance. In addition, the impacts are mainly anticipated during the drilling phase and the vegetation cover is expected to recover during the closure and rehabilitation. The cumulative impact for impact on floral species is, therefore, expected to be low negative Preliminary mitigation measures include:	Terrestrial Biodiversity Impact Assessment & EIA Phase impact assessment
		Construction /	Medium to low -	Low -	Medium to low -		
		Construction / Operational (Survey)	Medium to low -	Low -	Medium to low -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
		Closure & Rehab	Medium to low -	Low -	Low -	• Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities; • All construction / exploration and access must make use of the existing roads as far as possible; • A suitable qualified Environmental Officer (EO) or Environmental Compliance Officer (ECO) must be appointed prior to the construction / exploration phase. If the final seismic transect route and/or the drilling location changes from the currently proposed areas, but within the assessed footprint and is situated within the high sensitive area, the EO / ECO must undertake final walkdown along the specific final planned transect route/s and drilling location/s in order to ensure that no sensitive vegetation or floral SCC are to be impacted; • Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed; • Areas rated as High sensitivity outside of the direct construction / exploration areas should be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent impacts and access to these areas from construction workers and machinery; and • All laydown, chemical toilets etc. should be restricted to low / medium sensitivity areas. Any materials may not be stored for extended periods of time and must be removed from the project area once the construction/exploration phase has been concluded.	
14	Impacts on Fauna species	Planning (pre-construction)	Medium to high -	Medium to high -	Medium to high -	Localised loss of modified habitat may occur within the remaining areas providing shelter for faunal species due the clearance of vegetation for new temporary access roads, drilling pads, drilling areas, site camp, vehicular movement and seismic transects. The loss of habitat will directly result in the loss of fauna community (i.e. amphibians and birds). Disturbance and mortalities of fauna species such as amphibians, reptiles and birds are anticipated. Loss of habitat also means loss of food and nesting resources, cover and movement corridors, which could lead to the disappearance of the affected species from the area. Although fauna species will be negatively impacted due to the construction / exploration, there is a high likelihood that they can easily relocate to the adjacent properties and may even resettle during the post exploration phase of the project. The cumulative impact for impact on fauna species is, therefore, expected to be low with mitigation. Preliminary mitigation measures include: • The duration of the construction / exploration should be minimized to as short term as possible, to reduce the period of disturbance on fauna;	Terrestrial Biodiversity Impact Assessment & EIA Phase impact assessment
		Construction / Operational	Medium to low -	Low -	Medium to low -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
		Construction / Operational	Medium to low -	Low -	Medium to low -	• Noise must be kept to an absolute minimum during the evenings and at night to minimize all possible disturbances to amphibian species and nocturnal mammals; • No trapping, killing, or poisoning of any wildlife is to be permitted on site; • Outside lighting should be designed and limited to minimize impacts on fauna; • Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities; • All construction/operational and access must make use of the existing roads as far as possible; • Construction impacts associated with the proposed project must be contained within the footprint of the demarcated areas as indicated on the final approved project layout plan; and • A suitable qualified Environmental Officer must be appointed prior to the construction / exploration phase. The ECO must undertake walkdowns / surveys along the final planned transect routes and drilling locations in order to ensure that no sensitive, protected or SCC fauna species are to be directly impacted; • Areas rated as High sensitivity outside of the direct development areas should be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent impacts / access to these areas from construction workers and machinery; and • Identified protected or SCC fauna species that will be impacted upon must be relocated by a suitably qualified environmentalist / ecologist.	
		Closure & Rehab	Medium to low -	Low -	Low -		
15	Disturbance / Destruction of Heritage Features	Planning (pre-construction)	High -	Medium to low -	Medium to high -	Construction activities such as vegetation clearance, excavations, drilling, seismic transects, site establishment and/or vehicular movement could expose or damage features of heritage and cultural value beneath the surface. The main impact on archaeological sites/ remains will be the physical disturbance of the material and its context. The clearing of vegetation for the proposed activities may expose, disturb and displace archaeological sites / material. However, from the specialist investigations, it appears that the cultural heritage features are easily identifiable and with the recommended buffer zones, these will not be impacted upon. However, there is always a risk of impacts on new discoveries during the construction / exploration phase which will impact on irreversible loss of cultural heritage features. Therefore, the cumulative impact on heritage resources is medium negative. Preliminary mitigation measures include: • The planning of all additional exploration footprints must take cognizance of the heritage sensitivities depicted on the heritage sensitivity maps;	Heritage Impact Assessment & EIA Phase impact assessment
		Construction / Operational	Medium to high -	Medium to low -	Medium to high -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
		Construction / Operational	High -	Medium to low -	Medium to high -	• An independent and suitably qualified ECO must be appointed and should be able to recognise potential heritage features; • All burial grounds and graves should be retained and avoided with a buffer zone of 30m as per SAHRA guidelines. If this is not possible, the graves could be relocated after completion of a detailed grave relocation process, that includes a thorough stakeholder engagement component, adhering to the requirements of s36 of the NHRA and its regulations as well as the National Health Act and its regulations; and • Should any heritage features be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the ECO shall be notified within 24hours, and a Chance Find Protocol must be implemented. The responsible heritage resources authority (FSPHRA), as well as the South African Police Service (SAPS) must be notified within 72hours.	
		Closure & Rehab	Medium to high -	Medium to low -	Medium to high -		
16	Disturbance / Destruction of Palaeontological Features	Planning (pre-construction)	High -	Medium to low -	Medium to high -	Threats to palaeontological resources are earth moving equipment/machinery for example haul trucks, drilling rigs, Vibroseis truck, front end loaders, excavators, graders, dozers during drilling activities and/or seismic activities. The main impact on palaeontology remains (if any) will be the physical disturbance of the material and its context. The clearing of vegetation, excavations and/or drilling may expose, disturb and displace archaeological sites/material. However, impact (if any) on palaeontological features will be local and not result in extensive significant loss of palaeontological features in the regional scale as there will likely be more similar features in the extended area. Therefore, the cumulative impact on palaeontological resources is low negative with mitigation. Preliminary mitigation measures include: • The planning of all additional exploration footprints must take cognizance of the heritage sensitivities depicted on the heritage sensitivity maps. • Once the drilling sites are final, the applicant should invite a professional palaeontologist to monitor drilling samples for subsurface fossil remains that may be intersected by the drilling process; • The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils if necessary; • All known heritage features should be retained and avoided with a buffer zone of 30m as per SAHRA guidelines. If this is not possible, the graves could be relocated after completion of a detailed grave relocation process, that includes a thorough stakeholder engagement component, adhering to the requirements of s36 of the NHRA and its regulations as well as the National Health Act and its regulations; • An independent and suitably qualified ECO must be appointed and should be able to recognise potential palaeontological features; and	Palaeontological Impact Assessment & EIA Phase impact assessment
		Construction / Operational	Medium to high -	Medium to low -	Medium to high -		
		Construction / Operational	Medium to low -	Medium to low -	Medium to high -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
		Closure & Rehab	Medium to high -	Medium to low -	Medium to high -	• Should any palaeontological features be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the ECO shall be notified within 24hours, and a Chance Find Protocol must be implemented. The responsible heritage resources authority (FSPHRA), as well as the South African Police Service (SAPS) must be notified within 72hours.	
17	Impacts on Traffic and road infrastructure	Planning (pre-construction)	Medium to low -	Low -	Low -	The movement of construction vehicles during the construction of the proposed roads can result in an increase in traffic congestion on local roads. Activities during the construction / exploration phase of the project for both the drilling and seismic survey such as the movement of abnormal loads of infrastructure in and out of the development area can impact on the overall traffic and subsequently damage to the road infrastructure. It was noted during the site inspection that the road leading to the southern section (R73) was in poor condition and movement of heavy vehicles associated with the exploration activities may cause further degradation. However, during visits to the study area, it was also noted that there is very little to no traffic in the area as it is located on the outskirts. The short duration of increased traffic as a result of the exploration works as well as few vehicle trips (especially heavy vehicles) are not anticipated to have a significant impact on the existing road networks and subsequent damage to road infrastructure. Therefore, it is anticipated that there will be low negative cumulative impact on traffic and damage to road infrastructure. However, the applicant must monitor the condition of roads to ensure that any damage caused by the exploration works is adequately rectified. Preliminary mitigation measures include: • All construction and vehicles using public roads must be in a roadworthy condition and their loads secured. They must adhere to the speed limits and all local, provincial and national regulations with regards to road safety and transport; • Damage caused to public roads as a result of the construction activities must be repaired in consultation with the relevant municipal authorities; • The working hours stipulated in the Construction permit, where applicable, must be adhered to. Where this is not applicable, the normal construction working hours (Monday – Friday: 07H00 -17h00) must be adhered to; and • Construction vehicles must not exceed speed limits of 20 km/h within the construction site.	EIA Phase impact assessment
		Construction / Operational	Medium to low -	Low --	Low -		
		Construction / Operational	Medium to low -	Low -	Low -		
		Closure & Rehab	Medium to low -	Low -	Low -		

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
18	Stakeholder Fatigue / Public Participation Fatigue	Planning (pre-construction)	Medium to low -	Low -	Medium to low -	Signs of stakeholder fatigue are visible in the communities. There are a number of applications for onshore oil and gas activities, mining and renewable energy developments in the area that the stakeholders continue to be invited to. The most obvious way to deal with this would be to avoid working with communities, suffering from stakeholder fatigue (Durham et *al.,* 2014), but this is not always possible and infringe on their rights. The EIA process requires public participation and information sharing. The volume of consultation and information shared are confusing to the communities. Stakeholders start to feel overloaded, which negatively affects their willingness to participate and lessens the quality of their input. Over time only those who are deeply interested, that is strongly supportive or strongly opposing may still participate. This can hinder potential projects and can particularly occur when the stakeholders consulted are not actively involved in decision-making. To be effective and to reduce stakeholder fatigue, engagements need to be targeted, with clear aims and results. Stakeholders need to be clear on what the goal or end benefits to themselves would be for participating. It must be kept in mind that the more stakeholders contribute their time and knowledge, the more they will expect in return from the project, so one always need to ensure that the relationship remains balanced. It should however be noted that there are only two planned public meetings for this application, one during the scoping phase and another during the EIA phase. It is not anticipated that there will be exhaustive public participation. Preliminary mitigation measures include: • Undertake fewer, but more informative / effective stakeholder consultations; • Where possible, avoid prolonged engagements with communities suffering from stakeholder fatigue; and • To be effective and to reduce stakeholder fatigue, engagements need to be targeted, with clear aims and results.	Social Impact Assessment & EIA Phase impact assessment
		Construction / Operational	Low -	Low -	Low -		
		Construction / Operational	Low -	Low -	Low -		
		Closure & Rehab	Low -	Low -	Low -		
19	Upliftment of Communities / Employment	Planning (pre-construction)	Low to medium +	Low to medium +	Medium to low +	The proposed activities will have a small short-term positive impact in the area as suppliers of construction / exploration materials will experience economic growth during the drilling and/or seismic survey phase. During the exploration phase, the creation of skilled and semiskilled jobs will be created. The use of local labour, as far as possible, is recommended as this would have a positive impact on the local economy and would prevent the influx of job seekers from outside the area. Employment opportunities for some unskilled, skilled labour as well as providing services during construction (e.g. accommodation, transportation, etc.) may arise from this project. It is important to note that employment opportunities for locals will be minimal as the project entails aspects which require qualified and skilled personnel (i.e. Vibroseis techniques and	Social Impact Assessment & EIA Phase impact assessment

#	Impact	Phase	Pre-mitigation	Post-mitigation Risk	Final Significance	Description and Preliminary Mitigation	Further Assessment
		Construction / Operational	Low +	Low +	Low +	drilling). The proposed activities also cover a small footprint and a short period of survey. Therefore, there will be minimal opportunities for locals for tasks largely related to unskilled labour, resulting in low positive cumulative impact on socioeconomics. Preliminary mitigation measures include: • Developer must allow for a transparent employment opportunity for locals; and • Local suppliers and workers must be prioritised as far as possible for economic and professional growth.	
		Construction / Operational	Low +	Low +	Low +		
		Closure & Rehab	Low -	Low -	Low -		

8 SENSITIVITY MAPPING

Environmental sensitivity mapping provides a strategic overview of the environmental, cultural and social assets in a region. The sensitivity mapping technique integrates numerous datasets (base maps and shapefiles) into a single consolidated layer making use of Geographic Information System (GIS) software and analysis tools. Environmental sensitivity mapping is a rapid and objective method applied to identify areas which may be particularly sensitive to development based on environmental, cultural and social sensitivity weightings – which is refined by specialists' input within each respective specialist field based on aerial or ground-surveys. Therefore, the sensitivity mapping exercise assists in the identification of sensitive areas within and surrounding the proposed application area. **Table 40** provides an overview of the sensitivity ranking system.

This sensitivity mapping approach allows for the identification of lower risk areas for positioning the project infrastructure whilst protecting identified sensitive environmental areas/ features through more rigorous mitigation (where possible). Areas identified as no-go would be fully excluded from any project related development regardless of the level of mitigation put forward. Furthermore, environmental sensitivity is used to aid in decision-making during consultation processes, forming a strategic part of environmental assessment processes.

The compilation of this map has taken into consideration the individual raking of sensitivity by all the identified specialist disciplines (e.g. Air Quality, Geohydrology, Terrestrial and Aquatic Ecology, Heritage, Social, etc.). Work within the various sensitivity rankings must be managed according to the EMPr as well as the recommendations in the individual specialist reports.

This sensitivity mapping approach allows for the proposed activities to be undertaken whilst protecting identified sensitive environmental areas / features. Furthermore, environmental sensitivity is used to aid in decision-making during consultation processes, forming a strategic part of Environmental Assessment processes. **Table 40** below provides a breakdown of the sensitivity rating and weightings applied to determine the sensitivity score of each aspect. **Figure 76** presents the preliminary combined sensitivity map for the project. These areas and sensitivities will be further refined in the EIA phase once further detailed assessments are completed. It must be noted that most of the area currently indicated as high-sensitive on the map is as a result of the relative palaeosensitivity theme layer from the DFFE. This map will be updated for the EIA phase of the project once detailed specialist studies are completed.

Table 40: Sensitivity rating and weighting system.

Sensitivity Rating	Description	Weighting
Least concern	The inherent feature status and sensitivity is already degraded. The proposed development will not affect the current status and/or may result in a positive impact. These features would be the preferred alternative for mining or infrastructure placement.	0
Low	The proposed development will have not have a significant effect on the inherent feature status and sensitivity.	1
Medium	The proposed development will negatively influence the current status of the feature.	2
High	The proposed development will negatively significantly influence the current status of the feature.	3
No-Go	**The proposed development cannot legally or practically take place. No development permitted under any circumstances.**	99

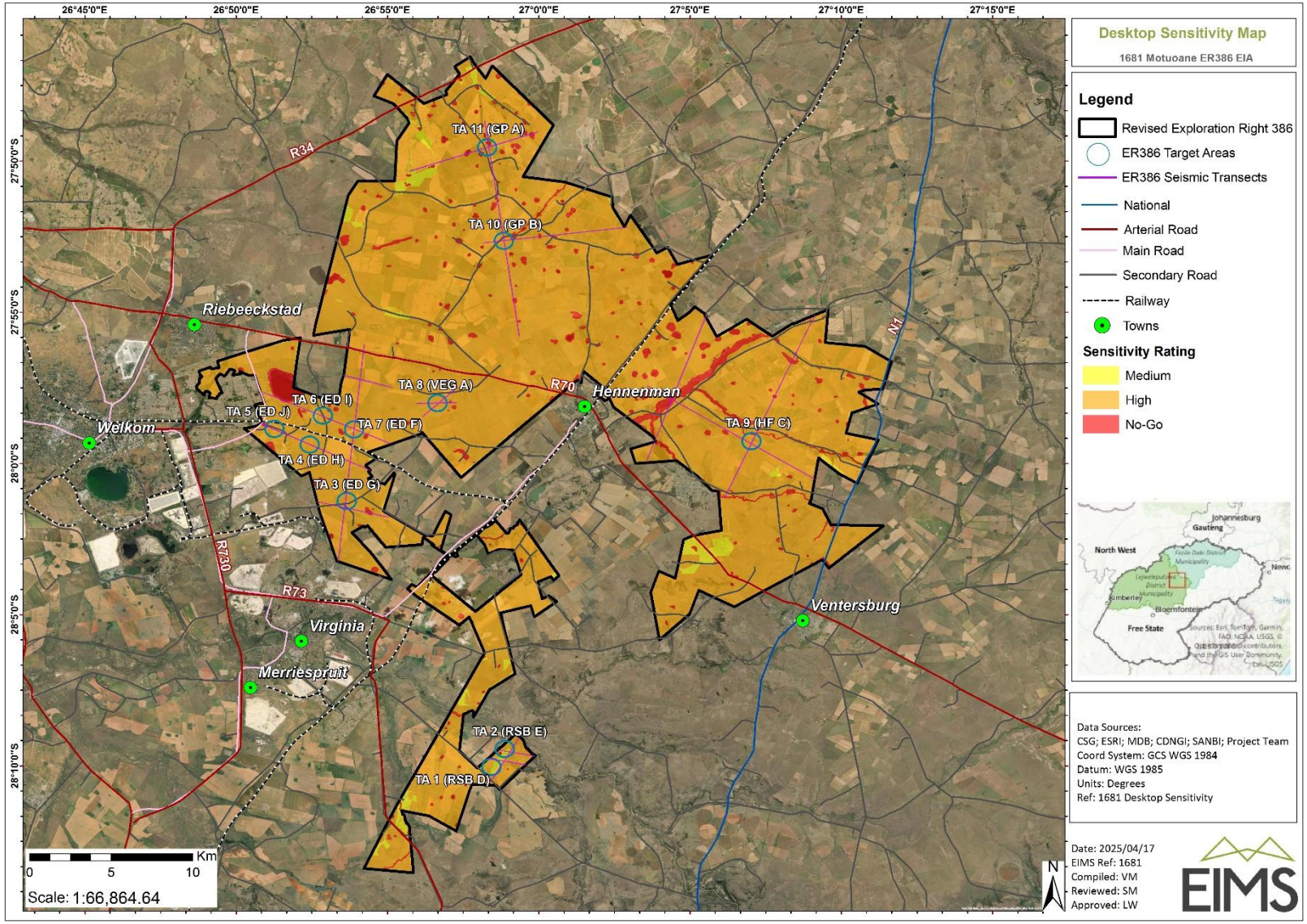


Figure 76: Combined scoping sensitivity map.

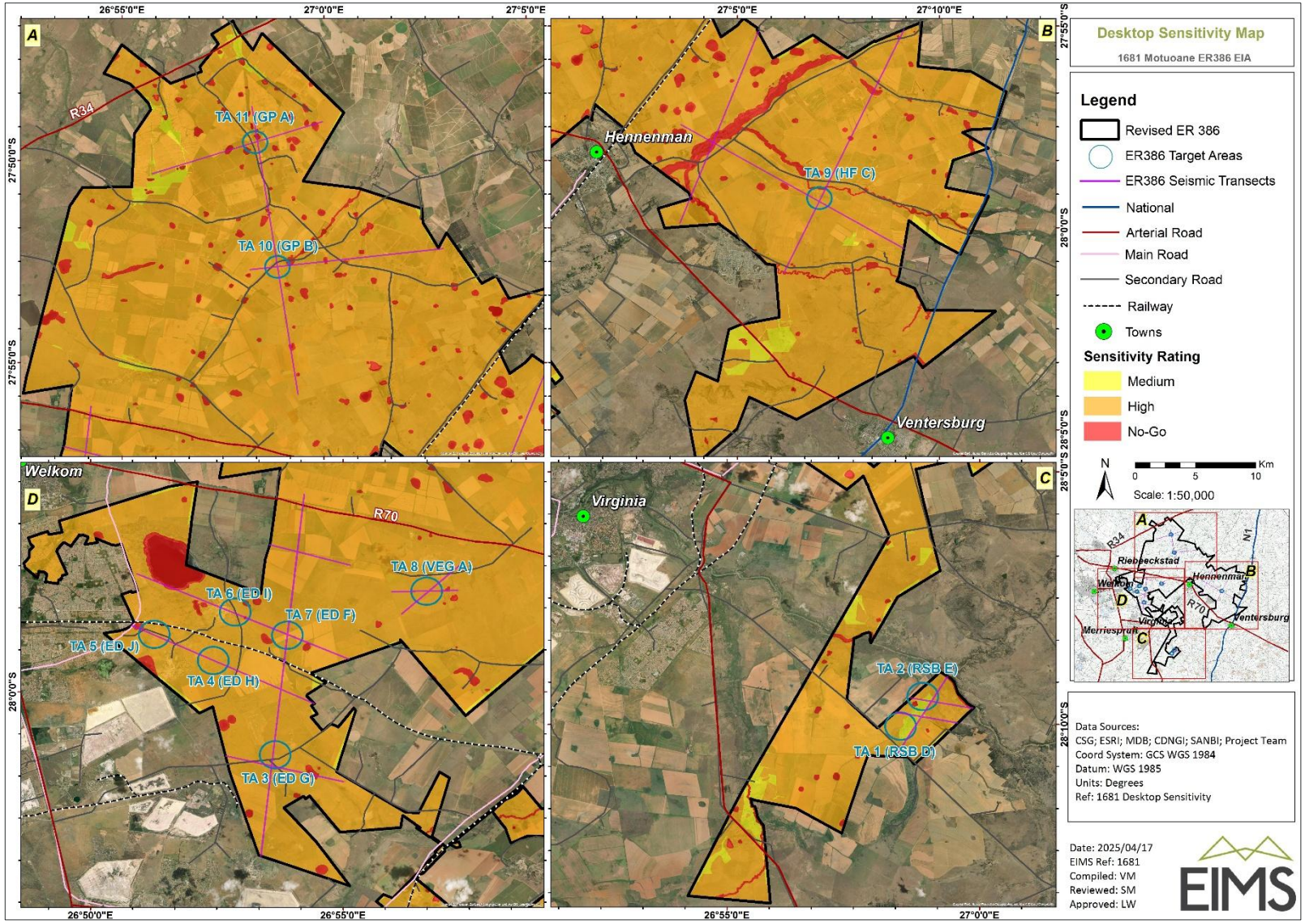


Figure 77: Combined scoping sectional sensitivity map.

9 PLAN OF STUDY FOR ENVIRONMENTAL IMPACT ASSESSMENT

The section below outlines the proposed plan of study which will be conducted for the various environmental aspects during the EIA Phase. It is also important to note that the plan of study will also be guided by comment obtained from I&AP's and other stakeholders during the PPP.

9.1 DESCRIPTION OF ALTERNATIVES TO BE CONSIDERED IN EIA PHASE

Only incremental and/or feasible alternatives will be considered further going into the EIA phase. Incremental and/or feasible alternatives typically arise during the EIA process and are usually suggested as a means of addressing identified impacts. These alternatives are closely linked to the identification of mitigation and management measures and are not specifically identified as distinct alternatives. Alternatives to be considered by the applicant and which will be explored further during the EIA phase include those preliminary identified in this report which are summarized as follows (refer to **Section 5** for detailed information):

a) Locality Property Alternatives

   (i) Exploration Activities Within Preliminary Identified Target Exploration Locations; or
   (ii) Exploration Activities Outside Preliminary Exploration Target Areas.

b) Process Alternatives:

   (i) Exploration Drilling Alternatives

      - Rotary Drilling Method;
      - Percussion Drilling Method;
      - Rotary-Percussion Drilling Method; or
      - Diamond Core Drilling Method.

   (ii) Seismic Survey Alternatives

      - Vibroseis Technique;
      - Accelerated Weight Drop; or
      - Magnetotelluric Survey.

c) Scale Alternatives

   (i) Undertaking Limited Drilling and Seismic Activities within the ER; or

   (ii) Undertaking Unlimited Drilling and Seismic Activities within the ER.

d) Design or Layout Alternatives:

   (i) Traditional lined pond (drill sump pits); or

   (ii) Aboveground sumps with secondary containment (Pitless drilling).

e) No-Go Alternative.

The abovementioned alternatives and any other incremental and/or feasible alternatives identified during the Scoping and EIA Phase will be investigated further during the EIA phase and will form part of the EMPr.

9.2 DESCRIPTION OF THE ASPECTS TO BE ASSESSED AS PART OF THE EIA PROCESS

The following aspects will be assessed further during the EIA phase investigation to be undertaken:

- Agricultural Potential, Soils & Land Capability;
- Air Quality;

- Climate Change;
- Aquatics and Wetland;
- Archaeological and Cultural Heritage;
- Palaeontological Heritage;
- Terrestrial Biodiversity;
- Geohydrology;
- Socioeconomics;
- Noise; and
- Financial Provisions.

No aspect has been disregarded at scoping:

9.3 ASPECTS TO BE ASSESSED BY SPECIALISTS

Table 41 below details the various aspects of the project to be addressed in the EIA phase through detailed specialist studies.

Table 41: Details of specialist input during the EIA phase.

Aspect	Component	Scope of Work / Terms of Reference
Soils and Agriculture	Soils and Agriculture	The following will be undertaken as part of the EIA phase study: • Land use identification using aerial imagery and ground-truthing; • Confirmation of "Low" and "High" sensitivities; • Identifying the effects that the proposed activities will have on agricultural production in the area; • Outline potential mitigation measures to be included in the EMPr; and • Compilation of a comprehensive report.
Air quality	Air Quality Impact Assessment	The following will be undertaken as part of the EIA phase study: • Discussion of updated meteorological data from the SAWS Welkom station for the period 2022 – 2024; • The compilation of an emissions inventory, comprising the identification and quantification of potential sources of emissions due to the project; • Dispersion simulations of all potential pollutants from the project for applicable averaging periods; • Evaluation of potential for human health and nuisance dustfall impacts; • Determination of environmental risk according to stipulated impact assessment methodology; • Recommendation of mitigation and management measures, where applicable; and • Compilation of a comprehensive report
Climate Change	Climate Change Impact Assessment	The following will be undertaken as part of the EIA phase study: • An estimation of the CO_2-equivalent (CO_2e) emissions from the project, associated fuel use, vegetation clearing activities, and electricity use; • Estimate the impact of the project on national greenhouse gas emissions; • Evaluation of the potential impact of global climate change on the project by identifying potential physical risks to the project, employees, and communities;

Aspect	Component	Scope of Work / Terms of Reference
		• Provide the potential risk of climate change on the project and the risk of the project on climate change; • Determination of environmental risk according to stipulated Impact Assessment methodology; and • Recommendation of mitigation and management measures, where applicable Compilation of a comprehensive report
Noise	Noise Impact Assessment	The following will be undertaken as part of the EIA phase study: • Sampling will be carried out using a Type 1 sound level meter (SLM) that meets all appropriate International Electrotechnical Commission (IEC) standards and is subject to annual calibration by an accredited laboratory. • The acoustic sensitivity of the SLM will be tested with a portable acoustic calibrator before and after each measurement session. • Samples representative and sufficient for statistical analysis, will be taken with the use of the portable SLM capable of logging data continuously over the time. Measurements representative of the day- and night-time conditions will be taken. • As generally recommended, the following acoustic indices will be recorded: L_{Aeq} (T), L_{AIeq} (T); L_{AFmax}; L_{AFmin}; statistics and 3rd octave frequency spectra. • The SLM will be located approximately 1.5 m above the ground and 10 m from reflecting surfaces. • SANS 10103 states that one must ensure (as far as possible) that the measurements are not affected by the residual noise and extraneous influences, e.g., wind, electrical interference and any other non-acoustic interference. All measurements will be taken during periods where wind speeds are less than 5 m/s; and • Compilating of an impact assessment report.
Biodiversity (Terrestrial)	Terrestrial Biodiversity Assessment	The surveys will include the following: • A survey for Red and Orange Data plant species; • A survey of fauna species occurring in the area; • Vegetation units will be identified, classified and delineated; and • Habitat types will be classified and delineated. The floristic survey should be conducted during the growing season (the rainy season when most plants are in flower or seeding), over the project areas. These will give an indication of the actual species present on site and will be discussed in context of plant communities (should the area support distinct communities) within the ecosystem of the area.

Aspect	Component	Scope of Work / Terms of Reference
		Protected, endemic, exotic, alien invasive and culturally significant species will also be discussed as separate issues and related back to relevant legal requirements. Furthermore, the identification of red data and protected species as listed according to the IUCN List, NEMBA and other Provincial and National legislation will be completed. Depending on the vegetation and terrain, the timed meander sampling could be used during vegetation assessments, however, should dominant vegetation types require other methods be used, then these shall be motivated. The surveys will include the following: • The identification of these features and delineation thereof; and • The location of any unique or protected habitat features. All sensitive areas, as described by the provincial and national legislation, will be identified. The locality and extent, as well as species composition of sensitive areas such as the wetlands or pans, streams, rivers and rocky outcrops will be conducted to identify and map all such sensitive areas present. Sensitive areas will be identified and delineated. A terrestrial ecology assessment report will be written. This report will be compiled according to the necessary requirements and standards.
Biodiversity (Aquatic) and wetlands	Aquatic and Wetland Biodiversity Assessment	The areas will be traversed on foot to identify local freshwater resources. The following will be achieved to supplement the approach: • A desktop assessment of all available datasets; • GIS processing to preliminary identify water accumulation areas; and • The delineation of water resources in accordance with the DWAF (2005) guidelines, whereby the outer edges will be identified; and • A functional and integrity assessment of the water resources. The "Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries" (Macfarlane, *et al*., 2014) will be used to determine the appropriate buffer zone for the proposed activity. The risk assessment will be completed in accordance with the requirements of the DWS General Authorisation (GA) in terms of Section 39 of the NWA for water uses as defined in Section 21(c) or Section 21(i) (GN 509 of 2016). An aquatics and wetlands assessment report will be written. This report will be compiled according to the necessary requirements and standards.

Aspect	Component	Scope of Work / Terms of Reference
Heritage	Heritage Impact Assessment	The following is included in the HIA for the EIA phase of the project: • Desktop Study An archaeological and historical desktop study will be undertaken by utilising the previous studies conducted. This will be augmented by an assessment of old topomaps and previous archaeological and heritage impact assessments undertaken for the study area and surroundings. • Fieldwork: An experienced fieldwork team from will undertake an archaeological and heritage site survey to identify the heritage resources within the study area. Tracklogs will be recorded and the locations of all heritage resources identified during the fieldwork will be documented using a hand-held GPS. Furthermore, the documentation will reflect a brief qualitative description and statement of significance for each site and includes a photographic record of all the sites. • Report: A Heritage Impact Assessment will be written. This report will be compiled according to the necessary requirements and standards.
Palaeontology	Palaeontology Impact Assessment	The following is included in the PIA for the EIA phase of the project: • A PIA desktop study will be undertaken by utilising available data. • A site survey will be undertaken. • A Palaeontological Impact Assessment will be compiled according to the necessary requirements and standards.
Hydrogeological	Hydrogeological Assessment	The aim of the geohydrological study is to assess the following: • Assessment of the hydrogeological environment in terms of aquifer development, aquifer hydraulics, groundwater flow and groundwater chemistry. • Assessment of the potential short and long-term impact from the exploration activities on the groundwater environment. • Recommended management measures to mitigate potential impacts. The study will include the following: • Establish site baseline and background conditions and identify sensitive environmental receptors. This will entail a hydrocensus to cover a total buffer zone of 500m in the vicinity of each proposed drill site; • Determine the current status quo of the regional groundwater system including aquifer classification, aquifer unit delineation and vulnerability;

Aspect	Component	Scope of Work / Terms of Reference
		• Development of a conceptual groundwater flow model; • Development of a numerical groundwater flow and mass transport model in order to quantify and qualify the potential impact of the gas extraction as well as simulate potential saline water migration towards the shallow aquifer; • Hydrogeological impact assessment and risk matrix; • Recommendations on best practise mitigation and management measures to be implemented; • Compilation of an integrated groundwater monitoring network and protocol.
Closure and Rehabilitation	Engineering Designs and Financial	A closure plan and closure cost estimate in support of the exploration right application will be undertaken. This report will address the closure measures that will be implemented and provides the cost of environmental rehabilitation at closure. The financial provisioning will be undertaken in accordance with the 2015 National Environmental Management Act: Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations.

Social Assessment	Socio-Economic Impact Assessment	The following activities will form part of the process forward:
		• Fieldwork will be conducted to obtain additional information and communicate with key stakeholders. Key stakeholders are likely to include:
		  ○ Authorities: local municipalities that fall in the project area.
		  ○ Affected parties: communities and individuals that will be affected by the project.
		  ○ Interested parties: local business in the area, community-based organisations and non-governmental organisations within the affected communities, trade unions, and political groups.
		• Methodologies will include in-depth interviews, participatory rural appraisal, in-the-moment discussion groups, focus groups and immersions. Field notes will be kept of all interviews and focus groups. Initial meetings have been conducted.
		• An interview schedule might be utilised instead of formal questionnaires. An interview schedule consists of a list of topics to be covered, but it is not as structured as an interview. It provides respondents with more freedom to elaborate on their views.
		• The final report will focus on current conditions, providing baseline data. Each category will discuss the current state of affairs, but also investigate the possible impacts that might occur in future. The impacts identified in the scoping report will be revisited and rated accordingly. New impacts that have not been identified will be added to the report. Recommendations for mitigation will be made at the end of the report.

Aspect	Component	Scope of Work / Terms of Reference
		• The SIA process will have a participatory focus. This implies that the SIA process will focus strongly on including the local community and key stakeholders. • The public consultation process needs to feed into the SIA. • Impacts will be rated according to significance (severity), probability, duration, spatial extent, and stakeholder sensitivity. • Information obtained through the public processes will inform the writing of the final SIA and associated documents

9.4 PROPOSED METHOD OF ASSESSING ENVIRONMENTAL ASPECTS

The same method of assessing impact significance as was used during the Scoping phase will be applied during the EIA phase. This methodology is described in detail in **Section 7.1** of this report.

9.5 PROPOSED METHOD FOR ASSESSING DURATION AND SIGNIFICANCE

The significance of environmental impacts will be rated before and after the implementation of mitigation measures. These mitigation measures may be existing measures or additional measures that may arise from the impact assessment and specialist input. The impact rating system considers the confidence level that can be placed on the successful implementation of the mitigation. The proposed method for the assessment of environmental issues is set out in the **Section 7.1**. This assessment methodology enables the assessment of environmental issues including: the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

The specialist studies will recommend practicable mitigation measures or management actions that effectively minimise or eliminate negative impacts, enhance beneficial impacts, and assist project design. If appropriate, the studies will differentiate between essential mitigation measures, which must be implemented and optional mitigation measures, which are recommended.

9.6 STAGES AT WHICH COMPETENT AUTHORITIES WILL BE CONSULTED

Competent authorities have been and will be consulted during the initial notification period, the scoping phase as well as during the EIA phase.

9.7 PROPOSED METHOD OF EIA PHASE PUBLIC PARTICIPATION

The proposed public participation process to be followed for the EIA phase is provided below.

- The commenting periods that will be provided to the I&AP's (and the competent authorities) will be a minimum of 30 days as per the relevant legislative requirements.
- The dates of the review and commenting period for the draft EIA/EMPr will be determined later and communicated to all registered I&AP's through faxes, emails, SMS's and/or registered letters.
- The location at which the hard copy of the EIA Report will be made available is the same public places in the project area that the Scoping Report was made available (refer to **Section 6.3.4**), sent electronically to stakeholders who request a copy, and placed on the EIMS website: https://www.eims.co.za/public-participation/.
- The public participation will be undertaken in compliance with NEMA GNR 982 (Chapter 6).
- A public meeting will be held during the review period for the EIA report. Focus group meetings will also be held with key stakeholders as and when necessary.
- All comments and issues raised during the comment periods will be incorporated into the final EIA Report.

9.8 DESCRIPTION OF TASKS THAT WILL BE UNDERTAKEN DURING THE EIA PROCESS

The plan of study detailed in the above sections and is summarised below. The following tasks will be undertaken as part of the EIA phase of the project:

- EIA-phase specialist studies.
- Public consultation:

- Notification of the availability of the EIA Report for review and comment to all registered I&AP's;
- Public meeting;
- Focus group meetings (if necessary); and
- Site visit with PASA and/or DMRE Officials (if necessary).

- Authority consultation:
  - Consultation will be undertaken with administrative and competent authorities (PASA and DMRE) who will be provided with copies of the EIA Report for review and comment. The officials will also be invited to the public meeting and a site visit as requested during the pre-application meeting; and
  - Commentary Authority consultation including Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs, Matjhabeng Local Municipality and Moqhaka Local Municipalities, Lejweleputswa and Fezile Dabi District Municipalities will be consulted further and provided with the EIA Reports to review and comment on. The officials will also be invited to the public meeting.
- Document compilation:
  - The EIA and EMPr will be compiled in line with the requirements of Appendix 3 and 4 of the NEMA EIA Regulations.
  - The EIA and EMPr will be made available for public comment for a period of 30 days.
  - The EIA and EMPr will be finalised and submitted to the DMRE for adjudication and decision making.

9.9 MEASURES TO AVOID, REVERSE, MITIGATE, OR MANAGE IMPACTS

All comments received from I&APs during the Scoping Report review will be taken into consideration and where applicable inform the high-level mitigation measures. Detailed mitigation measures will be further developed as part of the EIA phase. The potential impacts will further be assessed in terms of the mitigation potential, taking into consideration the following:

- Reversibility of impact:
  - Reversible;
  - Partially reversible.; and
  - Irreversible.
- Irreplaceable loss of resources:
  - Replaceable;'
  - Partially replaceable; and
  - Irreplaceable.
- Potential of impacts to be mitigated:
  - High;
  - Medium; and
  - Low.

More detailed findings for each identified impact taking the above into consideration will be provided in the EIA Report and associated EMPr.

10 UNDERTAKING REGARDING CORRECTNESS OF INFORMATION

I **Vukosi Mabunda** herewith undertake that the information provided in the foregoing report is correct to the best of my knowledge, and that the comments and inputs from stakeholders and Interested and Affected Parties has been correctly recorded in the report where applicable.

……

Signature of the EAP

Date: 2025/05/14

11 UNDERTAKING REGARDING LEVEL OF AGREEMENT

I **Vukosi Mabunda** herewith undertake that the information provided in the foregoing report is correct, and that the level of agreement with Interested and Affected Parties and stakeholders has been correctly recorded and reported herein.

……

Signature of the EAP

Date: 2025/05/14

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