BASIC ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE PROPOSED PROSPECTING ON A PORTIONS OF PORTION 9 OF THE FARM VLAKFONTEIN 281 IR, NIGEL, GAUTENG PROVINCE

DMR REF. NO: GP/30/5/1/1/2 (10613) PR
ENVASS REF. NO: 184-17_18

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Submitted to:
Department of Mineral Resources
Gauteng Region
Johannesburg

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

BASIC ASSESSMENT REPORT

AND

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

NAME OF APPLICANT: Ilangabi Investments 12 (Pty) Ltd

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FILE REFERENCE NUMBER SAMRAD: GP 30/5/1/1/2/10613 PR

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<table>
<tr><th colspan="4">DOCUMENT CONTROL</th></tr>
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<tr><td>Report Number</td><td colspan="3">NEMA BA-REP-184-19_20</td></tr>
<tr><td>Version</td><td colspan="3">0.0</td></tr>
<tr><td>Date</td><td colspan="3">October 2019</td></tr>
<tr><td>Submitted to</td><td colspan="3">Contact Person: Mr. Murray Reid
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<tr><td>Distribution</td><td colspan="3">1X Ilangabi Investments 12 (Pty) Ltd
1X Environmental Assurance (Pty) Ltd
3X Department of Mineral Resources (Gauteng Region)</td></tr>
<tr><th colspan="4">QUALITY CONTROL</th></tr>
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DISCLAIMER

EXECUTIVE SUMMARY

Environmental Assurance (Pty) Ltd (ENVASS) as an independent environmental consultant was appointed by Ilangabi Investments 12 (Pty) Ltd (Ilangabi) to undertake the Environmental Authorisation Application process for the proposed prospecting in the City of Ekurhuleni, Gauteng Province. The prospecting is proposed on A Portion of Portions 9 of the farm Vlakfontein 281 IR, Gauteng Province (the study area), constituting a total area of 60.2 hectares (ha). The study area is located approximately 6 km North East of Nigel. Ilangabi has an operating coal mine adjacent to the study area.

Legislative Requirements

The most important legislation applicable to the proposed project are listed below:

National Environmental Management Act (No. 107 of 1998) [as amended]

Section 28: Duty of Care and responsibilities to minimise and remediate environmental degradation.

EIA Regulations, 2014 (Government Notices 982) [as amended]

The EIA regulations prescribe the manner and content of the Basic Assessment and Public Participation Processes to be followed as well as content of the Environmental Management Programme.

Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) [as amended]

In order to apply for a prospecting right, an application was submitted on the Department of Mineral Resources' Samrad online application system.

Need and Desirability

The project is not completely aligned with the objectives of the municipal Spatial Development Framework (SDF) and Integrated Development Plan (IDP), however, it will not compromise the integrity of these respective forward planning documents, due to the small extent and fairly short-term period of the prospecting activities. Unemployment within the City of Ekurhuleni is high, according to the IDP of the CoE Municipality. The Ilangabi operations will have a positive impact on the socio-economic conditions of the local communities involved, should the results of the prospecting show that feasible reserves are present to mine and a mining right is approved. The mining and resulting brick-making will sustain several employment opportunities after the closure of the existing clay mines in the area.

The approval of this prospecting application will not compromise the integrity of the existing environmental management priorities of the area as defined in the GPEMF, provided that sensitive areas and vegetation as indicated by the specialists are avoided and the mitigation measures as recommended in this report and in the EMPR (refer to Part B of this report), are implemented. However, should a mining right be applied for and be approved in future, the integrity of the existing environmental management priorities of the area may be compromised, and a full Environmental Impact Assessment must then be conducted to determine the sustainability of the mining activities.

The study area where prospecting is proposed is located adjacent to the existing Ilangabi Coal and clay mine. The existing infrastructure is sufficient and no new infrastructure is required for the proposed activities.

Prevention and mitigation measures as recommended by the specialists were included in this Basic Assessment Report (BAR) and the Environmental Management Programme (EMPR) (please refer to Table 13 Mitigation Measures (the EMPR section). The implementation of the EMPR will ensure that the environment is affected to the minimum. The potential cumulative impacts were also assessed and found not to be of high significance after mitigation for the prospecting period.

It should be noted, however, that future mining activities may have more significant cumulative impacts.

Alternatives

Prospecting is conducted in phases, where the activities and location of drilling and trenching to sample soil are dependent on the previous phase. Therefore, the specific locations and extent of soil sampling and core drilling cannot be predetermined. The overall prospecting area is indicated in Figure 1. Areas to be avoided in terms of sensitivities are also indicated on the sensitivity maps in this report.

The following alternatives were investigated as feasible alternatives:

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

Ilangabi Investments 12 (Pty) Ltd is an operating coal and clay mining company which conducts mining immediately northwest of the study area and also has brick making factories to the south of the study area. Therefore, infrastructure and resources are available in close proximity to the study area. In addition, geological information indicated that the area potentially contains shale that weathers to clay on surface. The clay present in the area can be used in various applications with numerous quarries and brickworks located in the region.

The site is therefore, the preferred site and alternative sites are not considered.

b) The type of activity to be undertaken

Prospecting activities will not compromise any future land uses on the study area. Should results of the prospecting indicate a viable reserve is present, then a comprehensive social and environmental impact assessment will be conducted to obtain environmental authorisation and a mining right from the competent authority/ies, in accordance with legislation. Alternative land uses to mining would be investigated as part of the social and environmental impact assessments.

c) The design or layout of the activity

The specific locations of intrusive drilling activities will be determined during Phase 1 of the Prospecting Work Programme. All infrastructure to be developed will be mobile and temporary.

d) The technology to be used in the activity

In terms of technologies proposed, prospecting work will initially entail a high-level desktop study and potential desktop resource evaluation. This will include a data search of any previous drilling, trenching, sampling activities, exploration activities, existing maps and relevant historical data. Desktop studies to be undertaken would include studying of geological reports, prospecting data, plans/maps, aerial photographs, topography maps and any other related geological information regarding the specific area.

On successful completion of this desktop study, further possible drilling, trenching and resource estimations will be performed if the results warrant it. The type of invasive prospecting activities have been determined based on the historic success of the methods to be utilised. The prospecting activities are, however, dependent on the preceding phase (non-invasive) as indicated above and therefore no alternatives are indicated, but rather a phased approach of trusted prospecting techniques.

Diamond core drilling is planned to be executed on a phase by phase basis. Planned borehole depths will be determined during the desktop study, but it is estimated that drilling activities will be conducted down to relatively shallow depths. Logging and sampling of the borehole core will be performed to evaluate the area. Trenching will involve the digging of excavation trenches down to approximately 3 metres below surface using graders and excavators. Mapping of the trench walls will then be performed.

e) The operational aspects of the activity

No permanent services including water supply, electricity, or sewerage facilities are required. All infrastructure to be developed will be mobile and temporary including generators, portable toilets and water tanks.

f) The option of not implementing the activity

According to Section 24 of the Constitution, a development must be ecologically sustainable and also support socio-economic development.

Not implementing the prospecting activities will result in a loss of information of mineral reserves present on the study area. Should economically feasible reserves exist on the study area and the applicant cannot prospect, the opportunity to utilise the reserves for future mining and brick-making will be lost, i.e. the minerals will be sterilised and resultant socio-economic benefits will be lost.

The proposed prospecting activities have the potential to have a negative impact on the ecological environment as well as the social environment of the area. These impacts, however, can potentially be prevented, minimised, mitigated and managed to low and very low levels, as shown through the impact assessment.

Public Participation

A Public Participation Process is undertaken for the Environmental Authorisation for prospecting. The process is undertaken to ensure compliance with regard to the requirements in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) [as amended] (MPRDA) and the Environmental Impact Assessment Regulations (2014) [as amended].

Tasks undertaken for the Public Participation Process (PPP):

- Identification of key interested and affected parties (affected and adjacent landowners) and other stakeholders (organs of state and other parties);

Interested and Affected parties (I&APs) representing the following sectors of society have been identified:

- National, provincial and local government;
- Agriculture, including local landowners (affected and adjacent);
- Community Based Organisations;
- Non-Governmental Organisations;
- Water bodies;
- Tourism;
- Industry and mining;
- Commerce; and
- Other stakeholders.

- Formal notification of the application to interested and affected parties (including all affected and adjacent landowners) and other stakeholders
  - Publication of media advertisement (English) in the Heidelberg Nigel Heraut on 7 November 2019;
  - Two site notices were erected on site and at visible locations close to the site on 7 December 2019;
  - I&AP's and other key stakeholders, who included the above-mentioned sectors, were directly informed of the proposed development by e-mail on 7 December 2019.

I&APs were given 30 days to comment and / or raise issues of concern regarding the proposed development. The commenting period expired on the 7 December 2019.

- Consultation and correspondence with I&APs and stakeholders.

All I&AP registrations and comments that are received from stakeholders will formally be recorded in the Comments and Responses Report. The Draft BAR and EMPR are herewith released for a period of 30 days from 7 November 2019 to 7 December 2019. Hard copies of the Draft BAR and EMPR are also submitted to all relevant organs of state and authorities. In addition, copies are placed at Nigel Local Library, and on the ENVASS website (www.envass.co.za).

Next phases of the public participation process

All comments received from I&APs and organs of state and responses sent will be included in the final BAR and EMPR to be submitted to the Competent Authority (CA).

Specialist studies

The following specialist studies have been conducted:

- Biodiversity Assessment;
- Heritage Impact Assessment;
- Palaeontological assessment; and
- Land Capability and Agricultural Potential Assessment.

The main objective of the specialist studies is to provide independent scientifically sound information on issues of concern relating to the project proposal and propose management and/or mitigation measures for issues identified.

The findings and recommendations identified by the various specialist studies undertaken, were incorporated into the Basic Impact Assessment.

- Biodiversity Assessment;
- Heritage Impact Assessment;
- Palaeontological assessment; and
- Land Capability and Agricultural Potential Assessment.

Reasoned Opinion of the EAP

Based on the findings of the Basic Impact Assessment, the EAP is of the opinion that the proposed prospecting be approved, due to the potential positive social and economic impacts it will have on the local and regional communities. The potential negative impacts can be mitigated to levels of low and very low significance, provided that the mitigation measures are strictly implemented and monitored. All the recommendations of the specialists and mitigation measures provided in the Environmental Management Programme (PART B of this report) are adhered to.

Recommendations

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through physical measures, the recommendations from the BAR are included within the Environmental Management Programme (EMPR). The EMPR is based on all the information contained within this report as well as all the specialists' reports.

Key specialist recommendations:

- Care must be taken to reduce impacts on the adjacent properties through the implementation of all the mitigation measures proposed by the specialists;
- No vegetation clearance outside the demarcated areas, except for the removal of alien invasive species will be allowed;
- Environmental awareness training to all staff and sub-contractors entering the site should be conducted;

- Prior to any development, construction or prospecting, a qualified archaeologist should conduct a site inspection on the areas demarcated for geotechnical drilling/prospecting. Proposed access roads to the drill sites should also be surveyed in order to avoid the destruction of heritage material;
- Should the prospecting outcome result in further development or construction and mining, a full Phase 1 Archaeological Impact Assessment must be conducted on the affected area if triggered.

A variety of mitigation measures have been identified that will serve to mitigate the scale, intensity, duration or significance of the potential negative impacts identified. These include guidelines to be applied during all phases of the proposed prospecting. The EMPR contains detailed mitigation measures for all impacts identified.

The proposed mitigation measures, if implemented, will reduce the significance of the majority of the identified impacts.

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ABBREVIATIONS

CA	Competent Authority
CBA	Critical Biodiversity Area
CoJ	City of Johannesburg
CoE	City of Ekurhuleni
CSA	Constitution of South Africa (Act No. 108 of 1996)
DAFF	Department of Agriculture, Forestry and Fisheries
DEFF	Department of Environmental, Forestry and Fisheries
DMR	Department of Mineral Resources
DTM	Dimensional Terrain Modelling
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPR	Environmental Management Programme
ENVASS	Environmental Assurance (Pty) Ltd
ESA	Ecological Support Area
ESM	Environmental Site Manager
GDARD	Gauteng Department of Agriculture and Rural Development
GDP	Gross Domestic Product
GEMF	Gauteng Environmental Management Framework
GN	Government Notice
GIS	Geographic Information System
GPS	Global Positioning System
GVA	Gross Value Added
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
Mamsl	Metres above mean sea level
MHSA	Mine Health and Safety Act (Act No. 29 of 1996) [as amended]
MPRDA	Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (as amended)
NEMA	National Environmental Management Act, 1998 (Act no 107 of 1998) (as amended)
NEMAQA	National Environmental Management: Air Quality Act (Act No. 39 of 2004) (as amended)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMWA	National Environmental Management: Waste Act (Act No. 59 of 2008) (as amended)

NHRA	National Heritage Resource Act, 1999 (Act No. 25 of 1999)
NVFFA	National Veld and Forest Fire Act (Act No. 101 of 1998)
NWA	National Water Act, 1998 (Act No. 36 of 1998) (as amended)
PM	Public Meeting
PPE	Personal Protective Equipment
PPP	Public Participation Process
SAHRA	South African Heritage Resources Agency
SANS	South African National Standards
SAWS	South African Weather Service
SDF	Spatial Development Framework
SLP	Social and Labour Plan
SM	Site Manager
VAC	Visual Absorption Capacity

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment and an environmental authorisation is issued".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application conforms to the requirements of the EIA Regulations, any protocol or minimum information requirements relevant to the application as identified and gazetted by the Minister in a government notice or instruction or guidance provided by the competent authority to the submission of application.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of this template. Furthermore, please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

Objective of the basic assessment process

The objective of the basic assessment process is to, through a consultative process—

(a) determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;

(b) identify the alternatives considered, including the activity, location, and technology alternatives;

(c) describe the need and desirability of the proposed alternatives;

(d) through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine:

(i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and

(ii) the degree to which these impacts—

(aa) can be reversed;

(bb) may cause irreplaceable loss of resources; and

(cc) can be managed, avoided or mitigated;

(e) through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to—

(i) identify and motivate a preferred site, activity and technology alternative;

(ii) identify suitable measures to manage, avoid or mitigate identified impacts; and

(iii) identify residual risks that need to be managed and monitored.

PART A

SCOPE OF ASSESSMENT AND BASIC ASSESSMENT REPORT

1. Contact Person and correspondence address

a) Details of:

i) The EAP who prepared the report

Name of The Practitioner: Corrie Retief

Tel No.: 012 460 9768
Fax No.: 012 460 3071
e-mail address: corrie@envass.co.za

ii) Expertise of the EAP

(1) The qualifications of the EAP

(With evidence attached as Appendix 1)

- University of South Africa, BA Hons Geography - 2007
- University of South Africa, BA Environmental - 2005

(2) Summary of the EAP's past experience.

(Attach the EAP's curriculum vitae as Appendix 2)

Corrie Retief is an Environmental Scientist with more than 12 years of experience in applying the principles of Integrated Environmental Management, and in applying the Environmental Legislation to a number of development projects and initiatives in Southern Africa. He has co-ordinated and managed a number of diverse projects and programs related to the Environment and Waste within both the public and private sectors for national, multi-national and international companies. His interpersonal and organisational skills have enabled him to efficiently direct these projects from initiation to implementation. Furthermore his training in sustainability and sustainable project delivery has helped him to deliver profitable sustainability into customers operations throughout the asset lifecycle.

A significant element of public participation is required throughout the life cycle of an EIA process. Corrie has successfully liaised with interested and affected parties, ensuring that all communication procedures and dialogues are open and transparent, and that capacity building is conducted where necessary. His proficient report-writing skills have been utilised for the compilation of a wide variety of reports, which include but is not limited to Basic Assessment Reports, Scoping and Environmental Impact Assessment Reports, Environmental Management Plans (Planning, Construction, Operation and

Closure), Environmental Audit Reports, Opportunities and Constraints Analyses, Feasibility studies, Waste License Applications, Water-Use Application Reports, Prospecting Right and Mining Right Applications.

The EAP has experience in the following disciplines:

- Environmental risk assessments;
- Environmental site screening, investigation and evaluations;
- Environmental legal screenings;
- Environmental feasibility studies;
- Environmental impact assessments;
- Basic assessments;
- Environmental compliance auditing;
- Compilation, implementation and monitoring of environmental management plans;
- Waste Management;
- Waste Disposal site selection screenings;
- Waste license applications;
- Water-Use License Applications;
- Mining Right applications;
- Managing and facilitating public participation; and
- Prospecting Right Applications.

2. Location of the overall Activity

Table 1: Location of the Overall Activity

Farm Name:	Portion of Portions 9 of the Farm Vlakfontein 281 IR
Application area (Ha)	64.2
Magisterial district:	City of Ekurhuleni
Distance and direction from nearest town	Approximately 6 km north-east of Nigel CBD
21 digit Surveyor General Code for each farm portion	T0IR00000000028100009

3. Locality map

(show nearest town, scale not smaller than 1:250000)

Refer to Appendix 3 for the locality map.

4. Description of the scope of the proposed overall activity

Provide a plan drawn to a scale acceptable to the competent authority but not less than 1: 10 000 that shows the location, and area (hectares) of all the aforesaid main and listed activities, and infrastructure to be placed on site.

(i) Listed and specified activities

Table 2: Listed and specified activities

NAME OF ACTIVITY (All activities including activities not listed) (E.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, stormwater control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.)	**AERIAL EXTENT OF THE ACTIVITY HA OR M²**	**LISTED ACTIVITY** Mark with an X where applicable or affected.	**APPLICABLE LISTING NOTICE** (*GNR 983, GNR 984 or GNR 985 /NOT LISTED*)	**WASTE MANAGEMENT AUTHORISATION** (Indicate whether an authorisation is required in terms of the Waste Management Act)
OPERATIONAL PHASE				
• Clearing of vegetation and topsoil.	Less than 1 hectare in total	-	NOT LISTED	NOT LISTED
• Stockpiling of overburden positioned for later rehabilitation.	Less than 1 hectare in total	-	NOT LISTED	NOT LISTED
• Prospecting.	Less than 1 hectare in total.	X	Listing Notice 1 Activity 20	NOT LISTED
• Dust Suppression.	Extent of dirt roads open, non-paved areas.		NOT LISTED	NOT LISTED

(ii) Description of the activities to be undertaken

(Describe Methodology or technology to be employed, including the type of commodity to be prospected/mined and for a linear activity, a description of the route of the activity)

Background

Ilangabi Investment 12 (Pty) Ltd is applying for a Prospecting Right without bulk sampling, to prospect the following types of minerals:

- (CS) Shale/Brick Clay;
- (Cy) Clay (General);
- (Q) Silica Sand (General);
- (Qy) Sand (General); and
- (C) Coal.

The area demarcated for the prospecting covers an area of approximately 64.2 ha (refer to Table 3 and Figure 1).

Table 3: Property name & coordinates

Property	Portion	Coordinates
Vlakfontein 281 IR	9	A 28.484979,-26.343965 B 28.486152,-26.343352 C 28.487749,-26.340156 D 28.489127,-26.340156 E 28.489926,-26.339871 F 28.492412,-26.341376 G 28.495444,-26.344419 H 28.496612,-26.346688 J 28.494450,-26.348750 K 28.492673,-26.348490 L 28.491245,-26.347263 M 28.490727,-26.345757 N 28.488728,-26.347399

Prospecting work will initially entail a high-level desktop study and potential desktop resource evaluation. This will include a data search of any previous drilling, trenching, sampling activities, exploration activities, existing maps and relevant historical data. On successful completion of this desktop study, further possible drilling, trenching and resource estimations will be performed if the results warrant it.

Prospecting Method:

- Planned non-invasive activities

Desktop studies to be undertaken over the area would include studying of geological reports, prospecting data, plans/maps, aerial photographs, topography maps and any other related geological information about this area.

- Planned invasive activities

Diamond core drilling is planned to be executed on a phase by phase basis. Planned borehole depths will be determined during the desktop study, but it is estimated that drilling activities will be done down to relatively shallow depths. Logging and sampling of the borehole core will be performed to evaluate the area. Trenching will involve the digging of excavation trenches down to approximately 3 metres below surface using graders and excavators. Mapping of the trench walls will then be performed.

- Pre-feasibility studies

Geological modelling of gathered existing geological data and prospecting data will be performed, if the results warrant it.

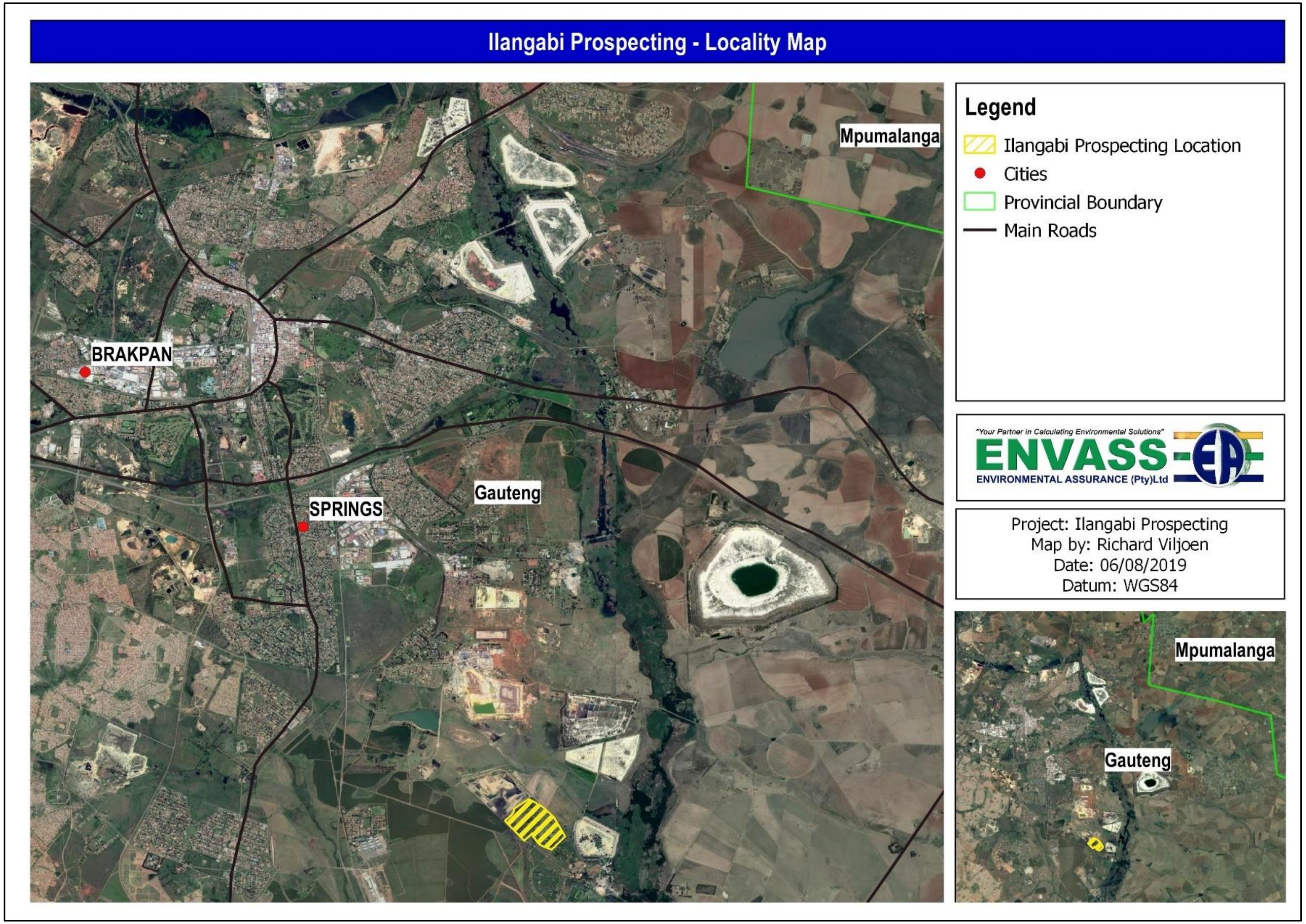


Figure 1: Farm Portions of the Study Area

5. Policy and Legislative Context

Table 4: Policy and Legislative Context

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(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)*	**REFERENCE WHERE APPLIED**
Constitution of South Africa, 1996 (Act No. 108 of 1996) [as amended] • *Section 24* *Environment. -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* *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*	The proposed activity has the potential to harm the environment and poses a risk to the health and wellbeing of people. The Applicant has the overall responsibility to ensure that the rights of people in terms of Section 24 of the Constitution is protected in terms of the proposed prospecting activity.
National Environmental Management Act (No. 107 of 1998) [as amended] • *Section 24* *Environmental Authorisations* • *Section 28 (1)* *Duty of Care and responsibilities to minimise and remediate environmental degradation.*	The proposed activity is a listed activity in terms of the EIA Regulations and requires environmental authorisation. Overall responsibility of the prospecting rests with the Applicant, especially in terms of liabilities associated with the operational phase.
EIA Regulations, 2014 (Government Notices 982 and 984) [as amended in 2017] *Chapter 2: Timeframes for EIA processes* *Chapter 3: Duties of proponent*	The EIA Regulations, 2014 [as amended] prescribes *inter alia*: the manner in which public participation needs to be conducted as well as the requirements of a basic assessment process and content of a basic assessment

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(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)*	**REFERENCE WHERE APPLIED**
Chapter 4: Application for Environmental Authorisation: *Part 2: Basic Assessment* *Part 4: Environmental Authorisation* *Chapter 6: Regulation 39 to 44: Public Participation* *Appendix 1: Basic Assessment Report* *Appendix 4: Environmental Management Programme* *Appendix 6: Specialist Reports*	report, Environmental Management Programme and specialist reports.
Mineral and Petroleum Resources Development Act, 2002 (Act. 28 of 2002) [as amended]: *Chapter 2 (5): Legal nature of a prospecting right;* *Chapter 4: Mineral and Environmental Regulation* *(9) Order of processing of applications* *(10) Consultation with Interested and Affected Parties;* *(16 – 19) Prospecting right application.* *(37) Environmental Management Principles*	The application is for a prospecting right and therefore all regulations pertaining to the application process of a prospecting right and environmental management are applicable to this application.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) [as amended] • *Section 16* *General duty in respect of waste management;* • *Section 17;* *Reduction, re-use, recycling and recovery of waste;* • *Section 21* *General requirements for storage of hazardous and general waste.*	The proposed activities will produce general and hazardous waste which need to be managed and disposed of according to best practices such as recycling, safe storage, etc.
National Water Act, 1998 (Act No. 36 of 1998) [as amended] • *Section 3* *Regulation of flow and control of all water* • *Section 19* *Prevention of pollution to watercourses*	Stormwater needs to be managed properly in order to achieve prevention of pollution and hazards.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(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)*	**REFERENCE WHERE APPLIED**
Mine Health and Safety Act, 1996 (Act No. 29 of 1996) [as amended] and associated regulations • *Chapter 2, Sections 2 – 4* *Responsibilities of owner* • *Chapter 2, Sections 5 – 13* *Responsibilities of manager;* • *Chapter 2, Sections 14 – 18;* *Documentation requirements;* • *Chapter 2, Section 19 – 20 and 22 to 24* *Employee's rights and duties; and* • *Chapter 2, Section 21* *Manufacturer's and supplier's duty for health and safety*.	The development activities will create an environment that may not be safe and healthy for workers on, and visitors to the site. The act provides for measures to prevent threats to the health and safety of humans in the development area.
National Heritage Resources Act, 1999 (Act No. 25 of 1999) • *Section 38* *Statutory Comments to be obtained from the South African Heritage Resources Agency (SAHRA)* • *Section 44 (1);* *Preservation and protection of heritage resources;* • *Section 3 Types and ranges of heritage resources (i) (i);* *Objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens*.	Protection of indigenous heritage resources that may potentially occur on the property. A cultural heritage desktop assessment was conducted in 2019 by Tobias Coetzee. The specialist concluded that the general region is significant from a heritage perspective. Heritage sites are likely to include graveyards, Iron Age/Farmer and Historical remains. Since heritage sites, e.g. graves, are not always clearly identifiable as it might consist of stone cairns, it is advised that a qualified archaeologist inspect the proposed prospecting sites prior to drilling to establish whether the sites might be sensitive from a heritage perspective. Comments to be obtained from SAHRA on the Draft BAR and EMPR and cultural heritage desktop assessment.
National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) [as amended] • *Section 32*	Impacts on surrounding landowners need to be managed through dust and noise monitoring and mitigation measures.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(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)*	**REFERENCE WHERE APPLIED**
Control of dust • *Section 34* *Control of noise*	
National Dust Control Regulations, 2013 (Government Notice 827 of 2013) • *Section 3* *Dust fall standard* • *Section 4* *Dust fall monitoring program* • *Section 6* *Measures for control of dust* • *Section 7* *Ambient air quality monitoring (PM10)* • *Section 8* *Offences* • *Section 9* *Penalties*	Dust fallout needs to be monitored in accordance to the standards set out in the monitoring programme with the specified measures. This is a result of the Applicant being liable to offences and penalties associated with non-conformance to dust which may influence employees and surrounding landowners.
Veld and Forest Fire Act, 1998 (Act No. 101 of 1998) [as amended] • *Section 12 (1)* *Duty of the landowner to prevent fire from spreading to neighbouring properties.*	Cautionary steps in avoiding the spread of fires to and from neighbouring properties.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) [as amended] • *Section 9* *Norms and standards* • *Section 27* *Delegation of power and duties* • *Section 30*	Indigenous vegetation needs to be protected and managed in accordance with management measures set out in the management plans developed for the proposed activity. The Applicant needs to ensure he is aware of and covers his liabilities.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(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)*	REFERENCE WHERE APPLIED
Financial accountability • *Section 43* *Biodiversity management plans.*	
(Government Notice 609 of 2017) Notice of the List of Protected Tree Species under the National Forests Act, 1998 (Act No. 84 of 1998).	It is the responsibility of the Applicant to avoid unnecessary removal of protected tree species. Should protected tree species need to be removed, a permit must be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF).
Alien and Invasive Species Regulations (Government Notice 598 of 2014) and Alien and Invasive Species List, 2016 in terms of NEMBA (Government Notice 864 of 2016) • *Notice 2* *Exempted Alien Species in terms of Section 66 (1)* • *Notice 3* *National Lists of Invasive Species in terms of Section 70(1) – List 1, 3-6 8 & 11* • *Notice 4* *Prohibited Alien Species in terms of Section 67 (1) – List 1, 3-6, 9 & 12*	It is the responsibility of the Applicant to ensure that all prohibited plant and animal species are eradicated as far as possible.
Conservation of Agricultural Resources Act (no. 43 of 1983) • *Section 5* *Prohibition of spreading of weeds* • *Section 12* *Maintenance of soil conservation works and maintenance of certain states of affairs* • *Section 16* *Regional Conservation Committees*	Listed invader/alien plants occurring on site which requires management measures to be implemented to strive to maintain the status quo environment, especially through the guidelines provided by the Regional Conservation Committee.
Hazardous Substances Act, 1973 (Act 15 of 1973) [as amended]	The Applicant must ensure the safety of people working with hazardous chemicals (specifically fuels), as well as

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(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)*	REFERENCE WHERE APPLIED
• *Section 2* *Declaration of grouped hazardous substances;* • *Section 4* *Licensing;* • *Section 16* *Liability of employer or principle* • *Section 9 (1)* *Storage and handling of hazardous chemical substances* • *Section 18* *Offences*	safe storage, use and disposal of containers during the on-site operational phase together with the associated liability should non-compliance be at the order of the day.
Hazardous Chemical Substances Regulations, 1995 (Government Notice 1179 of 1995) • *Section 4* *Duties of persons who may be exposed to hazardous chemical substances* • *Section 9A (1)* *Penalties*	Hazardous substances will be stored and utilised on the site and non-compliance to management measures will result in prosecution of the Applicant in terms of his liabilities to the socio-economic environment.
NEMA: Government Notice. 805 Companion Guideline on the Implantation of the Environmental Impact Assessment Regulations, 2010, October 2012.	The application for Environmental Authorisation is submitted in terms of the EIA Regulations.
NEMA: GN. 807 Public Participation Guideline, October 2012	Consultation with Interested and Affected Parties and Communities.
National Development Plan 2030 (2012)	Land uses
National Framework for Sustainable Development (2008)	Land uses
National Strategy for Sustainable Development and Action Plan 2011 – 2014 (NSSD 1) (2011)	Land uses
Gauteng Spatial Development Framework (SDF)	Land uses
Gauteng Spatial Development Plan (SDP)	Land uses

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(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)*	**REFERENCE WHERE APPLIED**
Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector (2013) (Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute.	The Guideline provides guidance on the impacts on biodiversity typically associated with mining as well as mitigation measures and strategies. The guideline is taken into consideration in this EIA and the development of the Environmental Management Programme.
Gauteng Transport Infrastructure Act, 2001 (Act No. 8 of 2001) [as amended];	• An application must be submitted to the Department for a way leave if any part of a proposed service falls within 95,0 m (measured from the centreline of any of the Department's existing or future road(s)/railway line or within a 500,0 m radius of any intersection on said road(s)/railway line. • Where mining operations are to be undertaken, Section 49 of the Gauteng Transport Infrastructure Act, 2001 (Act No 8 of 2001) shall apply.
City of Ekurhuleni Metropolitan Spatial Development Framework (MSDF), 2012	Land use
City of Ekurhuleni Regional Spatial Development Framework (RSDF): Region 3	Land use
City of Ekurhuleni Draft Integrated Development Plan (IDP) 2017/21	Land use Socio-economic baseline information and need and desirability for the development.
Magaliesberg Biosphere Proposed Management Plan	Guidelines for activities and land uses within the biosphere.
Magaliesberg Protected Environment: Environmental Management Framework and Plan	Guidelines for activities and land uses within the biosphere.
SANS 10103:2008 The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, and Annoyance and to Speech Communication.	Impacts on surrounding landowners need to be managed through noise mitigation measures.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT *(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)*	REFERENCE WHERE APPLIED
SANS 1929: Ambient Air Quality – Limits for Common Pollutants	Impacts on surrounding landowners need to be managed through dust mitigation measures.
SANS 1137: Standard test method for the collection and measurement of dust fall (settleable particulate matter).	Impacts on surrounding landowners need to be managed through dust mitigation measures.
SANS 10234: 2008 Globally Harmonised Systems of classification and labelling of chemicals (GHS) Government Notice 634. August 2013: Waste Classification	All dangerous goods on site need to be managed according to these standards.
SANS 10228:2006 The Identification and Classification of Dangerous Goods for Transport	All dangerous goods to be transported to and from the site need to be managed according to these standards.
ASTM d 1739, 1970 or equivalent approved protocol for dust monitoring.	Impacts on surrounding landowners need to be managed through dust mitigation measures.
Gauteng Conservation Plan: Version 3.3	Identifies Critical Biodiversity Areas, Ecological Support Areas, and irreplaceable, protected and important areas.
All other relevant national, provincial, district and local municipality legislation and guidelines that may be applicable to the application.	-

6. Need and desirability of the proposed activities

(Motivate the need and desirability of the proposed development including the need and desirability of the activity in the context of the preferred location).

According to the Western Cape Department of Environmental Affairs and Development Planning's (WC DEADP) Guideline on Need and Desirability: EIA Guideline and Information Document Series (2011), to describe the need for a development, it must be determined whether it is the right time for locating the type of land use and/or activity being proposed. To describe the desirability for a development, it must be determined, whether it is the right place for locating the type of land use and/or activity being proposed. Need and desirability can be equated to the concept of wise use of land which can be determined through the question of what is the most sustainable use of land. In light of the above, the need and desirability of an application must be addressed separately and in detail answering *inter alia* the following questions:

Table 5: Need and desirability considerations

A) NEED (TIMING)		
QUESTION A1: Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority?		The project is not completely aligned with the objectives of the municipal Spatial Development Framework (SDF) and Integrated Development Plan (IDP), however, it will not compromise the integrity of these respective forward planning documents, due to the relatively short-term prospecting period of only 1 year.
YES X	**NO**	
QUESTION A2: Should development, or if applicable, expansion of the town/area concerned in terms of this land use (associated with the activity being applied for) occur here at this point in time?		The proposed activities will enable Ilangabi Investments 12 (Pty) Ltd to extend the life of mine (LOM) with a significant number of years and therefore the benefits for local communities and South Africa as a whole for e.g. employment provision and social upliftment will continue for longer.
YES X	**NO**	
QUESTION A3: Does the community/area need the activity and the associated land use concerned (is it a societal priority)?		Unemployment within the Ekurhuleni Metropolitan Municipality is high, according to the IDP of Ekurhuleni. The Ilangabi Investments 12 (Pty) Ltd prospecting, will have a positive impact on the socio-economic conditions of the local communities involved once operations commence. The prospecting will sustain the Ilangabi Vlakfontein Mine. The mine will also contribute towards the socio-economic development of the region as a whole through social-upliftment and job creation as primary agents.
YES X	**NO**	
QUESTION A4: Are the necessary services with the adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?		All infrastructure for services and capacity is sufficient for the existing and proposed mining activities.
YES	**NO X**	
QUESTION A5: Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)?		No municipal infrastructure will be required for the study area.
YES	**NO X**	

QUESTION A6: Is this project part of a national programme to address an issue of national concern or importance?		No. This project will however lead to the creation of jobs and the growing of the local economy within the area which will contribute to overall GDP.
YES	**NO X**	
B) DESIRABILITY (PLACING)		
QUESTION B1: Is the development the best practicable environmental option for this land/site?		The majority of the study area is transformed as it is a golf course which has already had an impact in terms of environmental management
YES X	**NO**	
QUESTION B2: Would the approval of this application compromise the integrity of the existing approved and credible municipal IDP and SDF as agreed to by the relevant authorities?		The project is not completed aligned with the objectives of the municipal Spatial Development Framework (SDF) and Integrated Development Plan (IDP) in terms of land use, however, it will not compromise the integrity of these respective forward planning documents. Unemployment is a major problem in South Africa as in Ekurhuleni Metropolitan Municipality, and the prospecting will be able to provide the sustaining of current jobs for a significant period of time at the Vlakfontein mine
YES	**NO X**	
QUESTION B3: Would the approval of this application compromise the integrity of the existing environmental management priorities of the area (e.g. as defined in EMFs), and if so, can it be justified in terms of sustainability considerations?		The study area consists mostly of a golf course therefore very little to no natural vegetation exists on the study area. These impacts will be assessed in this report.
YES	**NO X**	
QUESTION B4: Do location factors favour this land use (associated with the activity applied for) at this place, etc.)?		The study area where the prospecting is proposed is located adjacent to the existing Vlakfontein Mine, which is owned by Ilangabi Investments, a subsidiary of Brikor Limited. The existing infrastructure is sufficient for the prospecting operation. No new infrastructure is required for the proposed mine.
YES X	**NO**	
QUESTION B5: Will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)?		A cultural heritage impact assessment was conducted in 2019 by Tobias Coetzee. No archaeological (Stone age and Iron age) or historical settlements, structures, features, assemblages or artefacts were identified by the specialist.
YES	**NO X**	
QUESTION B6: Will the development impact on people's health and wellbeing		Noise, dust and visual pollution will increase, and possibly water pollution, if impacts are not managed effectively, but with the proper mitigation and

(e.g. in terms of noise, odours, visual character and sense of place, etc.)?		good practice environmental management measures, it will result in minimal impacts.
YES X	**NO**	
QUESTION B7: Will the proposed land use result in unacceptable cumulative impacts?		As already mentioned, through the implementation of good practice environmental management measures as well as mitigation measures, all direct and cumulative impacts which may result from the proposed development will be addressed and ensure that the environment is affected to the minimum.

7. Motivation for the overall preferred site, activities and technology alternative

8. Full description of the process followed to reach the proposed preferred alternatives within the site

(NB!! – This section is about the determination of the specific site layout and the location of infrastructure and activities on site, having taken into consideration the issues raised by interested and affected parties, and the consideration of alternatives to the initially proposed site layout.)

Prospecting is conducted in phases, where the activities and location of drilling and trenching to sample soil are dependent on the previous phase. Therefore, the specific locations and extent of soil sampling and diamond core drilling cannot be predetermined. The overall prospecting area is indicated in Figure 1. Areas to be avoided in terms of sensitivities are also indicated on the sensitivity maps in this report. Positioning of invasive prospecting planned in the sensitive areas and buffer zones should be conducted with a suitably qualified ecologist in order to avoid or minimise the destruction of any sensitive vegetation or habitats occurring in these areas.

i) Details of all alternatives considered

(With reference to the site plan provided as Appendix 4 and the location of the individual activities on site, provide details of the alternatives considered with respect to:

- *(a) the property on which or location where it is proposed to undertake the activity;*
- *(b) the type of activity to be undertaken;*
- *(c) the design or layout of the activity;*
- *(d) the technology to be used in the activity;*
- *(e) the operational aspects of the activity; and*
- *(f) the option of not implementing the activity)*

According to the Western Cape Department of Environmental Affairs & Development Planning (WC DEADP) Guideline on alternatives: EIA Guideline and Information Document Series (2011) feasible and reasonable alternatives have to be identified for a development as required by the NEMA EIA Regulations and applicable to EIA. Each alternative is to be accompanied by a description and comparative assessment of the advantages and disadvantages that such development and activities will pose on the environment and socio-economy. Alternatives form a vital part of the initial assessment process through the consideration of modifications in order to prevent and/or mitigate environmental impacts associated with a particular development. Alternatives are to be amended when the development's scope of work is amended. It is vital that original as well as amended alternative identification, investigation and assessment together with the generation and consideration of modifications and changes to the development and activities are documented.

Although an array of alternatives could be investigated for each project, such alternatives will not necessarily be applicable to each project and/or project phase. However, there must always be strived to seek alternatives that maximises efficient and sustainable resource utilisation and minimise any negative impacts on the biophysical and socio-economic environments.

Feasible alternatives

The following alternatives were investigated as feasible alternatives:

g) The property on which or location where it is proposed to undertake the activity

Ilangabi Investments 12 (Pty) Ltd is an operating coal and clay mining company with its Vlakfontein mine immediately northwest of the study area. Infrastructure and resources are available in close proximity to the study area. In addition, geological information indicated that the area potentially contains coal and clay. In addition, the site has been severely impacted upon by the golf course and has therefore been already disturbed.

The site is therefore, the preferred site and alternative sites are not considered.

h) The type of activity to be undertaken

Prospecting activities will not compromise any future land uses on the study area. Should results of the prospecting indicate a viable reserve is present, then a comprehensive social and environmental impact assessment will be conducted to obtain environmental authorisation and a mining right from the competent authority/ies, in accordance with legislation. Alternative land uses to mining would be investigated as part of the social and environmental impact assessments.

i) The design or layout of the activity

The specific locations of intrusive drilling activities will be determined during Phase 1 of the Prospecting Work Programme. All infrastructure to be developed will be mobile and temporary.

j) The technology to be used in the activity

In terms of technologies proposed, prospecting work will initially entail a high-level desktop study and potential desktop resource evaluation. This will include a data search of any previous drilling, trenching, sampling activities, exploration activities, existing maps and relevant historical data. Desktop studies to be undertaken would include studying of geological reports, prospecting data, plans/maps, aerial photographs, topography maps and any other related geological information regarding the specific area.

On successful completion of this desktop study, further possible drilling, trenching and resource estimations will be performed if the results warrant it. The type of invasive prospecting activities have been determined based on the historic success of the methods to be utilised. The prospecting activities are, however, dependent on the preceding phase (non-invasive) as indicated above and therefore no alternatives are indicated, but rather a phased approach of trusted prospecting techniques.

Diamond core drilling is planned to be executed on a phase by phase basis. Planned borehole depths will be determined during the desktop study, but it is estimated that drilling activities will be conducted down to relatively shallow depths. Logging and sampling of the borehole core will be performed to evaluate the area. Trenching will involve the digging of excavation trenches down to approximately 3 metres below surface using graders and excavators. Mapping of the trench walls will then be performed.

k) The operational aspects of the activity

No permanent services including water supply, electricity, or sewerage facilities are required. All infrastructure to be developed will be mobile and temporary including generators, portable toilets and water tanks.

l) The option of not implementing the activity

According to Section 24 of the Constitution, a development must be ecologically sustainable and also support socio-economic development.

Not implementing the prospecting activities will result in a loss of information of mineral reserves present on the study area. Should economically feasible reserves exist on the study area and the applicant cannot prospect, the opportunity to utilise the reserves for future mining and brick-making will be lost, i.e. the minerals will be sterilised and resultant socio-economic benefits will be lost.

The proposed prospecting activities have the potential to have a negative impact on the ecological environment as well as the social environment of the area. These impacts, however, can potentially be prevented, minimised, mitigated and managed to low and very low levels, as shown through the impact assessment.

ii) Details of the Public Participation Process Followed

(Describe the process undertaken to consult interested and affected parties including public meetings and one on one consultation. NB the affected parties must be specifically consulted regardless of whether or not they attended public meetings. (Information to be provided to affected parties must include sufficient detail of the intended operation to enable them to assess what impact the activities will have on them or on the use of their land)

A Public Participation Process is undertaken for the proposed prospecting. The process is undertaken to ensure compliance with regard to the requirements in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) [as amended] (MPRDA), the National Environmental Management Act, 1998 (Act No. 107 of 1998) [as amended] (NEMA), the National Environmental Management: Waste Act, 2008 (Act No 59 of 2008) [as amended] (NEMWA), the

National Water Act, 1998 (Act No. 36 of 1998) [as amended] (NWA) and Environmental Impact Assessment Regulations (2014) [as amended].

Tasks undertaken for the Public Participation Process (PPP)

This section of the report provides an overview of the tasks undertaken for the PPP to date. All PPP undertaken is in accordance with the requirements of the NEMA requirements and EIA Regulations (2014) [as amended]. It further provides an outline of the next steps in the PPP and makes recommendations for tasks to be undertaken during the environmental assessment phase of the environmental authorisation process.

The PPP tasks conducted for the proposed prospecting project to date include:

IDENTIFICATION OF KEY INTERESTED AND AFFECTED PARTIES (AFFECTED AND ADJACENT LANDOWNERS) AND OTHER STAKEHOLDERS (ORGANS OF STATE AND OTHER PARTIES)

Public Participation is the involvement of all parties who are either potentially interested and / or affected by the proposed development. The principle objective of public participation is to inform and enrich decision-making. This is also its key role in this BA process.

Interested and Affected parties (I&APs) representing the following sectors of society have been identified:

- National, provincial and local government;
- Agriculture, including local landowners (affected and adjacent);
- Community Based Organisations;
- Non-Governmental Organisations;
- Water bodies;
- Tourism;
- Industry and mining;
- Commerce; and
- Other stakeholders.

FORMAL NOTIFICATION OF THE APPLICATION TO INTERESTED AND AFFECTED PARTIES (INCLUDING ALL AFFECTED AND ADJACENT LANDOWNERS) AND OTHER STAKEHOLDERS

The project was announced as follows:

- Newspaper advertisement

Publication of media advertisement (English) in the Heidelberg Nigel Heraut 7 November 2019. *Refer to Appendix 5.1 for proof of newspaper notice placement.*

- Site notice placement

In order to inform surrounding communities, affected and adjacent landowners of the proposed development, two site notices were erected on site and at visible locations close to the site on 7 November 2019. *Refer to Appendix 5.2 for proof of site notice placement.*

- Written notification

I&AP's and other key stakeholders, who included the above-mentioned sectors, were directly informed of the proposed development by e-mail on 7 November 2019. I&APs were given 30 days to comment and / or raise issues of concern regarding the proposed development. The commenting period expired on the 7 December 2019. *Refer to Appendix 5.3 for proof of email notification.*

- Notification to and consultation with landowners and/or lawful occupiers.

CONSULTATION AND CORRESPONDENCE WITH I&AP'S AND STAKEHOLDERS

All I&AP registrations and comments that are received from stakeholders are formally recorded in the Comments and Responses Report. *Refer to Appendix 5.4 for comments and responses.*

Draft Basic Assessment Report (BAR) and Environmental Management Programme (EMPR)

The Draft BAR and EMPR are herewith released for a period of 30 days from 7 November 2019 to 7 December 2019.

Hard copies of the Draft BAR and EMPR are herewith submitted to all organs of state and relevant authorities. In addition, copies are placed at Nigel Local Library, and on the ENVASS website (www.envass.co.za). Refer to Appendix 5.5 for proof of notification of the basic assessment report review period and submission to relevant parties.

NEXT PHASES OF THE PUBLIC PARTICIPATION PROCESS

All comments received from I&APs and organs of state and responses sent will be included in the final BAR and EMPR to be submitted to the Competent Authority (CA).

Once the BAR and EMPR are submitted, the CA will have 107 days to reach a decision on the application. Thereafter the registered I&APs will be notified of the CA's decision.

Summary of issues raised by I&APs

(Complete the table summarising comments and issues raised, and reaction to those responses)

Table 6: Summary of issues raised

Interested and Affected Parties **List the names of persons consulted in this column and mark with an X where those who must be consulted were in fact consulted.**		**Date Comments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status** (consensus dispute, not finalised, etc)
<u>AFFECTED PARTIES</u>					
Landowner/s					
Lawful occupier/s of the land					
Landowners or lawful occupiers on adjacent properties					
Municipal councillor					
Local Municipality – City of Ekurhuleni Metropolitan Municipality					
District Municipality – N/A					
Organs of state (Responsible for infrastructure that may be affected Roads Department, Eskom, Telkom, DWS etc.					

Interested and Affected Parties List the names of persons consulted in this column and mark with an X where those who must be consulted were in fact consulted.		Date Comments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc)
Communities					
Dept. Land Affairs					
Traditional Leaders					
.					
Dept. Environmental Affairs					
Other Competent Authorities affected					
OTHER AFFECTED PARTIES					
INTERESTED PARTIES					

9. The Environmental attributes associated with the alternatives

(The environmental attributes described must include socio-economic, social, heritage, cultural, geographical, physical and biological aspects)

Baseline Environment

(1) Locality

The proposed development is planned to be situated on Portion 9 of Farm Vlakfontein 281 IR within the Ekurhuleni Metropolitan Municipality of the Gauteng Province of South Africa. The study area was located in the suburb of Marievale between the towns of Springs and Nigel on an existing South African Army golf course at centre point 26° 20’ 41.07” S, 28° 29’ 31.68” E

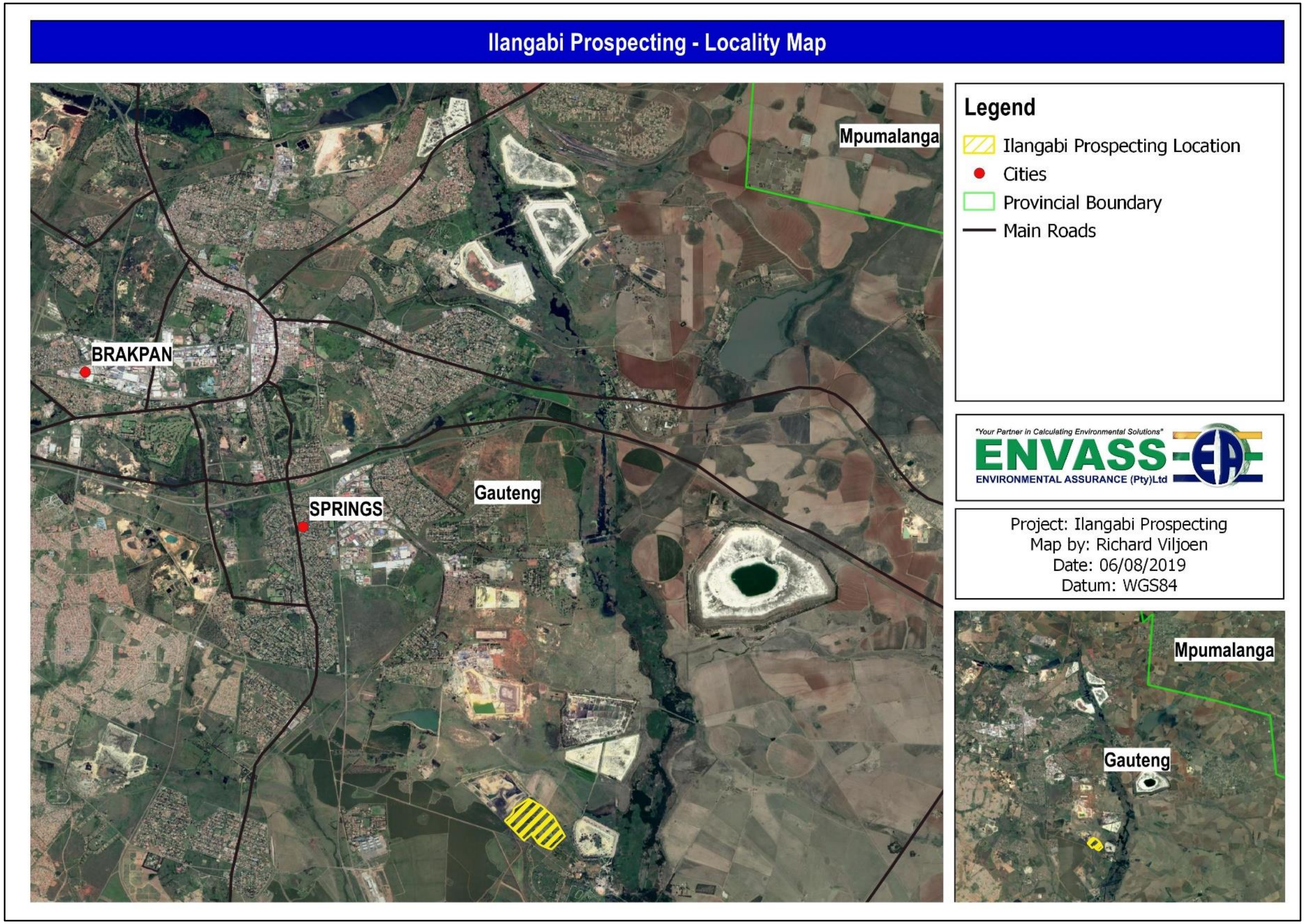


Figure 2: Regional Locality Map of the Study Area

(a) Type of environment affected by the proposed activity.

(It's current geographical, physical, biological, socio- economic, and cultural character)

Gradient and landscape context

The average elevation for the Moot Plains Bushveld, in which the majority of the study area is located, varies between 1050 and 1450 mamsl while the elevation for the Gold Reef Mountain Bushveld, in which a small section of the study area is located, varies between 1200 and 1750 mamsl. The topography of the study area is characterised by flat terrain and the average elevation is 1320 mamsl and it is noted that the northern boundary is more elevated as it borders the Magaliesberg. The most prominent geomorphological feature in the area is the Magaliesberg Mountain range, which runs from West to East immediately to the North of the study area. The Magaliesberg Mountain range is a National Protected Area. The Magaliesberg Mountain range rises to approximately 1800 mamsl at its highest point.

Geology and Soils

Figure 3 below illustrates the geological units that were recorded to be underlying the study area, and consequently providing the parent material from which the overlying soils were created. It was evident that the study area was underlain by two (2) lithostratigraphic units, namely the: Dwyka Group overlain by the Vryheid Formation of the Karoo Group. The Dwyka Group was recorded to have been deposited between 280 and 310 millennia ago (ma) within the Palaeozoic Era of the Phanerozoic Eon and consists of diamictite with varved shale, mudstone with dropstone and fluvioglacial gravel towards the north. The Vryheid Formation, which forms part of the Ecca Group of the Karoo Supergroup, was recorded to be deposited between 260 and 279 ma within the Permian Period of the Palaeozoic Era within the Phanerozoic Eon. This lithostratigraphic unit consisted of fine to coarse-grained sandstone, shale and coal seams in the upper layers.

Both of the abovementioned lithostratigraphic units can be described at moderately-to-highly impermeable underlying sequences that weather to create low permeable soils that exhibit low-to-moderate particle cohesion, and thus low-to medium moisture retention properties.

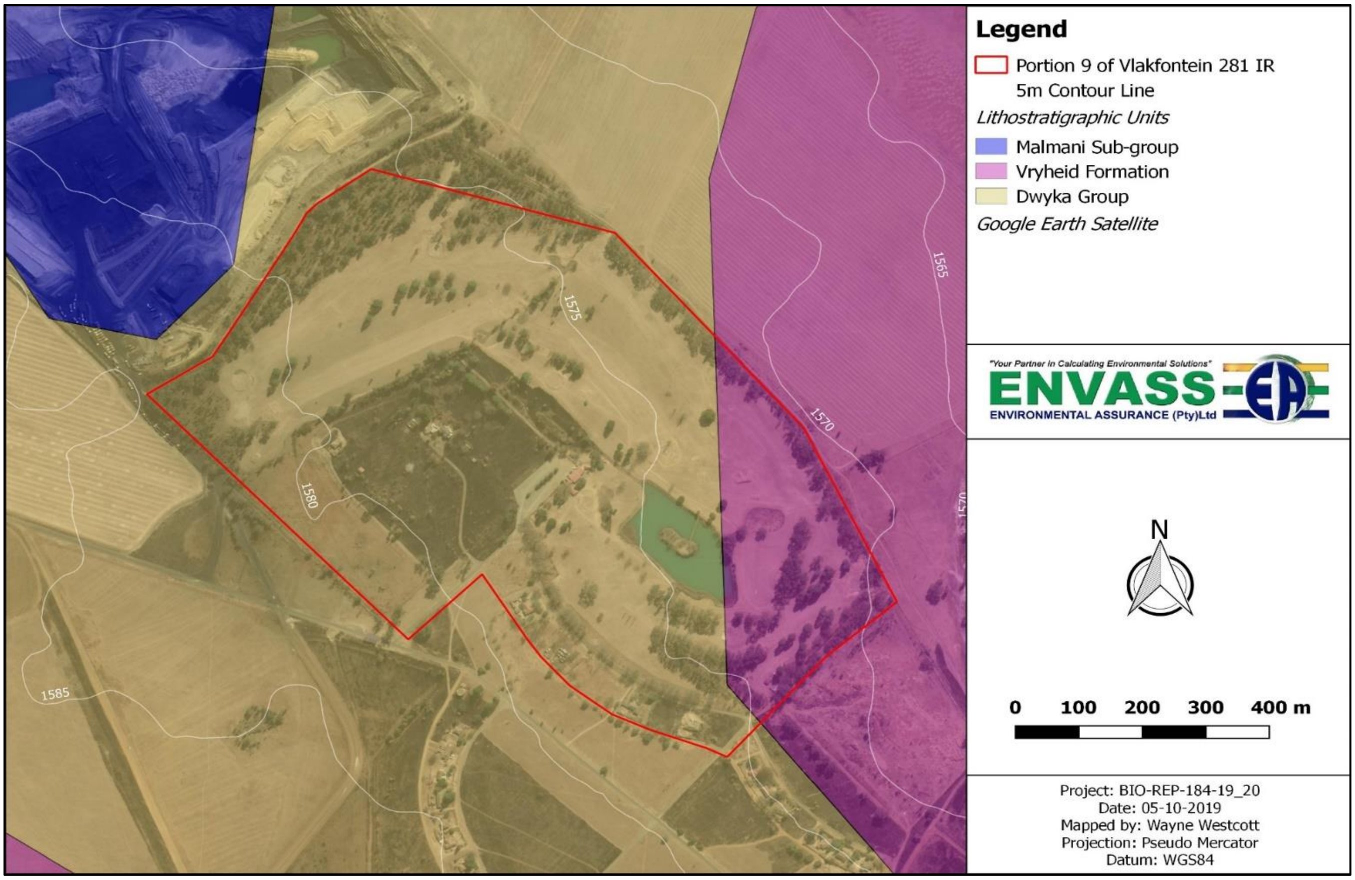


Figure 3: Lithostratigraphic units applicable to the study area (Council of Geoscience, 2008).

Figure 4 below illustrates the soil groups that were recorded to be within the study area. It is evident that soil group C formed the majority of the material overlying the abovementioned lithostratigraphic units (Macfarlane & Bredin, 2016). This group exhibited characteristics of moderately-high inherent runoff potential, very slow infiltration rates and severely restricted permeability. This coupled with the impermeable sub-terrain geologies may result in subsurface flow occurring above the B soil horizon during and subsequent to heavy rainfall events.

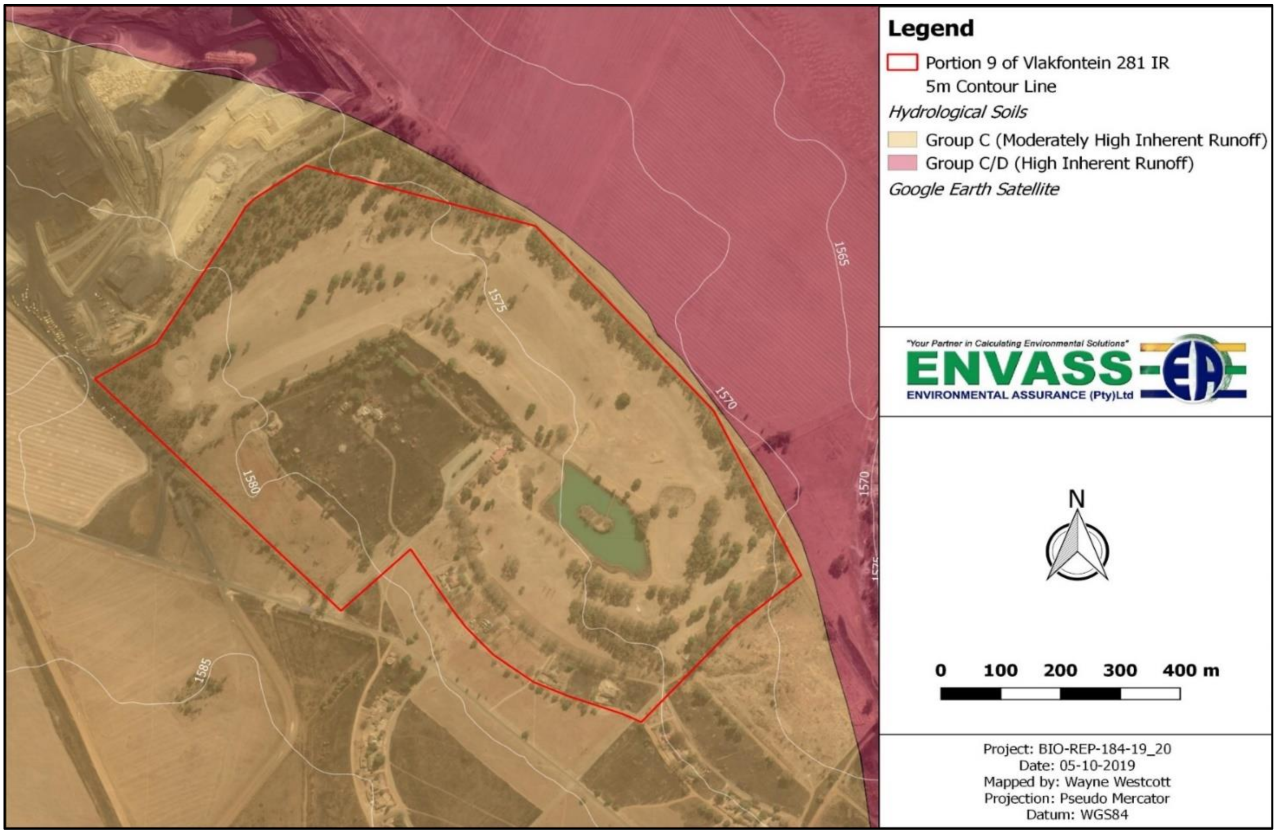


Figure 4: Hydrological soil classes and their inherent runoff potential within the study area (Macfarlane & Bredin, 2016).

Climate

Regional Climate

The City of Ekurhuleni is situated in the Highveld Climatic Zone, which is a temperate climate with a summer rainfall season. Temperatures vary between a minimum of 3°C in winter to maximum of 30°C in summer. The mean annual rainfall is 650 mm in the western region and 900 mm in the eastern region of the zone.

Precipitation is mainly in the form of thunderstorms in the summer months (October to March). Thunderstorms appear frequently and are often violent with severe lightning and strong winds, with occasional hail. The winter months (April to September) are normally dry.

The mean daily maximum temperature is approximately 27ºC in January and 17ºC in July. However, maximum temperatures may rise to approximately 38 ºC in January and 26 ºC in July. The mean daily minimum temperatures vary between approximately 13 ºC in January and 0 ºC in July. The average daily minimum temperatures range from about 13ºC in January to 0º in July, whereas extremes may plunge to 1ºC in January and -13ºC in July. Frost is likely to occur between May and September.

Local Climate

The average annual rainfall for Pretoria is roughly 573 mm per year. The average maximum temperature for the study area ranges from 18.3 ºC in June to 27.5 ºC in January. The lowest temperatures occur during July when an average of 1.7 ºC is reached during the night (SA Explorer accessed 24/10/2017). The predominant wind direction in the region is from South-West (SW) to North-East (NE).

Surface Water

The study area was observed to fall within quaternary catchment C21E, within the Downstream Vaal Dam Sub-Water Management Area (WMA) of the greater Upper Vaal WMA (***Figure 5***). The study area was recorded to have been situated in the C21E- 1442 Blesbokspruit Sub-Quaternary Reach (SQR), which was observed to have had a Present Ecological State (PES) score falling within Class C (Moderately modified) and have been of a moderate Ecological Importance and Ecological Sensitivity within the broader catchment area (DWS, 2012). The primary land-use practices that were observed to have impacted on the overall PES of the SQR were agricultural practices and gold mine towards the lower reaches (DWS, 2012).

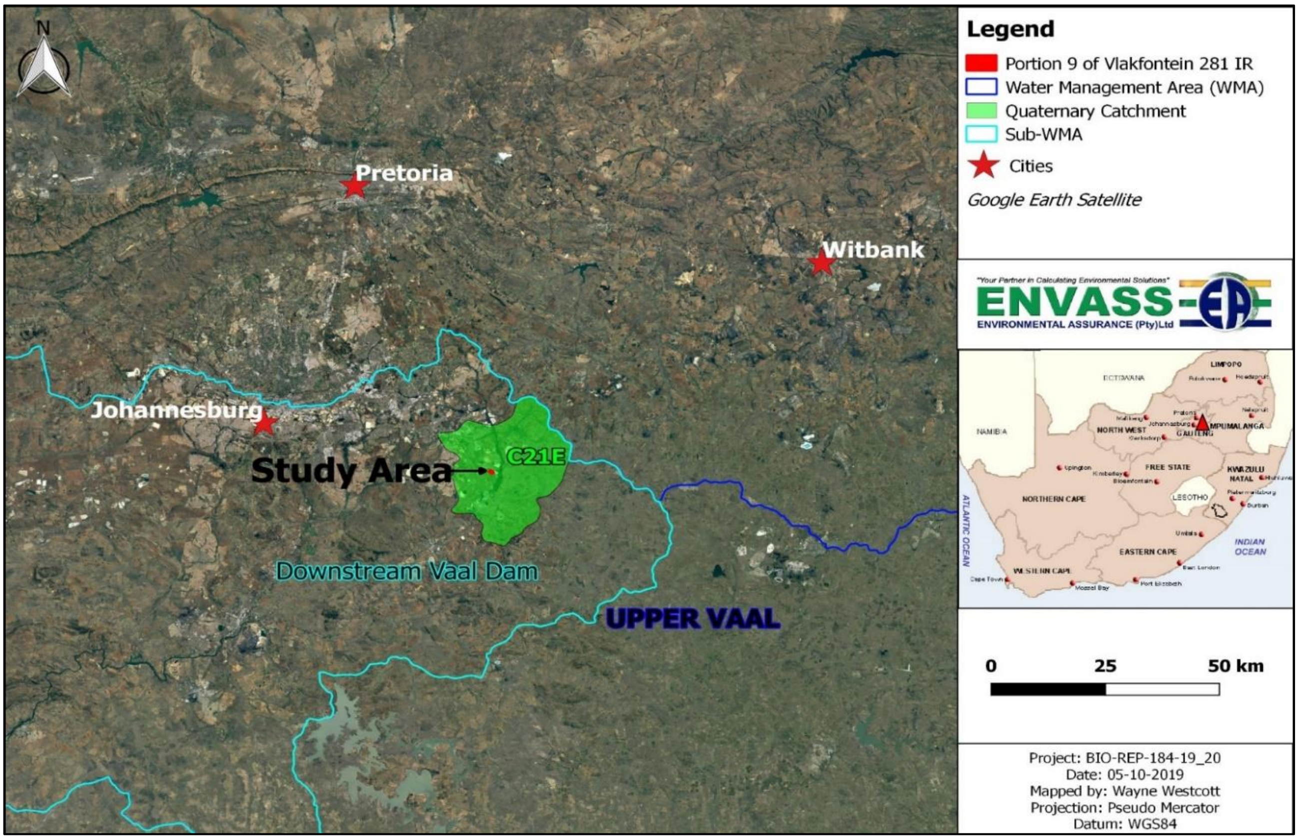


Figure 5: Presentation of the WMA, sub-WMA and catchments relevant to the study area (SANBI, 2017).

Biodiversity

The information in this section has been obtained from the Ecological Assessments by ENVASS (Westcott, 2019)
Environmental Assurance (Pty) Ltd was appointed by Ilangabi Investments 12 (Pty) Ltd to undertake an ecological baseline assessment for the remaining semi-natural area on the study area.

The study area consists mostly of natural vegetation with a few residential houses and their associated structures present. The study site falls on six (6) portions of land. Each contains houses and their associated structures. The main land use is residential, with roads, fences and power lines present on site.

Ecoregion

According to the delineation provided by Dallas (2005), the level 1 ecoregion in which the proposed development was situated was the Highveld ecoregion (no. 11) Kleynhans et al. (2005) describes the ecoregion to consist of a diverse range of morphological types with plains of moderate to low relief, covered by various grassland vegetation types, defining this high-lying region. The average altitude varied from 1100 to 2100 Mean Average Metres Above Sea Level (mamsl) and the major rivers that had cut through the landscape included: Vet, Modder, Riet, Vaal, Olifants, Steelpoort, Marico, Crocodile and Great Usutu. Table 7 below presents the primary characteristics and data that have been collected for the Highveld ecoregion.

Table 7: Highveld Ecoregion attributes (Kleynhans et al., 2005)

MAIN ATTRIBUTES	HIGHVELD
Terrain morphology: Broad division (dominant types in bold (Primary)	**Plains; Low Relief; Plains; Moderate Relief;** Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to High Relief
Vegetation types (Dominant types in bold)	Mixed Bushveld (limited); Rocky Highveld Grassland; **Dry Sandy Highveld Grassland;** Dry Clay Highveld Grassland; **Moist Cool Highveld Grassland;** Moist Cold Highveld Grassland; North Eastern Mountain Grassland; Moist Sandy Highveld Grassland; Wet Cold Highveld Grassland (limited); Moist Clay Highveld Grassland; Patches Afromontane Forest (very limited)
Altitude (mamsl) (secondary)	1100-2100, 2100-2300 (very limited)
MAP (mm) (modifying)	400 to 1000
Coefficient of Variation (% of annual precipitation)	<20 to 35
Rainfall concentration index	45 to 65
Rainfall seasonality	Early to late summer
Mean annual temp. (°C)	12 to 20
Mean daily max temp. (°C) February	20 to 32
Mean daily max temp. (°C) July	14 to 22
Mean daily min. temp. (°C): February	10 to 18
Mean daily min. temp. (°C): July	-2 to 4
Median annual simulated runoff (mm) for quaternary catchment	5 to >250

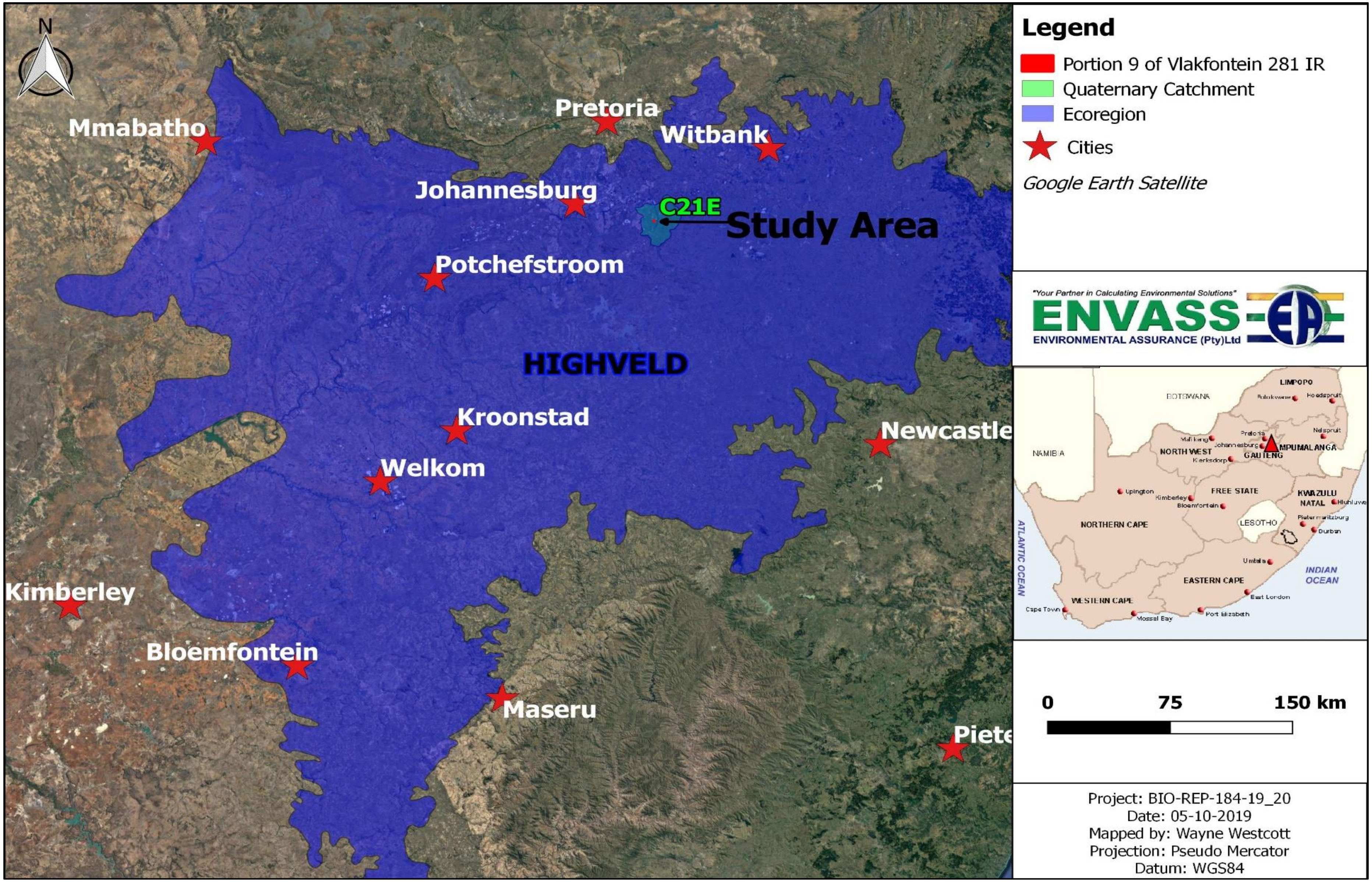


Figure 6: Ecoregion recorded to have been applicable to the study area (DWS, 2012).

Vegetation and Ecosystems

The vegetation communities recorded to be within the study area were observed to have been significantly altered in comparison to the reference state, as formulated using the broad vegetation units presented in the SANBI (2006-18) dataset and discussed within Mucina and Rutherford (2006-12). Consequently, the vegetation recorded on-site can no longer be considered a true representation of the endangered Tsakane Clay Grassland vegetation unit. During the brief field survey, the recreational golf course that encompassed the entire study area was observed to have been dominated by grass species along the fairways and in the rough, with woody Eucalyptus grandis and Pinus patula tree species surrounding the site and intermittently spaced along the fairways. The grass species that were identified within the study area included; Themeda triandra, Hyparrhenia hirta, Microchloa caffra, Heteropogon contortus, Elionurus muticus and several Eragrostis species. The indigenous Vachellia karroo (Sweet Thorn) tree species was also recorded in three places within the study area, however no other indigenous tree species were identified within the site during the field survey. This can presumably be attributed to the IAPS being planted in the golf course prior to historical vegetation clearing and subsequent landscaping having occurred.

No Species of Conservation Concern (SCC) or protected species were encountered at the time of the assessment and the probability of SCC or protected species occurring within the study area is considered to be very low due to the current transformed state of the vegetation. The successful rehabilitation of the natural vegetation community and possible re-establishment of SCC or protected species within the study area is considered highly unlikely due to the current land use surrounding and within the study area, and due to the expected loss of the indigenous seedbank following years of historic cultivation and subsequent construction of the current golf course

Faunal Assessment

As previously mentioned, the portion of the Tsakane Clay Grassland vegetation unit in which the study area was situated was recorded to have been significantly degraded, and consequently encroached upon by several IAPS. As a result of the continued cutting of the grassland areas, open landscape, movement of machinery and humans within the study area the site did not present suitable habitat for faunal species to seek refuge in. Additionally, the lack of open water sources away from existing human disturbance and any rocky areas presumably limited the movement and likelihood of occurrence of amphibious and reptilian species within the site. The woody species on-site, such as Eucalyptus grandis, Pinus patula and Vachellia karroo, were however recorded to have provided refuge, to some degree, to several avifaunal species. It is recommended that these species remain, until such time as a change in land-use is evident, which may present an opportunity to rehabilitate the current floral composition to a near-natural state with the guidance of a rehabilitation plan.

A proactive approach could be adopted by the current landowner in an effort to comply with General Notice 864 (GG 40166, 2016), which was drafted under the National Environmental Management Plan: Biodiversity Act (Act no. 10 of 2004), to ensure that all alien and invasive species are eradicated. As Eucalyptus grandis is listed as a Category 1b in the Grassland Biome, as well as any area that has been listed for conservation in terms of a Bioregional Plan (i.e. the ESAs on-site). When adequate budget is available, it is recommended that indigenous tree and shrub species be planted intermittently in between and around the Eucalyptus species and the IAPS be cut down when the newly planted species have reached an adequate height (i.e. >3m). This will provide alternative refuge for faunal and avifaunal species within the study area. However, as the client does not have a responsibility on the study area under this project the abovementioned recommendation will need to be discussed separately with the landowner.

Due to the fact that the majority of faunal species are either nocturnal, hibernators, secretive and/or seasonal it is increasingly difficult to confirm their presence or absence by means of actual observations alone. Therefore a number of authoritative tomes such as field guides, databases and scientific literature were utilised to deduce the probable occurrence of faunal species. The Virtual Museum (http://vmus.adu.org.za/) was consulted to verify the records and occurrence of recorded mammal species within the QDSs 2628AD. The following sections will provide lists of potential mammals, herpetofauna (amphibians and reptiles) and invertebrate species that have the potential to occur within the study area. It must be noted that due to the briefness of the field survey for ground-truthing purposes, few species were recorded on-site.

Mammals

The occurrence of mammal species is largely dependent on the availability and diversity of habitats, such as vegetated areas, rocky outcrops, arboreal, wetlands and/or rivers, within the study area, or region. Therefore, the presence or potential for mammals to occur within a specific study area can be inferred by assessing the habitat types on-site considering their known distribution ranges. The lack of habitat availability and diversity within the study area associated with this project drastically reduced the probability of occurrence and refuge identified to provide suitably sleeping, breeding and forging for mammal species. As the proposed point-impact development would not result in a significant destruction of altered highly degraded habitat it would pose little risk to the sparse existing mammal population

Herpetofauna

The majority of herpetofauna species are nocturnal, poikilothermic secretive and seasonal, which makes it difficult to observe them during field surveys. Therefore, to determine the probability of occurrence of the amphibian and reptile species within the study area field guides, scientific literature, atlases, databases and respected books were consulted to obtain information relevant to the study area

Invertebrates

Invertebrate species are usually small, poikilothermic, and seasonal, which makes them difficult to observe during field surveys. As this survey was conducted in the beginning of spring, it was unlikely that a high abundance of invertebrate species would've been identified on-site. The primary habitat on-site that may be suitable to hemi-metabolous invertebrates to complete their lifecycle would be the artificial dam that was situated towards the south east, in which nymphs/juveniles could thrive. As this site will not be disturbed by the proposed development, these species may not be at risk of being impacted on by the associated activities. Only the endangered Chrysoritis aureus (Heidelberg opal) has the potential to occur within the study area, however none were observed during the field survey

Conclusion of the ecological scan

Subsequent to conducting a brief once-off field survey of the study area on the 11th of September 2019, the site was recorded to have been significantly degraded in comparison to its formulated reference state. It was assumed that the current land use as a recreational golf course stemmed from the historic clearing of natural vegetation, landscaping of the soil profile and subsequently planting of Eucalyptus grandis, Pinus patula and Salix babylonica woody species along and around the fairways and now dry water features. This has resulted in the drastic reduction of biodiversity within the study area and consequent destruction of potential faunal refugia, as well as severe encroachment by several IAPS. Overall, the state of the flora and fauna that was recorded within the study area was not representative of the reference conditions formulated through a review of the desktop information and during the ground-truthing exercise.

- It is the specialist's recommendation that the proposed prospecting continue within the study area, provided that the following preventative and mitigation measures are implemented:
  - Existing access roads must be utilised by the drilling rig and associated Trackless Mobile Machines (TMMs). If the TMMs traverse outside of the existing routes and cause disturbance and/or destruction of the vegetation, the disturbed areas must be tilled and revegetation with a mixture of indigenous grass species, such as Themeda triandra, or Eragrostis curvula which can both be obtained from a commercial nursery.
  - The disturbance area at the proposed drilling sites must be limited to the core area, which must be encircled with orange barrier netting to avoid human and faunal species falling within the core holes, and all excess sediment around the mouth is to be backfilled in the holes. In instances where the excess sediment does not cover the mouth of a hole, the core hole must be capped with a wooden plank cut to just larger than the hole. This cap must be implemented by excavating the top layer of soil to an approximate depth of 200mm, inserting the cap, backfilling, compacting the surface slightly and revegetation using the grass species previously cleared from the site.
  - All drilling activities must occur during the day time between the hours of 8am and 5pm to avoid continued disturbance to nocturnal faunal species.
  - No indigenous woody species must be cut during the proposed development.

Cultural and Heritage

Cultural heritage desktop assessment (Coetzee 2019)

Coetzee (2019) conducted an archaeological desktop study. The aim of the report was to contextualise the general study area in terms of heritage resources to provide the developers with general information regarding potentially sensitive areas. The purpose of the study was to determine the scope of heritage resources that might be encountered during the prospecting phase and subsequent heritage studies, as well as to provide recommendations for the safeguarding of archaeological resources during prospecting. Information regarding heritage resources in the vicinity of the study area based on results from previous studies and written historical information is provided.

The study area: Portion of Portion 9 of the Farm Vlakfontein 281 IR (The former Marievale Engineers

Golf Club) As can be seen from previous research done in the area the general region is mostly significant from a heritage perspective in terms of mining history. Heritage sites are likely to include graveyards and historical buildings. Since heritage sites, such as graves, are not always clearly identifiable as it might consist of stone cairns, care must be exercised when prospecting.

Figure 7 indicates the study area on a recent aerial backdrop with structures/areas that are potentially sensitive from a heritage perspective indicated according to date first observed on aerial imagery. These areas were identified using historical areal imagery dating to between 1938 and 1953. The structures visible on the 1938 aerial image are at least 81 years old, the structures on the 1941 aerial image at least 78 years old and the 1953 structures at least 66 years old. All these structures, therefore exceed 60 years of age and are protected under Section 34 of the National Heritage Resources Act, 1999. Because the exact boundaries of these structures could not be established accurately from the aerial images, a conservation buffer of 50 m is recommended and indicated on Figure 7 to prevent prospecting causing damage to the structures. The Marievale Golf Course also first appears on the 1941 aerial image, making the general area significant from a heritage perspective.

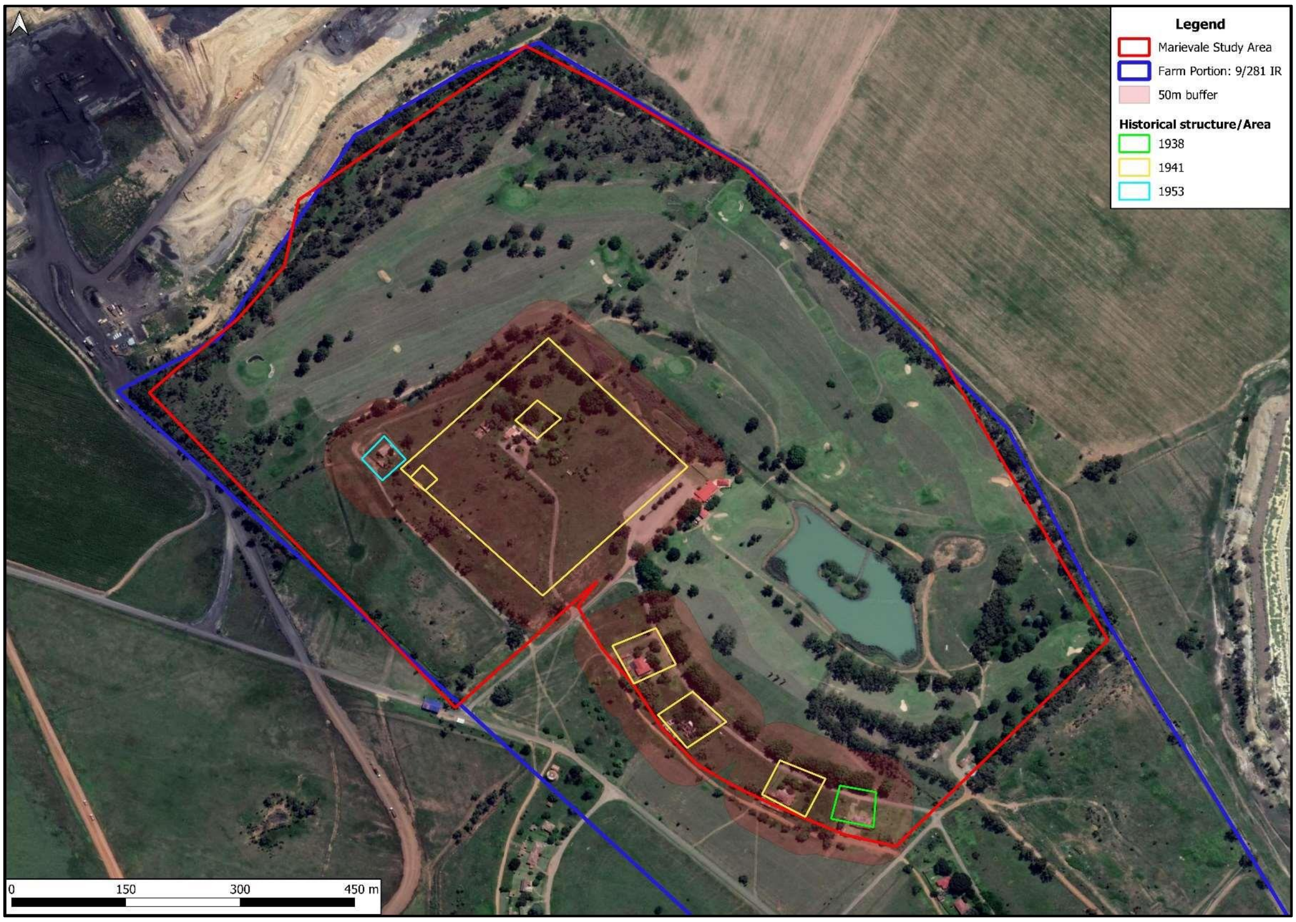


Figure 7 : Proposed prospecting site on a 2019 aerial backdrop.

Paleontological Assessments

Palaeontological Impact Assessment: Phase 1 Field Study (Fourie, 2019)

The area is not accessible, but could be viewed. It is disturbed due to being a golf course with lawns, trees, signboards and roads present. The property was viewed and it was found that it is situated on the Vryheid Formation, but the Dwyka Group is nearby (geological map). The drilling of 10 boreholes will have a small impact and it will give additional information about the depth of the formation. Boreholes are always drilled for the Geotechnical and Geohydrological studies during the Environmental Impact Assessment process and normally more than 10 holes are drilled.

There is no objection (see Recommendation B) to the development, but it was necessary to request a Phase 1 Palaeontological Impact Assessment: Field study to determine whether the development will affect fossiliferous outcrops as the palaeontological sensitivity is VERY HIGH. A Phase 2 Palaeontological Mitigation is only required if the Phase 1 Palaeontological Assessment identified a fossiliferous formation or surface fossils or if fossils are found during construction excavations and drilling. Fossils were not found during the walkthrough. The Protocol for Chance Finds and Management Plan is included in the EMPr section of this report.

Land Profile Report

Land Profile Report: Phase 1 Field Study (Strydom, 2019)

The study area is not located within a sensitive biodiversity area but is however located in close proximity to a wetland and the Marievale Protected Area.

The land capability of the study area and the surrounding area is high. The area is arable due to favourable soils and topographical properties. The recommended commodity is irrigated vegetables, should cultivation be considered.

Land capability zones were defined using agricultural suitability with respect to climate-, soils-, and topographical variables. Refer to previous paragraphs. For the study area (refer ***Figure 9***), 2 uniquely defined land capability zones were mapped.

These land capability units are unique with respect to agro-climate; -soils; and topographical capability.

High Potential Agricultural Land (HPAL), as defined by the Gauteng Agricultural Potential Atlas, is land with a land capability class of 8 or higher. The study area (and the surrounding areas) has a land capability class value of moderate to high (classes 8 – 10), as classified and zoned by both the national and provincial system. The study area land therefor qualifies as HPAL (excluding the current land use).

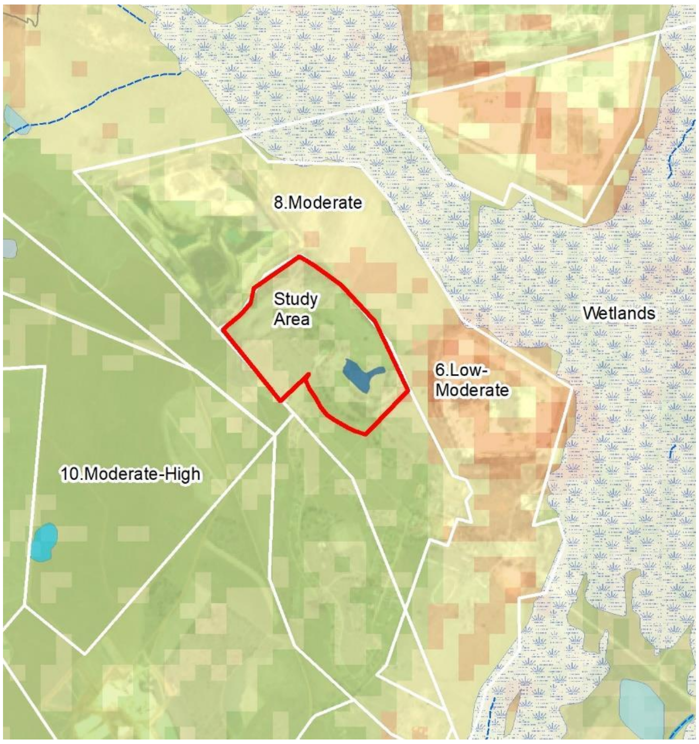


Figure 8 : National Land capability of the study- and surrounding areas.

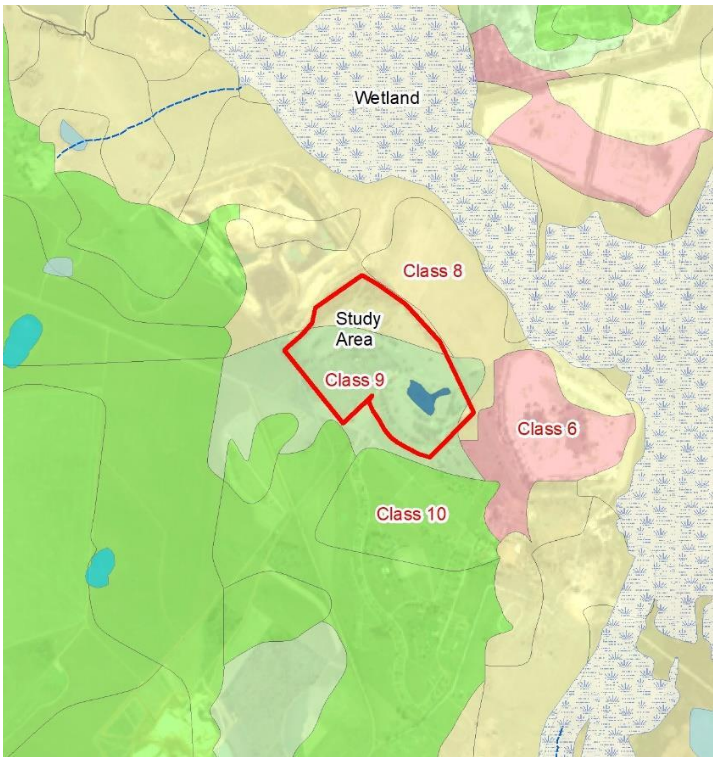


Figure 9: Land capability polygons- study area.

The area is however considered to be transformed to an extent that will severely limit the economic viability of any proposed cultivated farming practice. Agricultural infrastructure in support of the surrounding agricultural activities and the requirement of the Lesedi Agricultural Hub, could however be a consideration.

High Potential Agricultural Land (HPAL) is a scarce commodity in the Province that are protected. The study area land qualifies as HPAL.

The main constraint, considering cultivated agriculture, is the current land use and the resulting transformation status of the land.

The Land Profile Report concluded that:

- The study area land is arable when considering its soil and topographical properties.
- Considering rainfed, cultivated agriculture:
    - The land capability is high.
    - The soil capability is high.
    - The climate capability is moderate.
    - The topographical capability is high.
- The surface area of 64 ha will severely limit the economic viability of any agricultural practice.
- The existing land use (golf course) transformed the area into land that is considered sub- optimal for agricultural production.
- Any new farming activity on the land should be incorporated with an existing viable farming unit to increase the economic viability of the land.
- The recommended commodity is vegetables under irrigation.
- The area could be utilized for agricultural infrastructure in support of the surrounding agricultural activities (packhouse, etc.).
- The study area is located within the boundaries of the Gauteng Lesedi Agricultural Hub. The preferred land use within the boundaries of the Hub is cultivated agriculture or infrastructure
- development in support of agriculture.

Noise and Dust Sources

Noise sources and baseline

Prospecting and associated activities often emit significant noise levels which can become a nuisance or health risk when not properly managed. This impact may affect not only to the prospecting area, but also to the surrounding land users and occupiers. The most sensitive receptors identified for the project area are the landowners and lawful occupiers of the study area itself, surrounding communities including land users, mine workers, industry, residential areas and permanent small holding homesteads and settlements. The local area is predominantly occupied by mining, agricultural, military and residential land uses.

The main noise generation activities of the proposed activities during all phases are:

Construction phase:

- Construction of temporary water handling infrastructure and other required infrastructure; and
- Loading and off-loading of movable infrastructure.

Operational phase:

- Transportation of materials;
- Excavations;
- Drilling; and
- Loading and off-loading of equipment and materials.

Closure or care and maintenance phase:

- Limited amount of vehicles moving around the site; and
- Decommissioning of temporary infrastructure.

Noise generation can be expected on the proposed site due to various activities and actions as indicated above. Noise levels may possibly exceed allowed limits for noise as indicated in SANS 10103: 2008. The closest sensitive receptor is the homesteads on and immediately adjacent to the study area. Due to the close proximity of the homesteads to prospecting activities, mitigation measures are required to be implemented to reduce this impact. Mitigation measures may include keeping noisy activities to normal working hours and not over weekends or public holidays, and maintaining machinery and vehicles in order to avoid unnecessary excessive noise emanating. It is also recommended that consultations be held with affected parties in order to establish an acceptable schedule of noisy activities.

Dust Sources and baseline

The following sensitive receptors of dust have been identified and it is expected that these receptors may be affected by dust fallout and other air pollutants, resulting from the proposed prospecting activities:

- Landowners and lawful occupiers of the study area;
- Landowners and lawful occupiers of the properties adjacent to the study area;
- Surrounding communities including land users, mine workers, industry, residential areas and permanent agricultural holding homesteads and settlements including *inter alia*:
  - Ilangabi Vlakfontein mine to the west of the study area;
  - Dunotter Military Base to the south of the study area;

The main source of air pollution in the local area is the dust and other emissions emanating from the abovementioned Ilangabi Vlakfontein mine. The results of the measurement of current dust fallout levels indicate that the levels are below the allowed limits. The amount of dust fallout expected outside the study area is not significant. It is not expected that the air quality outside of the study area will deviate from its current condition during prospecting. Normal vehicular activity, as is already present, will most likely continue. There is, however, a risk that dust levels may increase as a result of the proposed activity and therefore mitigation measures will be recommended. Limiting the speed of vehicles on the gravel roads to 30km/h will have a threefold benefit in terms of health and safety: it will reduce dust fallout, reduce exhaust emissions and ensure the safety of workers. Another measure is to suppress dust by means of spraying water on the gravel roads.

Aesthetic Quality

It is important to bear in mind that determining a visual resource in absolute terms is not achievable. Evaluating a landscape's visual quality is both complex and challenging, as many quality standards apply and it is largely subjective, with individuals basing evaluations on experiences, their social level and their cultural background. Furthermore, natural features are inherently variable. Climate, season, atmospheric conditions, region and sub-region all affect the attributes that comprise the landscape.

Visual Absorption Capacity (VAC) can be described as the ability of an area to absorb physical modifications. Factors affecting VAC include *inter alia*, vegetation, the built environment, existing infrastructure and topography. In terms of these factors, the receiving environment is perceived to have a low to medium VAC.

The prospecting activities will not modify the physical characteristics of the landscape significantly, and can easily be rehabilitated upon completion. Prospecting on the property will not be totally out of place in the local area, as there are already existing mining activities occurring to the north of the study area and therefore, partially compatible with the surrounding land uses.

Socio-Economic Environment

Demographics

Ekurhuleni houses 6% of the country's population and 26% of Gauteng's. It has a resident population of approximately 3 178 470 million people and 1 015 645 million households (Stats SA, 2011 Census). The municipality has an annual population growth rate of 2.47%. Between 2001 and 2011, the number of households in Ekurhuleni increased by 36.1%, a figure which was above the average national growth of 35.7%. This growth in population holds serious service delivery implications since it translates into increased demand for municipal services **Figure 10** below shows the composition and size of the different population groups in Ekurhuleni. The municipality is home to 79% Africans, 16% Whites, 3 % Coloureds and 2% Indians.

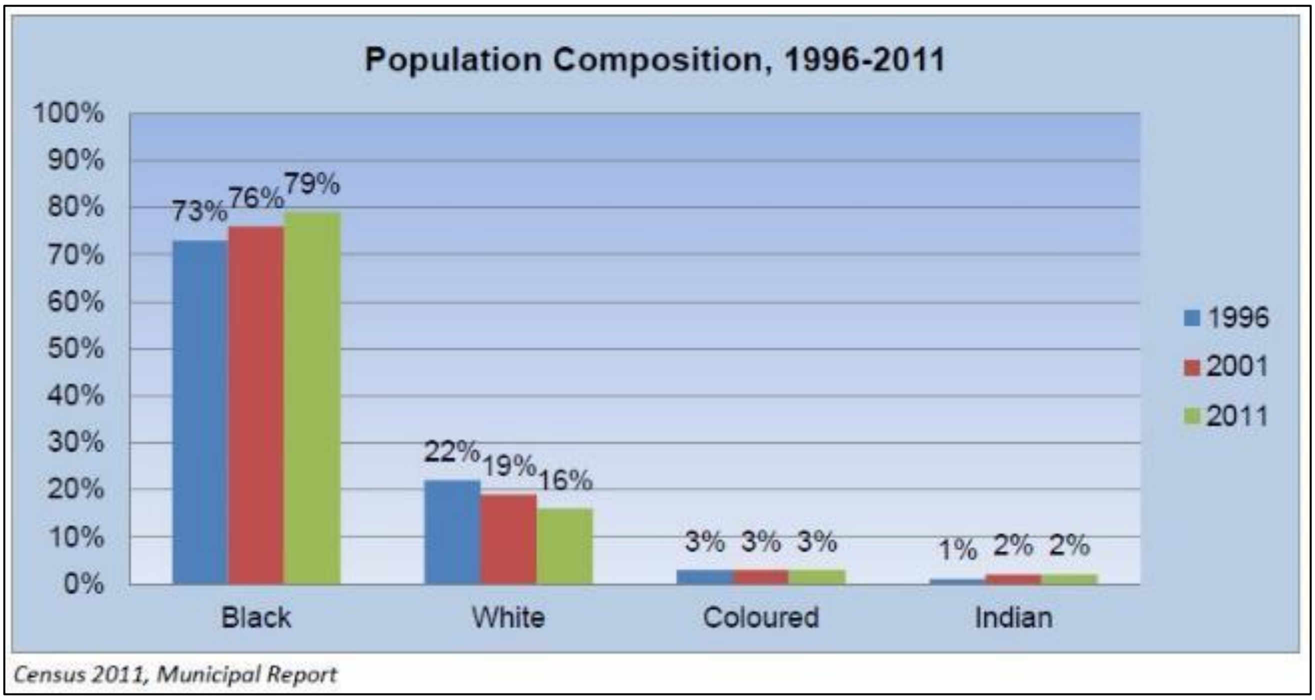


Figure 10: Population Composition

Ekurhuleni was expected to have a population of 3 485 697 at the end of 2016. Other projections based on the 2011 Census data indicate that by 2019 Ekurhuleni's population will reach 3 875 681. Germiston and Boksburg are the fastest growing towns in the municipality. The general population increase in the municipality is attributed to migration by those in search of job opportunities.

From **Figure 11** below it can be observed that a sizeable portion of the population group falls within the 0 to 4 years age group, which calls for more early childhood development facilities.

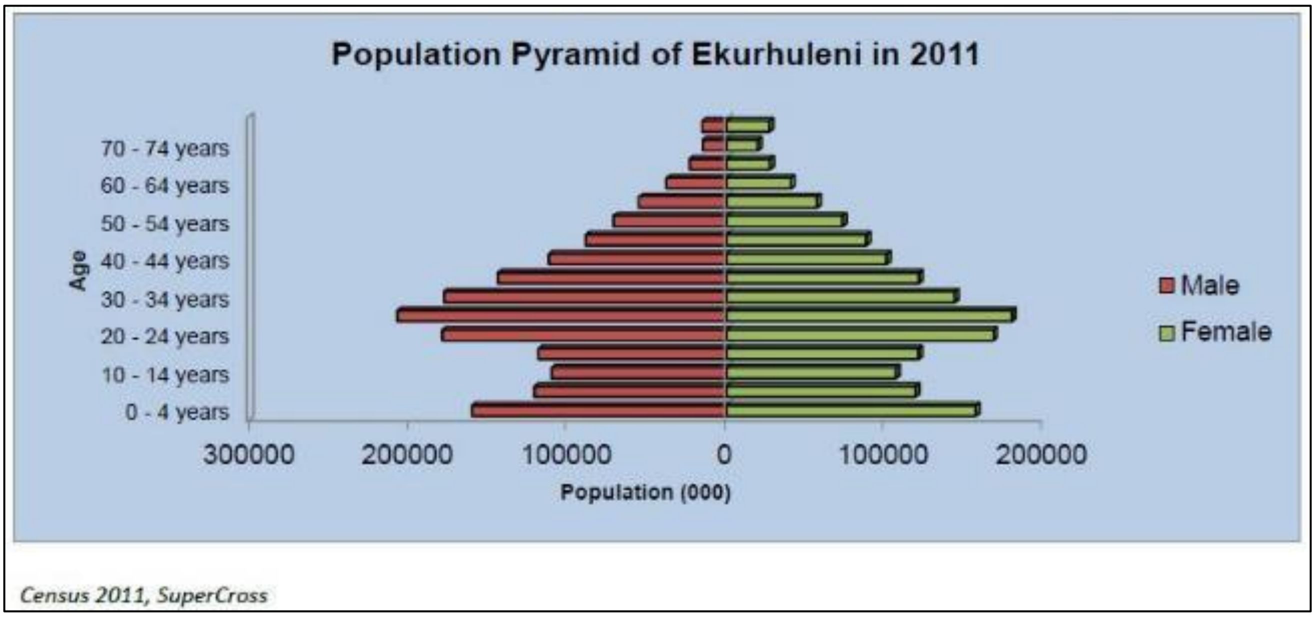
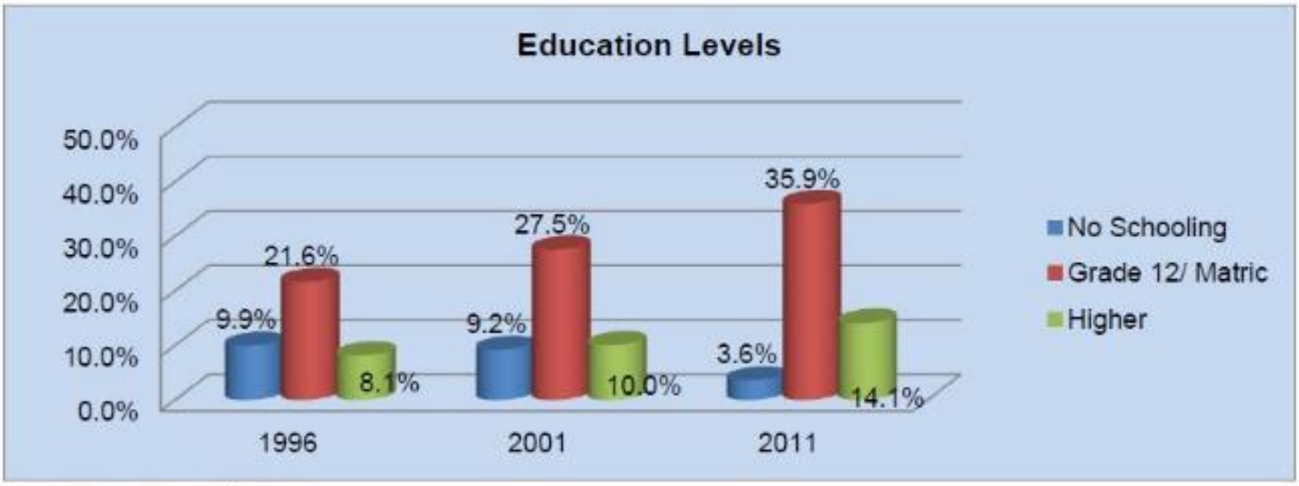


Figure 11: Age and Gender Distribution of the Ekurhuleni Metropolitan Municipality, 2011

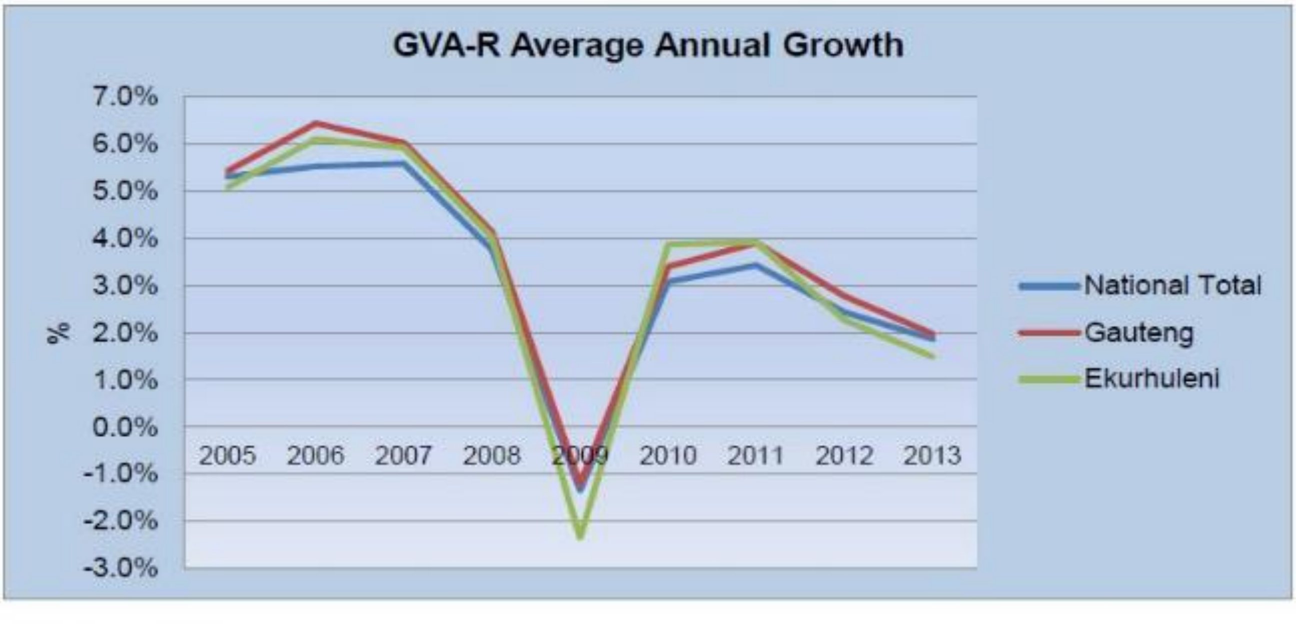
Education levels in the municipality increased consistently over the last few decades and with the 2011 Census 35.9% of the population had a Grade 12 Certificate (**Figure 12** below).



Census 2011, Municipal Report

Figure 12: Education levels in the Ekurhuleni Metropolitan Municipality

The municipality's economy has evolved since its heydays as an economy founded on mining. Today, the municipality faces a problem of illegal mining in old mining areas. Ekurhuleni has the largest concentration of industrial activity in Southern- and Sub-Saharan Africa. It is not a commercial and manufacturing hub of South Africa. The municipality's economic contribution to South Africa's GDP is 6%, and to Gauteng's economic output, 18%. Its contribution to national unemployment is 9%. The estimated average economic growth between 1997 and 2012 was 3.1%. The GDP in Ekurhuleni is forecasted to reach 2.7% by 2016. Over the period between 2005 and 2013, the economy of Ekurhuleni registered a steady growth following a slump from 2009 (***Figure 13***). It is evident for the figure that the growth trend over this period was volatile, reaching both lows of -2.3% and highs of 6.1% over the 8-year period.



Global Insight 2014

Figure 13: GVA-R Average Annual Growth of the Ekurhuleni Metropolitan Municipality

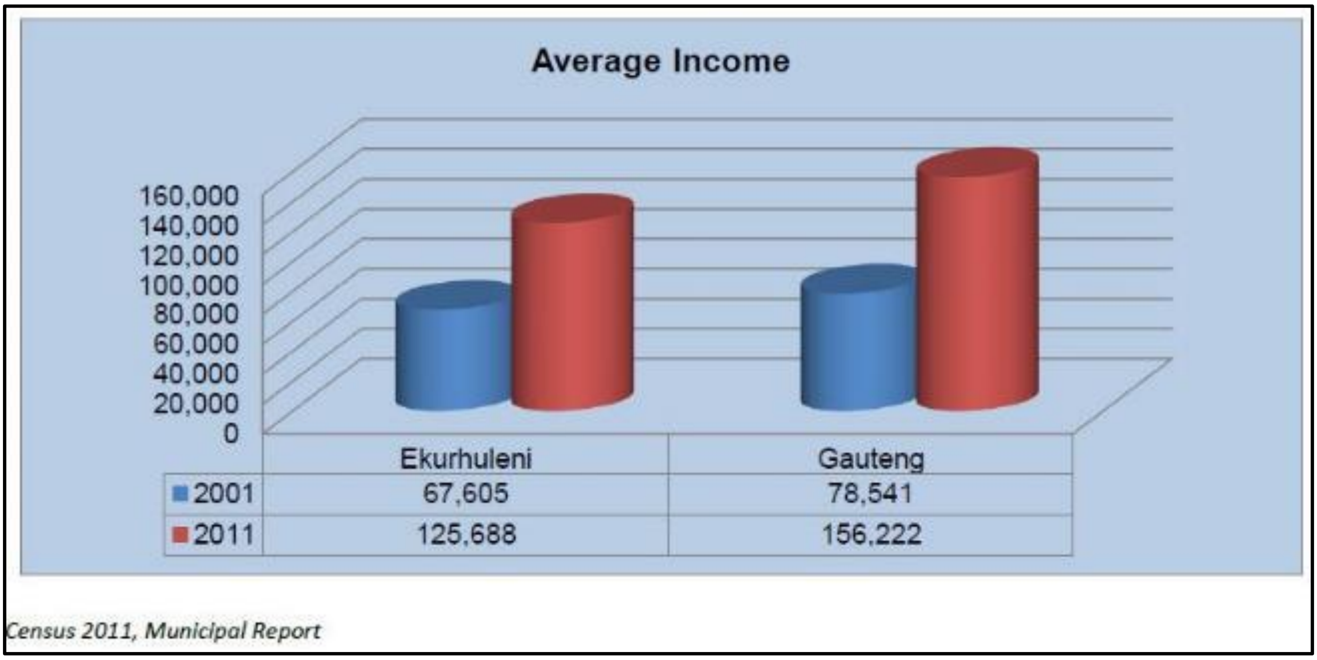
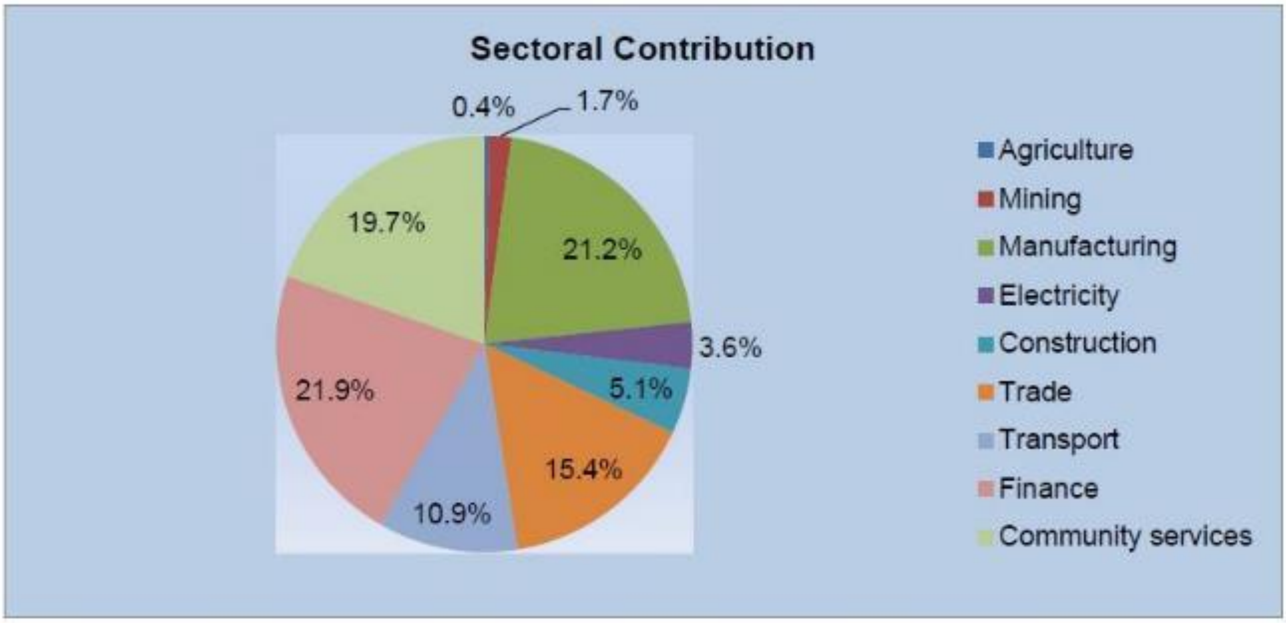


Figure 14: Average Income of households within the Ekurhuleni Metropolitan Municipality

In South Africa, high unemployment (25.4% in quarter three of 2014) coincides with low economic growth (1.4% in quarter three of 2014). The same conditions are evident in Ekurhuleni. The municipality has the highest unemployment rate in the Gauteng Province, compared to other metros. According to StatSA, unemployment in Ekurhuleni, currently stands at 28.8%. This is higher than the national rate and can be attributed, among other factors, to internal migration with individuals being attracted to Ekurhuleni in search of employment. 36.9% of the unemployed are youth. 72% of the population is economically active. Another factor contributing to unemployment in the municipality is the declining contribution of the manufacturing sector to the economy of the municipality. Ekurhuleni's manufacturing sector declined by 9.3% between 2004 and 2014. A closer look into manufacturing shows that the sub-sectors of fuel, petroleum, chemical, rubber, metal, machinery and household appliances suffered major declines during this period. However, manufacturing remains an important sector to Ekurhuleni's economy, specifically metal products, machinery and household appliances sub-sectors, which has been the main driver behind output (***Figure 15***).



Global Insight 2014

Figure 15: Economic Sectoral Contribution within the Ekurhuleni Metropolitan Municipality

Household income and per capita income exceed the national average by 10% and 33% respectively. The percentage of people living in poverty nationally is 44.4%, compared to 24.2% in Ekurhuleni (Source: Global Insight Regional eXplorer (ReX) v.351). Income levels in Ekurhuleni are above national average (which is to be expected for most urban areas in South Africa), but below that of the Gauteng province's average. In the northern service delivery region, 16% of households have no income, compared to 25% in the southern and eastern regions. In the north, 44% of households have an annual income of less than R19 200, compared to 60% in the southern and eastern regions. While the northern region has both high and low income, the latter in informal settlements, the eastern and southern regions are characterised by middle to high income areas, as well as low income in the informal settlements.

The majority of people living below the poverty line live on the urban periphery, far away from job opportunities and social amenities. Nearly a third of the approximately 1.5 million people living in Ekurhuleni live in poverty. Currently unemployment is estimated at 40%, which is unacceptably high. Many people are forced to resort to desperate measures in order to merely survive. The majority of people below the poverty line live on the urban periphery, far from mainstream job opportunities and urban amenities, and in informal settlements without basic services. In total, approximately 98% of all the people in Ekurhuleni that live below the poverty line are Africans. Although the Ekurhuleni community has a fairly high literacy rate (±84%), technical skills levels are low and not a good fit for the skills demands of the local economy in the area. The prevalent lack of skills and the low local economic growth rate has entrenched the cycle of poverty, deprivation and violence. Malnutrition, especially amongst children, remains a severe challenge, while a high rate of HIV/Adis and other poverty related diseases such as TB is experienced, especially in the peripheral townships and informal settlements. Health services within Ekurhuleni are rendered by the Gauteng Province, the Metro and the private sector. The Metro is primarily responsible for basic healthcare and runs a total number of 109 clinics (4 community health centers, 74 fixed clinics, 20 satellite clinics and 11 mobile clinics), throughout its area of jurisdiction. A high degree of functional integration with provincial health services has been achieved. Crime and domestic violence, including violence against women and children, are at unacceptably high levels, especially in some of the marginalized and poverty-stricken areas.

Parties to be potentially affected by the prospecting activities:

The majority of the landowners and occupiers likely to be affected by the prospecting activities will be residents on agricultural holdings on and immediately adjacent to the study area. Other industries and landowners likely to be affected include *inter alia*:

- Vlakfontein Mine west of the study area;
- Dunotter Military Base to the south of the study area;

(b) Description of the current land uses

The majority of the study area is a golf course for the Dunotter military Base. A few military houses and buildings occur on the study area (refer to Figure 20. Surrounding land uses include *inter alia:*

- Ilangabi Vlakfontein mine to the west of the study area;
- Dunotter Military Base to the south of the study area;

Figure 16: Natural veld along perimeter.

Figure 17: Road on the site.

Figure 18: Natural veld towards the north-western part of the site

Figure 19: View from north towards the proposed site.

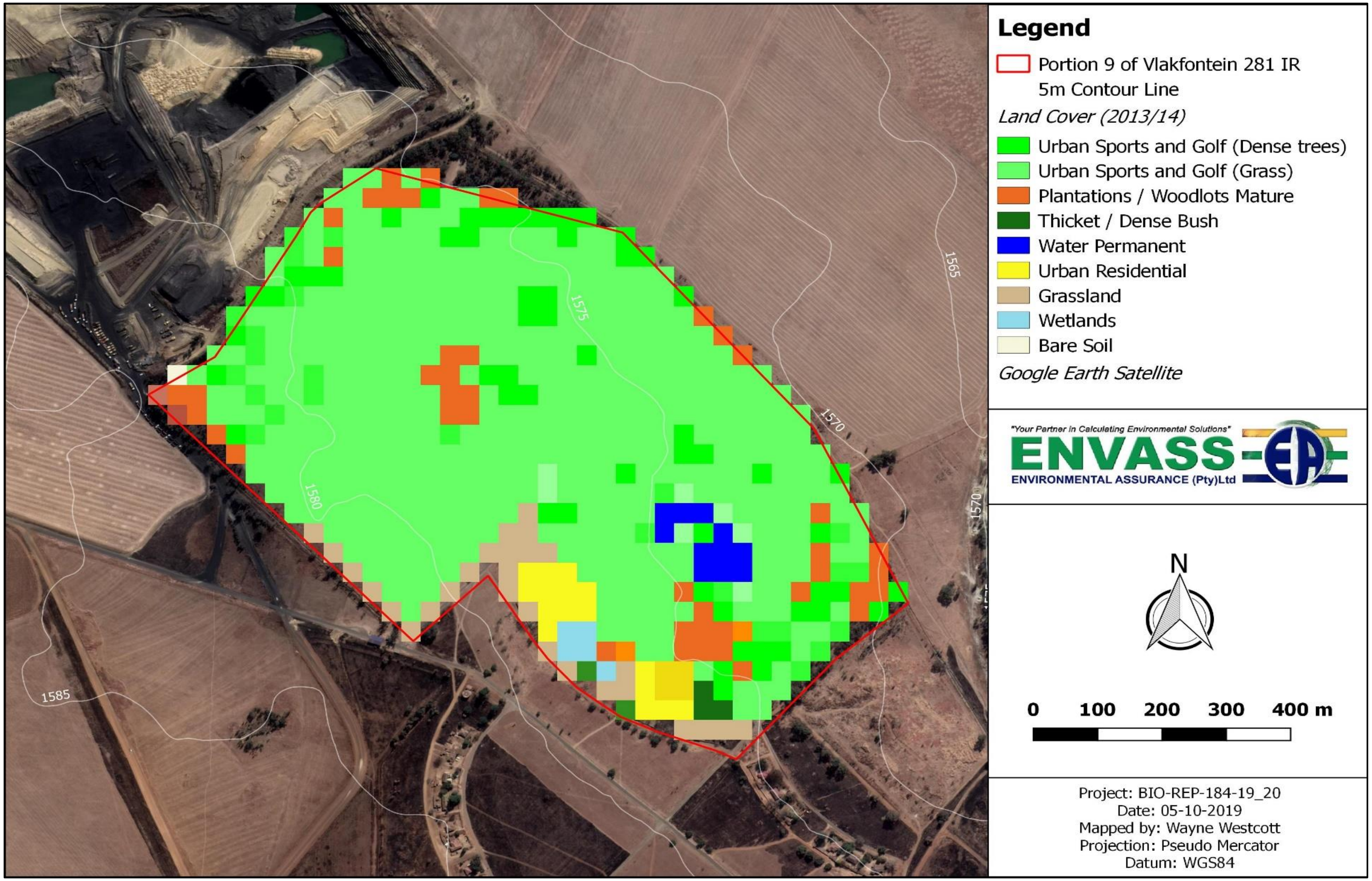


Figure 20: Land Use Classes of the Study Area

(c) Description of specific environmental features and infrastructure on the site

Environmental Features

The major sensitive features within the study area include:

- Houses and residents on the small holdings;
- Potential heritage objects or buildings;

Infrastructure on the study area and in close proximity

Roads

Roads on the study area consist of footpaths for the golf course

Powerlines

A powerline runs along Kenneth road providing electricity to the homesteads on the property.

(d) Environmental and current land use map

(Show all environmental, and current land use features)

Refer to Appendix 6.

10. Impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts

(Provide a list of the potential impacts identified of the activities described in the initial site layout that will be undertaken, as informed by both the typical known impacts of such activities, and as informed by the consultations with affected parties together with the significance, probability, and duration of the impacts. Please indicate the extent to which they can be reversed, the extent to which they may cause irreplaceable loss of resources, and can be avoided, managed or mitigated).

Table 8: Impact Significance Calculation – Construction, Operational and Rehabilitation Phase

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	IMPACT STATUS	MAGNITUDE	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
GEOLOGY AND SOILS	Minor loss and disturbance to topsoil as a result of clearing of vegetation and drilling and trenching. When vegetation is cleared and the topsoil is stripped, the soil's natural structure is disturbed and as a result the natural cycle is broken exposing the bare soil to erosion. Vehicles driving on these soils cause compaction of soils and reduces the soil's ability to be penetrated by root growth. Compaction also increases erosion potential. When soils are not stripped and stockpiled according to the soil stripping guidelines these soils would have lost their natural physical and chemical properties, reducing the topsoil's ability to be a plant growth medium. The above factors all contribute to a loss of the topsoil's ability to be a resource through alterations and removal.	_	3	2	1	2	8	5	40	Medium	20	Certain	Very Low
	Hydrocarbon spills on soils can occur where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. There is always a chance of these breaking down and/or leaking.	_	3	2	1	3	9	2	18	Medium	9	Sure	Very Low
HYDROLOGY GROUNDWATER SURFACE WATER	Stormwater, erosion and siltation impacts due to a lack of implementing temporary measures to manage stormwater run-off quantity and quality.	_	3	3	1	3	10	3	30	Medium	15	Sure	Very Low
	Contamination of stormwater runoff and groundwater, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery and fuel storage area.	_	3	2	1	3	9	2	18	Medium	9	Sure	Very Low
BIODI VERS ITY	Minor loss of natural vegetation and destruction of habitat will result in associated loss of fauna and flora species.	_	3	3	1	3	10	4	40	Low	27	Sure	Very Low

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	IMPACT STATUS	MAGNITUDE	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
	Disruption in the movement patterns of fauna species may impact on biodiversity. Noise, dust and potential light pollution, as well as migration of pollutants such as hydrocarbons in the soils, dust and emissions from vehicle and machinery altering air quality will all have an impact on biodiversity.	_	3	3	1	3	10	4	40	Low	27	Sure	Very Low
	Introduction and spread of alien invasive species. The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in construction materials and on vehicles. Invasion of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse through stormwater, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system, alien plants can spread throughout the catchment. If allowed to seed before control measures are implemented, alien plants can easily colonise and impact on downstream users.	_	4	3	1	3	11	4	44	Medium	22	Sure	Very Low
ARCHAEOLOGICAL/ HERITAGE RESOURCES	Alteration of archaeological, historical and palaeontological resources that may be discovered during earthworks and drilling.	_	2	1	5	5	13	2	26	Low	17	Sure	Very Low
VISUAL AND SENSE OF PLACE	Visibility from sensitive receptors / visual scarring of the landscape as a result of the prospecting activities.	_	3	3	1	1	8	5	40	Medium	20	Sure	Very Low
NOISE AND VIBRATION	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.	_	4	3	1	2	10	5	50	Low	33	Sure	Very Low
AIR QUALITY	Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and drilling.	_	4	3	1	2	10	5	50	High	16	Sure	Very Low
	Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	_	3	3	1	3	10	5	50	Low	33	Sure	Very Low

ENVIRONMENTAL ASPECT	NATURE OF THE IMPACT	IMPACT STATUS	MAGNITUDE	EXTENT	DURATION	REVERSIBILITY	IRREPLACEABILITY	PROBABILITY	SIGNIFICANCE PRE-MITIGATION	MITIGATION POTENTIAL	SIGNIFICANCE POST-MITIGATION	CONFIDENCE RATING	CUMULATIVE IMPACTS
WASTE	Generation of additional general waste, litter and building rubble and hazardous waste.	_	3	3	1	5	12	5	60	Medium	30	Certain	Very Low
SERVICES	Minor impact caused by need for services i.e. water, electricity and sewerage systems during the prospecting phase causing additional strain on natural resources and service infrastructure.	_	2	2	1	3	8	5	40	Medium	20	Certain	Very Low
TRAFFIC	Minor change in traffic patterns as a result of traffic entering and exiting the site on the surrounding road infrastructure and existing traffic.	_	2	3	1	1	7	5	35	High	12	Sure	Very Low
	Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, and heavy vehicles.	_	5	3	5	5	18	3	54	High	18	Sure	Very Low
HEALTH AND SAFETY	Possibility of prospecting activities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	_	5	4	5	5	19	3	57	High	19	Sure	Very Low
	Increased risk to public and worker safety: If not fenced off, the public and workers may fall into excavated areas and trenches.	_	5	3	5	5	18	3	54	High	18	Sure	Very Low
SOCIO-ECONOMIC	Potential creation of very limited extent short term employment opportunities for the local community, during the prospecting phase.	+	3	3	1	1	8	5	40	N/A	40	Certain	Very Low
	Multiplier effects on local economy will be positive, but very limited in extent and only short term.	+	2	3	1	1	7	5	35	N/A	35	Certain	Very Low

11. Methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;

(Describe how the significance, probability, and duration of the aforesaid identified impacts that were identified through the consultation process was determined in order to decide the extent to which the initial site layout needs revision).

A "significant impact" is defined as it is defined in the EIA Regulations (2014): "an impact that may have an notable effect on one or more aspects of the environment or may result in non-compliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence". The objective of this EIA methodology is to serve as a framework for accurately evaluating impacts associated with current or proposed activities in the biophysical, social and socio-economical spheres. It aims to ensure that all legal requirements and environmental considerations are met in order to have a complete and integrated environmental framework for impact evaluations.

The process of determining impacts to be assessed is one of the most important parts of the environmental impact assessment process. It is of such high importance because the environmental impacts identified can and are often linked to the same impact stream. In this method all impacts on the biophysical environment are assessed in terms of the overall integrity of ecosystems, habitats, populations and individuals affected. For example, the removal of groundcover for the sloping or scraping of an embankment, can lead to higher amounts of water runoff which increases the rate of erosion. Further down in the river the amount of sediment increases because of the increased erosion. A number of fish species cannot endure the high amount of sediment and moves off. The habitat is thus changed or in the process of changing. Thus, one needs to understand that the root of the problem (removal of groundcover) is assessed in terms of the degree of change in the health of the environment and/or components in relation to their conservation value. Thus, if the impact of removal of groundcover of a definable system is high and the conservation value is also high then the impact of removal of groundcover is highly significant.

Environmental Impact Assessment (EIA) Regulations, 2014 requirements

The Environmental Impact Assessment (EIA) 2014 Regulations promulgated in terms of Sections 24 (5), 24M and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) [as amended] (NEMA), requires that all identified potential impacts associated with the proposed project be assessed in terms of their overall potential significance on the natural, social and economic environments. The criteria identified in the EIA Regulations (2014) include the following:

- Nature of the impact;
- Extent of the impact;
- Duration of the impact
- Probability of the impact occurring;
- Degree to which impact can be reversed;
- Degree to which impact may cause irreplaceable loss of resources;
- Degree to which the impact can be mitigated; and
- Cumulative impacts.

ENVASS has developed an impact assessment methodology (as defined below) whereby the Significance of a potential impact is determined through the assessment of the relevant temporal and spatial scales determined of the Extent, Magnitude and Duration criteria associated with a particular impact. This method does not explicitly define each of the criteria but rather combines them and results in an indication of the overall significance.

ENVASS Impact Assessment Methodology

By considering the root cause of the issue in this way, the probability that the activity undertaken does or may result in an impact, can be determined. The associated impact can then be assessed in order to determine its significance and to define mitigation measures or management measures to address the impact.

The following definitions therefore apply:

- An activity is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organisation;
- An environmental aspect is an 'element of an organisation's activities, products and services which can interact with the environment. The interaction of an aspect with the environment may result in an impact;
- Environmental impacts are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality;
- Receptors can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as aquifers, flora and palaeontology. Impacts on the environment can lead to changes in existing conditions; the impacts can be direct, indirect or cumulative;
- Direct impacts refer to changes in environmental components that result from direct cause-effect consequences of interactions between the environment and project activities. Indirect impacts result from cause-effect consequences of interactions between the environment and direct impacts; and
- Cumulative impacts refer to the accumulation of changes to the environment caused by human activities.

Assessment of Impact Significance

The accumulated knowledge and the findings of the environmental investigations form the basis for the prediction of impacts. Once a potential impact has been determined, it is necessary to identify which project activity will cause the impact, the probability of occurrence of the impact, and its magnitude and extent (spatial and temporal). This information is important for evaluating the significance of the impact, and for defining mitigation and monitoring strategies. The aspects and impacts identified are therefore described according to the following:

(a) Nature of the impact

The NATURE of an impact can be defined as: "a *brief description of the impact being assessed, in terms of the proposed activity or project, including the socio-economic or environmental aspect affected by this impact*".

(b) The status of the impact:

	Status	Description
STATUS	Positive (+)	A benefit to the holistic environment.
	Negative (-)	A cost to the holistic environment.
	Neutral (N)	No cost or benefit to the holistic environment.

(c) Magnitude of the impact

The MAGNITUDE of an impact can be defined as: "*a brief description of the intensity or amplitude of the impact on socio-economic or environmental aspects".*

Determining the magnitude of an impact			
	Magnitude	Score	Description
MAGNITUDE Magnitude / intensity of impact (at the specified scale)	Zero	1	Natural and/or social functions and/or processes remain unaltered.
	Very low	2	Natural and/or social functions and/or processes are negligibly altered.
	Low	3	Natural and/or social functions and/or processes are slightly altered.
	Medium	4	Natural and/or social functions and/or processes are notably altered.
	High	5	Natural and/or social functions and/or processes severely altered.

(d) Extent of the impact

The EXTENT of an impact can be defined as: "*a brief description of the spatial influence of the impact or the area that will be affected by the impact*".

Determining the extent of an impact			
	Extent	Score	Description
EXTENT Extent or spatial influence of impact	Footprint	1	Only as far as the activity, such as footprint occurring within the total site area
	Site	2	Only the site and/or 500m radius from the site will be affected
	Local	3	Local area / district (neighbouring properties, transport routes and adjacent towns) is affected
	Region	4	Entire region / province is affected.
	National	5	Country is affected

(e) Duration of the impact

The DURATION of an impact can be defined as: "*a short description of the period of time the impact will have an effect on aspects*".

Determining the duration of an impact			
	Extent	**Score**	**Description**
DURATION **Duration of the impact**	**Short term**	**1**	**Less than 2 years**
	Short to medium term	**2**	**2 – 5 years**
	Medium term	**3**	**6 – 25 years**
	Long term	**4**	**26 – 45 years**
	Permanent	**5**	**46 years or more**

(f) Degree to which impact can be reversed

The REVERSIBILITY of an impact can be defined as: *"the ability of an impact to be changed from a state of affecting aspects to a state of not affecting aspects*".

Determining the reversibility of an impact			
	Reversibility	**Score**	**Description**
REVERSIBILITY	**Completely reversible**	**1**	**Impacts can be reversed through the implementation of minimal mitigation measures and rehabilitation with negligible residual effects.**
	Nearly completely reversible	**2**	**Impacts can nearly be completely reversed through the implementation of mitigation measures and rehabilitation, with marginal residual effects.**
	Partly reversible	**3**	**Impacts can be partly reversed through the implementation of mitigation measures and rehabilitation with moderate residual effects.**
	Nearly irreversible	**4**	**Impacts can be mitigated, but only marginally reversed through the implementation of mitigation measures and rehabilitation with severe residual effects.**
	Irreversible	**5**	**Impacts are permanent and can't be reversed by the implementation of mitigation measures or rehabilitation is not viable.**

(g) Degree to which impact may cause irreplaceable loss of resources

The irreplaceability of an impact can be defined as "the amount of resources that can/can't be replaced".

Irreplaceability = Magnitude + Extent + Duration + Reversibility

Degree to which impact may cause irreplaceable loss of resources			
IRREPLACEABILITY Irreplaceable loss of resources	**Irreplaceability**	**Score**	**Description**
	No loss	**0**	**No loss of any resources**
	Very Low	**1 - 5**	
	Low	**6 - 10**	**Marginal loss or resources**
	Medium	**11 - 15**	**Significant loss of resources**
	High	**16 - 20**	**Complete loss of resources**

(h) Probability of the impact occurring

The PROBABILITY of an impact can be defined as: "the *estimated chance of the impact happening*".

Determining the probability of an impact			
PROBABILITY	**Probability**	**Score**	**Description**
	Unlikely	**1**	**Unlikely to occur (0 – 15% probability of impact occurring)**
	Possible	**2**	**May occur (15 – 40% chance of occurring)**
	Probable	**3**	**Likely to occur (40– 60% chance of occurring)**
	Highly Probable	**4**	**Between 60% and 85% sure that the impact will occur**
	Definite	**5**	**Will certainly occur (85 - 100% chance of occurring)**

(i) Significance of Impacts - Pre-Mitigation

The SIGNIFICANCE can be defined as:" *the combination of the duration and importance of the impact, in terms of physical and socio-economic extent, resulting in an indicative level of mitigation required*".

The significance of an impact is determined as follows:

Significance = Irreplaceability x Probability

The maximum value is 100 significance points (SP). Environmental impacts were rated as either of Very High (VH) High (H), Medium (M), Low (L) or Very Low (VL) significance on the following basis:

Table 9: Significance Rating (SR) Basis

Score	Significance
0	Neutral
1 to 20	Very low
21 to 40	Low
41 to 60	Medium
61 to 80	High
81 to 100	Very high

(j) Degree to which the impact can be mitigated

The degree to which an impact can be MITIGATED can be defined as: "the effect of mitigation measures on the impact and its degree of effectiveness".

	Determining the mitigation potential of an impact		
	Degree	**Calculation**	**Description**
MITIGATION POTENTIAL	High	Pre-mitigation SR / 3 = Post Mitigation SR	Impact 100% mitigated
	Medium	Pre-mitigation SR / 2 = Post Mitigation SR	Impact >50% mitigated
	Low	Pre-mitigation SR / 3 = x Then: Pre-mitigation SR – x = Post Mitigation SR	Impact <50% mitigated

(k) Significance of Impacts Post-Mitigation

The SIGNIFICANCE can be defined as:" *the combination of the duration and importance of the impact, in terms of physical and socio-economic extent, resulting in an indicative level of mitigation required*".

The significance of an impact is determined as follows:

Significance = Irreplaceability x Probability

Table 10: Significance Rating

Score	Significance
0	Neutral
1 to 20	Very low
21 to 40	Low
41 to 60	Medium
61 to 80	High
81 to 100	Very high

(l) Confidence rating

CONFIDENCE in the assessment of an impact can be defined as the:" *level of certainty of the impact occurring*".

Determining the confidence rating of an impact			
CONFIDENCE RATING	CONFIDENCE	Certain	Amount of information on and/or understanding of the environmental factors that potentially influence the impact is unlimited and sound
		Sure	Amount of information on and/or understanding of the environmental factors that potentially influence the impact is reasonable and relatively sound
		Unsure	Amount of information on and/or understanding of the environmental factors that potentially influence the impact is limited

(m) Cumulative impacts

The effect of CUMULATIVE impacts can be described as:" the effect the combination of past, present and "reasonably foreseeable" future actions have on aspects".

Determining the confidence rating of an impact			
CUMULATIVE RATING	CUMULATIVE EFFECTS	Low	Minor cumulative effects
		Medium	Moderate cumulative effects
		High	Significant cumulative effects

The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and the community that may be affected

(Provide a discussion in terms of advantages and disadvantages of the initial site layout compared to alternative layout options to accommodate concerns raised by affected parties).

This section will be completed once comments have been received from interested and affected parties.

The possible mitigation measures that could be applied and the level of risk.

(With regard to the issues and concerns raised by affected parties provide a list of the issues raised and an assessment/ discussion of the mitigations or site layout alternatives available to accommodate or address their concerns, together with an assessment of the impacts or risks associated with the mitigation or alternatives considered).

This section will be completed once comments have been received from interested and affected parties.

Motivation where no alternative sites were considered

Prospecting is conducted in phases, where the activities and location of drilling and trenching to sample soil are dependent on the previous phase. Therefore, the specific locations and extent of soil sampling and diamond core drilling cannot be predetermined. The overall prospecting area is indicated in Figure 1. Areas to be avoided in terms of sensitivities are also indicated on the sensitivity maps in this report. Positioning of invasive prospecting planned in the sensitive areas and buffer zones should be conducted with a suitably qualified ecologist in order to avoid or minimise the destruction of any sensitive vegetation or habitats occurring in these areas. Ilangabi Investments 12 (Pty) Ltd is an operating clay mining company, mining immediately west of the study area and also to the east of the study area. Therefore, infrastructure and resources are available in close proximity to the study area. In addition, geological information indicated that the area potentially contains shale that weathers to clay on surface. The clay present in the area can be used in various applications with numerous quarries and brickworks located in the region.

The site is therefore, the preferred site and alternative sites are not considered.

b) Statement motivating the alternative development location within the overall site

(Provide a statement motivating the final site layout that is proposed)

The specific locations of intrusive drilling activities will be determined during Phase 1 of the Prospecting Work Programme. All infrastructure to be developed will be mobile and temporary. The ecologists, however, did recommend that no prospecting be conducted on the sensitive northern portions of the study area.

c) Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (in respect of the final site layout plan) through the life of the activity

(Including (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures).

- **Approach to the EIA**

An Environmental Impact Assessment (EIA) is a good planning tool. It identifies the environmental impacts of a proposed development and assists in ensuring that a project will be environmentally acceptable and integrated into the surrounding environment in a sustainable way.

The Basic Impact Assessment for this project complies with the National Environmental Management Act (1998) (as amended) and the NEMA EIA Regulations (2014) and guidelines of the Department of Environmental Affairs (DEA). The guiding principles of an EIA are listed below.

- **Guiding principles for an EIA**

The EIA must take an open participatory approach throughout. This means that there should be no hidden agendas, no restrictions on the information collected during the process and an open-door policy by the proponent. Technical information must be communicated to stakeholders in a way that is understood by them and that enables them to meaningfully comment on the project.

There should be ongoing consultation with interested and affected parties representing all walks of life. Sufficient time for comment must be allowed. The opportunity for comment should be announced on an on-going basis. There should be opportunities for input by specialists and members of the public. Their contributions and issues should be considered when technical specialist studies are conducted and when decisions are made.

- **Information gathering**

Early in the Basic Assessment process, the Environmental Assessment Practitioner (EAP) identified the information that would be required for the impact assessment and the relevant data were obtained. In addition, available information about the receiving environment was gathered from reliable sources, interested and affected parties, previous documented studies in the area and previous EIA Reports. The project team visited the site to gain first-hand information and an understanding of the existing operations and the proposed project.

- **Specialist Assessments**

The following specialist studies have been conducted:

- Palaeontological Assessments;
- Ecological and Biodiversity Scan; and
- Cultural heritage desktop assessment.
- Land Capability Assessments

The main objective of the specialist studies is to provide independent scientifically sound information on issues of concern relating to the project proposal.

The findings and recommendations identified by the various specialist studies undertaken, were incorporated into the Basic Impact Assessment.

- **Legislative Framework**

The legal requirements were described and assessed in detail.

- **Alternatives**

Prospecting is conducted in phases, where the activities and location of drilling and trenching to sample soil are dependent on the previous phase. Therefore, the specific locations and extent of soil sampling and core drilling cannot be predetermined.

The following alternatives were investigated as feasible alternatives:

m) The property on which or location where it is proposed to undertake the activity

Ilangabi Investments 12 (Pty) Ltd is an operating coal and clay mining company which conducts mining immediately northwest of the study area and also has brick making factories to the south of the study area. Therefore, infrastructure and resources are available in close proximity to the study area. In addition, geological information indicated that the area potentially contains shale that weathers to clay on surface. The clay present in the area can be used in various applications with numerous quarries and brickworks located in the region.

The site is therefore, the preferred site and alternative sites are not considered.

n) The type of activity to be undertaken

Prospecting activities will not compromise any future land uses on the study area. Should results of the prospecting indicate a viable reserve is present, then a comprehensive social and environmental impact assessment will be conducted to obtain environmental authorisation and a mining right from the competent authority/ies, in accordance with legislation. Alternative land uses to mining would be investigated as part of the social and environmental impact assessments.

o) The design or layout of the activity

The specific locations of intrusive drilling activities will be determined during Phase 1 of the Prospecting Work Programme. All infrastructure to be developed will be mobile and temporary.

p) The technology to be used in the activity

In terms of technologies proposed, prospecting work will initially entail a high-level desktop study and potential desktop resource evaluation. This will include a data search of any previous drilling, trenching, sampling activities, exploration activities, existing maps and relevant historical data. Desktop studies to be undertaken would include studying of geological reports, prospecting data, plans/maps, aerial photographs, topography maps and any other related geological information regarding the specific area.

On successful completion of this desktop study, further possible drilling, trenching and resource estimations will be performed if the results warrant it. The type of invasive prospecting activities have been determined based on the historic success of the methods to be utilised. The prospecting activities are, however, dependent on the preceding phase (non-invasive) as indicated above and therefore no alternatives are indicated, but rather a phased approach of trusted prospecting techniques.

Diamond core drilling is planned to be executed on a phase by phase basis. Planned borehole depths will be determined during the desktop study, but it is estimated that drilling activities will be conducted down to relatively shallow depths. Logging and sampling of the borehole core will be performed to evaluate the area. Trenching will involve the digging of excavation trenches down to approximately 3 metres below surface using graders and excavators. Mapping of the trench walls will then be performed.

q) The operational aspects of the activity

No permanent services including water supply, electricity, or sewerage facilities are required. All infrastructure to be developed will be mobile and temporary including generators, portable toilets and water tanks.

r) The option of not implementing the activity

According to Section 24 of the Constitution, a development must be ecologically sustainable and also support socio-economic development.

Not implementing the prospecting activities will result in a loss of information of mineral reserves present on the study area. Should economically feasible reserves exist on the study area and the applicant cannot prospect, the opportunity to utilise the reserves for future mining and brick-making will be lost, i.e. the minerals will be sterilised and resultant socio-economic benefits will be lost.

The proposed prospecting activities have the potential to have a negative impact on the ecological environment as well as the social environment of the area. These impacts, however, can potentially be prevented, minimised, mitigated and managed to low and very low levels, as shown through the impact assessment.

- **Description and assessment of impacts identified**

A comprehensive list of all potential impacts of the prospecting as identified by the EAP and the specialists, are provided and are assessed.

- **Environmental management programme**

An Environmental Management Programme containing mitigation, management and monitoring measures and specifying roles and responsibilities was compiled with specialist input and are included in this report.

- **Stakeholder engagement**

Registered interested and affected parties including relevant organs of state, are consulted with during the process. All their comments will be formally responded to and incorporated into the Final Basic Assessment Report and Environmental Management Programme that will be submitted to the competent authority.

d) Assessment of each identified potentially significant impact and risk

(This section of the report must consider all the known typical impacts of each of the activities (including those that could or should have been identified by knowledgeable persons) and not only those that were raised by registered interested and affected parties)

Potential impacts that may be caused by the proposed development will be identified using input from the following:

- Views of I&APs;
- Existing information;
- Specialist investigations;
- Site visit with the project team; and
- Legislation.

The following potential major direct, indirect and cumulative impacts were identified:

- Contamination and compaction of soils;
- Erosion;
- Contamination of ground- and surface water quality and decline in quantity;
- Impacts on biodiversity;
- Loss and displacement of fauna;
- Impacts on existing land use of the study and surrounding area;
- Destruction or loss of heritage features including graves and other historical sites of importance that may be uncovered during excavations;
- Decreased aesthetic value and impact on "Sense of Place";
- Poor air quality and decreased visibility due to dust pollution;
- Increased noise levels;
- Waste generation;
- Increased demand on service infrastructure and resources;
- Slight increase in traffic and need for maintenance of road infrastructure;
- Potential injury and loss of health and life of humans; and
- Altered Socio-Economic Environment (Positive or negative).

Table 11: Assessment of each identified potentially significant impact and risk

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
• Clearing of vegetation and topsoil. • Stockpiling of overburden positioned for later rehabilitation. • Prospecting including diamond core drilling, logging and sampling of the borehole core, trenching will involve the digging of excavation trenches down to approximately 3 metres below surface using graders and excavators.	Minor loss and disturbance to topsoil as a result of clearing of vegetation and drilling and trenching. When vegetation is cleared and the topsoil is stripped, the soil's natural structure is disturbed and as a result the natural cycle is broken exposing the bare soil to erosion. Vehicles driving on these soils cause compaction of soils and reduces the soil's ability to be penetrated by root growth. Compaction also increases erosion potential.	Soil	Prospecting	**Low (-)**	**Prevent and reduce through management measures.** **Stripping of topsoil:** • Clearing of areas to take place a maximum of one month prior to intended prospecting in the area; • Stripping of topsoil will not take place during rain or excessive wind; and • The top 30 cm of vegetation and topsoil is to be stripped from the area to be prospected. **Storage of topsoil / overburden:** • Topsoil (top 30cm) is to be stored in predetermined topsoil berms, (+/- 5m) outside the boundary of the specific area; and • Topsoil stockpiles will be restricted to 1.5 to 2m in height. **Maintenance and monitoring of topsoil stockpiles:** • The stored topsoil should be used as soon as possible in concurrent rehabilitation; • Weekly visual inspections to be conducted.	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
• Dust Suppression.	When soils are not stripped and stockpiled according to the soil stripping guidelines these soils would have lost their natural physical and chemical properties, reducing the topsoil's ability to be a plant growth medium. The above factors all contribute to a loss of the topsoil's ability to be a resource through alterations and removal.					
	Hydrocarbon spills on soil can occur where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel	Soil	Prospecting	**Very Low (-)**	**Prevent and reduce and remedy through management measures.** • All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks; • All leaks will be cleaned up immediately using an absorbent material and spill kits, in the prescribed manner; and	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
	to run. There is always a chance of these breaking down and/or leaking.				• The approved Integrated Water and Waste Management Plan to be implemented. ***Hydrocarbons and hazardous waste*** • All hazardous waste generated shall be kept separate and shall not be mixed with general waste; and • All hazardous waste shall be stored within a sealed drum on an impermeable surfaced area within the central waste storage and transition area.	
	Stormwater, erosion and siltation impacts due to a lack of implementing temporary measures to manage stormwater run-off quantity and quality.	Surface water	Prospecting	**Low (-)**	**Prevent and reduce and remedy through management measures.** • A Stormwater Management Plan (SMP) to be developed for the collective area where prospecting will occur, (or the existing SMP updated, where applicable for present and future activities) and should include the management of stormwater during excavation, as well as the installation of temporary stormwater and erosion control measures during prospecting, followed up by rehabilitation of the area;	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					• The slopes of the area where prospecting activities will occur, should be profiled to ensure that they are not subjected to excessive erosion but capable of drainage run-off with minimum risk of scrub (hydrologic action by water that causes erosion). A maximum gradient of 1:3 is recommended; • If necessary, temporary diversion channels should be constructed ahead of the stockpiles (if relevant) to intercept clean run-off and divert it around disturbed areas into the natural drainage system downstream (down gradient) of the prospecting area; • Existing vegetation must be retained as far as possible to minimise erosion problems; • Rehabilitation of the prospecting area shall be planned and completed (after conclusion of the prospecting activities) in such a way that the run-off water (if any) will not cause erosion; • Visual inspections shall be done on a weekly basis with regard to the stability of the temporary water control structures, erosion and siltation (if required).	

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					• Sediment-laden run-off from cleared areas should be prevented from entering rivers and streams; • No river or surface water may be affected by silt emanating from the prospecting area • No wastewater may run freely into any of the surrounding naturally vegetated areas.	
	Contamination of stormwater runoff and groundwater, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery and fuel storage area.	Surface water and groundwater resources	Prospecting	**Very Low (-)**	**Prevent and reduce through management measures.** In accordance with Government Notice 704 (GN 704), the onsite management should: • Keep clean and dirty water separated; • Contain any dirty water within a system; and • Prevent the contamination of clean water. In order to achieve these objectives, the following stormwater management measures must be implemented on the site to ensure that those potential stormwater impacts are kept to a minimum: • Clean and dirty stormwater needs to be separated. Dirty stormwater may not be released	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					into the environment and should be contained and treated on site; • All temporary stormwater infrastructure (if any) on-site shall be maintained and kept clean throughout the prospecting period; • Immediate reporting of any polluting or potentially polluting incidents so that appropriate measures can be implemented; • Fuel and oil spills shall be treated immediately by appropriate mop-up products. Several hydrocarbon absorption/remediation products (i.e. Spill kits) must be placed throughout the site; • Use of bunds or traps to ensure full containment of hydrocarbon and other hazardous materials are mandatory; • Any contaminated material is disposed of in an appropriate manner and the potential risks associated with such spills are limited; • Stormwater leaving the site must in no way be contaminated; • Ensure good housekeeping practices;	

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					• Increased runoff should be managed using berms and other suitable structures as required to ensure flow velocities are reduced; and • Removal of spills, rainwater and waste produced during clean-up of the bunds – shall be done in accordance to relevant specifications.	
	Minor loss of natural vegetation and destruction of habitat will result in associated loss of fauna and flora species.	Surface water	Prospecting	**Low (-)**	**Reduce through management measures.** • A suitably qualified specialist (ecologist) to accompany the site manager to demarcate areas for prospecting, in order to avoid damaging sensitive vegetation as identified during the specialist study and according to the sensitivity maps provided in this report; • Only vegetation falling directly into demarcated access routes or project sites should be removed; • No further vegetation clearance except for the removal of alien invasive species will be allowed; and • All remaining indigenous vegetation should be conserved wherever possible.	**Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
	Disruption in the movement patterns of fauna species may impact on biodiversity. Noise, dust and potential light pollution, as well as migration of pollutants such as hydrocarbons in the soils, dust and emissions from vehicle and machinery altering air quality will all have an impact on biodiversity.	Biodiversity	Prospecting	**Low (-)**	**Prevent and reduce through management measures.** • Reduce the levels of disturbance on areas indicated by the Environmental Control Officer (ECO) as migratory routes, if any; • Environmental awareness training should include that no hunting, trapping or killing of fauna are allowed; • Any animals rescued or recovered will be relocated in a suitable habitat away from the prospecting operations and associated infrastructure; • Any lizards, snakes or monitors encountered should be allowed to escape to a suitable habitat away from disturbance. • No reptile should be intentionally killed, caught or collected during any phase of the project; and • General avoidance of snakes is the best policy if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area.	**Low (-)**
	Introduction and spread of alien invasive species.	Biodiversity Soils	Prospecting	**Medium (-)**	**Prevent and control through management measures.**	**Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
	The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in construction materials and on vehicles. Invasion of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse through stormwater, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system, alien plants can spread throughout the catchment. If allowed to seed before control measures are implemented, alien plants can easily colonise and	Surface water ecosystems			• Regular removal of invasive alien species should be undertaken. This should extend through to the closure phase of the project; and • No spreading of alien vegetation onto adjacent properties should be allowed.	

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
	impact on downstream users.					
	Alteration of archaeological, historical and palaeontological resources that may be discovered during earthworks and drilling.	Cultural Heritage	Prospecting	**Low (-)**	**Protect heritage resources through developing and implementing procedures.** • Prior to any development, construction or prospecting, a qualified archaeologist should conduct a site inspection on the areas demarcated for geotechnical drilling/prospecting. Proposed access roads to the drill sites should also be surveyed in order to avoid the destruction of heritage material; • Should the prospecting outcome result in further development or construction and mining, a full Phase2 Archaeological Impact Assessment must be conducted on the affected area if triggered; • Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also,	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					should skeletal remains be exposed during development and construction phases, all activities must be suspended and the relevant heritage resources authority contacted (see National Heritage Resources Act (Act No. 25 of 1999) Section 36 (6)). Should culturally significant material or skeletal remains be exposed during prospecting all activities must be suspended pending further investigation by a qualified archaeologist (Refer to the National Heritage and Resources Act, 25 of 1999 section 36 (6)); • Should any objects of archaeological or palaeontological remains be found during activities, work must immediately stop in that area and the Environmental Control Officer (ECO) must be informed; • The ECO must inform SAHRA and contact an archaeologist and / or palaeontologist, depending on the nature of the find, to assess the importance and rescue them if necessary (with the relevant SAHRA permit). No work may	

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					be resumed in this area without the permission of the ECO and SAHRA.	
	Visibility from sensitive receptors / visual scarring of the landscape as a result of the prospecting activities.	Aesthetic quality and sense of place	Prospecting	**Low (-)**	**Reduce through controlling management measures.** • Unnecessary lights should be switched off during the day and / or night to avoid light pollution; • If lighting is required, the lighting will be located in such a place and such a manner so as to minimise any impact on the surrounding community and fauna; • Install temporary lights that will not create a night sky glow; • Security lighting should be designed in such a way as to minimise emissions onto undisturbed areas on site and neighbouring properties. Light fittings should face downwards; • Housekeeping on site should be enforced; • Rehabilitation measures such as re-vegetation and plan to be implemented; • Reduce the prospecting period through careful planning and productive implementation of resources;	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					• Plan the placement of lay-down areas and any potential temporary prospecting camps in order to minimise vegetation clearing; • Restrict the activities and movement of workers and vehicles to the immediate prospecting site and existing access roads; • Ensure that rubble, litter and issued materials are managed and removed regularly; • Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way; and • Reduce and control dust through the use of approved dust suppression techniques.	
	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.	Health of landowners and occupiers Biodiversity	Prospecting	**Medium (-)**	**Reduce through controlling measures.** • Vehicles and machinery will be regularly serviced to ensure acceptable noise levels are not exceeded; • Silencers will be utilised where possible; • Heavy vehicle traffic should be routed away from noise sensitive areas where possible; • Noise levels should be kept within acceptable limits. All noise and sounds generated should	**Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					adhere to South African Bureau of Standards (SABS) specifications for maximum allowable noise levels for construction sites. No pure tone sirens or hooters may be utilised except where required in terms of SABS standards or in emergencies; • With regard to unavoidable very noisy activities in the vicinity of noise sensitive areas, the Site Manager (SM) should liaise with local residents and a suitably qualified ecologist and how best to minimise impacts, and the local population should be kept informed of the nature and duration of intended activities; • The SM should take measures to discourage labourers from loitering in the area, causing noise disturbance; • Noise impacts should be minimised by restricting the hours (between 06h00 and 18h00 on Monday to Friday, and 06h00 and 13h00 on Saturdays), during which the offending activities are carried out and, where possible, by insulating machinery and/or enclosing areas of activity;	

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					• No noisy activities to occur on Sundays or public holidays; • Personal Protective Equipment to all persons working in areas where high levels of noise can be expected; • Signs where it is compulsory;	
	Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and drilling.	Aesthetic environment Sense of Place Air quality Biodiversity	Prospecting	**Medium (-)**	**Reduce through controlling measures.** • Dust suppression shall be implemented during dry periods and windy conditions; • All exposed surfaces should be minimised in terms of duration of exposure to wind and stormwater; • Excavation, handling and transportation of erodible materials shall be avoided under high wind conditions (excess of 35km/hr) or when a visible dust plume is present; • Ensure that the shortest routes are used for material transport; • Ensure that stockpile height is kept to a minimum; • Minimise travel speed on unpaved roads;	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					• Implement monthly site inspection to check for possible areas of dust generation not addressed or not effectively managed; • Spray areas to be cleared with water; • Ensure minimum travel distance between working areas and stockpiles; • Ensure that topsoil for stockpiles is sprayed with water before tipping to prevent dust generation; • Ensure graded areas are sprayed with water; • Minimise the amount of graded areas; • Load and offload material, as far as possible, downwind of topsoil stockpiles.	
	Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	Health of landowners and occupiers	Prospecting	**Medium (-)**	• All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks; • Proper planning of movements (vehicle trips) and working of machinery should take place, in order to avoid unnecessary trips and hours of operation.	**Low (-)**
	Generation of additional general waste, litter and building rubble and hazardous waste.	Biodiversity Health and safety Soil	Prospecting	**Medium (-)**	**Control through management measures.** • A central waste storage and transition area shall be established within the site camp;	**Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
		Surface water systems			• The central waste storage and transition area shall be surfaced and demarcated appropriately; • Portable wheelie bins shall be placed throughout the site camp as well as at the remainder of the site and at all working areas in the field; • Wheelie bins shall be colour coded and labelled to identify the waste stream for which it is intended; • All portable wheelie bins and other containers shall be emptied at the central waste storage and transition area a minimum of once a week or when filled, as to avoid waste build-up; • The waste shall be removed (within 30 days) by a licensed waste service provider as shall be disposed of at a licensed waste landfill site and records of safe disposal (as required for hazardous wastes) shall be supplied to the Contractor. These records shall be kept on site by the ESM; • Wherever possible and practical, waste materials generated on site must be recycled; and	

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
					• Waste specific (hazardous, timber, steel etc.) mitigation measures to be implemented.	
	Minor impact caused by need for services i.e. water, electricity and sewerage systems during the prospecting phase causing additional strain on natural resources and service infrastructure.	Natural resources including water and energy resources	Prospecting	**Low (-)**	**Reduce through controlling management measures.** • Energy savings measures to be implemented at the site e.g.: ➢ No lights to be switched on unnecessarily; ➢ Only security lights to be switched on at night; • Energy saving bulbs to be installed; and • Water should be recycled as far as possible to avoid any additional water usage.	**Very Low (-)**
	Minor change in traffic patterns as a result of traffic entering and exiting the site on the surrounding road infrastructure and existing traffic.	Traffic	Prospecting	**Low (-)**	**Reduce through controlling management measures.** • Where feasible heavy vehicles should not operate on public roads during peak hours; and • Heavy vehicles should adhere to the speed limit of the road.	**Very Low (-)**
	Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area	Safety of workers, contractors and landowners	Prospecting	**Medium (-)**	**Prevent through controlling management measures.** • Drivers will be enforced to keep to set speed limits; • Trucks will be in a road-worthy condition;	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
	including cars, and heavy vehicles.	and occupiers			• Roads and intersections will be signposted clearly. Only main roads should be used; • Where feasible vehicles should not operate on public roads during peak hours; • Vehicles should adhere to the speed limit of the road; • Heavy vehicles should always travel with their headlights switched on; • Heavy vehicles should not stop on the road to pick up hitchhikers – No stopping on the road approaching the site will be allowed; • Ilangabi Investments 12 (Pty) Ltd shall be responsible for ensuring that suitable access is maintained for public traffic to all relevant businesses and properties; and • All traffic accommodation measures are to conform to the latest edition of the South African Road Signs Manual.	
	Possibility of prospecting activities and workers causing veld fires, which can potentially cause	Biodiversity Health and safety of landowners,	Prospecting	**Medium (-)**	**Prevent through controlling management measures.** • All workers will be sensitised to the risk of fire;	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
	injury and or loss of life to workers and surrounding landowners, visitors and workers.	occupiers, visitors and workers			• Smoking is only allowed in designated smoking areas and disposal of cigarette butts safely in sand buckets; • The Applicant shall ensure that the basic fire-fighting equipment is available on the site; • Extinguishers should be located outside hazardous materials and chemicals storage containers; • Fire response and evacuation: ➢ An Emergency Plan (including Fire Protection, Response and Evacuation Plan) is to be prepared by the Applicant and conveyed to all staff on the site' ➢ Identify major risks to minimise the environmental impacts e.g., air pollution and contaminated effluent runoff.	
	Increased risk to public and worker safety: If not fenced off, the public and workers may fall into excavated areas and trenches.	Health and safety of landowners, occupiers of land, workers, visitors and	Prospecting	**Medium (-)**	• A health and safety plan in terms of the Mine Health and Safety Act (Act 29 of 1996) should be compiled and implemented to ensure worker safety; • A health and safety control officer should monitor the implementation of the health and safety plan for the operational phase;	**Very Low (-)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
		the general public.			• A record of health and safety incidents should be kept on site and made available for inspection; • Any health and safety incidents should be reported to the Site Manager (SM) immediately; • First aid facilities should be available on site at all times; • Workers have the right to refuse work in unsafe conditions; • Material stockpiles or stacks should be stable and well secured to avoid collapse and possible injury to site workers. • Access to excavation must be controlled; • Excavated areas should be temporarily fenced-off; and • Excavations will be backfilled and landscaped as soon as possible.	
	Potential creation of very limited extent short term employment opportunities for the local community, during the prospecting phase.	Socio-economic	Prospecting	**Low (+)**	• Local labour to be sourced where possible.	**Low (+)**

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
	Multiplier effects on local economy will be positive, but very limited in extent and only short term.	Socio-economic	Prospecting	**Low (+)**	• Supplies to be bought locally as far as possible.	**Low (+)**

The supporting impact assessment conducted by the EAP must be attached as an appendix, marked Appendix 7 – Please refer to Table 8: **Impact Significance Calculation – Construction, Operational and Rehabilitation Phase** *for the full impact assessment.*

e) Summary of specialist reports

(This summary must be completed if any specialist reports informed the impact assessment and final site layout process and must be in the following tabular form): -

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Ecological and Biodiversity Scan	• Existing access roads must be utilised by the drilling rig and associated Trackless Mobile Machines (TMMs). If the TMMs traverse outside of the existing routes and cause disturbance and/or destruction of the vegetation, the disturbed areas must be tilled and revegetation with a mixture of indigenous grass species, such as Themeda triandra, or Eragrostis curvula which can both be obtained from a commercial nursery. • The disturbance area at the proposed drilling sites must be limited to the core area, which must be encircled with orange barrier netting to avoid human and faunal species falling within the core holes, and all excess sediment around the mouth is to be backfilled in the holes. In instances where the excess sediment does not cover the mouth of a hole, the core hole must be capped with a wooden plank cut to just larger than the hole. This cap must be implemented by excavating the top layer of soil to an approximate depth of 200mm, inserting the cap, backfilling, compacting the surface slightly and revegetation using the grass species previously cleared from the site.	X	Basic Assessment Report and EMPR Part B (EMPR)

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• All drilling activities must occur during the day time between the hours of 8am and 5pm to avoid continued disturbance to nocturnal faunal species. • No indigenous woody species must be cut during the proposed development.		
Cultural heritage desktop assessment	From the previous research records conducted in the area, the specialist concluded that the general region is significant from a heritage perspective. Heritage sites are likely to include graveyards, Iron Age/Farmer and Historical remains. Since heritage sites, e.g. graves, are not always clearly identifiable as it might consist of stone cairns, it is advised that a qualified archaeologist inspect the proposed prospecting sites prior to drilling to establish whether the sites might be sensitive from a heritage perspective. The following recommendations were made in terms of the National Heritage Resources Act (Act No. 25 of 1999) in order to avoid the destruction of heritage remains in areas demarcated for prospecting: - Prior to any development, construction or prospecting, a qualified archaeologist should conduct a site inspection on the areas demarcated for geotechnical drilling/prospecting. Proposed access roads to the drill sites should also be surveyed in order to avoid the destruction of heritage material;	X	Basic Assessment Report and EMPR Part B (EMPR)

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	- Should the prospecting outcome result in further development or construction and mining, a full Phase 1 Archaeological Impact Assessment must be conducted on the affected area if triggered; - Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed during development and construction phases, all activities must be suspended and the relevant heritage resources authority contacted (see National Heritage Resources Act (Act No. 25 of 1999) Section 36 (6)).		

Attach copies of Specialist Reports as appendices (Please refer to ***Appendix 7 - 9***)

f) Environmental impact statement

(i) Summary of the key findings of the environmental impact assessment;

Table 12: Summary of the Possible Impacts Associated with the Proposed Prospecting

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
Minor loss and disturbance to topsoil as a result of clearing of vegetation and drilling and trenching. When vegetation is cleared and the topsoil is stripped, the soil's natural structure is disturbed and as a result the natural cycle is broken exposing the bare soil to erosion. Vehicles driving on these soils cause compaction of soils and reduces the soils' ability to be penetrated by root growth. Compaction also increases erosion potential. When soils are not stripped and stockpiled according to the soil stripping guidelines these soils would have lost their natural physical and chemical properties, reducing the topsoil's ability to be a plant growth medium. The above factors all contribute to a loss of the topsoil's ability to be a resource through alterations and removal.	**Low (-)**	**Prevent and reduce through management measures.** **Stripping of topsoil:** • Clearing of areas to take place a maximum of one month prior to intended prospecting in the area; • Stripping of topsoil will not take place during rain or excessive wind; and • The top 30 cm of vegetation and topsoil is to be stripped from the area to be prospected. **Storage of topsoil / overburden:** • Topsoil (top 30cm) is to be stored in predetermined topsoil berms, (+/- 5m) outside the boundary of the specific area; and • Topsoil stockpiles will be restricted to 1.5 to 2m in height. **Maintenance and monitoring of topsoil stockpiles:** • The stored topsoil should be used as soon as possible in concurrent rehabilitation; • Weekly visual inspections to be conducted.	**Very Low (-)**
Hydrocarbon spills on soil can occur where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. There is always a chance of these breaking down	**Very Low (-)**	**Prevent and reduce and remedy through management measures.** • All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks;	**Very Low (-)**

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
and/or leaking.		• All leaks will be cleaned up immediately using an absorbent material and spill kits, in the prescribed manner. ***Hydrocarbons and hazardous waste*** • All hazardous waste generated shall be kept separate and shall not be mixed with general waste; and • All hazardous waste shall be stored within a sealed drum on an impermeable surfaced area within the central waste storage and transition area.	
Stormwater, erosion and siltation impacts due to a lack of implementing temporary measures to manage stormwater run-off quantity and quality.	**Low (-)**	**Prevent and reduce and remedy through management measures.** • A Stormwater Management Plan (SMP) to be developed for the collective area where prospecting will occur, (or the existing SMP updated, where applicable for present and future activities) and should include the management of stormwater during excavation, as well as the installation of temporary stormwater and erosion control measures during prospecting, followed up by rehabilitation of the area; • The slopes of the area where prospecting activities will occur, should be profiled to ensure that they are not subjected to excessive erosion but capable of drainage run-off with minimum risk of scrub (hydrologic action by water that causes erosion). A maximum gradient of 1:3 is recommended; • If necessary, temporary diversion channels should be constructed ahead of the stockpiles (if relevant) to intercept clean run-off and divert it around	**Very Low (-)**

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
		disturbed areas into the natural drainage system downstream (down gradient) of the prospecting area; • Existing vegetation must be retained as far as possible to minimise erosion problems; • Rehabilitation of the prospecting area shall be planned and completed (after conclusion of the prospecting activities) in such a way that the run-off water (if any) will not cause erosion; • Visual inspections shall be done on a weekly basis with regard to the stability of the temporary water control structures, erosion and siltation (if required). • Sediment-laden run-off from cleared areas should be prevented from entering rivers and streams; • No river or surface water may be affected by silt emanating from the prospecting area (especially aimed at prevention of siltation of the nearby Blesbokspruit); and • No wastewater may run freely into any of the surrounding naturally vegetated areas.	
Contamination of stormwater runoff and groundwater, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery and fuel storage area.	**Very Low (-)**	**Prevent and reduce through management measures.** In accordance with Government Notice 704 (GN 704), the onsite management should: • Keep clean and dirty water separated; • Contain any dirty water within a system; and • Prevent the contamination of clean water.	**Very Low (-)**

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
		In order to achieve these objectives, the following stormwater management measures must be implemented on the site to ensure that those potential stormwater impacts are kept to a minimum: • Clean and dirty stormwater needs to be separated. Dirty stormwater may not be released into the environment and should be contained and treated on site; • All temporary stormwater infrastructure (if any) on-site shall be maintained and kept clean throughout the prospecting period; • Immediate reporting of any polluting or potentially polluting incidents so that appropriate measures can be implemented; • Fuel and oil spills shall be treated immediately by appropriate mop-up products. Several hydrocarbon absorption/remediation products (i.e. Spill kits) must be placed throughout the site; • Use of bunds or traps to ensure full containment of hydrocarbon and other hazardous materials are mandatory; • Any contaminated material is disposed of in an appropriate manner and the potential risks associated with such spills are limited; • Stormwater leaving the site must in no way be contaminated; • Ensure good housekeeping practices; • Increased runoff should be managed using berms and other suitable structures as required to ensure flow velocities are reduced; and	

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
		• Removal of spills, rainwater and waste produced during clean-up of the bunds – shall be done in accordance with relevant specifications.	
Minor loss of natural vegetation and destruction of habitat will result in associated loss of fauna and flora species.	**Low (-)**	**Reduce through management measures.** • A suitably qualified specialist (ecologist) to accompany the site manager to demarcate areas for prospecting, in order to avoid damaging sensitive vegetation as identified during the specialist study and according to the sensitivity maps provided in this report; • Only vegetation falling directly into demarcated access routes or project sites should be removed; • No further vegetation clearance except for the removal of alien invasive species will be allowed; and • All remaining indigenous vegetation should be conserved wherever possible.	**Low (-)**
Disruption in the movement patterns of fauna species may impact on biodiversity. Noise, dust and potential light pollution, as well as migration of pollutants such as hydrocarbons in the soils, dust and emissions from vehicle and machinery altering air quality will all have an impact on biodiversity.	**Low (-)**	**Prevent and reduce through management measures.** • Reduce the levels of disturbance on areas indicated by the Environmental Control Officer (ECO) as migratory routes, if any; • Environmental awareness training should include that no hunting, trapping or killing of fauna are allowed; • Any animals rescued or recovered will be relocated in a suitable habitat away from the mining operations and associated infrastructure; • Any lizards, snakes or monitors encountered should be allowed to escape to a suitable habitat away from disturbance.	**Low (-)**

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
		• No reptile should be intentionally killed, caught or collected during any phase of the project; and • General avoidance of snakes is the best policy if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area.	
Introduction and spread of alien invasive species. The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in construction materials and on vehicles. Invasion of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse through stormwater, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system, alien plants can spread throughout the catchment. If allowed to seed before control measures are implemented, alien plants can easily colonise and impact on downstream users.	**Medium (-)**	**Prevent and control through management measures.** • Regular removal of invasive alien species should be undertaken. This should extend through to the closure phase of the project; and • No spreading of alien vegetation onto adjacent properties should be allowed.	**Low (-)**
Alteration of archaeological, historical and palaeontological resources that may be discovered during earthworks and drilling.	**Low (-)**	**Protect heritage resources through developing and implementing procedures.** • Prior to any development, construction or prospecting, a qualified archaeologist should conduct a site inspection on the areas demarcated for geotechnical drilling/prospecting. Proposed access roads to the drill	**Very Low (-)**

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
		sites should also be surveyed in order to avoid the destruction of heritage material; • Should the prospecting outcome result in further development or construction and mining, a full Phase 1 Archaeological Impact Assessment must be conducted on the affected area if triggered; • Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed during development and construction phases, all activities must be suspended and the relevant heritage resources authority contacted (see National Heritage Resources Act (Act No. 25 of 1999) Section 36 (6)). Should culturally significant material or skeletal remains be exposed during prospecting all activities must be suspended pending further investigation by a qualified archaeologist (Refer to the National Heritage and Resources Act, 25 of 1999 section 36 (6)); • Should any objects of archaeological or palaeontological remains be found during activities, work must immediately stop in that area and the Environmental Control Officer (ECO) must be informed; • The ECO must inform SAHRA and contact an archaeologist and / or palaeontologist, depending on the nature of the find, to assess the importance and rescue them if necessary (with the relevant SAHRA	

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
		permit). No work may be resumed in this area without the permission of the ECO and SAHRA.	
Visibility from sensitive receptors / visual scarring of the landscape as a result of the prospecting activities.	**Low (-)**	**Reduce through controlling management measures.** • Unnecessary lights should be switched off during the day and / or night to avoid light pollution; • If lighting is required, the lighting will be located in such a place and such a manner so as to minimise any impact on the surrounding community and fauna; • Install temporary lights that will not create a night sky glow; • Security lighting should be designed in such a way as to minimise emissions onto undisturbed areas on site and neighbouring properties. Light fittings should face downwards; • Housekeeping on site should be enforced; • Rehabilitation measures such as re-vegetation and plan to be implemented; • Reduce the prospecting period through careful planning and productive implementation of resources; • Plan the placement of lay-down areas and any potential temporary prospecting camps in order to minimise vegetation clearing; • Restrict the activities and movement of workers and vehicles to the immediate prospecting site and existing access roads;	**Very Low (-)**

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
		• Ensure that rubble, litter and issued materials are managed and removed regularly; • Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way; and • Reduce and control dust through the use of approved dust suppression techniques.	
Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.	**Medium (-)**	**Reduce through controlling measures.** • Vehicles and machinery will be regularly serviced to ensure acceptable noise levels are not exceeded; • Silencers will be utilised where possible; • Heavy vehicle traffic should be routed away from noise sensitive areas where possible; • Noise levels should be kept within acceptable limits. All noise and sounds generated should adhere to South African Bureau of Standards (SABS) specifications for maximum allowable noise levels for construction sites. No pure tone sirens or hooters may be utilised except where required in terms of SABS standards or in emergencies; • With regard to unavoidable very noisy activities in the vicinity of noise sensitive areas, the Site Manager (SM) should liaise with local residents and a suitably qualified ecologist and how best to minimise impacts, and the local population should be kept informed of the nature and duration of intended activities;	**Low (-)**

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
		• The SM should take measures to discourage labourers from loitering in the area, causing noise disturbance; • Noise impacts should be minimised by restricting the hours (between 06h00 and 18h00 on Monday to Friday, and 06h00 and 13h00 on Saturdays), during which the offending activities are carried out and, where possible, by insulating machinery and/or enclosing areas of activity; • No noisy activities to occur on Sundays or public holidays; • Personal Protective Equipment to all persons working in areas where high levels of noise can be expected; Signs where it is compulsory; • Regular inspections and maintenance of equipment, vehicles and machinery to prevent unnecessary noise.	
Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and drilling.	**Medium (-)**	**Reduce through controlling measures.** • Dust suppression shall be implemented during dry periods and windy conditions; • All exposed surfaces should be minimised in terms of duration of exposure to wind and stormwater; • Excavation, handling and transportation of erodible materials shall be avoided under high wind conditions (excess of 35km/hr) or when a visible dust plume is present; • Ensure that the shortest routes are used for material transport; • Ensure that stockpile height is kept to a minimum;	**Very Low (-)**

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
		• Minimise travel speed on unpaved roads; • Implement monthly site inspection to check for possible areas of dust generation not addressed or not effectively managed; • Spray areas to be cleared with water; • Ensure minimum travel distance between working areas and stockpiles; • Ensure that topsoil for stockpiles is sprayed with water before tipping to prevent dust generation; • Ensure graded areas are sprayed with water; • Minimise the amount of graded areas; • Load and offload material, as far as possible, downwind of topsoil stockpiles.	
Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	**Medium (-)**	• All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks; • Proper planning of movements (vehicle trips) and working of machinery should take place, in order to avoid unnecessary trips and hours of operation.	**Low (-)**
Generation of additional general waste, litter and building rubble and hazardous waste.	**Medium (-)**	**Control through management measures.** • A central waste storage and transition area shall be established within the site camp; • The central waste storage and transition area shall be surfaced and demarcated appropriately; • Portable wheelie bins shall be placed throughout the site camp as well as at the remainder of the site and at all working areas in the field;	**Low (-)**

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
		• Wheelie bins shall be colour coded and labelled to identify the waste stream for which it is intended; • All portable wheelie bins and other containers shall be emptied at the central waste storage and transition area a minimum of once a week or when filled, as to avoid waste build up; • The waste shall be removed (within 30 days) by a licensed waste service provider as shall be disposed of at a licensed waste landfill site and records of safe disposal (as required for hazardous wastes) shall be supplied to the Contractor. These records shall be kept on site by the ESM; • Wherever possible and practical, waste materials generated on site must be recycled; and • Waste specific (hazardous, timber, steel etc.) mitigation measures to be implemented.	
Minor impact caused by need for services i.e. water, electricity and sewerage systems during the prospecting phase causing additional strain on natural resources and service infrastructure.	**Low (-)**	**Reduce through controlling management measures.** • Energy savings measures to be implemented at the site e.g.: ➢ No lights to be switched on unnecessarily; ➢ Only security lights to be switched on at night; • Energy saving bulbs to be installed; and • Water should be recycled as far as possible to avoid any additional water usage.	**Very Low (-)**
Minor change in traffic patterns as a result of traffic entering and	**Low (-)**	**Reduce through controlling management measures.**	**Very Low (-)**

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
exiting the site on the surrounding road infrastructure and existing traffic.		• Where feasible heavy vehicles should not operate on public roads during peak hours; and • Heavy vehicles should adhere to the speed limit of the road.	
Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, and heavy vehicles.	**Medium (-)**	**Prevent through controlling management measures.** • Drivers will be enforced to keep to set speed limits; • Trucks will be in a road-worthy condition; • Roads and intersections will be signposted clearly. Only main roads should be used; • Where feasible vehicles should not operate on public roads during peak hours; • Heavy vehicles should always travel with their headlights switched on; • Heavy vehicles should not stop on the road to pick up hitchhikers – No stopping on the road approaching the site will be allowed; • Ilangabi Investments 12 (Pty) Ltd shall be responsible for ensuring that suitable access is maintained for public traffic to all relevant businesses and properties; and • All traffic accommodation measures are to conform to the latest edition of the South African Road Signs Manual.	**Very Low (-)**
Possibility of prospecting activities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	**Medium (-)**	**Prevent through controlling management measures.** • All workers will be sensitised to the risk of fire; • Smoking is only allowed in designated smoking areas and disposal of cigarette butts safely in sand buckets;	**Very Low (-)**

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
		• The Applicant shall ensure that the basic fire-fighting equipment is available on the site; • Extinguishers should be located outside hazardous materials and chemicals storage containers; • Fire response and evacuation: ➢ An Emergency Plan (including Fire Protection, Response and Evacuation Plan) is to be prepared by the Applicant and conveyed to all staff on the site' ➢ Identify major risks to minimise the environmental impacts e.g., air pollution and contaminated effluent runoff.	
Increased risk to public and worker safety: If not fenced off, the public and workers may fall into excavated areas and trenches.	**Medium (-)**	• A health and safety plan in terms of the Mine Health and Safety Act (Act 29 of 1996) should be compiled and implemented to ensure worker safety; • A health and safety control officer should monitor the implementation of the health and safety plan for the operational phase; • Any health and safety incidents should be reported to the Site Manager (SM) immediately; • First aid facilities should be available on site at all times; • Workers have the right to refuse work in unsafe conditions; • Material stockpiles or stacks should be stable and well secured to avoid collapse and possible injury to site workers. • Access to excavation must be controlled;	**Very Low (-)**

Description of Impact	Significance Pre-Mitigation	Mitigation Measures	Significance Post-Mitigation
		• Excavated areas should be temporarily fenced-off; and • Excavations will be backfilled and landscaped as soon as possible.	
Potential creation of very limited extent short term employment opportunities for the local community, during the prospecting phase.	**Low (+)**	Local labour to be sourced where possible.	**Low (+)**
Multiplier effects on local economy will be positive, but very limited in extent and only short term.	**Low (+)**	Supplies to be bought locally as far as possible.	**Low (+)**

(ii) Final Site Map

(Provide a map at an appropriate scale which superimposes the proposed overall activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers. Attach as ***Appendix 6****)*

The specific locations of intrusive drilling activities will be determined during Phase 1 of the Prospecting Work Programme. All infrastructure to be developed will be mobile and temporary. The ecologists, however, did recommend that no prospecting be conducted on the sensitive northern portions of the study area (refer to Figure 1).

(iii) Summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;

Please refer to Table 12.

g) Proposed impact management objectives and the impact management outcomes for inclusion in the EMPR;

(Based on the assessment and where applicable the recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPR as well as for inclusion as conditions of authorisation).

The following management objectives and impact management outcomes are recommended for inclusion in the EMPR:

- Biodiversity: Prevent and / or restrict the loss of indigenous fauna and flora as far as possible;
- Physical aspects: Prevent and / or restrict the impact on soils and surface water;
- Social Aspects: Ensure the health and safety of employees of Ilangabi Investments 12 (Pty) Ltd and any contractors associated with the development and operation of the proposed activity as well as the surrounding community and visitors;
- Heritage: Ensure the protection of any potential heritage features or objects that may be excavated during the proposed development.

h) Aspects for inclusion as conditions of Authorisation

(Any aspects which must be made conditions of the Environmental Authorisation)

The following aspects are recommended to be included as conditions in the Environmental Authorisation:

- The EMPR is a contractual document and must be implemented at all times during the prospecting phase;
- An independent environmental control officer (ECO) must be appointed to monitor the implementation of the EMPR and audit reports to be kept by the applicant;
- All contractors and employees of Ilangabi Investments 12 (Pty) Ltd must be made aware of the EMPR and its requirements as well as the impact of not implementing the measures of the EMPR;

- Copies of the EMPR, Integrated Environmental Authorisation and any emergency procedures and method statements, must be kept on site and be available on request of the Competent Authority.

i) Description of any assumptions, uncertainties and gaps in knowledge.

(Which relate to the assessment and mitigation measures proposed)

- All information provided to the environmental team, by the applicant and I&APs was correct and valid at the time that it was provided;
- The investigations undertaken by specialists during the BA process, indicate the development site as suitable and technically acceptable, except for the northern portions, which are sensitive and recommended to be excluded from prospecting;
- It is not always possible to involve all I&APs individually, however, every effort has been made to involve as many affected stakeholders as possible;
- The information provided by the applicant and specialists was accurate and unbiased; and
- The scope of this investigation is limited to assessing the environmental impacts associated with the prospecting activity.

j) Reasoned opinion as to whether the proposed activity should or should not be authorised

i) Reasons why the activity should be authorised or not

In general, it is recognised that the proposed prospecting activities have the potential to pose various risks to the environment as well as to the residents or businesses in the surrounding area. However, based on the findings of this BA documented in this report, all impacts can be mitigated to insignificant levels.

This report shows that the proposed development has the potential to provide socio-economic benefits to the local and regional communities. The EAP therefore recommends that the proposed activities be approved on condition that the EMPR is strictly implemented and monitored for compliance and that the northern portions of the study area are excluded from prospecting.

Not implementing the prospecting activities will result in a loss of information on mineral reserves present on the study area. Should economically feasible reserves exist on the study area and the applicant cannot prospect, the opportunity to utilise the reserves for future mining and brick-making will be lost, i.e. the minerals will be sterilised and resultant socio-economic benefits will be lost.

The proposed prospecting activities have the potential to have a negative impact on the ecological environment as well as the social environment of the area. These impacts, however, can potentially be prevented, minimised, mitigated and managed to low and very low levels, as shown through the impact assessment.

ii) Conditions that must be included in the authorisation

- The EMPR is a contractual document and must be implemented at all times during the prospecting phase;

- An independent environmental control officer (ECO) must be appointed to monitor the implementation of the EMPR and audit reports to be kept by the applicant;
- All contractors and employees of Ilangabi Investments 12 (Pty) Ltd must be made aware of the EMPR and its requirements as well as the impact of not implementing the measures of the EMPR;
- Copies of the EMPR, Environmental Authorisation and any emergency procedures and method statements, must be kept on site and be available on request of the Competent Authority.

12. Period for which the Environmental Authorisation is required.

This Environmental Authorisation is required for a period of 5 years.

13. Undertaking

(Confirm that the undertaking required to meet the requirements of this section is provided at the end of the EMPR and is applicable to both the Basic assessment report and the Environmental Management Programme report).

Please refer to the EMPR in Part B of this document.

14. Financial Provision

(State the amount that is required to both manage and rehabilitate the environment in respect of rehabilitation).

The closure cost assessment will be conducted, if required. The report will be submitted to the Department of Mineral Resources together with the Final Basic Impact Assessment report, if required.

iii) Explain how the aforesaid amount was derived

The financial provision amount will be calculated utilising the methodology as prescribed by the Guideline Documents for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine issued by the DMR.

iv) Confirm that this amount can be provided for from operating expenditure

(*Confirm that the amount, is anticipated to be an operating cost and is provided for as such in the Mining work programme, Financial and Technical Competence Report or Prospecting Work Programme as the case may be).*

The applicant submits that it is an operating clay mining company and is able to fund the planned prospecting from its operational budget. It is confirmed that the amount for financial provision is anticipated to be an operating cost and is provided for as such in the Prospecting Work Programme.

15. Specific Information required by the competent Authority

v) Compliance with the provisions of sections 24(4)(a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act (Act 107 of 1998). the EIA report must include the: -

(1) Impact on the socio-economic conditions of any directly affected person

(Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond prospecting on any directly affected person including the landowner, lawful occupier, or, where applicable, potential beneficiaries of any land restitution claim, attach the investigation report as an Appendix).

Potential impacts on landowners, land occupiers, communities or individuals or competing land uses in the area include:

- Potential soil pollution which may result from any hydrocarbon spills where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. There is always a chance of these breaking down and/or leaking;
- Contamination of stormwater runoff and groundwater, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery and fuel storage area.
- Visual impacts: Visibility from sensitive receptors / visual scarring of the landscape as a result of the prospecting activities.
- Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.
- Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and drilling.
- Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.
- Generation of additional general waste, litter and building rubble and hazardous waste.
- Minor impact caused by need for services i.e. water, electricity and sewerage systems during the prospecting phase causing additional strain on natural resources and service infrastructure.
- Minor change in traffic patterns as a result of traffic entering and exiting the site on the surrounding road infrastructure and existing traffic.
- Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, and heavy vehicles.
- Possibility of prospecting activities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.
- Increased risk to public and worker safety: If not fenced off, the public and workers may fall into excavated areas and trenches.
- Potential creation of very limited extent short term employment opportunities for the local community, during the prospecting phase.
- Multiplier effects on local economy will be positive, but very limited in extent and only short term.

Mitigation measures are included in this report, as well as the EMPR.

(2) Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act

(Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond prospecting on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) with the exception of the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act, attach the

investigation report as Appendix 2.19.2 and confirm that the applicable mitigation is reflected in 2.5.3; 2.11.6.and 2.12.herein).

From these previous research records conducted in the area; the specialist concluded that the general region is significant from a heritage perspective. Heritage sites are likely to include graveyards, Iron Age/Farmer and Historical remains. Since heritage sites, e.g. graves, are not always clearly identifiable as it might consist of stone cairns, it is advised that a qualified archaeologist inspect the proposed prospecting sites prior to drilling to establish whether the sites might be sensitive from a heritage perspective.

The following recommendations were made in terms of the National Heritage Resources Act (Act No. 25 of 1999) in order to avoid the destruction of heritage remains in areas demarcated for prospecting:

- Prior to any development, construction or prospecting, a qualified archaeologist should conduct a site inspection on the areas demarcated for geotechnical drilling/prospecting. Proposed access roads to the drill sites should also be surveyed in order to avoid the destruction of heritage material;
- Should the prospecting outcome result in further development or construction and mining, a full Phase 1 Archaeological Impact Assessment must be conducted on the affected area if triggered;
- Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed during development and construction phases, all activities must be suspended and the relevant heritage resources authority contacted (see National Heritage Resources Act (Act No. 25 of 1999) Section 36 (6)).

16. Other matters required in terms of sections 24(4)(a) and (b) of the Act

(the EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in sub-regulation 22(2)(h), exist. The EAP must attach such motivation as Appendix 4).

The EAP included all aspects as required by the EIA regulations, 2014 for the EIA and EMPR as described in the Executive Summary of this report. Please refer to Part A Section 3 (g).

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

1. Draft environmental management programme

a) Details of the EAP

(Confirm that the requirement for the provision of the details and expertise of the EAP are already included in PART A, section 1(a) herein as required).

Herewith, it is confirmed that the requirement for the provision of the details and expertise of the EAP are already included in PART A, Section 1(a) of this report.

b) Description of the Aspects of the Activity

(Confirm that the requirement to describe the aspects of the activity that are covered by the draft environmental management programme is already included in PART A, section (1) (h) herein as required).

Herewith, it is confirmed that the requirement to describe the aspects of the activity that are covered by the draft environmental management programme is already included in PART A, section (1) (h) herein as required.

c) Composite Map

(Provide a map (Attached as an Appendix) at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers).

Refer to Appendix 6.

d) Description of Impact management objectives including management statements

i) Determination of closure objectives

(Ensure that the closure objectives are informed by the type of environment described).

The prospecting activities are dependent on the preceding phase (non-invasive). Prospecting is conducted in phases, where the activities and location of drilling and trenching to sample soil are dependent on the previous phase. Therefore, the specific locations and extent of soil sampling and diamond core drilling cannot be predetermined. Mapping of prospecting activities can also not be conducted.

The closure objectives include:

- Ensure that there are no safety risks associated with the drill boreholes through drill hole capping and backfilling;

- Rehabilitate any pollution that occurred through hazardous spills or waste materials and remove the source of the pollution;
- Establish an area that is not susceptible to soil erosion;
- Re-vegetate disturbed areas with endemic plant species that occur naturally within the area.

ii) **Volumes and rate of water use required for the operation**

Water will be received via the Vlakfontein mine and transported to the site via trucks.

iii) **Has a water use licence been applied for?**

It is not required from the applicant to apply for a water use license, due to the low volume of water required for prospecting.

iv) Impacts to be mitigated in their respective phases

e) Measures to rehabilitate the environment affected by the undertaking of any listed activity

ACTIVITIES	PHASE	SIZE AND SCALE of disturbance	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			•		

Please refer to ***Table 13*** for the above requested information.

f) Impact Management Outcomes

(A description of impact management outcomes, identifying the standard of impact management required for the aspects contemplated in paragraph ();

Table 13: Measures to rehabilitate the environment affected by the undertaking of any listed activity, impact management outcomes, and impact management actions for

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
• Clearing of vegetation and topsoil. • Stockpiling of overburden positioned for	Minor loss and disturbance to topsoil as a result of clearing of vegetation and drilling and trenching. When vegetation is cleared and the topsoil is stripped, the soil's natural structure is disturbed and as a result	**Prevent and reduce through management measures.** **Stripping of topsoil:** • Clearing of areas to take place a maximum of one month prior to intended prospecting in the area;	Impact avoided. All topsoil used in concurrent rehabilitation.	Rehabilitation objectives and standards	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
later rehabilitation. • Prospecting including diamond core drilling, logging and sampling of the borehole core, trenching will involve the digging of excavation trenches down to approximately 3 metres below surface using graders and excavators.	the natural cycle is broken exposing the bare soil to erosion. Vehicles driving on these soils cause compaction of soils and reduces the soils' ability to be penetrated by root growth. Compaction also increases erosion potential. When soils are not stripped and stockpiled according to the soil stripping guidelines these soils would have lost their natural physical and chemical properties, reducing the topsoil's ability to be a plant growth medium. The above factors all contribute to a loss of the topsoil's ability to be a resource through alterations and removal.	• Stripping of topsoil will not take place during rain or excessive wind; and • The top 30 cm of vegetation and topsoil is to be stripped from the area to be prospected. **Storage of topsoil / overburden:** • Topsoil (top 30cm) is to be stored in predetermined topsoil berms, (+/- 5m) outside the boundary of the specific area; and • Topsoil stockpiles will be restricted to 1.5 to 2m in height. **Maintenance and monitoring of topsoil stockpiles:** • The stored topsoil should be used as soon as possible in concurrent rehabilitation; • Weekly visual inspections to be conducted.	Rehabilitation objectives and standards		

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
• Dust Suppression.	Hydrocarbon spills on soil can occur where heavy machinery and vehicles are parked such as the hard park area because they contain large volumes of lubricating oils, hydraulic oils, and diesel to run. There is always a chance of these breaking down and/or leaking.	**Prevent and reduce and remedy through management measures.** • All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks; • All leaks will be cleaned up immediately using an absorbent material and spill kits, in the prescribed manner; and ***Hydrocarbons and hazardous waste*** • All hazardous waste generated shall be kept separate and shall not be mixed with general waste; and • All hazardous waste shall be stored within a sealed drum on an impermeable surfaced area within the central waste storage and transition area.	Impact avoided. No signs of soil contamination and loss of topsoil due to contamination. Meet rehabilitation objectives and standards.	Rehabilitation objectives and standards Spill procedure Hazardous Substances Act, 1973 (Act 15 of 1973) [as amended] • Section 2 Declaration of grouped hazardous substances; - Section 9 (1) Storage and handling of hazardous chemical substances	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
				- Section 18 Offences Hazardous Chemical Substances Regulations, 1995 (Government Notice 1179 of 1995) - Section 4 Duties of persons who may be exposed to hazardous chemical substances SANS 10234: 2008: Globally Harmonized	

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
				System of classification and labelling of • chemicals (GHS)	
	Stormwater, erosion and siltation impacts due to a lack of implementing temporary measures to manage stormwater run-off quantity and quality.	**Prevent and reduce and remedy through management measures.** • A Stormwater Management Plan (SMP) to be developed for the collective area where prospecting will occur, (or the existing SMP updated, where applicable for present and future activities) and should include the management of stormwater during excavation, as well as the installation of temporary stormwater and erosion control measures during prospecting, followed up by rehabilitation of the area; • Temporary stormwater management systems (such as sand bags) will be installed to prevent stormwater from entering or exiting the area where prospecting will occur, which could result in silt laden surface water from draining into the Blesbokspruit	Impact avoided. No signs of soil contamination and loss of topsoil due to contamination. Meet rehabilitation objectives and standards.	Rehabilitation objectives and standards Spill procedure GN704 Regulations in terms of the National Water Act, 1998 (Act No 36 of 1998) Hazardous Substances Act, 1973 (Act 15 of 1973) [as amended]	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• The slopes of the area where prospecting activities will occur, should be profiled to ensure that they are not subjected to excessive erosion but capable of drainage run-off with minimum risk of scrub (hydrologic action by water that causes erosion). A maximum gradient of 1:3 is recommended; • If necessary, temporary diversion channels should be constructed ahead of the stockpiles (if relevant) to intercept clean run-off and divert it around disturbed areas into the natural drainage system downstream (down gradient) of the prospecting area; • Existing vegetation must be retained as far as possible to minimise erosion problems; • Rehabilitation of the prospecting area shall be planned and completed (after conclusion of the prospecting activities) in such a way that the run-off water (if any) will not cause erosion; • Visual inspections shall be done on a weekly basis with regard to the stability of the temporary		• Section 2 Declaration of grouped hazardous substances; - Section 9 (1) Storage and handling of hazardous chemical substances - Section 18 Offences Hazardous Chemical Substances Regulations, 1995 (Government Notice 1179 of 1995)	

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		water control structures, erosion and siltation (if required). • Sediment-laden run-off from cleared areas should be prevented from entering rivers and streams; • No river or surface water may be affected by silt emanating from the prospecting area (especially aimed at prevention of siltation of the nearby Blesbokspruit); and • No wastewater may run freely into any of the surrounding naturally vegetated areas.		- Section 4 Duties of persons who may be exposed to hazardous chemical substances SANS 10234: 2008: Globally Harmonized System of classification and labelling of • chemicals (GHS)	
	Contamination of stormwater runoff and groundwater, caused by chemicals such as hydrocarbon-based fuels and oils or lubricants spilled from heavy vehicles and machinery and fuel storage area.	**Prevent and reduce through management measures.** In accordance with Government Notice 704 (GN 704), the onsite management should: • Keep clean and dirty water separated; • Contain any dirty water within a system; and	Impact avoided. No signs of soil contamination and loss of topsoil due to contamination.	Rehabilitation objectives and standards Spill procedure	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• Prevent the contamination of clean water. In order to achieve these objectives, the following stormwater management measures must be implemented on the site to ensure that those potential stormwater impacts are kept to a minimum: • Clean and dirty stormwater needs to be separated. Dirty stormwater may not be released into the environment and should be contained and treated on site; • All temporary stormwater infrastructure (if any) on-site shall be maintained and kept clean throughout the prospecting period; • Immediate reporting of any polluting or potentially polluting incidents so that appropriate measures can be implemented; • Fuel and oil spills shall be treated immediately by appropriate mop-up products. Several hydrocarbon absorption/remediation products (i.e. Spill kits) must be placed throughout the site;	Meet rehabilitation objectives and standards.	GN704 Regulations in terms of the National Water Act, 1998 (Act No 36 of 1998) Hazardous Substances Act, 1973 (Act 15 of 1973) [as amended] • Section 2 Declaration of grouped hazardous substances; - Section 9 (1) Storage and handling of hazardous	

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• Use of bunds or traps to ensure full containment of hydrocarbon and other hazardous materials are mandatory; • Any contaminated material is disposed of in an appropriate manner and the potential risks associated with such spills are limited; • Stormwater leaving the site must in no way be contaminated; • Ensure good housekeeping practices; • Increased runoff should be managed using berms and other suitable structures as required to ensure flow velocities are reduced; and • Removal of spills, rainwater and waste produced during clean-up of the bunds – shall be done in accordance to relevant specifications.		chemical substances - Section 18 Offences Hazardous Chemical Substances Regulations, 1995 (Government Notice 1179 of 1995) - Section 4 Duties of persons who may be exposed to hazardous chemical substances	

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
				SANS 10234: 2008: Globally Harmonized System of classification and labelling of • chemicals (GHS)	
	Minor loss of natural vegetation and destruction of habitat will result in associated loss of fauna and flora species.	**Reduce through management measures.** • A suitably qualified specialist (ecologist) to accompany the site manager to demarcate areas for prospecting, in order to avoid damaging sensitive vegetation as identified during the specialist study and according to the sensitivity maps provided in this report; • Only vegetation falling directly into demarcated access routes or project sites should be removed; • No further vegetation clearance except for the removal of alien invasive species will be allowed; and	Meet rehabilitation objectives and standards. Alien and invasive vegetation management plan implemented and outcomes achieved.	Meet rehabilitation objectives and standards. Alien and invasive vegetation management plan implemented and outcomes achieved.	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• All remaining indigenous vegetation should be conserved wherever possible.			
	Disruption in the movement patterns of fauna species may impact on biodiversity. Noise, dust and potential light pollution, as well as migration of pollutants such as hydrocarbons in the soils, dust and emissions from vehicle and machinery altering air quality will all have an impact on biodiversity.	**Prevent and reduce through management measures.** • Reduce the levels of disturbance on areas indicated by the Environmental Control Officer (ECO) as migratory routes, if any; • Environmental awareness training should include that no hunting, trapping or killing of fauna are allowed; • Any animals rescued or recovered will be relocated in a suitable habitat away from the mining operations and associated infrastructure; • Any lizards, snakes or monitors encountered should be allowed to escape to a suitable habitat away from disturbance. • No reptile should be intentionally killed, caught or collected during any phase of the project; and • General avoidance of snakes is the best policy if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area.	NEMBA: National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	NEMBA: National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
	Introduction and spread of alien invasive species. The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in construction materials and on vehicles. Invasion of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse through stormwater, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system, alien plants can spread throughout the catchment. If allowed to seed before control measures are implemented, alien plants can easily colonise and impact on downstream users.	**Prevent and control through management measures.** • An alien vegetation management plan should be drawn up and implemented; • Regular removal of invasive alien species should be undertaken. This should extend through to the closure phase of the project; and • No spreading of alien vegetation onto adjacent properties should be allowed.	Rehabilitation Objectives and Standards Alien and invasive vegetation management plan implemented and outcomes achieved. Proof of alien vegetation control. No listed species visible on the site.	Alien and Invasive Species Management Plan Rehabilitation Objectives and Standards Alien and Invasive Species Regulations (Government Notice 598 of 2014) and Alien and Invasive Species List, 2014 in terms of NEMBA (Government Notice 599 of 2014) - Notice 2	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
				Exempted Alien Species in terms of Section 66 (1) - Notice 3 National Lists of Invasive Species in terms of Section 70(1) – List 1, 3-9 & 11 - Notice 4 • Prohibited Alien Species in terms of Section 67 (1) – List 1, 3-7, 9-10 & 12	
	Alteration of archaeological, historical and palaeontological resources that may be discovered during earthworks and drilling.	**Protect heritage resources through developing and implementing procedures.** • Prior to any development, construction or prospecting, a qualified archaeologist should conduct a site inspection on the areas demarcated for geotechnical drilling/prospecting.	No loss of newly discovered material.	National Heritage Resources Act, 1999 (Act No. 25 of 1999) and associated regulations.	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		Proposed access roads to the drill sites should also be surveyed in order to avoid the destruction of heritage material; • Should the prospecting outcome result in further development or construction and mining, a full Phase 1 Archaeological Impact Assessment must be conducted on the affected area if triggered; • Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed during development and construction phases, all activities must be suspended and the relevant heritage resources authority contacted (see National Heritage Resources Act (Act No. 25 of 1999) Section 36 (6)). Should culturally		• South African Heritage Resources Agency Guidelines.	

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		significant material or skeletal remains be exposed during prospecting all activities must be suspended pending further investigation by a qualified archaeologist (Refer to the National Heritage and Resources Act, 25 of 1999 section 36 (6)); • Should any objects of archaeological or palaeontological remains be found during activities, work must immediately stop in that area and the Environmental Control Officer (ECO) must be informed; • The ECO must inform SAHRA and contact an archaeologist and / or palaeontologist, depending on the nature of the find, to assess the importance and rescue them if necessary (with the relevant SAHRA permit). No work may be resumed in this area without the permission of the ECO and SAHRA.			
	Visibility from sensitive receptors / visual scarring of the landscape as a result of the prospecting activities.	**Reduce through controlling management measures.** • Unnecessary lights should be switched off during the day and / or night to avoid light pollution;	Rehabilitation objectives and standards	• Rehabilitation objectives and standards	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• If lighting is required, the lighting will be located in such a place and such a manner so as to minimise any impact on the surrounding community and fauna; • Install temporary lights that will not create a night sky glow; • Security lighting should be designed in such a way as to minimise emissions onto undisturbed areas on site and neighbouring properties. Light fittings should face downwards; • Housekeeping on site should be enforced; • Rehabilitation measures such as re-vegetation and plan to be implemented; • Reduce the prospecting period through careful planning and productive implementation of resources; • Plan the placement of lay-down areas and any potential temporary prospecting camps in order to minimise vegetation clearing;			

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• Restrict the activities and movement of workers and vehicles to the immediate prospecting site and existing access roads; • Ensure that rubble, litter and issued materials are managed and removed regularly; • Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way; and • Reduce and control dust through the use of approved dust suppression techniques.			
	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise and vibration impacts associated with the operation of vehicles, machinery and equipment.	**Reduce through controlling measures.** • Vehicles and machinery will be regularly serviced to ensure acceptable noise levels are not exceeded; • Silencers will be utilised where possible; • Heavy vehicle traffic should be routed away from noise sensitive areas where possible; • Noise levels should be kept within acceptable limits. All noise and sounds generated should adhere to South African Bureau of Standards (SABS) specifications for maximum allowable noise levels for construction sites. No pure tone	Impact reduced. Records of service of all operational vehicles. Silencers utilised where applicable. All employees wear PPE where required.	Meet the South African National Standard SANS 10103:2008 Meet South African Bureau of Standards (SABS) specifications for maximum allowable noise	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		sirens or hooters may be utilised except where required in terms of SABS standards or in emergencies; • With regard to unavoidable very noisy activities in the vicinity of noise sensitive areas, the Site Manager (SM) should liaise with local residents and a suitably qualified ecologist and how best to minimise impacts, and the local population should be kept informed of the nature and duration of intended activities; • The SM should take measures to discourage labourers from loitering in the area, causing noise disturbance; • Noise impacts should be minimised by restricting the hours (between 06h00 and 18h00 on Monday to Friday, and 06h00 and 13h00 on Saturdays), during which the offending activities are carried out and, where possible, by insulating machinery and/or enclosing areas of activity; • No noisy activities to occur on Sundays or public holidays;		levels for construction sites. • Meet the requirements of the Mine Health and Safety Act (Act 29 of 1996)	

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• Personal Protective Equipment to all persons working in areas where high levels of noise can be expected; Signs where it is compulsory; • Regular inspections and maintenance of equipment, vehicles and machinery to prevent unnecessary noise.			
	Increased dust pollution due to vegetation clearance and vehicles driving on gravel roads and drilling.	**Reduce through controlling measures.** • Dust suppression shall be implemented during dry periods and windy conditions; • All exposed surfaces should be minimised in terms of duration of exposure to wind and stormwater; • Excavation, handling and transportation of erodible materials shall be avoided under high wind conditions (excess of 35km/hr) or when a visible dust plume is present; • Ensure that the shortest routes are used for material transport; • Ensure that stockpile height is kept to a minimum; • Minimise travel speed on unpaved roads;	Impact reduced. Speed limit road signs, complying with the South African Road Signs Manual on site. Dust fall monitoring programme should be implemented. Dust fallout and Particulate Matter	South Africa National Standard 1929:2005: Ambient Air Quality: Limits for common pollution Meet the requirements of the National Dust Control regulations, 2013, as published in the Government Gazette (No. 36974) of 1	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• Implement monthly site inspection to check for possible areas of dust generation not addressed or not effectively managed; • Spray areas to be cleared with water; • Ensure minimum travel distance between working areas and stockpiles; • Ensure that topsoil for stockpiles is sprayed with water before tipping to prevent dust generation; • Ensure graded areas are sprayed with water; • Minimise the amount of graded areas; • Load and offload material, as far as possible, downwind of topsoil stockpiles.	(PM) levels may not exceed the limits as set out in the Dust Control Regulations above. Monitoring dust stands occurring on site.	November 2013 (GNR 827 of 1 November 2013), in terms of the National Environmental Management: Air Quality Act 39 of 2004 •	
	Gaseous emissions from vehicles and machinery may cause an impact on ambient air quality.	• All vehicles and machinery will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks; • Proper planning of movements (vehicle trips) and working of machinery should take place, in order to avoid unnecessary trips and hours of operation.	Rehabilitation objectives and standards	• Rehabilitation objectives and standards	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
	Generation of additional general waste, litter and building rubble and hazardous waste.	**Control through management measures.** • A central waste storage and transition area shall be established within the site camp; • The central waste storage and transition area shall be surfaced and demarcated appropriately; • Portable wheelie bins shall be placed throughout the site camp as well as at the remainder of the site and at all working areas in the field; • Wheelie bins shall be colour coded and labelled to identify the waste stream for which it is intended; • All portable wheelie bins and other containers shall be emptied at the central waste storage and transition area a minimum of once a week or when filled, as to avoid waste build up; • The waste shall be removed (within 30 days) by a licensed waste service provider as shall be disposed of at a licensed waste landfill site and records of safe disposal (as required for hazardous wastes) shall be supplied to the Contractor. These records shall be kept on site by the ESM;	Waste management on site visible.	Waste management on site visible. Waste Classification and Management Regulations and Norms and Standards for the assessment of for landfill disposal and for disposal of waste to landfill, 2013 (Government Notice 634 – 635 of 2013) promulgated in terms of the National Environmental Management:	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• Wherever possible and practical, waste materials generated on site must be recycled; and • Waste specific (hazardous, timber, steel etc.) mitigation measures to be implemented.		Waste Act, 2008 (Act No. 59 of 2008) [as amended] and: Regulations regarding the planning and management of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation (GN R. 632 of 2015)	

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
				SANS 10234: 2008: Globally Harmonized System of classification and labelling of • chemicals (GHS)	
	Minor impact caused by need for services i.e. water, electricity and sewerage systems during the prospecting phase causing additional strain on natural resources and service infrastructure.	**Reduce through controlling management measures.** • Energy savings measures to be implemented at the site e.g.: ➢ No lights to be switched on unnecessarily; ➢ Only security lights to be switched on at night; • Energy saving bulbs to be installed; and • Water should be recycled as far as possible to avoid any additional water usage.	Impact avoided. Recycling of used and contaminated water through wastewater and sewage treatment and reuse.	• -	Prospecting Invasive Phase
	Minor change in traffic patterns as a result of traffic entering and exiting the site on the surrounding road infrastructure and existing traffic.	**Reduce through controlling management measures.** • Where feasible heavy vehicles should not operate on public roads during peak hours; and	Impact reduced. Speed limit road signs, complying	Reduce through controlling measures	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• Heavy vehicles should adhere to the speed limit of the road.	with the South African Road Signs Manual on site.	Set Speed Limits • South African Road Signs Manual	
	Nuisance, health and safety risks caused by increased traffic on and adjacent to the study area including cars, and heavy vehicles.	**Prevent through controlling management measures.** • Drivers will be enforced to keep to set speed limits; • Trucks will be in a road-worthy condition; • Roads and intersections will be signposted clearly. Only main roads should be used; • Where feasible vehicles should not operate on public roads during peak hours; • Vehicles should adhere to the speed limit of the road; • Heavy vehicles should always travel with their headlights switched on; • Heavy vehicles should not stop on the road to pick up hitchhikers – No stopping on the road approaching the site will be allowed;	Impact reduced. Speed limit road signs, complying with the South African Road Signs Manual on site. South Africa National Standard 1929:2005: Ambient Air Quality: Limits for common pollution	Reduce through controlling measures Set Speed Limits South African Road Signs Manual South Africa National Standard 1929:2005: Ambient Air Quality: Limits for common pollution	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• Ilangabi Investments 12 (Pty) Ltd shall be responsible for ensuring that suitable access is maintained for public traffic to all relevant businesses and properties; and • All traffic accommodation measures are to conform to the latest edition of the South African Road Signs Manual.	Meet the requirements of the National Dust Control regulations, 2013, as published in the Government Gazette (No. 36974) of 1 November 2013 (GNR 827 of 1 November 2013), in terms of the National Environmental Management: Air Quality Act 39 of 2004 Dust fall monitoring	National Dust Control regulations, 2013, as published in the Government Gazette (No. 36974) of 1 November 2013 (GNR 827 of 1 November 2013), in terms of the National Environmental Management: Air Quality Act 39 of 2004 Approved dust fall monitoring programme	

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
			programme should be implemented. Dust fallout and Particulate Matter (PM) levels may not exceed the limits as set out in the Dust Control Regulations above. Monitoring dust stands occurring on site.		
	Possibility of prospecting activities and workers causing veld fires, which can potentially cause injury and or loss of life to workers and surrounding landowners, visitors and workers.	**Prevent through controlling management measures.** • All workers will be sensitised to the risk of fire; • Smoking is only allowed in designated smoking areas and disposal of cigarette butts safely in sand buckets;	Mine Health and Safety Act (Act 29 of 1996) An Emergency Plan (including Fire Protection,	Impact avoided. No incidents of fires occurring on site.	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• The Applicant shall ensure that the basic fire-fighting equipment is available on the site; • Extinguishers should be located outside hazardous materials and chemicals storage containers; • Fire response and evacuation: ➢ An Emergency Plan (including Fire Protection, Response and Evacuation Plan) is to be prepared by the Applicant and conveyed to all staff on the site; ➢ Identify major risks to minimise the environmental impacts e.g., air pollution and contaminated effluent runoff.	Response and Evacuation Plan) Veld and Forest Fire Act, 1998 (Act No. 101 of 1998) [as amended] - Section 12 (1) Duty of the landowner to prevent fire from spreading to neighbouring properties.	No one smoking in unauthorised areas. Proof / records of training in terms of the risk of fire and of the emergency management plan. • Basic fire-fighting equipment located in the correct locations on site.	
	Increased risk to public and worker safety: If not fenced off, the public and workers may fall into excavated areas and trenches.	• A health and safety plan in terms of the Mine Health and Safety Act (Act 29 of 1996) should be compiled and implemented to ensure worker safety;	Mine Health and Safety Plan available on site and proof that it is	Health and safety plan in terms of the Mine Health and Safety Act (Act 29 of 1996)	Prospecting Invasive Phase

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
		• A health and safety control officer should monitor the implementation of the health and safety plan for the operational phase; • Any health and safety incidents should be reported to the Site Manager (SM) immediately; • First aid facilities should be available on site at all times; • Workers have the right to refuse work in unsafe conditions; • Material stockpiles or stacks should be stable and well secured to avoid collapse and possible injury to site workers. • Access to excavation must be controlled; • Excavated areas should be temporarily fenced-off; and • Excavations will be backfilled and landscaped as soon as possible.	being implemented. Proof of training in awareness of health and safety procedures. Proof / records of health and safety audits available on request. No health and safety incidents reported. Proof / record of stockpile and stacks inspections taking place.	•	

Activity Including Size/ scale	Aspects and potential impacts	Mitigation type and Measures	Standards to be achieved	Compliance with standards	Phase and / or time period for implementation
			Health and safety signs on site at appropriate locations.		
	Potential creation of very limited extent short term employment opportunities for the local community, during the prospecting phase.	Local labour to be sourced where possible.	-		Prospecting Invasive Phase
	Multiplier effects on local economy will be positive, but very limited in extent and only short term.	Supplies to be bought locally as far as possible.	-		Prospecting Invasive Phase

g) Impact Management Actions

(A description of impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (c) and (d) will be achieved)

ACTIVITY	POTENTIAL IMPACT	MITIGATION TYPE	TIME PERIOD FOR IMPLEMENTATION	COMPLIANCE WITH STANDARDS

Please refer to**Error! Reference source not found.** for the above requested information.

i) Financial Provision

(1) Determination of the amount of Financial Provision

(a) Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under the Regulation

The closure objectives include:

- Ensure that there are no safety risks associated with the drill boreholes through drill hole capping and backfilling;
- Rehabilitate any pollution that occurred through hazardous spills or waste materials and remove the source of the pollution;
- Establish an area that is not susceptible to soil erosion;
- Re-vegetate disturbed areas with endemic plant species that occur naturally within the area.

(b) Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties

This Basic Assessment Report and Environmental Management Programme will be subjected to a public consultation period, whereby I&APs are given 30 days to comment.

(c) Provide a rehabilitation plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure

The prospecting activities are dependent on the preceding phase (non-invasive). Prospecting is conducted in phases, where the activities and location of drilling and trenching to sample soil are dependent on the previous phase. Therefore, the specific locations and extent of soil sampling and diamond core drilling cannot be predetermined. Mapping of prospecting activities can also not be conducted.

Due to the small extent and fairly short-term period of the prospecting activities and as shown in the Environmental Impact Assessment, the impacts will be of a low or very low significance. Rehabilitation will be conducted concurrently and will include borehole capping and re-vegetation.

(d) Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives

Due to the small extent and fairly short-term period of the prospecting activities and as shown in the Environmental Impact Assessment, the impacts will be of a low or very low significance. Rehabilitation will be conducted concurrently and will include borehole capping and re-vegetation. Detailed mitigation measures are provided in the EMPR to ensure the closure objectives are met.

(e) Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline

The closure cost assessment will be conducted, if required. The report will be submitted to the Department of Mineral Resources together with the Final Basic Impact Assessment report, if required.

(f) Confirm that the financial provision will be provided as determined.

The financial provision will be provided as determined.

The applicant submits that it is an operating clay mining company and is able to fund the planned prospecting and rehabilitation thereof from its operational budget. It is confirmed that the amount for financial provision is anticipated to be an operating cost and is provided for as such in the Prospecting Work Programme.

Mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon, including

- **h) Monitoring of Impact Management Actions**
- **i) Monitoring and reporting frequency**
- **j) Responsible persons**
- **k) Time period for implementing impact management actions**
- **l) Mechanism for monitoring compliance**

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES)	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
PROSPECTING PHASE				
• Clearing of vegetation and topsoil. • Stockpiling of overburden positioned for later rehabilitation.	Surface Water	• A Stormwater Management Plan (SMP) to be developed for the collective area where prospecting will occur, (or the existing SMP updated, where applicable for present and future activities) and should include the management of stormwater during excavation, as well as the installation of temporary stormwater and erosion control measures during prospecting, followed up by rehabilitation of the area. This Stormwater	Applicant Engineer	After rain / storm events; and Weekly

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES)	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
• Prospecting including diamond core drilling, logging and sampling of the borehole core, trenching will involve the digging of excavation trenches down to approximately 3 metres below surface using graders and excavators. • Dust Suppression.		Management Plan to be monitored for implementation; • Visual inspections shall be done on a weekly basis with regard to the stability of the temporary water control structures, erosion and siltation.		
	Dust and air quality pollution	• A minimum of eight dust buckets must be erected around the site in the eight main wind directions. Monthly air quality report will be required as per the regulations to: • Ensure that the environmental mitigation and control measures are implemented; • Monitor environmental performance of the mining operations; • Tracking of progress due to pollution control measure implementation;	Applicant Environmental Specialist	Monthly

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES)	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
		• Verify compliance with all relevant legal and statutory requirements; • Promote environmental education and protection; and • Determine sources of significant pollution.		
	Spreading of alien invasive vegetation and impacts on habitat and vegetation.	Specialist monitoring on Faunal and Floral aspects include the monitoring of effects operational processes have on vegetation and accompanied animal life within the immediate or surrounding areas of the operations. • Alien vegetation control and management; • Habitat and vegetation management; • Rehabilitation services include the rehabilitation of operational disturbed areas and hydrocarbon spill areas; • Sloping and re-vegetation of disturbed area to surrounding landscape; and • Remediation of soil at spill sites.	Environmental Specialist	Visual inspections during all phases of the activities.

m) Indicate the frequency of the submission of the performance assessment/ environmental audit report.

A Performance Assessment Review of the EMPR should be conducted annually and the environmental audit report will be submitted annually.

n) Environmental Awareness Plan

(1) Manner in which the applicant intends to inform his or her employees of any the environmental risk which may result from their work

The environmental awareness plan will include the following:

- Induction of all staff and workers;
- Monthly 'toolbox' talks (awareness talks);
- Risk assessments for specific tasks with supervisors and staff involved in the task on a daily basis, or as often as the task is taking place.

The following principles and training will apply to the Environmental Awareness Plan (safety, health and environmental (SHE) training and the Environmental Management System (EMS) training):

- All personnel, including contactors, will as a minimum undergo general SHE induction and awareness training;
- The Safety, Health, Environmental and Quality (SHEQ) Manager will identify the SHE training requirements for all personnel and contractors. The training requirements will be recorded in a training needs matrix indicating particular training that must be undertaken by identified personnel and contractors. The training matrix will be administered by the Training Department; and Development of the Training Programme, which will include:
    - Job specific training – training for personnel performing tasks which could cause potentially significant environmental impacts;
    - Assessment of extent to which personnel are equipped to manage environmental impacts;
    - Basic environmental training;
    - EMS training;
    - Comprehensive training – on emergency response, spill management, etc;
    - Specialised skills;
    - Training verification and record keeping; and
    - Periodic re-assessment of training needs, with specific reference to new developments, newly identified issues and impacts and associated mitigation measures.

General Awareness Training

- The HR Manager, together with the SHEQ Manager, will be responsible for the development of, or facilitating the development of, the required general SHE induction and awareness training. A general environmental awareness training module will be developed and integrated into the general induction programme. The general awareness training must include the Environmental Policy, a description of the environmental impacts and aspects and the importance of conformance to requirements, general responsibilities of personnel and contractors with regard to the environmental requirements and a review of the emergency procedures and corrective actions; and

- A Training Practitioner will conduct the general awareness training. The training presenter will keep a record of the details of all persons attending general awareness training. Such attendance registers shall indicate the names of attendants and their organisations, the date and the type of training received.

Specific Environmental Training

- Specific environmental training will be in line with the requirements identified in the training matrix; and
- Personnel whose work tasks can impact on the environment will be made aware of the requirements of appropriate procedures/work instructions. The SHEQ Manager will communicate training requirements to responsible supervisors to ensure that personnel and contractors are trained accordingly.

Training Evaluation and Re-training

- Effectiveness of the environmental training will be reflected by the degree of conformance to EMPR requirements, the result of internal audits and the general environmental performance achieved;
- Incidents and non-conformances will be assessed through the Internal Incident Investigation and Reporting System, to determine the root cause, including the possible lack of awareness/training;
- Should it be evident that re-training is required, the SHEQ Manager will inform the managers of the need and take the appropriate actions;
- General awareness training of all personnel shall be repeated every year; and
- The re-induction shall take into consideration changes made in the EMPR, changes in legislation, current levels of environmental performance and areas of improvement.

Emergency Procedures

- Emergency procedures, as relevant to this project, shall be implemented;
- The SHEQ Manager shall define emergency reporting procedures for the project;
- All personnel shall be made aware of emergency reporting procedures and their responsibilities;
- Any spills will be cleaned up immediately in accordance with relevant legislation; and
- Telephone numbers of emergency services, including the local firefighting service, shall be conspicuously displayed.

(2) Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment

The procedure for dealing with environmental risk including the objectives, identification and calculation of environmental risks is described in the existing approved EMPR. A spill procedure should be developed and implemented by the applicant.

o) Specific information required by the Competent Authority

(Among others, confirm that the financial provision will be reviewed annually)

No specific information has been required by the Competent Authority at this point in time.

2) UNDERTAKING

The EAP herewith confirms

a) the correctness of the information provided in the reports ☒

b) the inclusion of comments and inputs from stakeholders and I&APs; ☒

c) the inclusion of inputs and recommendations from the specialist reports where relevant; ☒; and

d) that the information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties are correctly reflected herein. ☒

Signature of the environmental assessment practitioner:

Name of company:

Date:

-END-

Appendix 1 : The qualifications of the EAP

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Cornelius Johannes Retief

Registration Number: 113960

is registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Environmental Science

Effective **9 March 2016** Expires **31 March 2020**

Chairperson

Chief Executive Officer

Scan this code to view online version of this certificate

UNISA
UNIVERSITY OF SOUTH AFRICA

Ons verklaar dat

Cornelius Johannes Retief

op 10 Mei 2005

by 'n kongregasie van die Universiteit

toegelaat is tot die graad

BACCALAUREUS ARTIUM
met spesialisering in Omgewingsbestuur

aangesien aan die Wet op Hoër Onderwys

en die Institusionele Statuut voldoen is

Visekanselier

Uitvoerende Dekaan

Registrateur (Akademies)

SUID-AFRIKAANSE POLISIEDIENS
GARSFONTEIN
2014 -03- 08
CLIENT SERVICE CENTRE
SOUTH AFRICAN POLICE SERVICE

UNISA
UNIVERSITY OF SOUTH AFRICA

We certify that

Cornelius Johannes Retief

having complied with the requirements of the Higher Education Act

and the Institutional Statute, was admitted to the degree of

HONOURS BACHELOR OF ARTS

in Geography

at a congregation of the University

on 5 June 2007

Vice-Chancellor

Executive Dean

University Registrar

Appendix 2 : EAP's curriculum vitae

Environmental Assurance (Pty) Ltd

Employee Curriculum Vitae

CORRIE RETIEF

SENIOR ENVIRONMENTAL CONSULTANT

Environmental Assurance
Environmental consulting

ENVIRONMENTAL ASSURANCE (PTY) LTD

394 Tram Street, New Muckleneuk, Pretoria, 0181

T : 012 460 9768 ; M : 082 852 2134; F : 012 460 3071 ; E mail : corrie@envass.co.za

Date of Birth : 24 August 1982; Place of Birth : South Africa

Ethnic Group and Gender : White Male ; Disabilities : None

AREAS OF EXPERTISE

- Basic Assessment Reports
- Environmental Impact Assessments
- Environmental Audit Reports
- Mining Right Applications
- Waste License Applications
- Environmental Management Plans
- Public Participation Processes
- Project Management
- Report Writing
- Sustainable Project Delivery

WORK EXPERIENCE AND SKILLS

Corrie Retief is an Environmental Scientist with more than 10 years of experience in applying the principles of Integrated Environmental Management, and in applying the Environmental Legislation to a number of development projects and initiatives in Southern Africa. He has co-ordinated and managed number of diverse projects and programs related to the Environment and Waste within both the public and private sectors and for national, multi-national and international companies. His interpersonal and organisational skills have enabled him to efficiently direct these projects from initiation to implementation. Furthermore his training in sustainability and sustainable project delivery has helped him to deliver profitable sustainability into customers operations throughout the asset lifecycle.

A significant element of public participation is required throughout the life cycle of an EIA process. Corrie has successfully liaised with interested and affected parties, ensuring that all communication procedures and dialogues are open and transparent, and that capacity building is conducted where necessary. His proficient report-writing skills have been utilised for the compilation of a wide variety of reports, which include but is not limited to Basic Assessment Reports, Scoping and Environmental Impact Assessment Reports, Environmental Management Plans (Planning, Construction, Operation and Decommissioning), Environmental Audit Reports, Opportunities and Constraints Analyses, Feasibility studies, Waste License Applications, Water-Use Application Reports and Mining Right Applications.

CAREER HISTORY

Employer — **ENVIRONMENTAL ASSURANCE (PTY) LTD**

Period — May 2015– Current

ENVIRONMENTAL ASSURANCE (Pty)Ltd www.envass.co.za	**Environmental Assurance (Pty) Ltd**
	Employee Curriculum Vitae

Position **Senior Environmental Consultant**

Responsibilities

Responsible for the management of the environmental authorisations department. This include but is not limited to :

- Project management
- Financial management
- Business development
- Liaising with clients
- Liaising with relevant authorities
- Procurement and management of Sub-consultants
- Ensure Health and Safety Compliance of project teams
- Conducting Environmental risk assessments
- Environmental site screening, investigation and evaluations
- Environmental legal screenings
- Environmental feasibility studies
- Environmental impact assessments
- Basic assessments
- Environmental compliance auditing
- Compilation, implementation and monitoring of environmental management plans.
- Waste Management
- Waste Disposal site selection screenings
- Waste license applications
- Water-Use License Applications
- Mining Right applications
- Managing and facilitating public participation
- Sustainability and Sustainable project delivery
- Teams sustainability Software
- Virtual Mining Solutions

EDUCATION AND QUALIFICATIONS

University of South Africa, BA Hons Geography - 2007
University of South Africa, BA Environmental - 2005

PROFESSIONAL STATUS

Registration Membership SACNASP - Professional Natural Scientist

CONTINUED PROFESSIONAL DEVELOPMENT

COURSE	INSTITUTION	COMPLETED
Environmental Management	University of Pretoria	2014
SEAL Sustainable Design Lead Practitioner Course	Worley Parsons RSA	2013
Environmental Compliance	University of Pretoria	2013
ISO14001 Requirements	Training in Quality Management Systems	2009
ISO14001 Internal Auditor	Training in Quality Management Systems	2009

PROJECT EXPERIENCE

Project Name : **Lynca Meats EIA**
Client **Lynca Meats**
Project Summary : Environmental Impact Assessment for the expansion of abattoir facilities
Role and Responsibilities : Responsible for the overall project management
Involvement : 2015- Current
Location : Meyerton, Gauteng , Republic of South Africa

Project Name : **Blinkpan Siding**
Client **Makoya Group**
Project Summary : Basic Assessment and Water use licence for Coal Siding
Role and Responsibilities : Responsible for the overall project management
Involvement : 2015- Current
Location : Ermelo, Mpumalanga , Republic of South Africa

Project Name : **Argent Siding**
Client **Canyon Coal**
Project Summary : Basic Assessment and Water Use license for a new proposed Coal Siding.
Role and Responsibilities : Responsible for the overall project management.
Involvement : 2015- Current
Location : Delmas, Mpumalanga, Republic of South Africa

Project Name	:	**Eastplats WULA**
Client		**Eastern Platinum Limited**
Project Summary	:	Water Use Licensing of the total mine works.
Role and Responsibilities	:	Responsible for the overall project management.
Involvement	:	2015- Current
Location	:	Brits, Northwest, Republic of South Africa

Project Name	:	**Virtual Mining Solutions**
Client		**Various**
Project Summary	:	Development of online compliance monitoring software for environmental, legal and social compliance.
Role and Responsibilities	:	Responsible for project management and software development.
Involvement	:	2015- Current
Location	:	Pretoria, Gauteng, Republic of South Africa

Detailed Project Experience attached in Appendix A.

REFERENCES

CONTACT NAME	COMPANY	RELATIONSHIP	CONTACT NR
Christiaan Oosthuizen	Dr Ruth S Mompati District Municipality	Client	072 119 1488 053 927 0260
Ina Botha	Naledi Local Municipality	Client	082 847 4575

CERTIFICATION

I, **CORRIE RETIEF**

Declare that, to the best of my knowledge, all the information contained herein is true.

Signature: ________________ On the **09** day of **July** 2015.

APPENDIX A: Detailed Project Experience

PROJECT EXPERIENCE WITH WORLEYPARSONS RSA :

Project Name	:	**Uitvalfontein Landfill Audit**
Client		**Randfontein Local Municipality**
Project Summary	:	Compliance Audit of the Uitvalfontein landfill.
Role and Responsibilities	:	Responsible for the compliance audit.
Involvement	:	2014- 2014
Location	:	Randfontein, Gauteng , Republic of South Africa

Project Name	:	**Luvuvu Letaba Water Scheme**
Client		**Department of Water Affairs**
Project Summary	:	Development of a Reconciliation Strategy for the Luvuvhu and Letaba Water Supply Systems.
Role and Responsibilities	:	Responsible for Environmental feasibility studies.
Involvement	:	2014- 2015
Location	:	Limpopo, Republic of South Africa

Project Name	:	**Assmang Chrome Machadodorp**
Client		**Assmang Chrome**
Project Summary	:	ECO Audits for the Relocation of the Baghouse Dust Disposal Facility to the Existing Licensed slag disposal facility.
Role and Responsibilities	:	Responsible for the monthly environmental compliance audits for the construction.
Involvement	:	2014- 2015
Location	:	Machadodorp, Mpumalanga, Republic of South Africa

Project Name	:	**Syferbult WULA**
Client		**Rustenburg Local Municipality**
Project Summary	:	Water-use License Application (WULA) for the construction of water supply network.
Role and Responsibilities	:	Responsible for the WULA application of the project.
Involvement	:	2014 - 2015

Location : Rustenburg, Northewest, Republic of South Africa

Project Name : **Zeekoegat Waste Water Treatment Construction Audit**
Client **Bigen Africa**
Project Summary : Construction compliance audits for the Zeekoeigat phase 2 WWTW construction.
Role and Responsibilities : Responsible for the monthly environmental compliance audits for the construction phase.
Involvement : 2013 - 2015
Location : Pretoria, Gauteng, Republic of South Africa

Project Name : **Basic Assessment Apex Benoni**
Client **Halewood International South Africa (Pty) Ltd**
Project Summary : Basic Assessment for the rezoning and establishment of additional parking.
Role and Responsibilities : Responsible for the Basic Assessment application of the project.
Involvement : 2014 - 2014
Location : Benoni, Gauteng, Republic of South Africa

Project Name : **Water-use License SA Bank Note Company**
Client **SA Bank Note**
Project Summary : Water-use License Application for new stormwater culvert.
Role and Responsibilities : Responsible for the water-use application of the project.
Involvement : 2014 - 2015
Location : Pretoria, Gauteng, Republic of South Africa

Project Name : **Basic Assessment Transnet Tug Jetty**
Client **Transnet**
Project Summary : Basic Assessment for the establishment of new Tug Jetty at Durban Harbour.
Role and Responsibilities : Responsible for the Basic Assessment application of the project.
Involvement : 2013 - 2015
Location : Durban, KZN, Republic of South Africa

Project Name : **Jupiter B Substation WULA**
Client **Eskom**

Project Summary	:	Water-use License Application (WULA) for the construction of the Jupiter B Substation.
Role and Responsibilities	:	Responsible for the WULA application of the project.
Involvement	:	2013 - 2014
Location	:	Johannesburg, Gauteng, Republic of South Africa

Project Name	:	**SWT Health Care Risk Waste Facility Audit**
Client		**Solid Waste Technologies (Pty) Ltd**
Project Summary	:	Compliance audit for the City Deep healthcare risk waste facility.
Role and Responsibilities	:	Responsible for the compliance audit.
Involvement	:	2013 - 2014
Location	:	Johannesburg, Gauteng, Republic of South Africa

Project Name	:	**Environmental Management Plan (EMP) Update for Jupiter B Substation**
Client		**Eskom**
Project Summary	:	Update of the EMP for the construction of the Jupiter B Substation.
Role and Responsibilities	:	Responsible for the update and approval of the EMP for the project.
Involvement	:	2013 - 2014
Location	:	Johannesburg, Gauteng, Republic of South Africa

Project Name	:	**Taung Road Upgrade**
Client		**Northwest Department Public Works, Roads and Transport**
Project Summary	:	Application for environmental authorisation for the Upgrade of the Road D221 from Road P25/1 Via Maphoitsile to end of Tar Magogong.
Role and Responsibilities	:	Compilation of detailed environmental management plan for the authorisation of the project.
Involvement	:	2013 - 2014
Location	:	Taung, Northwest, Republic of South Africa

Project Name	:	**Goeboegoeboe Salt Mine**
Client		**Geoboegoeboe Salt Works**
Project Summary	:	Mining Right application for salt mining.
Role and Responsibilities	:	Responsible for the mining right application of the project.
Involvement	:	2013- 2015

Location	:	Upington, Northern Cape, Republic of South Africa

Project Name	:	**Assmang Chrome Machadodorp**
Client		**Assmang Chrome**
Project Summary	:	Compilation of EMP for the rehabilitation works on the hazardous H: H waste facility.
Role and Responsibilities	:	Responsible for the compilation of the EMP and audit documentation.
Involvement	:	2013- 2013
Location	:	Machadodorp, Mpumalanga, Republic of South Africa

Project Name	:	**ArcelorMittal Newcastle Works – GSB Rehab EMP**
Client		**ArcelorMittal SA**
Project Summary	:	Compilation of EMP for the rehabilitation works on the GSB waste facility.
Role and Responsibilities	:	Responsible for the compilation of an EMP and Audit documentation.
Involvement	:	2012- 2012
Location	:	Newcastle, KZN, Republic of South Africa

Project Name	:	**DR George Mukhari Hospital**
Client		**Driver Group**
Project Summary	:	Private Public Partnership project for the establishment of the new Dr George Mukhari Hospital.
Role and Responsibilities	:	Responsible for the environmental screening and fatal flaw analysis.
Involvement	:	2011- 2012
Location	:	Ga-Rankuwa, Gauteng, Republic of South Africa

Project Name	:	**Molopo Landfills**
Client		**Dr Ruth Segomotso Mompati District Municipality**
Project Summary	:	The Identification and licencing of new regional waste disposal facility for the towns of Tosca, Bray and Pomfret.
Role and Responsibilities	:	Responsible for the environmental impact assessment and waste licensing process of the project.
Involvement	:	2011- 2014
Location	:	Tosca, Northwest, Republic of South Africa

Project Name	:	**Kagisano Landfills**
Client		**Dr Ruth Segomotso Mompati District Municipality**
Project Summary	:	The Identification and licencing of new general waste disposal facilities for the towns of Piet Plessis, Ganyesa, Thlakgameng and Morokweng.
Role and Responsibilities	:	Responsible for the environmental impact assessment and waste licensing process of the project.
Involvement	:	2011- 2014
Location	:	Ganyesa, Thlakgameng, Morokweng and Piet Plessis, Northwest, Republic of South Africa

Project Name	:	**Lephalale Landfills**
Client		**Lephalale Local Municipality**
Project Summary	:	The Identification and licencing of a new general waste disposal facility for the Lephalale Local Municipality.
Role and Responsibilities	:	Responsible for the environmental impact assessment and waste licensing process of the project.
Involvement	:	2011- 2014
Location	:	Lephalale, Limpopo, Republic of South Africa

Project Name	:	**Rooipunt Solar Power Project**
Client		**SolarReserve South Africa**
Project Summary	:	Establishment of a Solar power park consisting of a 100MW concentrated solar power plant and three 75MW photovoltaic solar power developments.
Role and Responsibilities	:	Responsible for the Environmental impact assessment, Water-use Licensing and Waste Licensing process of the project.
Involvement	:	2010- 2015
Location	:	Upington, Northern Cape, Republic of South Africa

Project Name	:	**ArcelorMittal Newcastle Works – Basic Oxygen Furnace (BOF) Slag Dump Design and EIA**
Client		**ArcelorMittal SA**
Project Summary	:	The closure of the existing hazardous BOF slag disposal facility and establishment of a new hazardous BOF slag disposal facility.
Role and Responsibilities	:	Responsible for the environmental impact assessment and waste licensing process for the project.
Involvement	:	2010- 2012

Location	:	Newcastle, KZN, Republic of South Africa

Project Name	:	**Environmental Assessment Sebenza Substation**
Client		**Johannesburg City Power**
Project Summary	:	The establishment of a 1,000 MVA substation.
Role and Responsibilities	:	Responsible for the Basic assessment process.
Involvement	:	2009- 2012
Location	:	Johannesburg, Gauteng, Republic of South Africa

Project Name	:	**Goedemoed Prison Farm Landfill and Incinerator**
Client		**Department of Public Works**
Project Summary	:	Identify, design, environmental impact assessment for closure of existing landfill and establishment of new landfill and Incinerator.
Role and Responsibilities	:	Responsible for the environmental impact assessment, waste licensing and Air Emission licensing process.
Involvement	:	2009- 2011
Location	:	Aliwal North, Free State, Republic of South Africa

Project Name	:	**Nkangala Regional Landfill**
Client		**Mpumalanga Department Economic Development, Environment and Tourism**
Project Summary	:	Project entails the identification of a new landfill by means of a site selection process, the Environmental Impact Process and the design of the landfill including the design of a transfer station.
Role and Responsibilities	:	Responsible for the environmental impact assessment and waste licensing process of the project.
Involvement	:	2009- 2014
Location	:	Middelburg, Mpumalanga, Republic of South Africa

Project Name	:	**Naledi Landfills**
Client		**Naledi Local Municipality**
	:	Identify, design and licensing of new municipal landfill site.
Role and Responsibilities	:	Responsible for the environmental impact assessment process for the new site and a basic assessment process for the closure of the old site.
Involvement	:	2009- 2010
Location	:	Vryburg, Northwest , Republic of South Africa

PROJECT EXPERIENCE WITH RETIEF ENVIRONMENTAL CONSULTANTS:

Project Name	**:**	**Sodwana Bay Boat Lockers EMP**
Client		**Sodwana Bay Boat Lockers**
Project Summary	:	The establishment of a boat locker facility to store 30 boats.
Role and Responsibilities	:	Project Leader and responsible for the compilation of an environmental management plan for the boat locker facility.
Involvement	:	2009- 2009
Location	:	Durban, KZN, Republic of South Africa

Project Name	**:**	**Steenkamp Broiler Farms**
Client		**Steenkamp Farms**
Project Summary	:	The establishment of a broiler farming operation consisting of six broiler houses and associated infrastructure.
Role and Responsibilities	:	Project Leader, and responsible for public participation, data gathering and the compilation of the basic assessment for the establishment of the broiler farm.
Involvement	:	2008- 2009
Location	:	Brits, Northwest, Republic of South Africa

Project Name	**:**	**Glowing Autumn Sand Quarries**
Client		**GCL Construction Sand**
Project Summary	:	Mining permits application for the establishment of a sand quarry.
Role and Responsibilities	:	Project Leader, public participation, compilation of an environmental management plan for the establishment of the mining operation.
Involvement	:	2006- 2007
Location	:	Rustenburg, Northwest , Republic of South Africa

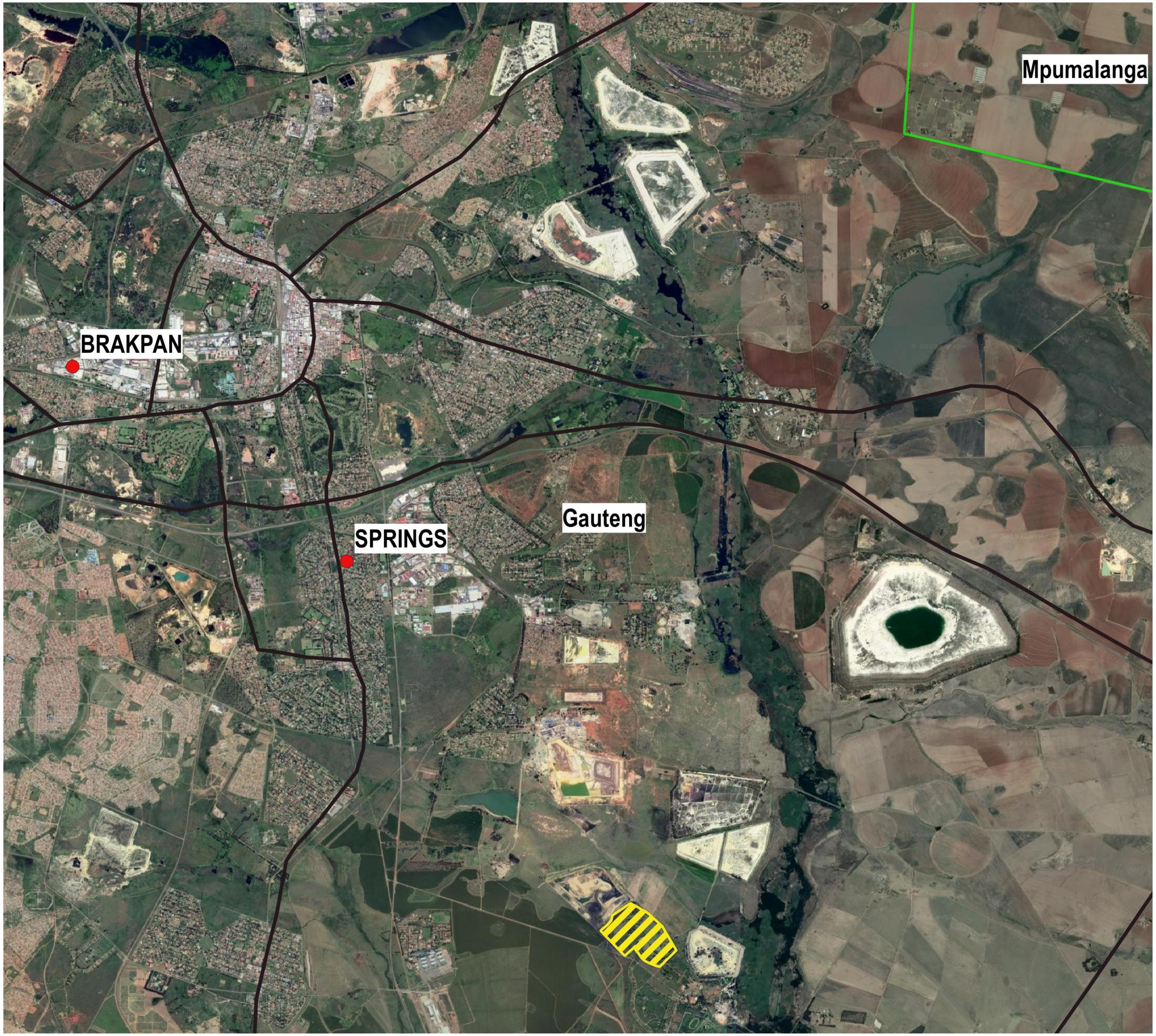
Project Name	**:**	**Dos Ramos Broiler Farm**
Client		**Dos Ramos Farms**
Project Summary	:	The establishment of a broiler farming operation consisting of four broiler houses.
Role and Responsibilities	:	Project Leader and responsible for public participation, completions of basic assessment and application for water-use license.

Involvement	:	2005- 2006
Location	:	Brits, Northwest, Republic of South Africa

Project Name	**:**	**Grand Palace Granite Mine**
Client		**Grand Palace Trading (Pty) Ltd**
Project Summary	:	The establishment of a granite mining operation.
Role and Responsibilities	:	Responsible for the amendment and completions of the environmental impact assessment and the establishment of a social and labour plan for the mining operation.
Involvement	:	2004- 2005
Location	:	Brits, North West Province, Republic of South Africa

Appendix 3 : Locality Map

Ilangabi Prospecting - Locality Map

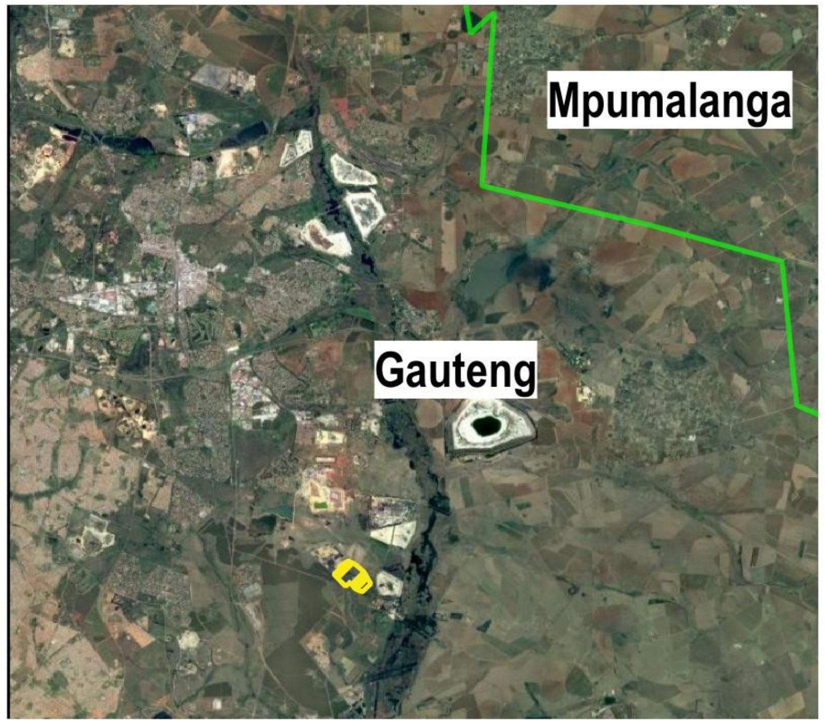


Legend

- Ilangabi Prospecting Location
- Cities
- Provincial Boundary
- Main Roads

"Your Partner in Calculating Environmental Solutions"
ENVASS ENVIRONMENTAL ASSURANCE (Pty)Ltd

Project: Ilangabi Prospecting
Map by: Richard Viljoen
Date: 06/08/2019
Datum: WGS84



Appendix 4 : Prospecting Work Programme and Site Plan

FORM B, Annexure I

DME 274

For official use only:

Application number label here.

DEPARTMENT: MINERALS AND ENERGY
REPUBLIC OF SOUTH AFRICA

APPLICATION FOR PROSPECTING RIGHT

[in terms of section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)

INSTRUCTIONS:

1. For any enquiries, contact the relevant Regional office or designated agency during office hours (refer to List 1).
2. Complete the form in block letters and in black pen.
3. Where options are given, please mark the appropriate block.
4. Complete the form in English and do not use abbreviations (e.g. Street not St).
5. For the type of mineral or minerals applied for, please see List 2 attached to the form.
6. Although the application forms are made available in electronic format, only a signed original hard copy shall be acceptable.
7. Ensure that all the required attachments accompany the application.
8. The application must be submitted to the relevant Regional Manager or designated agency where the land or area is situated.

MINISTER REGION: **G A U T E N G**

PART A: PARTICULARS OF APPLICANT

In the case of a natural person, please provide the following:

Surname:	**n / a**
Forename(s):	**n / a**
Identity no:	**n / a**

**(a certified copy of the identity number in the identity document must be attached)*

In the case of a person other than a natural person, please indicate:

Provincial Government		CC.		Partnership/Joint Venture	
Municipality		Co.		Other (specify):	

Name of Provincial Government, municipality, company, closed corporation, partnership or joint venture:

ILANGABI INVESTMENTS 12 (PTY) LTD

Registration number of Co. or CC.:

2 0 0 4/ 0 1 9 9 7 2/ 0 7

Trading as (if applicable):

n / a

In the case of a Co. or CC., attach the following:

A certified copy of the certificate of Incorporation:	Yes	**X**	No	
A certified copy of the certificate to commence business:	Yes	**X**	No	

PART B: OWNERSHIP OF PARTICIPATION BY HISTORICALLY DISADVANTAGED SOUTH AFRICANS (HDSA)

** (the completion of Part B is* ***optional*** *for application for a prospecting right)*

Please mark the appropriate block regarding the ownership or participation by Historically Disadvantaged South Africans:

[ ] HDSA controlled: 50% + 1 vote HDSA

[ ] Strategic Partnership: 25% + 1 vote HDSA

[X] Broad-based Ownership: HDSA dedicated mining unit trusts, employee share or ownership schemes.

PART C: CONTACT AND CORRESPONDENCE ADDRESS FOR THIS APPLICATION

Surname of contact person:	R E I D
Forename(s) of contact person:	M U R R A Y
Branch/Division:	G A U T E N G
Postal Address:	P O B O X 8 8 4
Suburb	N I G E L
District	E K U R H U L E N I
City	N I G E L
Province	G A U T E N G
Country	S O U T H A F R I C A
Postal Code	1 4 9 0
Telephone no:	0 1 1 8 1 4 8 5 6 1
Fax no.:	0 8 6 6 3 7 7 8 6 8
Cellphone no.:	0 8 3 4 4 7 6 7 0 1
E-mail address:	a d m i n @ i l a n g a b i c o a l . c o . z a
	m u r r a y @ i l a n g a b i c o a l . c o . z a

Relevant physical address:

Building Name:	B R I K O R
Building Number:	
Street Number:	1
Street Name 1:	M A R I E V A L E
Street Name 2: (corner of)	
Type e.g. Street, Avenue, Close, etc.	R O A D
Suburb::	V O R S T E R S K R O O N
Town/City:	N I G E L
District:	E K U R H U L E N I
Province:	G A U T E N G
Country:	S O U T H A F R I C A

PART D: DESCRIPTION OF LAND OR AREA

Provide the registered description of the land, area or offshore blocks to which this application relates, together with respective SG diagrams.

Farm name 2:	V L A K F O N T E I N
	Farm description
	S G Diagrams
Farm number and	2 8 1
	I R
Magisterial District	N I G E L
Farm subdivision name:	P O R T I O N 9 O F T H E
	V L A K F O N T E I N
Farm subdivision number:	
SG 21-digit code (if known):	
Offshore area (if applicable)	N / A

If more than one farm portion are indicated, please attach additional information in the same format.

If the production area is greater or less than a farm portion, please supply the co-ordinates of the corner points of the area/s in degrees, minutes and seconds or decimal degrees of LoX and LoY or indicate on Topocadastral map(s). In

the case of applications based on Topocadastral maps, the applicant must seek assistance from the Enquiry desk at the relevant Regional office.
With reference to co-ordinates, provide in decimal degrees.

If possible, please provide the co-ordinates in a digital format e.g. ASCII file (longitude, -latitude). When co-ordinates is provided in ASCII format, the LO, spheroid and datum information must still be completed on this form.*

If the application is for a whole farm portion/s there is no need to provide co-ordinates.

** An ASCII (American Standard Code for Information Interchange) file is any form of text file that can be interchanged between different users and interpreted through any software.*

1.	Longitude or LoY	28.484979	E
	Latitude or LoX	-26.343965	S
2.	Longitude or LoY	28.486152	E
	Latitude or LoX	-26.3433358	S
3.	Longitude or LoY	28.487749	E
	Latitude or LoX	-26.3409668	S
4.	Longitude or LoY	28.489127	E
	Latitude or LoX	-26.3401556	S
5.	Longitude or LoY	28.489926	E
	Latitude or LoX	-26.3398711	S
6.	Longitude or LoY	28.492412	E
	Latitude or LoX	-26.3413776	S
7.	Longitude or LoY	28.495444	E
	Latitude or LoX	-26.3444419	S
8.	Longitude or LoY	28.496612	E
	Latitude or LoX	-26.3466888	S
9.	Longitude or LoY	28.494450	E
	Latitude or LoX	-26.3487750	S
10	Longitude or LoY	28.492673	E
	Latitude or LoX	-26.3484890	S
11	Longitude or LoY	28.491245	E
	Latitude or LoX	-26.3472663	S
12.	Longitude or LoY	28.490727	E
	Latitude or LoX	-26.3457727	S
13.	Longitude or LoY	28.488728	E
	Latitude or LoX	-26.3473399	S

If more than 5 sets of co-ordinates, please attach additional information in the same format.

Each polygon must close, so the last co-ordinate must be the same as the first co-ordinate.

If the co-ordinates are supplied in LO, please give (a) the central meridian; and (b) the projection.

ASCII file handed in?	Yes ☐	No ☒

Spheroid and Datum:

Clarke 1880/Cape ☐	WGS84/WGS84 ☒	WGS84/Hartebeesthoek ☐

PART E: TYPE OF MINERAL OR MINERALS

Name the type of mineral for which the mining right is required (refer to the attached List 2):

Code	**Mineral**	**Type**
Cy	Clay	Cy
C	Coal	C
QY	Sand (General)	QY

Method(s) of prospecting:

Drilling of 10 Prospecting holes

Period for which the right is required:

Name of the mining operation (if applicable):

PART F: DECLARATION

I, the applicant

M	U	R	R	A	Y		R	E	I	D											

~~in my personal capacity or~~ duly authorized thereto by the legal entity and acting in a in a representative capacity, declare that the information contained in the application form is true and correct.
(attach certified copy of resolution, if acting in a representative capacity)

Capacity:

MINE MANAGER

THE APPLICATION MUST BE ACCOMPANIED BY THE FOLLOWING:

A. Details of the land or area
Provide a plan as contemplated in regulation 2(2).

B. Mining Work Programme
Full particulars of the mining work programme contemplated in regulation 11.

C. Financial and technical competence
Provide details and documentary proof of the applicant's technical ability and financial resources compatible with the mining work programme that are readily available or how they will be provided for, to enable the applicant to carry out the mining activities in terms of the mining work programme and to mitigate and rehabilitate relevant environmental impacts satisfactorily.

D. Detailed financing plan contemplated in regulation 11(g)

E. Title deed or deeds in respect of land
Provide a certified copy or copies of the title deed or deeds in respect of the land or area to which the application relates.

F. Existing rights
Provide a list of existing rights and permits held by the applicant to be compiled in tabular form which indicate the region, the location with regard to the land name and the existing right or permit number for each mineral or minerals.

G. Social and labour plan
A social and labour plan contemplated in regulation 48.

H. Prescribed fee
An amount of R 500.00, being the application fee specified in regulation 75(1)(c).

I. Copy of identity document
In the case of a natural person, a certified copy of the identity document must be attached.

J. A certified copy of the certificate of Incorporation, if applicable.

K. A certified copy of the certificate to commence business, if applicable.

L. .**Copy of resolution, if acting in a representative capacity (refer to Part F: Declaration)**

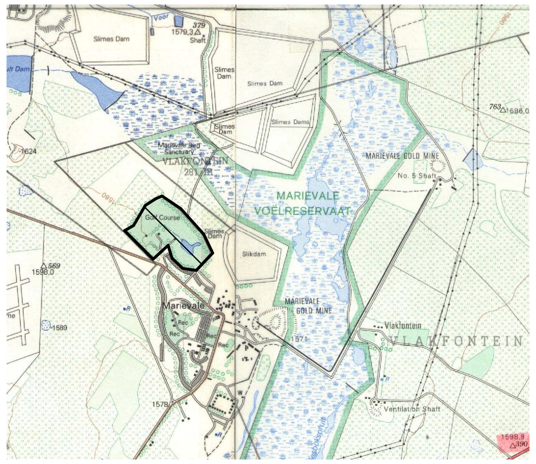
Signed at NIGEL
(Place)

on the | | | day of | J | U | N | E | | | | | | 2 | 0 | 1 | 9 |
(Month) ***(Year)***

SIGNATURE OF ~~APPLICANT /~~ REPRESENTATIVE (IF APPLICABLE)

(GP) 30/5/1/1/2............. (   )PR

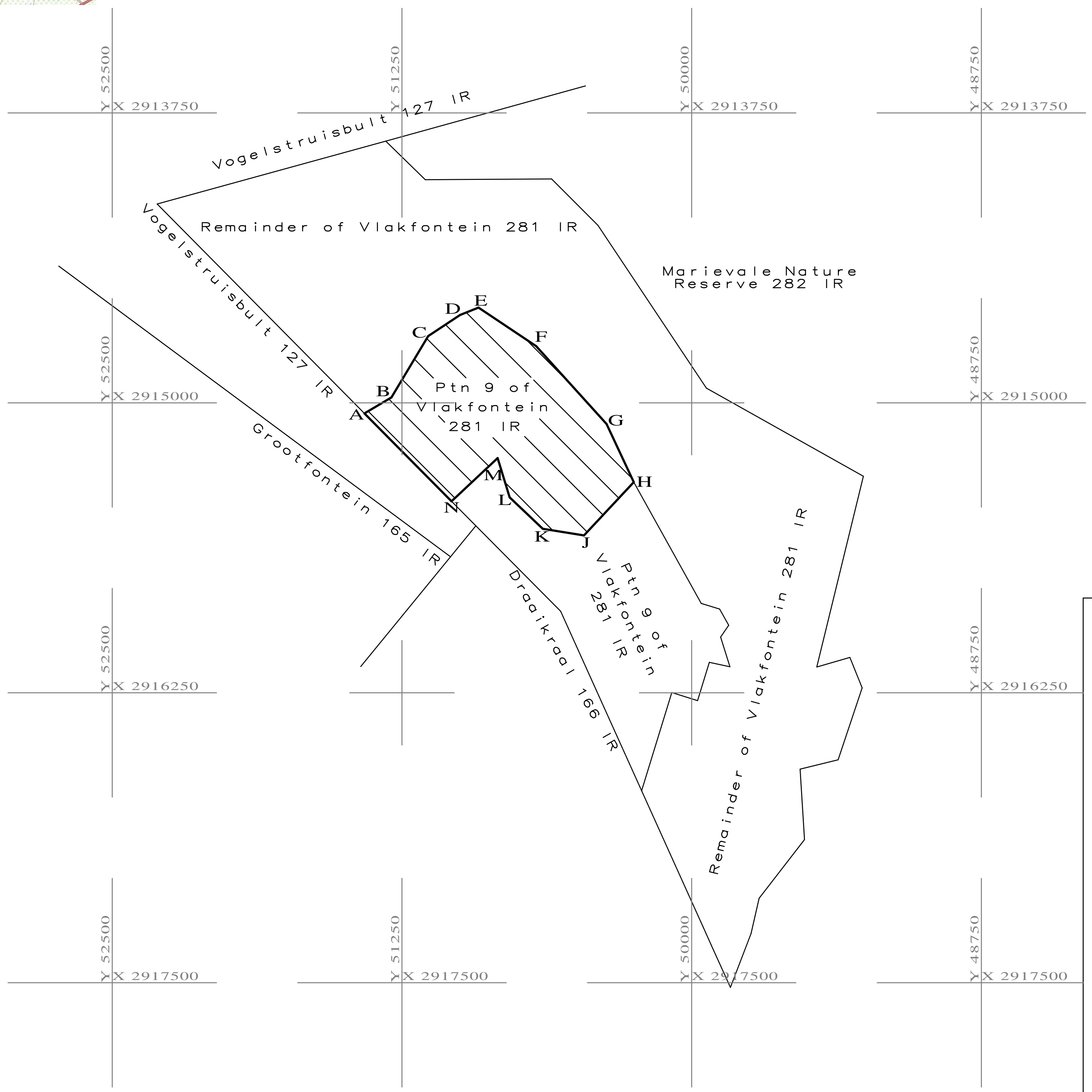
This plan is drafted in terms of Regulation 2(2) of the Regulations under the MPRDA for mining rights



Locality Plan

Scale 1:100 000

	Latitude	Longitude	Survey System - WGS84 (WG29)		
				Y	X
A	-26.343965	28.484979	A	51412.082	2915045.227
B	-26.343352	28.486152	B	51295.203	2914976.773
C	-26.340968	28.487749	C	51136.828	2914712.108
D	-26.340156	28.489127	D	50999.630	2914621.566
E	-26.339871	28.489926	E	50920.028	2914589.609
F	-26.341376	28.492412	F	50671.200	2914755.414
G	-26.344419	28.495444	G	50367.198	2915091.343
H	-26.346688	28.496612	H	50249.569	2915342.340
J	-26.348750	28.494450	J	50464.481	2915571.606
K	-26.348490	28.492673	K	50642.048	2915543.502
L	-26.347263	28.491245	L	50785.123	2915408.092
M	-26.345727	28.490727	M	50837.498	2915238.190
N	-26.347399	28.488728	N	51036.316	2915424.215



Scale 1:25 000

Extent of Area: 61.5992 ha

The figure A,B,C,D,E,F,G,H,J,K,L,M,N,A represents a portion of Portion 9 of the farm VLAKFONTEIN 281IR, situated in the district of NIGEL in respect of which application is made for a PROSPECTING RIGHT for coal, clay and sand in terms of Section 16 of the Mineral & Petroleum Resources Development Act. 2002 (Act 28 of 2002)

Applicant: Ilangabi Investments 12 (Pty) Ltd

....	....
Signature on behalf of applicant	Signature Regional Manager Gauteng Region
....	....
Date	Date

Appendix 5 : Public Participation (Included in Final BA)

Appendix 6 : Current environmental and land use maps

AGRICULTURAL SUITABILITY

Ilangabi Investments 12 (Pty) Ltd : Prospecting on a Portion of Portion 9 of the Farm Vlakfontein 281 IR

ABSTRACT

A desktop study was completed for a portion of the farm Vlakfontein 281 IR, using land capability as an indicator of agricultural suitability. An agro-climate, -soil and -topographical suitability are furthermore included.

EnviroGIS (Pty) Ltd

EXECUTIVE SUMMARY

The study area is located in Gauteng Province, Ekurhuleni Municipality, a portion of portion 9 of the farm Vlakfontein 281 IR. The current land use is recreation, utilised as a golf course. The surrounding land use is cultivation and surface mining.

The study area is not located within a sensitive biodiversity area but are however located in close proximity to a wetland and the *Marievale* Protected Area.

The land capability of the study area and the surrounding area is high. The area is arable due to favourable soils and topographical properties.

The recommended commodity is irrigated vegetables, should cultivation be considered.

The area is however considered to be transformed to an extent that will severely limit the economic viability of any proposed cultivated farming practice. Agricultural infrastructure in support of the surrounding agricultural activities and the requirement of the Lesedi Agricultural Hub, could however be a consideration.

High Potential Agricultural Land (HPAL) is a scarce commodity in the Province that are protected. The study area land qualifies as HPAL.

The main constraint, considering cultivated agriculture, is the current land use and the resulting transformation status of the land.

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LOCATION

The study area is located in the Gauteng Province, within the boundaries of the Ekurhuleni Municipality. The towns of Springs and Nigel is located to the north and south respectively. The study area is located within portion 9 of the farm Vlakfontein 281 IR and the municipal town planning area of Nigel. The farm is therefore not zoned as an agricultural farm and therefore not included by ACT70. The surface area is calculated at 64.09 ha. The current land use is a Golf Course, the Marievale Bird Sanctuary (wetland) is located approximately 600m to 1km east of the area. Mining and cultivated agriculture surround the area.

The following sections summarise the land cover and land use, the land capability and general agricultural suitability of the study area. A desk-top agricultural land-profile study is furthermore included, using the *EnviroGISSolutions* Farm Information Systems Database. The following figure shows the location of the study area:

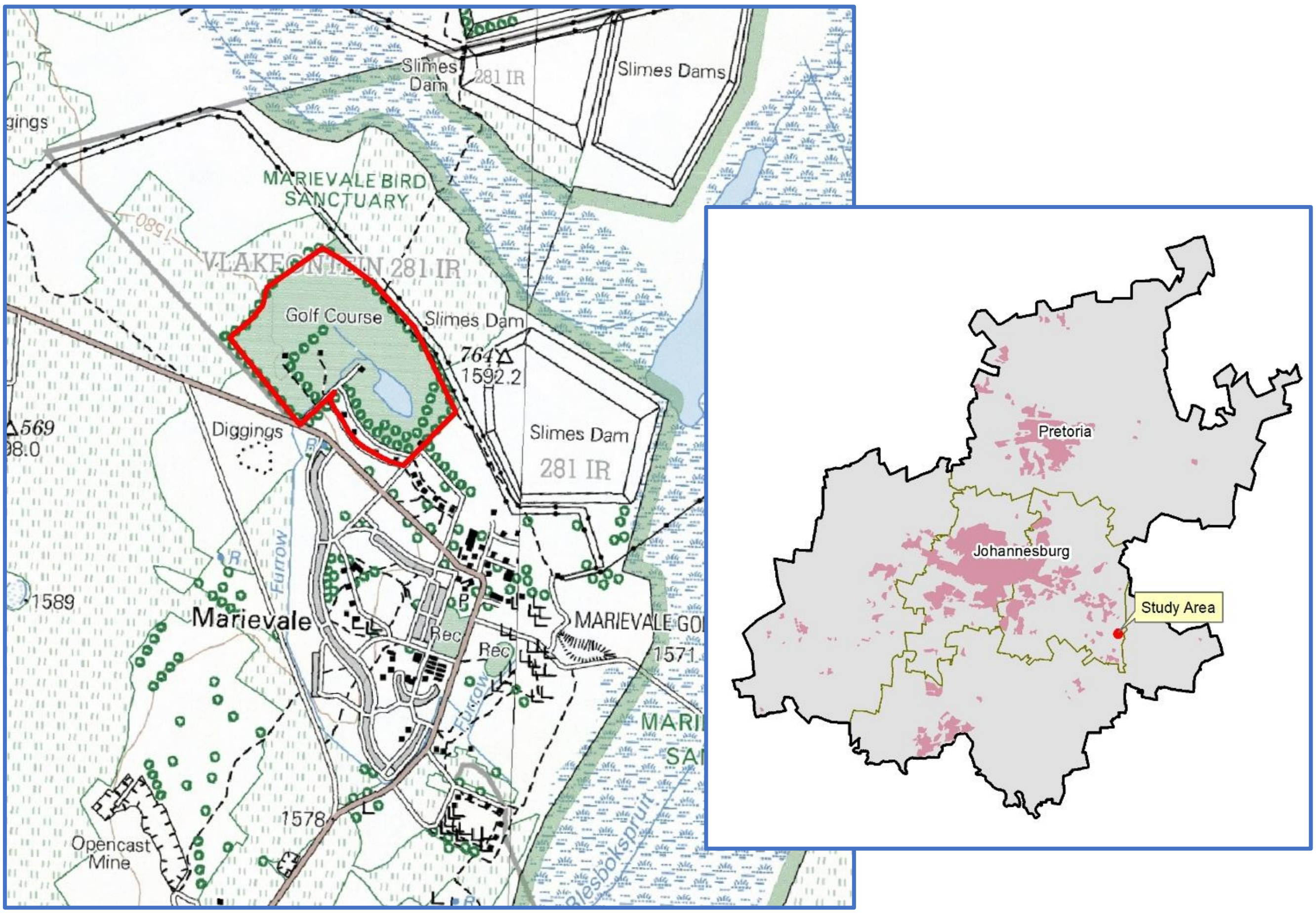

Figure 1: Location of the study area.

Land Cover and Land Use

The current land cover is a Golf Course (old?). The surrounding land cover is mostly cultivation- north-east, west and south-west of the study area. Surface mining is located in close proximity, bordering the north-western study area boundary.

A large and prominent wetland area is located north-east and east of the area (approximately 1km). The area is proclaimed as the *Marievale* Bird Sanctuary. Smallholdings are located directly south of the study area with the nearest residential areas located approximately 2km to the west.

The following two figures show the land cover (DEA 2014) and land use of the study area (black lines), and farm portions (white lines) in relation to the surrounding areas. The satellite image is dated May 2019.

Figure 2: Land cover/use of farms and surrounding areas.

Vegetation Status – SANBI and The Gauteng Conservation Plan:

SANBI – Study- and Surrounding Area:

Biome: Grassland

Vegetation Type: Tsakane Clay Grassland

Conservation Status: Endangered

Gauteng CPLAN:

The *Marievale* bird sanctuary is classified as a CPLAN *Protected Area*, the areas surrounding the study area is classified as '*critical biodiversity areas*'. The study area is not classified by CPLAN.

- The *Gauteng Environmental Management Framework* classifies the study area as part of Zone 4: *Normal Control Zone*.
- The study area is located within the boundaries of the *Lesedi Agricultural Hub*.

The following table and figure show the percentage land cover and land use distribution for the study area. The data were summarised from the National Land Cover dataset (Dept of Rural Development, 2014).

Table 1: Land cover of the study area.

Class	Ha	%
Water	1.22	1.9
Wetlands	0.61	1.0
Trees	5.86	9.1
Grassland	1.83	2.9
Bare	0.12	0.2
Sports and Golf	52.25	81.5
Buildings	2.20	3.4
Total:	**64.09**	**100.0**

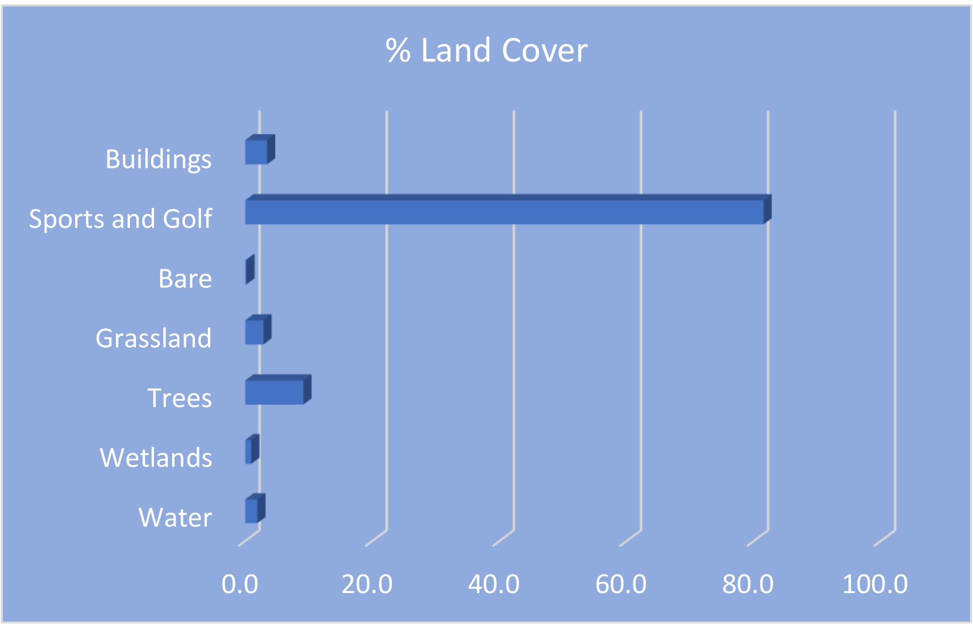

Figure 3: Land cover/use % of the study area.

Land Capability

Land Capability *refers to the suitability of land for use without permanent damage. Land capability, as ordinarily used, is an expression of the effect of physical land conditions, including climate, soil and topography on the total suitability for use, without damage, for crops that require regular tillage, for grazing, for woodland, and for wildlife. Land capability involves consideration of the risks of land damage from erosion and other causes and the difficulties in land use owing to physical land characteristics including climate (Strydom, 2000).* The following figure shows the land capability classes for the study area. Green refers to a high land capability and red to a lower land capability. The white lines show the farm portion boundaries.

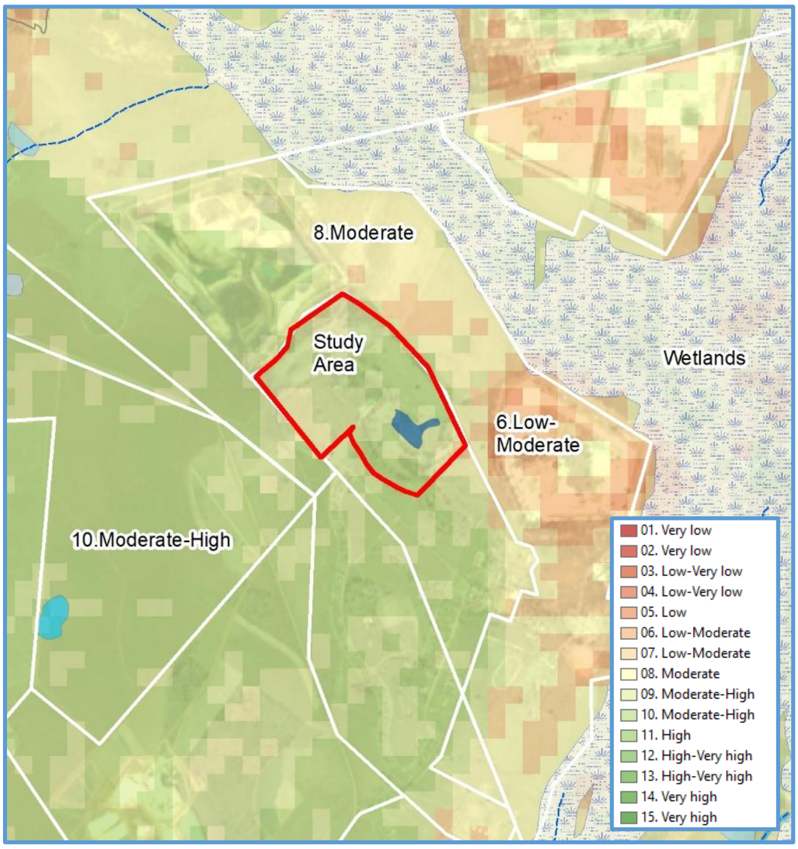

Figure 4: National Land capability of the study- and surrounding areas.

Comments:

i. Although the land capability of the study area qualifies as *High Potential Agricultural Land*, the area is already transformed (golf course) and therefore considered unsuitable for cultivated agriculture.
ii. Other farming activities, for e.g. supporting agricultural infrastructure could however be considered.
iii. The limited surface area of 64ha is below the threshold value of 100ha that is considered by the *Department of Agriculture Forestry and Fisheries* (DAFF) to be an economically viable farming unit.

Uniquely Defined Land Capability Polygons:

Land capability zones were defined using agricultural suitability with respect to climate-, soils-, and topographical variables. Refer previous paragraphs.

For the study area (refer adjacent figure), 2 uniquely defined land capability zones were mapped.

These land capability units are unique with respect to agro-climate; -soils; and -topographical capability.

High Potential Agricultural Land (HPAL), as defined by the *Gauteng Agricultural Potential Atlas*, is land with a land capability class of 8 or higher. The study area (and the surrounding areas) has a land capability class value of moderate to high (classes 8 – 10), as classified and zoned by both the national and provincial system. The study area land therefor qualifies as HPAL (excluding the current land use).

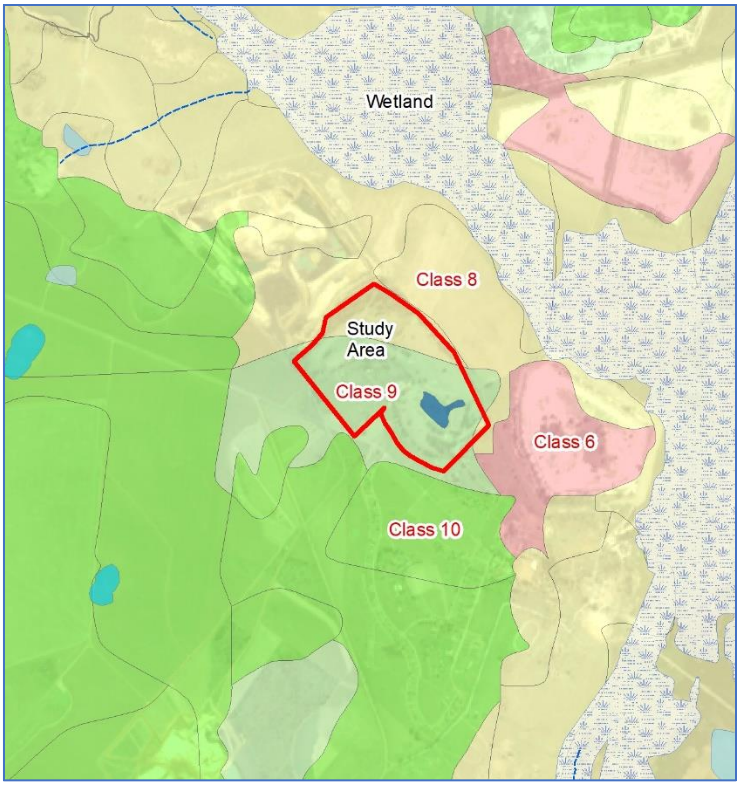

Figure 5: Land capability polygons- study area.

Area in hectares – Land Capability Classes:

Refer to the following table and figure for the land capability class percentage distribution for the study area. The majority of the study area has a moderate to high land capability value. Refer to a later section (page 16) in this document for study area detailed soils information.

Table 2: Land capability statistics for the study area.

Class	Area	%
Moderate - High	16.2	25
High	47.9	75
Total:	**64.1**	**100**

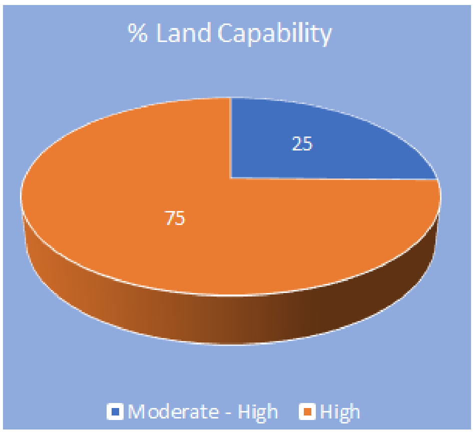

Figure 6: Land capability % distribution.

Comments:

i. Land capability is defined by *climate-*, *soil-*, and *topographical* suitability.
ii. The soil is considered arable and has a high potential for cultivated agriculture.
iii. Water for irrigation and applying sound irrigation management practices will improve the probability for commercial success, should cultivation be selected as a land use (intensive agriculture for e.g. vegetable farming).

Detailed Study Area Analysis

The study area comprises of a portion of a farm portion (portion of portion 9 of the farm Vlakfontein 281 IR with LPI Code: *T0IR00000000028100009)* with a surface area of 123.47 ha. The study area is 64.09 ha. The farm is located within the boundaries of the Nigel Town Planning Scheme. Refer to figure 7.

Figure 7: Location of the study area in relation to municipal land.

Comments:

i. The area is within the jurisdiction of the Ekurhuleni Municipality and Nigel Town Planning Scheme.
ii. The farm portion is not registered as ACT70 Land (this needs to be verified with the Deeds Office).

The following sections provide a detailed land profile analysis of the study area.

The Study Area Land Profile:

The land capability is a national classification, consisting of 15 classes (1= lowest and 15= highest). The range of values in the Gauteng Province is classes 2 (very low) to 12 (high).The following figure shows the land capability map of the study area. The areas with a higher land capability are coloured in green (moderate to high). The orange colours displayed on the map (figure 9) indicates lower land capability values. The land capability of the area is considered optimal for cultivated agriculture.

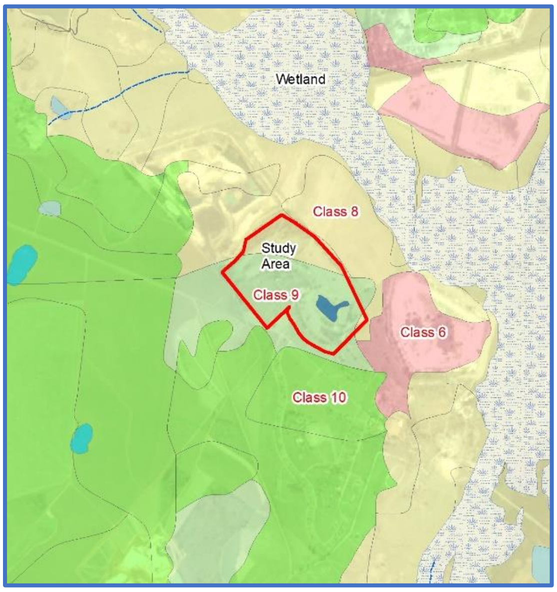

Figure 9: Land capability - farm portions.

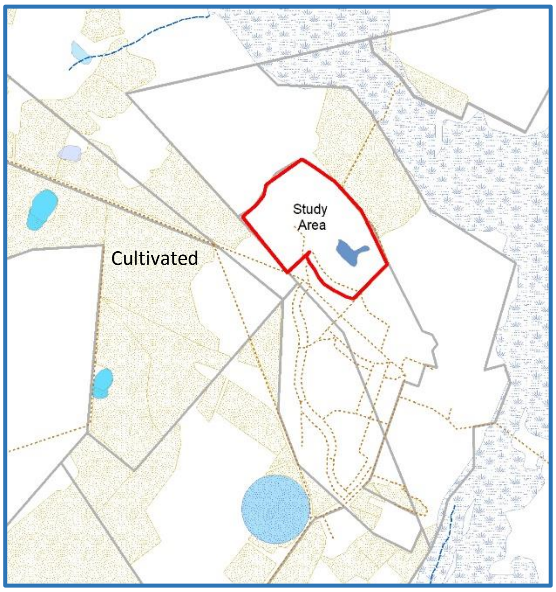

Figure 8: Cultivated areas.

Comments:

i. The study area is surrounded by cultivated agriculture and is part of the Lesedi Agricultural Hub.
ii. Fragmentation of land is considered to be the biggest threat to cultivated agriculture in the Province.
iii. In Gauteng Province, mining is the land use that shows the highest increase over time (2012 – 2019).

The information presented by the following tables and graphs presents a summary of the farm portion in terms of Agro-Climate, -Soil and -Topographical suitability.

A discussion is included as part to the *comments* following each of the legends and graphs.

Agro-Climate:

Agro-climate capability is a function of (i) *moisture supply capacity*; (ii) *plant physiological capacity*; (iii) *rainfall sensitivities*; (iv) *temperature sensitivities* and (v) a combined *agro-climatic hazard*. The following table presents a summary report of the agro-climate capability values, including important empirical values (mean annual rainfall, etc.). The report applies to the study area farm.

CLIMATE CAPABILITY					
Climate Capability Class:		5. Moderate	Climate Capabilty Value:		5.48
Median Annual Precipitation(mm):		668	Moisture Growing Season Start Day:		279
Annual Evapotranspiration(mm):		2111.38	Moisture Growing Season End Day:		85
Mean Annual Temperature(°C):		15.89	Moisture Growth Season Days:		171
AGRO-CLIMATE					
1.	Moisture Supply Capacity:	5. Moderate	4.	Rainfall Hazard:	5. Moderate
1.1	*Moisture growing season-moisture supply balance:*	6. Moderate-High	4.1	*Inter-annual rainfall variability:*	6. Moderate-Low
1.2	*Moisture growing season duration:*	5. Moderate	4.2	*Moisture growing season rainfall variability:*	9. Very low
1.3	*Three-monthly moisture growth periods:*	3:03	4.3	*Inter-annual rainfall concentration:*	3. High
1.4	*Accumulated annual moisture supply balances:*	6. Moderate-High	4.4	*Moisture growing season rainfall concentration:*	8. Low-Very low
2.	Physiological Capacity:	5. Moderate	5.	Temperature Hazard:	7. Low
2.1	*Accumulated heat units over 12 month's - number of 3-month periods >= 600:*	6	5.1	*Occurrence and severity of heat waves:*	9. Very low
			5.2	*Occurrence and severity of cold spells:*	7. Low
3.	CLIMATE HAZARD - *based on Rainfall and Temperature Hazards:*	6. Moderate-Low	5.3	*Frost hazard based on frequency, number of occurences, average duration:*	5. Moderate

Legend colours: Blue = High, Red = Low. (for e.g. Blue = high potential or low risk or Red = low potential or high risk.)

Comments:

i. The area is moderately suitable in terms of *agro-climate suitability* when considering rainfed agriculture.
ii. A moisture growing season of between 5 and 6 months is present. Double cropping (vegetables) is a possibility during the summer months.
iii. Irrigation (vegetables, pastures, etc.) would increase the yield and the economic value of the land.
iv. The rainfall is evenly spread within the crop-growth season, but the inter-annual rainfall concentration is high resulting in a drought risk during the winter months.
v. The temperature variation is low and the *physiological capacity* (heat units or temperature growth days) adequate for crop production.

Climate Sensitivity Analysis:

Climate sensitivity is a combination of (i) *rainfall risk*; (ii) *heat units*; (iii) *temperature risk* and (iv) *moisture supply capacity*. The following figure presents the climate sensitivity variables, expressed as a quantification of risk, for e.g.: the risk when considering the *concentration* and *frequency* of rainfall for dryland cultivated agriculture is 'moderate'. The temperature risk, considering *heat waves*, *cold spells* and *frost* is 'low'.

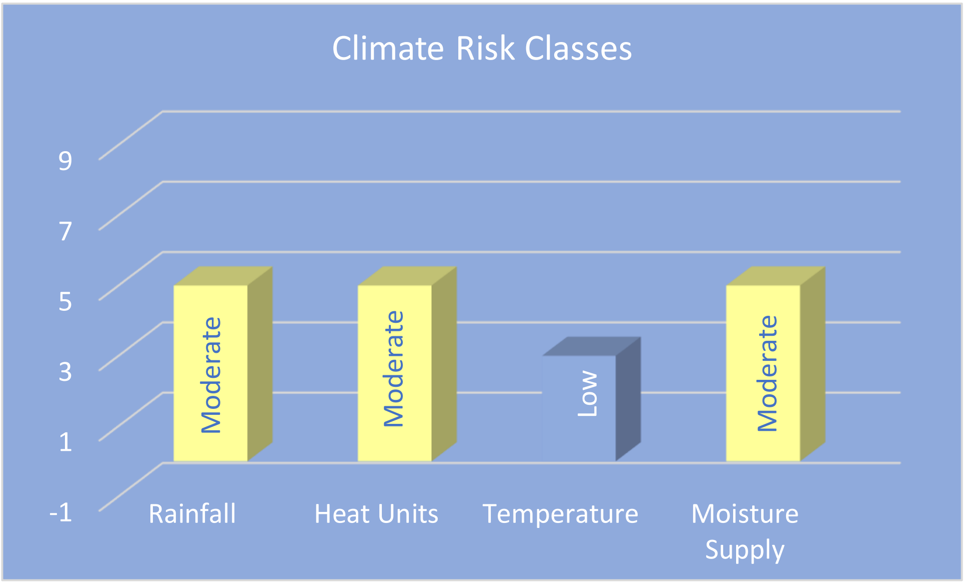

Figure 10: Climate sensitivity values.

<u>*Comments:*</u>

i. The area has a *moderate to low* agro-climatic sensitivity profile. The moisture growing season is determined by a function of *rainfall* and *evapotranspiration*. The moisture supply balances (excluding soil properties) are adequate to support dryland cultivation.
ii. Accumulated heat units are adequate, making the area suitable for possible winter plantings. Irrigation should however be applied during winter months.
iii. The possibility of drought during certain years should be planned for.
iv. The occurrence of frost is a possibility during certain years.

Agro-Soils:

The following three figures show the *soil groups, soil depth* and *topsoil clay %* for the larger study area. For detailed soils information presented on farm portion level, refer page 16 in the document.

Ea Group = Red and/or yellow high base-status soils. No water tables or plinthic catenas.

Bb Group = Red and/or yellow apedal soils. Yellow dystrophic and/or mesotrophic soils dominant. Plinthic catenas.

Geology:

The dominant underlying *geology* of the study area is *Tillite* (western portion) and *Dolomite* (eastern portion). The dominant *lithology* is *siliciclastic rocks* from the Karoo Supergroup, Dwyka Group.

The following figure shows the soil group distribution (Ea and Bb groups dominant).

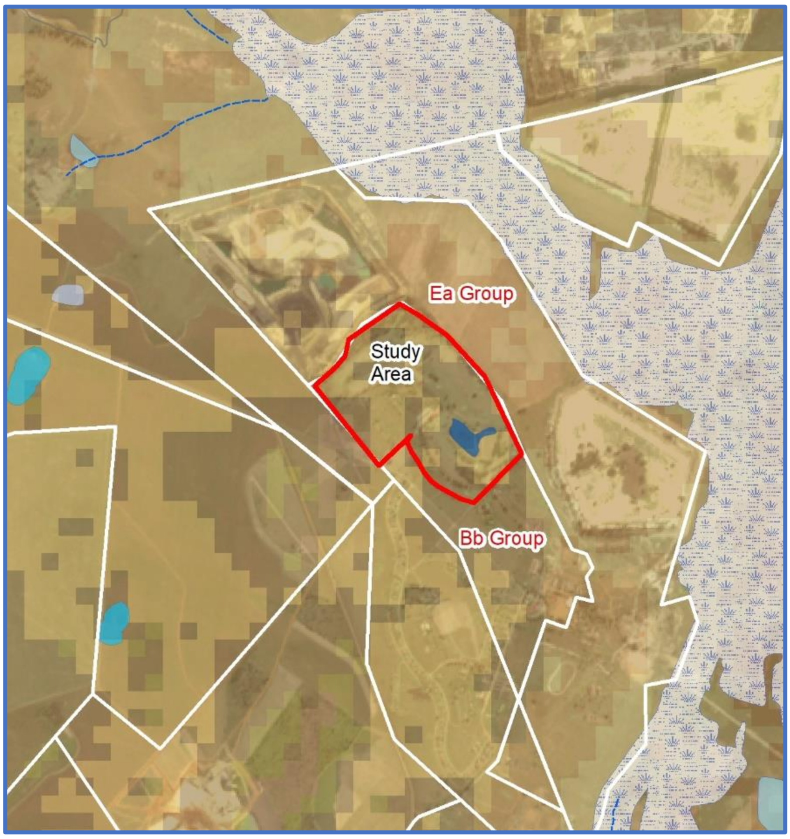

Figure 11: Soils of the study area.

The following two figures show the soil depth and topsoil clay % values for the larger area. The average soil depth for the study area is 80cm. The average topsoil clay is 20%. The combination of optimal depth and soil texture values results in a high soil potential for cultivated agriculture (irrespective of the current land use).

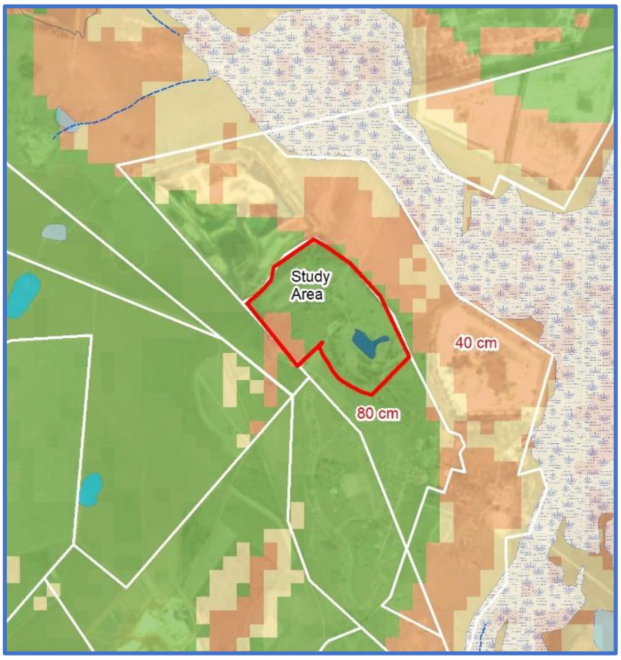

Figure 12: Total soil depth of the study area.

Figure 13: Topsoil clay % of the study area.

Agro-soil capability is a function of (i) *the ability of the soil to store and supply moisture*; (ii) *soil fertility*; and (iii) *soil sensitivities*. The following report presents a summary of the agro-soil capability values, including important empirical values (soil depth, etc.) for the farm portion.

SOIL CAPABILITY			
Soil Capability Class:	6. Moderate-High	Soil Capabilty Value:	6.05
		LANDTYPE:	TERRAIN POSITION:
The majority of the polygon is part of the following landtype and terrain position combination:		Bb3	Mid-slopes
Landtype/Terrain Unit Area(Ha):		69501.74	
Information pertaining to the dominant landtype/terrain position:			
Soil Group Description:	Red and/or yellow apedal soils. Yellow dystrophic and/or mesotrophic soils dominant. Plinthic catenas.		
Possible Soil Forms Occurring:	Av.Hu.Av.Ms.Ms.Va.Lo.We.Gc.Hu	Top-Soil Weighted Average Clay %:	21.73
Weighted Average Soil Depth (cm):	80.19	Sub-Soil Weighted Average Clay %:	25.83

AGRO-SOILS					
1.	The Ability of the Soil to Store and Supply Moisture:	6. Moderate-High	3.	Soil Sensitivity:	6. Moderate-Low
			3.1	*Susceptibility to wind erosion:*	6. Moderate-Low
2.	A Generalized Fertility Rating Under Pristine Conditions:	5. Moderate	3.2	*Susceptibility to water erosion:*	6. Moderate-Low
2.1	*Ability of the soil to store nutrients (CEC):*	3. Low	3.3	*Top-soil hardsetting (crusting) hazard:*	7. Low
2.2	*The ability of the soil to release nutrients (soil pH):*	8. High-Very high	3.4	*Compaction hazard:*	6. Moderate-Low

Legend colours: Green = High, Red = Low. (for e.g. Green = high potential or low risk or Red = low potential or high risk.)

Comments:

i. The *agro-soil capability* of the area is *moderate to high*. Mostly due to the favourable soil depth and texture values resulting in a high ability to store and supply moisture.
ii. A fertilizer regime should be drafted as to allow for improvement in the CEC values (if cultivation is considered).
iii. The soil sensitivity is low, considering erosion-, hardsetting- and compaction risk.
iv. Shallow- and wetland soils (Mispah and Westleigh) have a low potential and are not considered suitable for cultivation.
v. Structured soils may be present.

The following Table lists the detailed soils information for study area / soil unit combination:

Table 3: Soils information linked to the study area.

Study Area	Portion	Soil Unit	Area Ha	Likely Soil Forms Occurring	Total Soil Depth: cm	Topsoil Clay % Range	Subsoil Clay % Range
Portion of Portion 9 of the Farm Vlakfontein 281 IR	Portion of Portion 9	Bb3_1	45.9	Hutton, Avalon, Glencoe, Mispah, Westleigh	30 - 120	13 - 25	20 - 40
		Bb3_3	45.9	Avalon, Hutton, Mispah, Valsrivier, Longlands, Westleigh, Glencoe.	30 - 120	13 - 25	20 - 40
		Ea15_4	8.1	Rensburg, Arcadia, Bonheim (north-eastern boundary).	70 - 120	35 - 50	50+

Where Terrain: 1= Ridge top, 3= mid-slope, 4= lower slopes, 5= valley bottoms. (Terrain is indicated as part of the soil-unit code- the last value).

Comments:

i. Wetland soils may occur in the lower-lying areas: *Westleigh, Rensburg* and *Arcadia* forms at the eastern boundary.
ii. These soils are however sub-dominant, and the majority of the soils are considered arable (Hutton, Avalon forms).
iii. The average weighted soil depth of the study area is 80cm. The average weighted clay % values for top- and subsoil is 20 and 25% respectively.

Important:

The soils as presented were surveyed prior to the establishment of the existing golf course. The degree of disturbance would most likely result in soil properties significantly different from what is presented.

Soils Sensitivity Analysis:

Soil sensitivity is determined by the following four variables: (i) *compaction*; (ii) *crusting*; (iii) *water erosion*; and (iv) *wind erosion*. The following figure presents the soil sensitivity variables.

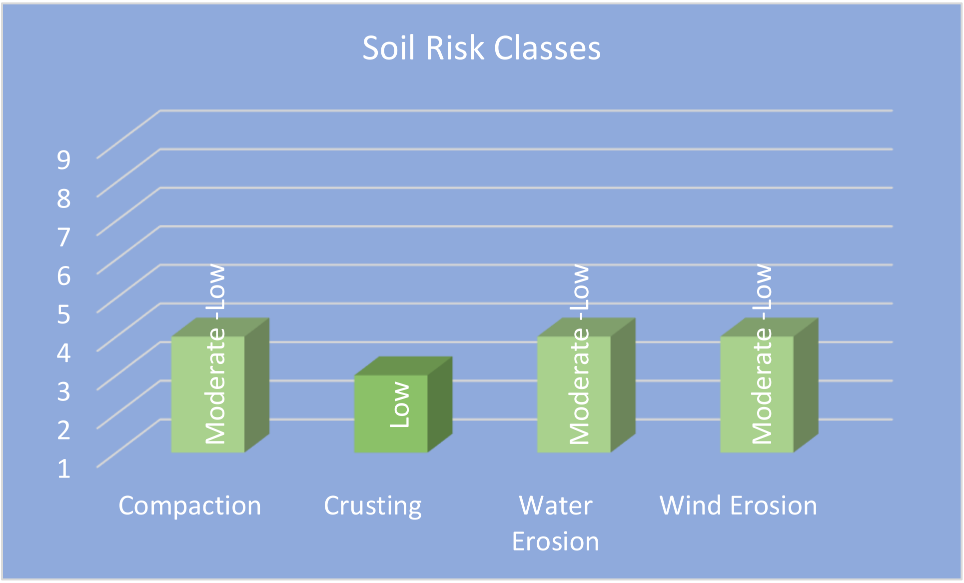

Figure 14: Soil sensitivity values.

<u>*Comments:*</u>

i. The soils are not sensitive towards any form of mechanical operations/disturbances.
ii. The soil quality is considered suitable for cultivation (in its natural state).
iii. The soils are moderately sensitive towards compaction and water- and wind erosion.

Agro-Topography:

Agro-topographical capability is a function of *(i) moisture accumulation; (ii) photosynthetic capacity;* and *(iii) topographical sensitivities*. A combined agro-topography hazard is included.

The following report presents summary information of the *agro-topography capability* values for the study area, including important empirical values (slope gradient values, etc.). The information for the farm portion is presented:

TERRAIN CAPABILTY						
TERRAIN CAPABILITY CLASS:	7. High		TERRAIN CAPABILTY VALUE:	6.57		
SLOPE PERCENTAGE (%):						
1. 0-3%:	79	4. 20-25%:	0		ALTITUDE (m.a.s.l):	1583.34
2. 3-12%:	21	5. 25-35%:	0		ASPECT:	East
3. 12-20%:	0	6. 35%+:	0		RELATIVE RELIEF:	6. Moderate-Low

AGRO-TOPOGRAPHY		
1.	MOISTURE ACCUMULATION as a function of slope gradient and slope shape:	5. Moderate
2.	PHOTOSYNTHETIC CAPACITY as a function of solar radiation, aspect and slope gradient:	7. High
3.	TERRAIN SENSITIVITY as a function of mechanical limitations, flooding- and erosion hazards:	7. Low
3.1	MECHANICAL LIMITATIONS as a function of ground strength and slope gradient:	8. Low-Very low
3.1.1	*Ground Strength Rating:*	9. Very high
3.2	FLOODING HAZARD as a function of soil physical properties, slope gradient and profile curvature (slope shape):	6. Moderate-Low
3.3	EROSION HAZARD as a function of slope gradient, profile curvature and relative relief:	6. Moderate-Low

Legend colours: Green = High, Red = Low. (for e.g. Green = high potential or low risk or Red = low potential or high risk.)

<u>Comments:</u>

i. The *agro-topographical suitability* is high, and the area is considered arable.
ii. There is no risk in terms of topographical constraints.

Topographical Sensitivity Analysis:

Agro-topographical sensitivity is a function of (i) *erosion hazard*; (ii) *flooding risk*; (iii) *ground strength* and (iv) *mechanical limitations*. The following figure presents the terrain sensitivity variables.

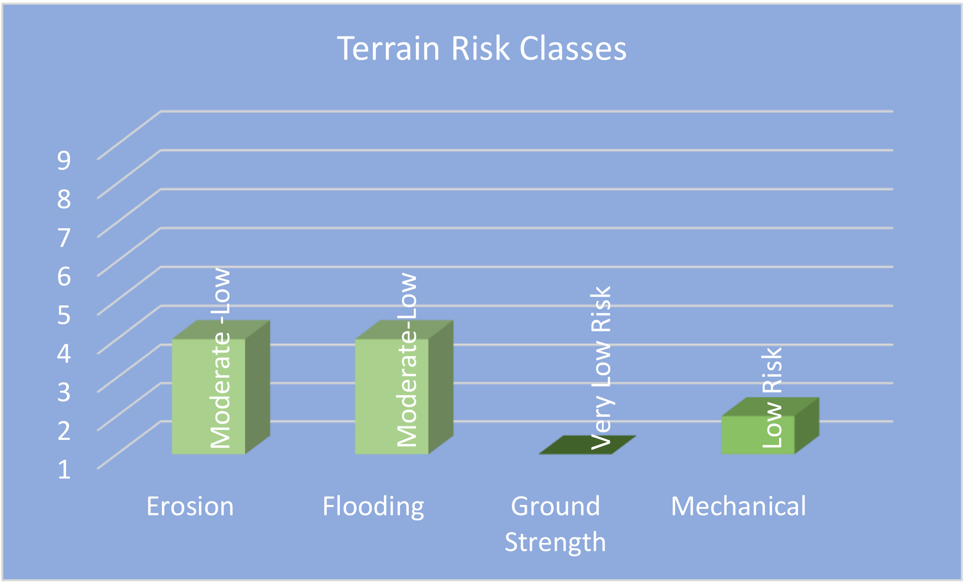

Figure 15: Terrain sensitivity values.

Comments:

i. The topography of the area is mostly flat.
ii. The relative relief (hilliness of the area) is moderate to low.
iii. The erosion- and flooding risk is moderate to low, the ground strength is high, resulting in a very low risk, and the mechanical limitations, considering slope and relative relief, is low.

The study area, considering the topographical characteristics, is arable.

Livestock, Crop Suitability, Irrigation Suitability

The following report shows the commodity suitability for the study area. The crop classification refers to crop types and not to the individual crops. The evaluation is independent of the economic viability of the commodity (cattle would need a larger area to be economically viable).

AGRICULTURAL COMMODITIES					
Livestock Suitability Description:	Grazing Capacity (2016) (Hectare per Large Stock Unit):		Minimum	Maximum	Mean
			5.0	5.5	5.3
	Livestock:	Beef:	All frames (metabolic & respiratory)		
		Dairy:	All Frames		
		Sheep:	Wool		
		Goats:	Meat		
Crop Classification Suitability:	Forage; Cereals; Oilseeds; Vegetables; Stone & Pome.				
Irrigation Suitability (Landtype):	Good				
Forestry Suitability:	Not Suitable				

Livestock Suitability and Grazing Capacity were supplied by DAFF.

Where: (Not all the crops within a group are suitable. At least one of the crops is considered suitable. An individual crop-suitability analysis is considered to be outside the scope of this study*).*

1. *Forage:* *Eragrostis, Kikuyu, Lucerne, Rye grass;*
2. *Cereals:* *Maize, Sorghum, Wheat;*
3. *Oilseeds:* *Soybeans, Groundnut, Sunflower;*
4. *Vegetables:* *Cabbage, Carrots, Dry beans, Potato, Pumpkin, Sweet potato, Tomato;*
5. *Stone & Pome:* *Apples, Peaches, Plum.*

Comments:

i. Vegetable farming under irrigation would be the preferred commodity.
ii. Industrial agriculture (broiler, piggery, etc.) could also be considered but are not dependent on the profile of the land.
iii. The current land-use (golf course) would however severely limit the possibilities for any form of cultivated agriculture.
iv. To increase the economic viability of the land, due to the limited surface area of 64ha, the farm should be incorporated into an existing, viable farming unit, should cultivation be considered.

CONCLUSIONS

i. The study area land is arable when considering its soil and topographical properties.
ii. Considering rainfed, cultivated agriculture:
    a. The land capability is high.
    b. The soil capability is high.
    c. The climate capability is moderate.
    d. The topographical capability is high.
iii. The surface area of 64 ha will severely limit the economic viability of any agricultural practice.
iv. The existing land use (golf course) transformed the area into land that are considered sub-optimal for agricultural production.
v. Any new farming activity on the land should be incorporated with an existing viable farming unit to increase the economic viability of the land.
vi. The recommended commodity is vegetables under irrigation.
vii. The area could be utilized for agricultural infrastructure in support of the surrounding agricultural activities (packhouse, etc.).
viii. The study area is located within the boundaries of the Gauteng Lesedi Agricultural Hub. The preferred land use within the boundaries of the Hub is cultivated agriculture or infrastructure development in support of agriculture.

GLOSSARY OF TERMS

Land Capability:

"In the context of this study, is defined as the extent to which land can meet the needs of one or more uses, under define conditions of management without permanent damage. It is the expression of the effect of physical factors (e.g. terrain form and soil), including climate on the total suitability and potential for use for crops that require regular tillage, for grazing, for forestry, and for wildlife without damage. It involves consideration of (i) the risks of damage from erosion and other causes, (ii) the difficulties in land use caused by physical factors, including climate and (iii) the production potential. It does not provide for indications on crop suitability for specific crops, the economic value of the land or the crop." (MTC / AGEN, 1990).

Agricultural Suitability:

"Agricultural suitability is defined as "as the capability of land to cultivate an agricultural crop under various soil, climate and terrain morphology conditions without improvement of the land through management amelioration practices such as irrigation, soil preparation, and fertilization." (Strydom, 2012).

Agricultural Potential:

"Agricultural potential is what is agriculturally possible on a piece of land and is *"a measure of possible productivity per unit area, per unit time, achieved with specified inputs of management".* Productivity as an indication of the agricultural potential for a given crop under a management level and for an identified portion of land as being dependent on precipitation, temperature, soil conditions, terrain and crop characteristics" (Schoeman & Scotney, 1987).

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Appendix 7 : Palaeontological Assessments

Proposed Prospecting on Portion 9 of the Farm Vlakfontein 281

Ekurhuleni Metropolitan Municipality, Gauteng Province

Farm: Portion 9 of Vlakfontein 281-IR

Fourie, H. Dr heidicindy@yahoo.com

012 322 7632/012 942 0110 x 1057

Palaeontological Impact Assessment: Phase 1 Field Study

Commissioned by: Environmental Assurance (Pty) Ltd

394 Tram Street,

Nieuw Muckleneuk,

0181

012 460 9768

Ref: Pending

2019/09/30

B. Executive summary

Outline of the development project: Environmental Assurance (Pty) Ltd has facilitated the appointment of Dr H. Fourie, a palaeontologist, to undertake a Palaeontological Impact Assessment (PIA), Phase 1 Field Study of the Proposed Prospecting on Portion 9 of the Farm Vlakfontein 281-IR in the Ekurhuleni Metropolitan Municipality, Gauteng Province.

The applicant, Ilangabi Investments 12 (Pty) Ltd intends to prospect without bulk sampling for clay (Cy) (General); Silica Sand (Q) (General); and coal ©.

The Project includes one Alternative (Figure 2):
Alternative 1: An area blocked in yellow situated near the town of Nigel on a Military Base east of Nigel-Springs Road and approximately 6 km north of the Nigel CBD. The approximate size of the site is 64.2 hectares.

Legal requirements:-

The **National Heritage Resources Act (Act No. 25 of 1999) (NHRA)** requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. The Republic of South Africa (RSA) has a remarkably rich fossil record that stretches back in time for some 3.5 billion years and must be protected for its scientific value. Fossil heritage of national and international significance is found within all provinces of the RSA. South Africa's unique and non-renewable palaeontological heritage is protected in terms of the National Heritage Resources Act. According to this act, palaeontological resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

The main aim of the assessment process is to document resources in the development area and identify both the negative and positive impacts that the development brings to the receiving environment. The PIA therefore identifies palaeontological resources in the area to be developed and makes recommendations for protection or mitigation of these resources.

For this study, resources such as geological maps, scientific literature, institutional fossil collections, satellite images, aerial maps and topographical maps were used. It provides an assessment of the observed or inferred palaeontological heritage within the study area, with recommendations (if any) for further specialist palaeontological input where this is considered necessary.

A Palaeontological Impact Assessment is generally warranted where rock units of **LOW to VERY HIGH** palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed area is unknown. The specialist will inform whether further monitoring and mitigation are necessary.

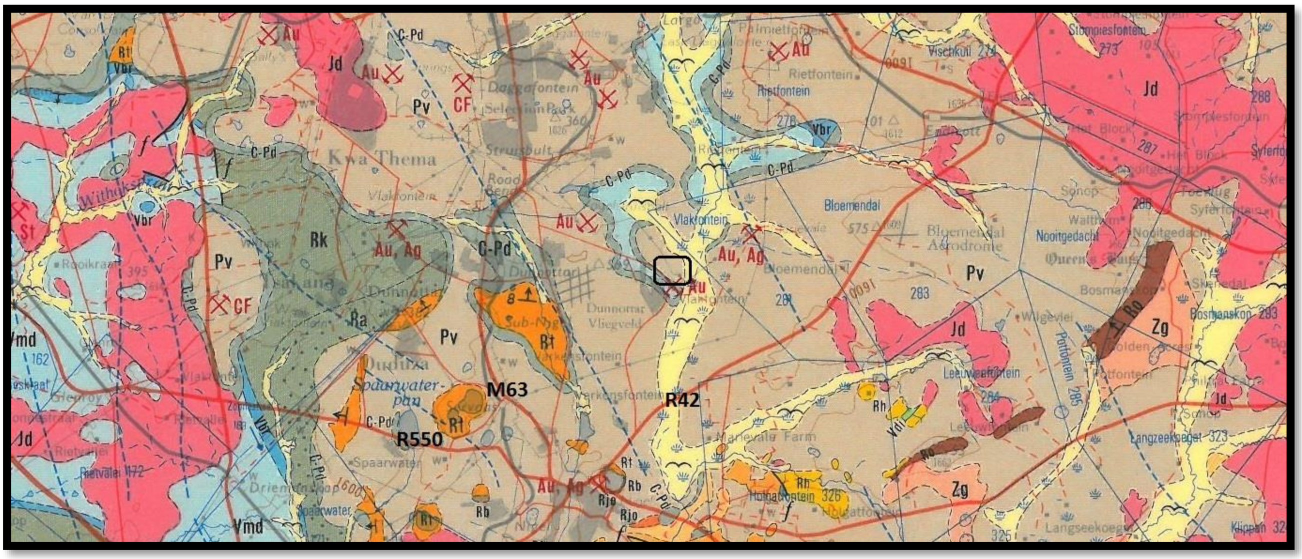
Types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (Act No.25 of 1999):
(i) (i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens.
This report adheres to the guidelines of Section 38 (1) of the National Heritage Resources Act (Act No. 25 of 1999).
Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as (a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length; (b) the construction of a bridge or similar structure exceeding

50 m in length; (c) any development or other activity which will change the character of a site (see Section 38); (d) the re-zoning of a site exceeding 10 000 m² in extent; (e) or any other category of development provided for in regulations by SAHRA or a PHRA authority.

This report aims to provide comment and recommendations on the potential impacts that the proposed development / prospecting project could have on the fossil heritage of the area and to state if any mitigation or conservation measures are necessary.

Outline of the geology and the palaeontology:
The geology was obtained from map 1:100 000, Geology of the Republic of South Africa (Visser 1984) and 1:250 000, 2628 East Rand (Keyser *et al.* 1986).

Figure 3: The geology of the development area.



Legend to map and short explanation.
M – Alluvium (yellow). Quaternary.
Pv – Sandstone, shaly sandstone, grit, shale, conglomerate and coal near base and top (brown). Vryheid Formation, Ecca Group, Karoo Supergroup. Permian.
C-Pd – Diamictite, shale (grey). Dwyka Group, Karoo Supergroup. Carboniferous.
Vmd – Dolomite, chert [=] (blue), Malmani Subgroup, Chuniespoort Group, Transvaal Supergroup. Vaalian.
------ – (blue) Lineament (Landsat, aeromagnetic).
------ - Concealed geological boundary.
⊥8 – Strike and dip of bed.
□ – Proposed prospecting area (blocked in black).

The Karoo Supergroup is renowned for its fossil wealth. The Vryheid Formation (Pe,Pv), Ecca Group is rich in plant fossils such as the *Glossopteris* flora represented by stumps, leaves, pollen and fructifications (Appendix 1). This formation is early to mid-Permian (Palaeozoic) in age and consists of sandstone, shaly sandstone, grit, conglomerate, coal and shale. Coal seams are present in the Vryheid Formation within the sandstone and shale layers with the fossils mainly present in the grey shale which is interlayered between the coal seams (Kent 1980, Visser 1989). Borehole logs in the coalfields show the following layers; soil, shale and sandstone, shale and sandstone interbedded, sandstone, coal, conglomerate reworked diamictite, Dwyka Tillite, and the Pre-Karoo Basement.

Palaeontology - Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity can generally be **LOW** to **VERY HIGH**, and here locally **VERY HIGH** for the Vryheid Formation, **HIGH** for the Malmani Subgroup, and **MODERATE** for the Dwyka Group (SG 2.2 SAHRA APMHOB, 2012).

The Ecca Group may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005).

Summary of findings (**1d**): The Phase 1 Palaeontological Impact Assessment: Field Study was undertaken in September 2019 in the summer in mild and dry conditions and the following is reported:

Field observation – The area is not accessible, but could be viewed. It is disturbed due to being a golf course with lawns, trees, sign boards and roads present. The property was viewed and it was found that it is situated on the Vryheid Formation, but the Dwyka Group is nearby (geological map). The drilling of 10 bore holes will have a small impact and it will give additional information about the depth of the formation. Bore holes are always drilled for the Geotechnical and Geohydrological studies during the Environmental Impact Assessment process and normally more than 10 holes are drilled.

The Project includes one Alternative (Figure 2):
Alternative 1: An area blocked in yellow situated near the town of Nigel on a Military Base east of Nigel-Springs Road and approximately 6 km north of the Nigel CBD. The approximate size of the site is 64.2 hectares.

The prospecting will be done on the Vryheid Formation. Only one Alternative is proposed with a very small impact. Outcrops were not found during the site visit.

Recommendation:
The potential impact of the development on fossil heritage is **VERY HIGH** for the Vryheid Formation and therefore a field survey was necessary for this development (according to SAHRA protocol). A Phase 2 PIA and or mitigation are generally only recommended if the Phase 1: Field Study finds fossils or fossils are found during construction excavations and blasting (plants) or in this instance prospecting.

Concerns/threats (**1g,1ni,1nii,1o,1p**) to be added to the EMPr:

1. Threats are earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, the sealing-in or destruction of the fossils by development, vehicle traffic, mining, prospecting, and human disturbance.
2. Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden as a site visit may have missed a fossiliferous outcrop. An appropriate Protocol and Management plan is attached for the Environmental Control Officer (Appendix 2).

The recommendations are:

1. Mitigation may be needed (Appendix 2) if fossils are found.
2. No consultation with parties was necessary. The Environmental Control Officer must familiarise him- or herself with the formation present and its fossils.
3. The prospecting may go ahead, but the ECO must survey for fossils before and or after drilling or excavating (temporary structures).
4. The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities. For a chance find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation. It is recommended that the EMPr be updated to include the involvement of a palaeontologist (pre-construction training of ECO) during the prospecting phase.

Stakeholders: Developer – Ilangabi Investments 12 (Pty) Ltd., P.O. Box 884, Nigel. Tel: 011 814 8561.
Environmental – Environmental Assurance (Pty) Ltd., 394 Tram Street, Nieuw Muckleneuk, 02, Tel: 012 460 9768.
Landowner – N/a.

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D. Background information on the project

Report

This report is part of the environmental impact assessment process under the National Environmental Management Act, as amended (Act No. 107 of 1998) (NEMA) and includes Appendix 6 (GN R326 of 7 April 2017) of the Environmental Impact Assessment Regulations (see Appendix 3). It is also in compliance with The Minimum Standards for Palaeontological Components of Heritage Impact Assessment Reports, SAHRA, APMHOB, Guidelines 2012, Pp 1-15.

Outline of development

This report discusses and aims to provide the applicant with information regarding the location of palaeontological material that will be impacted by the development. In the construction phase, it may be necessary for the applicant to apply for the relevant permit from the South African Heritage Resources Agency (SAHRA / PHRA) if a fossil is unearthed.

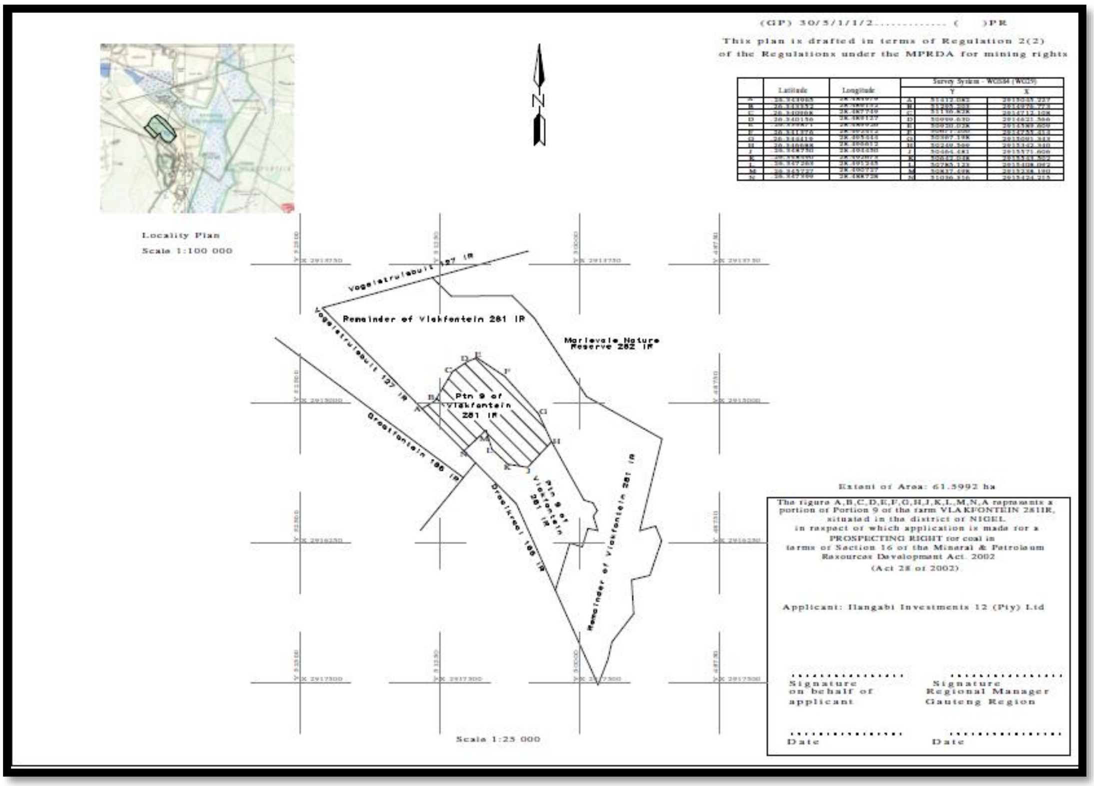
The applicant, Ilangabi Investments 12 (Pty) Ltd intends to prospect without bulk sampling for clay (Cy) (General); Silica Sand (Q) (General); and coal ©. After the initial desktop analysis, 10 holes will be drilled.

Local benefits of the proposed development include benefits to the local economy through possible job creation and local supplier procurement during the prospecting phase.

Related infrastructure:

1. Temporary buildings (ablution, accommodation, storage, office, workshop),
2. Processing plant,
3. Storm water control,
4. Berms, and
5. Conveyors.

Figure 1: Lay-out plan (Envass)



The Project includes one Alternative (Figure 2):
Alternative 1: An area blocked in yellow situated near the town of Nigel on a Military Base east of Nigel-Springs Road and approximately 6 km north of the Nigel CBD. The approximate size of the site is 64.2 hectares.

<u>Rezoning or subdivision of land:</u> No.
<u>Name of developer and consultant:</u> Ilangabi Investments 12 (Pty) Ltd and Environmental Assurance (Pty) Ltd.
<u>Terms of reference:</u> Dr H. Fourie is a palaeontologist commissioned to do a palaeontological impact assessment: field study to ascertain if any palaeontological sensitive material is present in the development area. This study will advise on the impact on fossil heritage mitigation or conservation necessary, if any.
<u>Short *Curriculum vitae:*</u> Dr Fourie obtained a Ph.D from the Bernard Price Institute for Palaeontological Research (now ESI), University of the Witwatersrand. Her undergraduate degree is in Geology and Zoology. She specialises in vertebrate morphology and function concentrating on the Therapsid Therocephalia. She is

currently employed by Ditsong: National Museum of Natural History as Curator of the fossil plant, invertebrate, amphibian, fish, reptile, dinosaur and Therapsid collections. For the past 13 years she carried out field work in the Eastern Cape, Western Cape, North West, Northern Cape, Free State, Gauteng, Limpopo, Kwazulu Natal, and Mpumalanga Provinces. Dr Fourie has been employed at the Ditsong: National Museum of Natural History in Pretoria (formerly Transvaal Museum) for 25 years.

Legislative requirements: South African Heritage Resources Agency (SAHRA) for issue of permits if necessary. National Heritage Resources Act (Act No. 25 of 1999). An electronic copy of this report must be supplied to SAHRA.

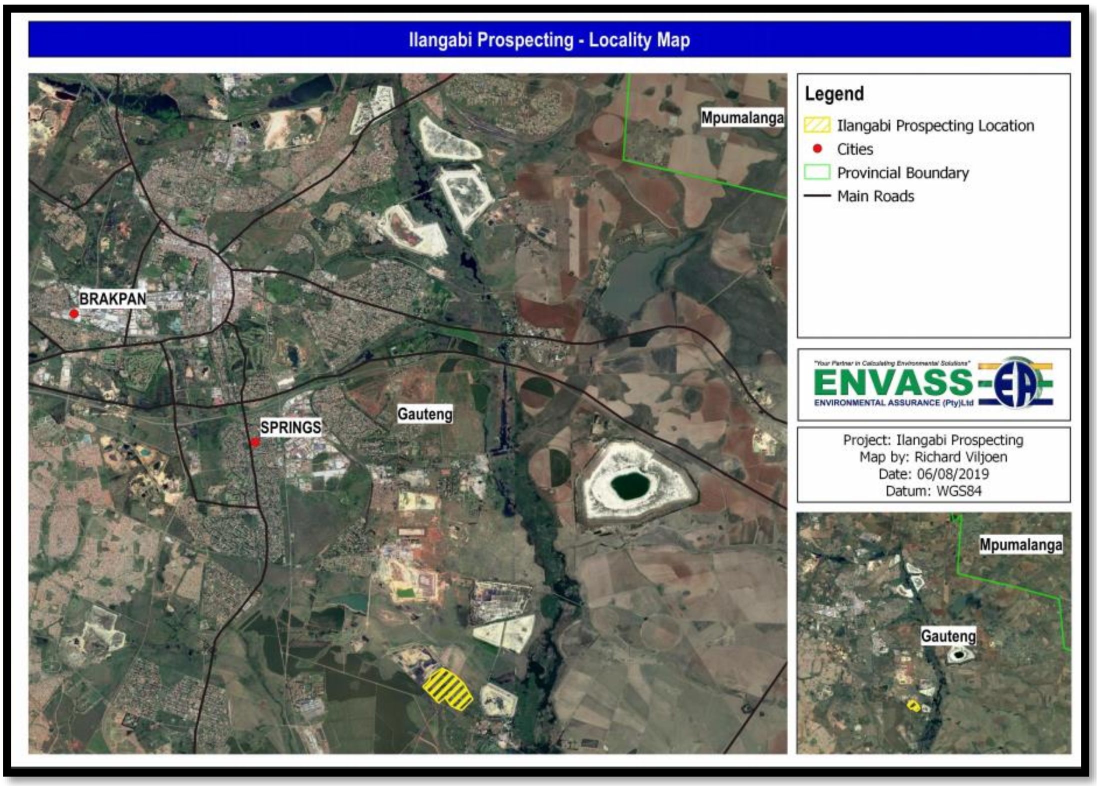
E. Description of property or affected environment

Location and depth:

The Proposed Prospecting will be done on Portion 9 of the Farm Vlakfontein 281-IR in the Ekurhuleni Metropolitan Municipality, Gauteng Province.

Depth is determined by the related infrastructure to be developed and the thickness of the formation in the development area as well as depth of the foundations, footings and channels to be developed. Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to determine due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot. Geological maps do not provide depth or superficial cover, it only provides mappable surface outcrops. The depth can be verified with test pit results or drill cores.

Figure 2: Location map (Envass).



The Project includes one Alternative (Figure 2):

Alternative 1: An area blocked in yellow situated near the town of Nigel on a Military Base east of Nigel-Springs Road and approximately 6 km north of the Nigel CBD. The approximate size of the site is 64.2 hectares.

F. Description of the Geological Setting

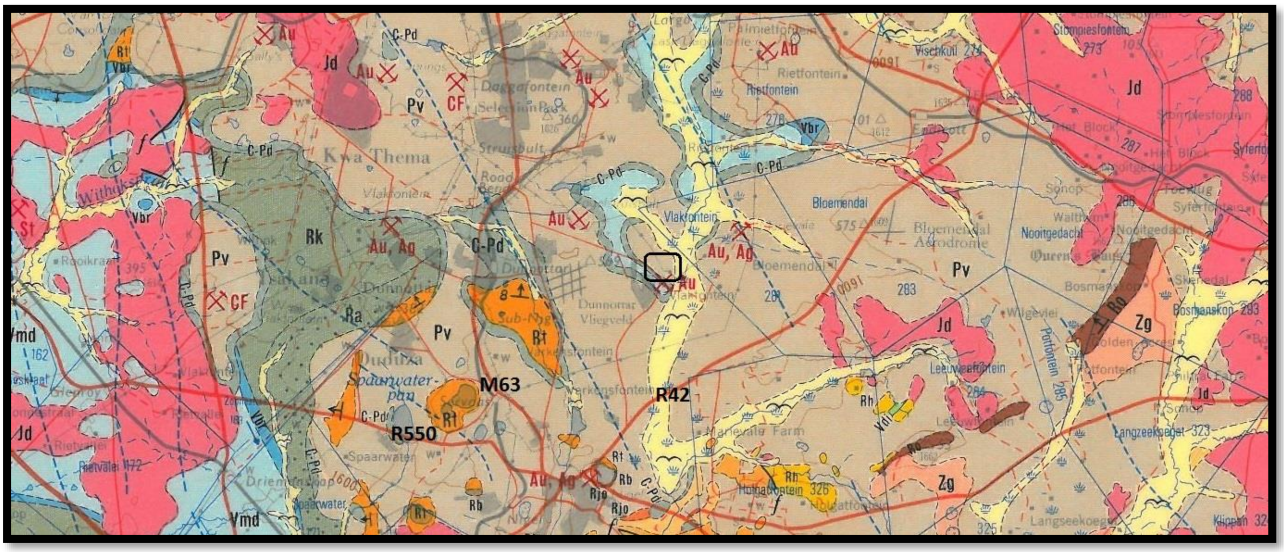
Description of the rock units:

Over areas totalling fully 40% of Southern Africa the 'hard rocks', from the oldest to the Quaternary, are concealed by normally unconformable deposits – principally sand, gravel, sandstone, and limestone. Inland deposits are much more extensive than marine deposits and are terrestrial and usually unfossiliferous. Some of these deposits date back well into the Tertiary, whereas others are still accumulating. Owing to the all-to-often lack of fossils and of rocks suitable for radiometric or palaeomagnetic dating, no clear-cut dividing line between the Tertiary and Quaternary successions could be established (Kent 1980). The alluvium sands were deposited by a river system and reworked by wind action (Snyman 1996).

The Karoo Supergroup is renowned for its fossil wealth (Kent 1980, Visser 1989). Large areas of the southern African continent are covered by the Karoo Supergroup. An estimated age is 150 – 180 Ma. and a maximum thickness of 7000 m is reached in the south. Three formations overlie the Beaufort Group, they are the Molteno, Elliot and Clarens Formations. At the top is the Drakensberg Basalt Formation with its pillow lavas, pyroclasts, and basalts (Kent 1980, Snyman 1996). The Beaufort Group is underlain by the Ecca Group which is underlain by the Dwyka Group.

The Ecca Group is early to mid-Permian (545-250 Ma) in age. Sediments of the Ecca group are lacustrine and marine to fluvio-deltaic (Snyman 1996). The Ecca group is known for its coal (mainly the Vryheid Formation) (five coal seams) and uranium. Coalfields formed due to the accumulation of plant material in shallow and large swampy deltas (see Appendix 1). The Ecca Group conformably overlies the Dwyka Group and is conformably overlain by the Beaufort Group, Karoo Supergroup. It consists essentially of mudrock (shale), but sandstone-rich units occur towards the margins of the present main Karoo basin in the south, west and north-east, with coal seams also being present in the north-east (Kent 1980, Johnson 2009).

Figure 3: Excerpt of 1:250 000 Geological Map 2628 East Rand (Keyser *et al.*1986).



Legend to map and short explanation.

M – Alluvium (yellow). Quaternary.

Pv – (brown) Sandstone, shaly sandstone, grit, shale, conglomerate and coal near base and top. Vryheid Formation, Ecca Group, Karoo Supergroup. Permian.

C-Pd – Diamictite, shale (grey). Dwyka Group, Karoo Supergroup. Carboniferous.

Vmd – Dolomite, chert [=] (blue), Malmani Subgroup, Chuniespoort Group, Transvaal Supergroup. Vaalian.

------ – (blue) Lineament (Landsat, aeromagnetic).

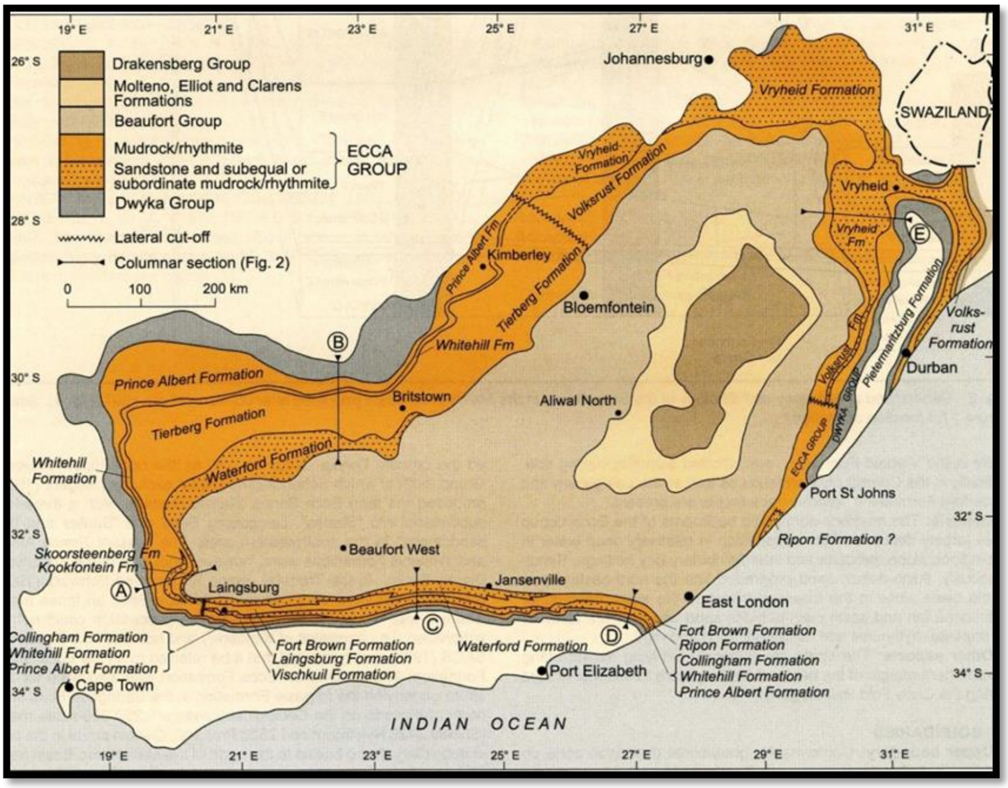
------ - Concealed geological boundary.

┴8 – Strike and dip of bed.
□ – Proposed prospecting (blocked in black).

Mining Activities on Figure:
Ag – Silver Au – Gold.

The Vryheid Formation is named after the type area of Vryheid-Volksrust. In the north-eastern part of the basin the Vryheid Formation thins and eventually wedges out towards the south, southwest and west with increasing distance from its source area to the east and northeast (Johnson 2009). The Vryheid Formation consists essentially of sandstone, shale, and subordinate coal beds, and has a maximum total thickness of 500 m. It forms part of the Middle Ecca (Kent 1980). This formation has the largest coal reserves in South Africa. The pro-delta sediments are characterised by trace and plants fossils (Snyman 1996).

Figure 4: Karoo Supergroup distribution and lithostratigraphy (Johnson 2009).



Coal has always been the main energy source in industrial South Africa. It is in Mpumalanga, south of the N4, that most of the coal-fired power stations are found. Eskom is by far the biggest electricity generator in Africa. Thick layers of coal just below the surface are suited to open-cast mining and where the overlying sediments are too thick, shallow underground mining. In 2003, coal was South Africa's third most valuable mineral commodity and is also used by Sasol for fuel- and chemicals-from-coal (Norman and Whitfield 2006). Grodner and Cairncross (2003) proposed a 3-D model of the Witbank Coalfield to allow easy evaluation of the sedimentary rocks, both through space and time. Through this, one can interpret the environmental conditions present at the time of deposition of the sediments. This can improve mine planning and mining techniques. The Vryheid Formation is underlain by the Dwyka Group and is gradually overlain by mudstones (and shale) and sandstones of the Volksrust Formation. The typical colours for the Vryheid Formation are grey and yellow for the sediments and black for the coal seam. The thickness of the grey shale can vary and this is interlayered with the also variable yellow sandstone and coal seams.

Ecca rocks are stable and lend themselves well to developments. It is only unstable in or directly above mining activities (Snyman 1996). The site itself is partly situated on the flat-lying Vryheid Formation, Ecca Group, Karoo Supergroup. Dolerite dykes occur throughout the Karoo Supergroup. Structural geological features such as dykes and faults can have a measurable influence on ground water flow and mass transport. The Vryheid Formation sediments may attain a thickness of 120 – 140 m. A typical profile includes soil and clay, sandstone and siltstone, shale, 2 upper seam, shale, 2 seam, sandstone, no 1 seam, shale and dolomite at the bottom. The typical colours for the Vryheid Formation are grey and yellow for the sediments and black for the coal seam. The thickness of the grey shale can vary and this is interlayered with the also variable yellow sandstone and coal seams.

The Dwyka Group is the lowermost unit of the Karoo Supergroup overlain by the Ecca Group and underlain by the Witteberg Group, Bokkeveld or Table Mountain Groups and various other groups. It ranges in age from Late Carboniferous to early Permian. Clastic rocks containing diamictite, varved shale, conglomerate, pebbly sandstone and mudrock are present. The rocks display features reflecting a glacial and glacially-related origin. Fossils are present (Kent 1980, Visser *et al.* 1990). Thickness varies between 100-800 m (Visser *et al.* 1990). As Gondwana drifted northward the first sediments to be deposited would have been the Dwyka. As the glaciers melted they left striations on the surface also vast quantities of mud and large fragments of rock which formed the characteristic, poorly sorted Dwyka tillite (McCarthy and Rubidge 2005). Visser *et al.* (1990) proposed two subdivisions for the Dwyka Group in the main Karoo basin, the Elandsvlei and Mbizane Formations. In the far north, the Tshidzi and Wellington Formations also form part of the Dwyka Group.

The Transvaal Supergroup fills an east-west elongated basin in the south-central part of the old Transvaal (now North – West, Gauteng and Mpumalanga) as far south as Potchefstroom. It is Vaalian in age, approximately 2600 Ma to 2100 Ma. A maximum thickness of the Transvaal Supergroup reaches 2000 m in the north-eastern section. The east-west elongated basin is filled with clastic, volcanic and chemical sedimentary rocks. Three groups based on lithological differences have been established: they are the Rooiberg, Pretoria and Chuniespoort Groups as well as other smaller groups (Kent 1980, Snyman 1996). It is the Bushveld Complex that is responsible for the tilting of the Transvaal sediments and the heat of its intrusion having created andalusite crystals (Norman and Whitfield 2006). This Supergroup is underlain by the Ventersdorp, Witwatersrand and Pongola Supergroups, and the Dominion Group. Three prominent ridges are present from the oldest to the youngest, the Time Ball Hill, Daspoort and Magaliesberg Formations (Norman and Whitfield 2006).

The Chuniespoort Group is made up of chemical and biochemical sediments such as dolomite, chert, limestone and banded iron formation, carbonaceous shale is also present. At the top of the Malmani Subgroup is the Duitschland Formation underlain by the Penge and Monte Christo Formations. Sandstone is mostly absent. It is this formation that has great economic value for its lead, zink, dolomite, and manganese (Kent 1980, Snyman 1996). Fluorspar, concrete aggregate, iron ore and managanese is also mined from this formation. Cave formation in the dolomite is a major concern in developing areas, especially in the 1500m thick dolomite of the Malmani Subgroup. Chemical sediments such as fine grained limestone and dolomite is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites.

Field Observations

The area is not accessible, but is disturbed due to being a golf course. Lawns, trees, sign boards and roads are present. The property was viewed and it was found that it is situated on the Vryheid Formation, but the Dwyka Group is nearby (geological map). The drilling of 10 bore holes will have a small impact as it will give additional information about the depth of the formation. Bore holes are always drilled for the Geotechnical and

Geohydrological studies during the Environmental Impact Assessment process and normally more than 10 holes are drilled.

Figure 5: Trees and road present on site.

Figure 6: Lawns and grasses.

Figure 7: Another view showing size of property.

Figure 8: One of the many sandpits.

Figure 9: View of short watercourse, bridge and sandpit.

There is some concern with the project due to the presence of the Vryheid Formation. The depth of the Formation will be verified with the geological cores. The topsoil, subsoil and overburden must be surveyed for fossils and Mitigation is needed for the shale layer if fossils are present.

The project includes one Alternative (Figure 2)
Alternative 1: An area blocked in yellow situated near the town of Nigel on a Military Base east of Nigel-Springs Road and approximately 6 km north of the Nigel CBD. The approximate size of the site is 64.2 hectares.

G. Background to Palaeontology of the area

<u>Summary</u>: When rock units of moderate to very high palaeontological sensitivity are present within the development footprint, a desk top and or field scoping (survey) study by a professional palaeontologist is usually warranted. The main purpose of a field scoping (survey) study would be to identify any areas within the development footprint where specialist palaeontological mitigation during the construction phase may be required (SG 2.2 SAHRA AMPHOB, 2012).

The Quaternary Formation may contain fossils. A very wide range of possible fossil remains, 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. Stromatolite structures range from a centimetre to several tens of metres in size.

The Ecca Group may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005).

The Glossopteris flora is thought to have been the major contributor to the coal beds of the Ecca. These are found in Karoo-age rocks across Africa, South America, Antarctica, Australia and India. This was one of the early clues to the theory of a former unified Gondwana landmass (Norman and Whitfield 2006).

Trace fossils are relatively abundant in the shales occurring near the top of the Dwyka Group. Lycopods (*Leptophloem australe*) have been described from the northern Free State (Mac Rae 1999). Spores and acritarchs have been reported from the interglacial mudrocks of the Dwyka Group, also spores, pollen, wood, and plant remains in the interbedded mudrocks as well as the diamictite itself, while anthropod trackways and fish trails are present in places on bedding planes (Visser *et al.* 1990).

Chemical sediments such as fine grained limestone and dolomite is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. These Early Proterozoic Transvaal stromatolitic dolomites formed and released free oxygen at around 2900 – 2400 Ma. Stromatolites are common in the Malmani dolomites, accepted to be the fossil remnants of the simplest single-celled organisms. They are finely layered, concentric, mound-like structures formed by microscopic algal organisms (Norman and Whitfield 2006). Chert may contain fossils such as echinoids or sponges if nodular, although not common and is rated unlikely. These structures range from a centimetre to several tens of metres in size. They are the result of algal growth in shallow water, indicating a very rich growth that would have caused an enrichment in the amount of oxygen in the atmosphere (Groenewald and Groenewald 2014).

Figure 10: Stromatolite in dolomite (Photograph E. Butler).

Table 1: Taken form The Palaeotechnical Report (Groenewald and Groenewald 2014).

KAROO	ECCA (P; Pe) (Undifferentiated)		Vryheid (Pv)		Deltaic sandstones, shales and coals, with minor conglomerates Early to Middle Permian	Rich assemblages of plant fossils (Glossopteris Flora), including tree trunks, stumps and roots, palynomorphs, rare insects, conchostracans, low diversity trace fossil assemblages. Very rich and historically important plant fossil collections from Vryheid Formation at Vereeniging	N.B. Important plant fossil sites lik Lawley may be equivalent to the Late Permian Estcourt Formation (i.e. Upper Ecca or Lower Beaufort Group) rather than the Middle Ecca, but are mapped as Vryheid Formation.
	DWYKA (C-Pd)		Probably Mbizane		Glacial to fluvioglacial diamictites, conglomerates, sandstones, shales Late Carboniferous to Early Permian in age	Possibility of interglacial or post-glacial trace fossil assemblages, fossil plants, shelly invertebrates – but these fossils not yet recorded from Gauteng	

CHUNIESPOORT		Duitschland (Vd)		Conglomerate	No fossils recorded	Good examples of stromatolites in Cradle of Humankind region ALERT FOR POTENTIALLY FOSSILIFEROUS LATE CAENOZOIC CAVE BRECCIAS WITHIN "TRANSVAAL DOLOMITE" OUTCROP AREA (breccias not individually mapped)
		Penge (Vp)		Iron-rich shale	Stromatolites	
	Malmani (Vm; Vmd; Vma)			Stromatolitic carbonates (limestones / dolomites), minor secondary cherts, mudrocks including carbonaceous shales	Range of shallow marine to intertidal stromatolites (domes, columns etc), organic-walled microfossils	
		Black Reef (Vbr)		Siliciclastic sediments (mature sandstones plus minor mudrocks, conglomerates) deposited during a fluvial to shallow marine transition	Possible equivalent of Black Reef Fm in N. Cape (Vryburg Formation) contains stromatolitic carbonates	

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally LOW to VERY HIGH.

Table 2: Criteria used (Fossil Heritage Layer Browser/SAHRA).

Rock Unit	Significance/vulnerability	Recommended Action
Vryheid Formation (Pv) (Pe)	**Very High**	Field assessment and protocol for finds is required
Dwyka Group (C-Pd)	**Moderate**	Desktop assessment is required
Malmani Subgroup	**High**	Desktop and Phase 1

Databases and collections: Ditsong: National Museum of Natural History. Evolutionary Studies Institute, University of the Witwatersrand (ESI).
Impact: **VERY HIGH**. There are significant fossil resources that may be impacted by the development (shale).

H. Description of the Methodology (1e)

The palaeontological impact assessment field study was undertaken on 18 September 2019. The walk through and drive through of the affected portion were done and photographs (in 20 mega pixels) were taken of the site with a digital Canon camera (PowerShot SX620HS). It was not necessary to use a Global Positioning System (GPS) (Garmin eTrex 10) to record outcrops if not covered with topsoil, subsoil, overburden, and vegetation. A literature survey is included and the study relied on literature, geological maps, google.maps, and google.earth images.

SAHRA Document 7/6/9/2/1 requires track records/logs from archaeologists not palaeontologists as palaeontologists concentrate on outcrops which may be recorded on a GPS. Isolated occurrences of rocks usually do not constitute an outcrop. Fossils can occur in dongas, as nodules, in fresh rock exposures, and in riverbeds. Finding fossils require the experience and technical knowledge of the professional palaeontologist, but that does not mean that an amateur can't find fossils. The geology of the region is used to predict what type of fossil and zone will be found in any particular region. An archaeozoologist can be called upon to survey for more recent fossils in the Quaternary and Tertiary deposits, if present.

Assumptions and Limitations (**1i**):-
The accuracy and reliability of the report may be limited by the following constraints:

1. Most development areas have never been surveyed by a palaeontologist or geophysicist.
2. Variable accuracy of geological maps and associated information.
3. Poor locality information on sheet explanations for geological maps.
4. Lack of published data.
5. Lack of rocky outcrops.
6. Inaccessibility of site.
7. Insufficient data from developer and exact lay-out plan for all structures (for this report all required data/information was provided).

A Phase 1 Palaeontological Impact Assessment: Field Study will include:

1. Recommendations for the future of the site.
2. Background information on the project.
3. Description of the property of affected environment with details of the study area.
4. Description of the geological setting and field observations.
5. Background to palaeontology of the area.
6. Heritage rating.
7. Stating of significance (Heritage Value).

A Phase 2 Palaeontological Impact Assessment: Mitigation will include:

1. Recommendations for the future of the site.
2. Description of work done (including number of people and their responsibilities).
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan.
6. Possible declaration as a heritage site or Site Management Plan.

The National Heritage Resources Act No. 25 of 1999 further prescribes -

Act No. 25 of 1999. National Heritage Resources Act, 1999. The National Estate as: 3 (2) (f) archaeological and palaeontological sites, (i)(1) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens, Heritage assessment criteria and grading used: (a) Grade 1: Heritage resources with qualities so exceptional that they are of special national significance; (b) Grade 2: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and (c) Grade 3: Other heritage resources worthy of conservation. SAHRA is responsible for the identification and management of Grade 1 heritage resources. Provincial Heritage Resources Authority (PHRA) identifies and manages Grade 2 heritage resources. Local authorities identify and manage Grade 3 heritage resources. No person may damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of a provincially protected place or object without a permit issued by a heritage resources authority or local authority responsible for the provincial protection. Archaeology, palaeontology and meteorites: Section 35.

(2) Subject to the provisions of subsection (8) (a), all archaeological objects, palaeontological material and meteorites are the property of the State.
(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or excavation, recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before a Phase 2 may be implemented.

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (*e. g.* during bedrock excavations), this must be safeguarded, where feasible *in situ,* and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (*e. g.* Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

I. Description of significant fossil occurrences (1f)
All Karoo Supergroup geological formations are ranked as **LOW** to **VERY HIGH**, and here the impact is potentially **VERY HIGH** for the Vryheid Formation, Ecca Group and **MODERATE** for the Dwyka Group. Rocks of Permian age in South Africa are particularly rich in fossil plants (Rayner and Coventry 1985). The fossils are present in the grey shale interlayered with the coal seams. The fossils are not very rare and occur also in other parts of the Karoo stratigraphy. It is often difficult to spot the greyish fossils as they are the same colour as the grey shale in which they are present as these coalified compressions have been weathered to leave surface replicas on the enclosing shale matrix. The pollen of the Greenside Colliery near Witbank also on the Vryheid Formation was the focus of a Ph.D study. A locality close to Ermelo, also Vryheid Formation, has yielded *Scutum, Glossopteris* leaves, *Neoggerathiopsis* leaves, the lycopod *Cyclodendron leslii,* and various seeds and scale leaves (Prevec 2011).

Fossils likely to be found are mostly plants (Appendix 1) such as '*Glossopteris* flora' of the Vryheid Formation. The aquatic reptile *Mesosaurus* and fossil fish may also occur with marine invertebrates, arthropods and insects. Trace fossils can also be present. The marine bivalve *Megadesmus* is found in the upper part of the Volksrust Formation near Newcastle (Johnson 2009).

During storms a great variety of leaves, fructifications and twigs accumulated and because they were sandwiched between thin films of mud, they were preserved to bear record of the wealth and the density of the vegetation around the pools. They make it possible to reconstruct the plant life in these areas and wherever they are found, they constitute most valuable palaeobotanical records (Plumstead 1963) and can be used in palaeoenvironmental reconstructions.

Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to be determined due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot. The vast coal mining industry (Vryheid Formation) provides palaeontologists with fantastic access to coal-associated plant fossils, while simultaneously resulting in the destruction of important National Palaeontological Heritage.

The threats to the National Palaeontological Heritage are:- earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, the sealing-in or destruction of fossils by development, vehicle traffic, and human disturbance. See Description of the Geological Setting (F) above.

J. Recommendation (1j,1l)

a. There is no objection (see Recommendation B) to the development, but it was necessary to request a Phase 1 Palaeontological Impact Assessment: Field study to determine whether the development will affect fossiliferous outcrops as the palaeontological sensitivity is **VERY HIGH**. A Phase 2 Palaeontological Mitigation is only required if the Phase 1 Palaeontological Assessment identified a fossiliferous formation or surface fossils or if fossils are found during construction excavations and drilling. Fossils were not found during the walk through. The Protocol for Chance Finds and Management Plan is attached (Appendix 2) for the ECO.

b. This project will benefit the environment, economy, and social development of the community.

c. Preferred choice: One Alternative is proposed (see Executive Summary).

d. The following should be conserved: if any palaeontological material is exposed during digging, excavating, drilling or blasting SAHRA must be notified. All construction activities must be stopped and a palaeontologist should be called in to determine proper mitigation measures.

<u>Sampling and collecting (**1m,1k**)</u>:

Wherefore a permit is needed from the South African Heritage Resources Agency (SAHRA / PHRA).

a. Objections: Cautious. See heritage value and recommendation.
b. Conditions of development: See Recommendation.
c. Areas that may need a permit: Only if a fossil is unearthed.
d. Permits for mitigation: **SAHRA/PHRA**.

K. Conclusions

a. All the land involved in the development was assessed and none of the property is unsuitable for development (see Recommendation B).

b. All information needed for the Phase 1 Palaeontological Impact Assessment and Field scope was provided by the Consultant. All technical information was provided by Environmental Assurance (Pty) Ltd.
c. Areas that would involve mitigation and may need a permit from the South African Heritage Resources Agency are discussed.
d. The following should be conserved: if any palaeontological material is exposed during digging, excavating, drilling or blasting, SAHRA must be notified. All development activities must be stopped and a palaeontologist should be called in to determine proper mitigation measures, especially for shallow caves.
e. Condition in which development may proceed: It is further suggested that a Section 37(2) agreement of the Occupational, Health and Safety Act 85 of 1993 is signed with the relevant contractors to protect the environment (fossils) and adjacent areas as well as for safety and security reasons.

L. Bibliography

ALMOND, J., PETHER, J, and GROENEWALD, G. 2013. South African National Fossil Sensitivity Map. SAHRA and Council for Geosciences.

DE ZANCHE, V. and MIETTO, P. 1977. *The World of Fossils.* Sampson Low Guides, Berkshire, Printed in Italy, Pp 256.

GRODNER, M. and CAIRNCROSS, B. 2003. A regional scale 3-D model of the Witbank Coalfield, Northern Karoo Basin, South Africa. *South African Journal of Geology,* **106(4):** 249-264.

GROENEWALD, G and GROENEWALD, D. 2014. SAHRA Palaeotechnical Report. Palaeontological Heritage of the Gauteng Province, Pp 20.

JOHNSON, M.R. 2009. Ecca Group. Karoo Supergroup. Catalogue of South African Lithostratigraphic Units. SACS, **10:** 5-7.

KENT, L. E., 1980. Part 1: Lithostratigraphy of the Republic of South Africa, South West Africa/Namibia and the Republics of Bophuthatswana, Transkei and Venda. SACS, Council for Geosciences, *Stratigraphy of South Africa. 1980. South African Committee for Stratigraphy.* Handbook 8, Part 1, pp 690.

KEYSER, N., BOTHA, G.A. and GROENEWALD, G.H. 1986. 1:250 000 Geological Map of the East Rand, 2628. South African Committee for Stratigraphy, Council for Geoscience, Pretoria.

MACRAE, C. 1999.*Life Etched in Stone: Fossils of South Africa.* Geological Society of south Africa, Johannesburg. Pp 305.

MCCARTHY, T and RUBIDGE, B. 2005. *The Story of Earth Life: A southern African perspective on a 4.6-billion-year journey.* Struik. Pp 333.

NIXON, N., ERIKSSON, P.G., JACOBS, R. and SNYMAN, C.P. 1988. Early Proterozoic micro-algal structures in carbonaceous shales of the Pretoria Group, south-west of Potchefstroom. *South African Journal of Science,* **84:** 592-595.

NORMAN, N. and WHITFIELD, G., 2006. *Geological Journeys.* De Beers, Struik, P 1-320.

PLUMSTEAD, E.P. 1963. The influence of plants and environment on the developing animal life of Karoo times. *South African Journal of Science,* **59(5):** 147-152.

PREVEC, R. 2011. A structural re-interpretation and revision of the type material of the glossopterid ovuliferous fructification *Scutum* from South Africa. *Palaeontologia africana,* **46:** 1-19.

RAYNER, R.J. and COVENTRY, M.K. 1985. A *Glossopteris* flora from the Permian of South Africa. *South African Journal of Science,* **81:** 21-32.

RUBIDGE, B. S. (ed.), 1995. Biostratigraphy of the Beaufort Group (Karoo Supergroup). South African Committee for Biostratigraphy, Biostratigraphic Series No. 1, 46pp. Council for Geoscience, Pretoria.

SG 2.2 SAHRA APMHOB Guidelines, 2012. Minimum standards for palaeontological components of Heritage Impact Assessment Reports, Pp 1-15.

SNYMAN, C. P., 1996. *Geologie vir Suid-Afrika*. Departement Geologie, Universiteit van Pretoria, Pretoria, Volume 1, Pp. 513.

VAN DER WALT, M., DAY, M., RUBIDGE, B. S., COOPER, A. K. & NETTERBERG, I., 2010. Utilising GIS technology to create a biozone map for the Beaufort Group (Karoo Supergroup) of South Africa. *Palaeontologia Africana,* **45:** 1-5.

VISSER, D.J.L. 1984 (ed). Geological Map of South Africa 1:100 000. South African Committee for Stratigraphy. Council for Geoscience, Pretoria.

VISSER, D.J.L. 1989 (ed). *Toeligting: Geologiese kaart (1:100 000). Die Geologie van die Republieke van Suid Afrika, Transkei, Bophuthatswana, Venda, Ciskei en die Koningkryke van Lesotho en Swaziland*. South African Committee for Stratigraphy. Council for Geoscience, Pretoria.

Declaration (disclaimer) 1(b)

I, Heidi Fourie, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project for which I was appointed to do a palaeontological assessment. There are no circumstances that compromise the objectivity of me performing such work.

I accept no liability, and the client, by receiving this document, indemnifies me against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the use of the information contained in this document.

It may be possible that the Phase 1 PIA study may have missed palaeontological resources in the project area as outcrops are not always present or visible due to vegetation while others may lie below the overburden of earth and may only be present once development commences.

This report may not be altered in any way and any parts drawn from this report must make reference to this report.

____

Heidi Fourie
2019/09/30

Appendix 1: Examples of Vryheid Formation fossils (MacRae 1999).

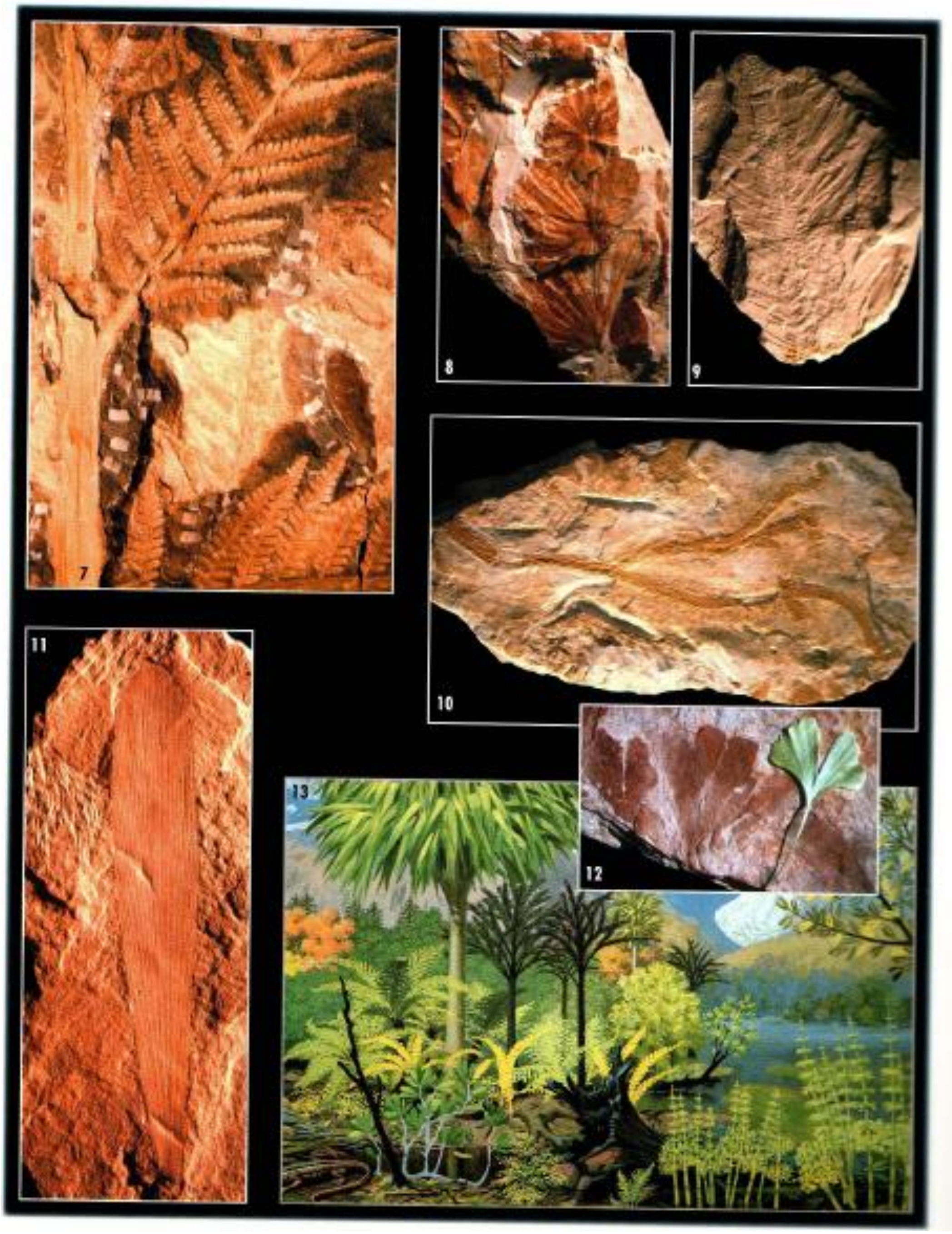


Figure 11: Example of a plant fossil (courtesy of the ESI). *Glossopteris* leave.

Appendix 2 (**1k,1m,1q**): **Protocol for Chance Finds and Management plan**
This section covers the recommended protocol for a Phase 2 Mitigation process as well as for reports where the Palaeontological Sensitivity is LOW; this process guides the palaeontologist / palaeobotanist on site and should not be attempted by the layman / developer. As part of the Environmental Authorisation conditions, an Environmental Control Officer (ECO) will be appointed to oversee the construction activities in line with the legally binding Environmental Management Programme (EMPr) so that when a fossil is unearthed they can notify the relevant department and specialist to further investigate. Therefore, the EMPr must be updated to include the involvement of a palaeontologist during the digging and excavation (ground breaking) phase of the development.

The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities. The protocol is to immediately cease all construction activities if a fossil is unearthed and contact SAHRA for further investigation. The area must be fenced-off and the construction workers must be informed that this is a no-go area. The ECO should familiarise him- or herself with the fossiliferous formations and its fossils. A bi-weekly site visit is recommended and the keeping of a photographic record. A regular monitoring presence over the period during which excavations are made, by a palaeontologist, is generally not practical. The Evolutionary Studies Institute, University of the Witwatersrand has good examples of Ecca Group Fossils.

The developer must survey the areas affected by the development and indicate on plan where the construction / development will take place. Trenches have to be dug to ascertain how deep the sediments are above the bedrock (can be a few hundred metres). This will give an indication of the depth of the topsoil, subsoil, and overburden, if need be trenches should be dug deeper to expose the interburden.

Mitigation will involve recording, rescue and judicious sampling of the fossil material present in the layers sandwiched between the geological / coal layers (if present). It must include information on number of taxa, fossil abundance, preservational style, and taphonomy. This can only be done during mining or excavations. In order for this to happen, in case of coal mining operations, the process will have to be closely scrutinised by a professional palaeontologist / palaeobotanist to ensure that only the coal layers are mined and the interlayers (siltstone and mudstone) are surveyed for fossils or representative sampling of fossils are taking place.

The palaeontological impact assessment process presents an opportunity for identification, access and possibly salvage of fossils and add to the few good fossil localities. Mitigation can provide valuable onsite research that can benefit both the community and the palaeontological fraternity.

A Phase 2 study is very often the last opportunity we will ever have to record the fossil heritage within the development area. Fossils excavated will be stored at a National Repository.

A Phase 2 Palaeontological Impact Assessment: Mitigation will include (SAHRA) -

1. Recommendations for the future of the site.
2. Description and purpose of work done (including number of people and their responsibilities).
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan and map.
6. Possible declaration as a heritage site or Site Management Plan.
7. Stakeholders.
8. Detailed report including the Desktop and Phase 1 study information.
9. Annual interim or progress Phase 2 permit reports as well as the final report.
10. Methodology used.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

The Palaeontological Society of South Africa (PSSA) does not have guidelines on excavating or collecting, but the following is suggested:

1. The developer needs to clearly stake or peg-out (survey) the areas affected by the mining (if applicable)/ construction/ development operations and dig representative trenches and if possible supply geological borehole data.
2. Fossils likely to occur are for example the fossil plants from the Vryheid Formation, these are present in the grey shale (or any other fossiliferous layer ranked as **VERY HIGH** or **HIGH**) or for example the invertebrates from the Volksrust Formation (or any other fossiliferous layer).
3. When clearing topsoil, subsoil or overburden and hard rock (outcrop) is found, the contractor needs to stop all work.
4. A Palaeobotanist / palaeontologist (contact SAHRIS for list) must then inspect the affected areas and trenches for fossiliferous outcrops / layers. The contractor / developer may be asked to move structures, and put the development on hold.
5. If the palaeontologist / palaeobotanist is satisfied that no fossils will be destroyed or have removed the fossils, development and removing of the topsoil can continue.
6. After this process the same palaeontologist / palaeobotanist will have to inspect and offer advice through the Phase 2 Mitigation Process. Bedrock excavations for footings may expose, damage or destroy previously buried fossil material and must be inspected.
7. When permission for the development is granted, the next layer can be removed, if this is part of a fossiliferous layer, then with the removal of each layer of sediment, the palaeontologist / palaeobotanist must do an investigation (a minimum of once a week).

8. At this stage the palaeontologist / palaeobotanist in consultation with the developer / mining company (if applicable) must ensure that a further working protocol and schedule is in place. Onsite training should take place, followed by an annual visit by the palaeontologist / palaeobotanist.

Fossil excavation if necessary during Phase 2:

1. Photography of fossil / fossil layer and surrounding strata.
2. Once a fossil has been identified as such, the task of extraction begins.
3. It usually entails the taking of a GPS reading and recording lithostratigraphic, biostratigraphic, date, collector and locality information.
4. Use Paraloid (B-72) as an adhesive and protective glue, parts of the fossil can be kept together (not necessarily applicable to plant fossils).
5. Slowly chipping away of matrix surrounding the fossil using a geological pick, brushes and chisels.
6. Once the full extent of the fossil / fossils is visible, it can be covered with a plaster jacket (not necessarily applicable to plant fossils).
7. Chipping away sides to loosen underside.
8. Splitting of the rock containing palaeobotanical material should reveal any fossils sandwiched between the layers.

SAHRA Documents:
Guidelines to Palaeontological Permitting Policy.
Minimum Standards: Palaeontological Component of Heritage Impact Assessment reports.
Guidelines for Field Reports.
Palaeotechnical Reports for all the Provinces.

Appendix 3: Table of Appendix 6 requirements.

Section	Point in Act	Heading
B	1(c)	Outline of development project
	1(d)	Summary of findings
	1(g)	Concerns/threats
	1(n)i	Concerns/threats
	1(n)ii	Concerns/threats
	1(o)	Concerns/threats
	1(p)	Concerns/threats
D	1(h)	Figures
	1(a)i	Terms of reference
H	1(e)	Description of Methodology
	1(i)	Assumptions and Limitations
I	1(f)	Heritage value
J	1(j)	Recommendation
	1(l)	Recommendation
	1(m)	Sampling and collecting
	1(k)	Sampling and collecting
Declaration	1(b)	Declaration
Appendix	1(k)	Protocol for finds
	1(m)	Protocol for finds
	1(q)	Protocol for finds

Appendix 8 : Ecological and Biodiversity Scan

BIODIVERSITY SCREENING

BIODIVERSITY SCREENING OF PORTION 9 OF THE FARM VLAKFONTEIN 281 IR FOR A PROSPECTING RIGHTS APPLICATION FOR ILANGABI INVESTMENTS

ILANGABI

"Your Partner in Calculating Environmental Solutions"
ENVASS
ENVIRONMENTAL ASSURANCE (Pty)Ltd

PREPARED FOR:	Ilangabi Investments 12 (Pty) Ltd.
PREPARED BY:	Environmental Assurance (Pty) Ltd.
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DATE:	October 2019
REPORT NUMBER:	BIO-REP-184-19_20
VERSION:	0.0

DOCUMENT CONTROL	
Document Title	Biodiversity Screening of Portion 9 of the Farm Vlakfontein 281 IR for a Prospecting Rights Application for Ilangabi Investments
Report Number	BIO-REP-184-19_20 (Ilangabi- Biodiversity Screening)
Version	0.0
Date of Field Assessment	11th September 2019
Date of Report	October 2019
Submitted to	Client: Ilangabi Investments 12 (Pty) Ltd. Contact Person: Marguerite Lubbe Email: Marguerite@ilangabicoal.co.za
Distribution	x1 Ilangabi Investments 12 (Pty) Ltd. x1 Environmental Assurance (Pty) Ltd.
EXPERTISE OF AUTHOR	
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QUALITY CONTROL			
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Name	Wayne Westcott	Wian Esterhuizen	Carl Schoeman
Designation	Ecologist	Environmental Consultant	Environmental Scientist
Signature			
Date	05-10-2019	17-10-2019	17-10-2019

DISCLAIMER

SPECIALIST DECLARATION:

I Wayne Westcott, declare that:

- I acted as an independent specialist;
- The assessment results were interpreted in an objective manner, even if the conclusions were not favourable to the client;
- I have the relevant expertise required to conduct a specialist report of this nature in terms of the National Environmental Management Act (NEMA) (Act no. 107 of 1998) and the National Environmental Management; Biodiversity Act (Act no. 10 of 2004);
- The contents of this report comply with the relevant legislative requirements, specifically Appendix 6 of the NEMA: EIA Regulations (2014, as amended in 2017);
- I understand that any false information published in this document is an offence in terms of Regulation 71 and is punishable in terms of Section 24(f) of the Act; and
- I am a registered scientist with the South African Council for Natural Scientific Professions (SACNASP).

Wayne Westcott
Business Unit Manager
Divisional Head: Wetland & Aquatics

Suggested Report Citation:

Environmental Assurance, 2019. *Biodiversity Screening of Portion 9 of the Farm Vlakfontein 281 IR for a Prospecting Rights Application for Ilangabi Investments.* Prepared for Ilangabi Investments 12 (Pty) Ltd. October 2019.

EXECUTIVE SUMMARY

Environmental Assurance (Pty) Ltd, hereafter referred to as ENVASS, was appointed by Ilangabi Investments 12 (Pty) Ltd. (ACER), hereafter referred to as the client, to undertake a biodiversity screening of Portion 9 of the Farm Vlakfontein 281 IR. The primary objective of this biodiversity screening was to provide specialist input into a prospecting right application on the aforementioned property, which was situated in the Ekurhuleni Metropolitan Municipality of the Gauteng Province, that will be submitted to the competent authority by the client. The site presented in **Figure 1** constituted as the study area for this project and will hereafter be referred to as such.

The field survey relevant to this biodiversity screening report was conducted on the 11th September 2019 within the South African National Biodiversity Institution (SANBI) prescribed dry season for the region. The following sections will provide the relevant desktop information and subsequent results that were gather in-field within the study area that was applicable to this project.

Impact Statement

The proposed development will involve the drilling of a total of ten (10) prospecting cores, which will be distributed across the study area (i.e. the golf course) in areas where accessibility via a drilling rig will be possible. This will require for a drilling rig to enter the study area via an existing tarred road and utilise existing gravel roads to traverse through the course thereafter. Only slight vegetation clearing may be required, and the only other disturbance to the receiving terrestrial environment will be compaction by the tyre tracks of the rig, noise and core excavation at the ten predetermined points. As the duration of the proposed drilling activities will presumably be one (1) day, and given the already highly degraded condition of the study area, any impacts that may be evident will be negligent.

Specialist's Recommendation

Subsequent to conducting a brief once-off field survey of the study area on the 11th September 2019, the site was recorded to have been significantly degraded in comparison to its formulated reference state. It was assumed that the current land use as a recreational golf course stemmed from the historic clearing of natural vegetation, landscaping of the soil profile and subsequently planting of *Eucalyptus grandis*, *Pinus patula* and *Salix babylonica* woody species along and around the fairways and now dry water features. This has resulted in the drastic reduction of biodiversity within the study area and consequent destruction of potential faunal refugia, as well as severe encroachment by several IAPS. Overall, the state of the flora and fauna that was recorded within the study area was not representative of the reference conditions formulated through a review of the desktop information and during the ground-truthing exercise.

It is the specialist's recommendation that the proposed prospecting continue within the study area, provided that the following preventative and mitigation measures are implemented:

- Existing access roads must be utilised by the drilling rig and associated Trackless Mobile Machines (TMMs). If the TMMs traverse outside of the existing routes and cause disturbance and/or destruction of the vegetation, the disturbed areas must be tilled and revegetated with a mixture of indigenous grass species, such as *Themeda triandra*, or *Eragrostis curvula* which can both be obtained from a commercial nursery.
- The disturbed area at the proposed drilling sites must be limited to the core area, which must be encircled with orange barrier netting to avoid human and faunal species falling within the core holes, and all excess sediment around the mouth is to be backfilled in the holes. In instances where the excess sediment does not cover the mouth of a hole, the core hole must be capped with a wooden plank cut to just larger than the hole. This cap must be implemented by excavating the top layer of soil to an approximate depth of 200mm, inserting the cap, backfilling, compacting the surface slightly and revegetation using the grass species previously cleared from the site.
- All drilling activities must occur during the day time between the hours of 8am and 5pm to avoid continued disturbance to nocturnal faunal species.
- No indigenous woody species must be cut during the proposed development.

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LIST OF ABBREVIATIONS AND ACRONYMS

TERM	EXPANSION
BA	Biodiversity Area
CBA	Critical Biodiversity Area
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EKZNW	Ezemvelo KwaZulu-Natal Wildlife
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
GIS	Geographic Information System
GPS	Geographic Positioning System
IAPS	Invasive Alien Plant Species
MAMSL	Meters Above Mean Sea Level
MAP	Mean Annual Precipitation
MAT	Mean Annual Temperature
NEMA	National Environmental Management Act (Act no. 107 of 1998)
NEM:BA	National Environmental Management: Biodiversity Act (Act no 10 of 2004)
NFEPA	National Freshwater Ecosystem Priority Area
NWA	National Water Act (Act no. 36 of 1998)
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
TSCP	Terrestrial Systematic Conservation Plan
VIA	Vegetation Impact Assessment
WMA	Water Management Area
WULA	Water Use Licence Application

1 INTRODUCTION

1.1 Background

Environmental Assurance (Pty) Ltd, hereafter referred to as ENVASS, was appointed by Ilangabi Investments 12 (Pty) Ltd. (ACER), hereafter referred to as the client, to undertake a biodiversity screening of Portion 9 of the Farm Vlakfontein 281 IR. The primary objective of this biodiversity screening was to provide specialist input into a prospecting right application on the aforementioned property, which was situated in the Ekurhuleni Metropolitan Municipality of the Gauteng Province, that will be submitted to the competent authority by the client. The site presented in **Figure 1** below constituted as the study area for this project and will hereafter be referred to as such.

The field survey relevant to this biodiversity screening report was conducted on the 11th September 2019 within the South African National Biodiversity Institution (SANBI) prescribed dry season for the region. The following sections will provide the relevant desktop information and subsequent results that were gather in-field within the study area that was applicable to this project.

1.2 Locality

The proposed development is planned to be situated on Portion 9 of Farm Vlakfontein 281 IR within the Ekurhuleni Metropolitan Municipality of the Gauteng Province of South Africa. The study area was located in the suburb of Marievale between the towns of Springs and Nigel on an existing South African Army golf course at centre point 26° 20’ 41.07” S, 28° 29’ 31.68” E. **Figure 2** overleaf presents the study area in relation to the surrounding towns within the relevant municipal boundaries.

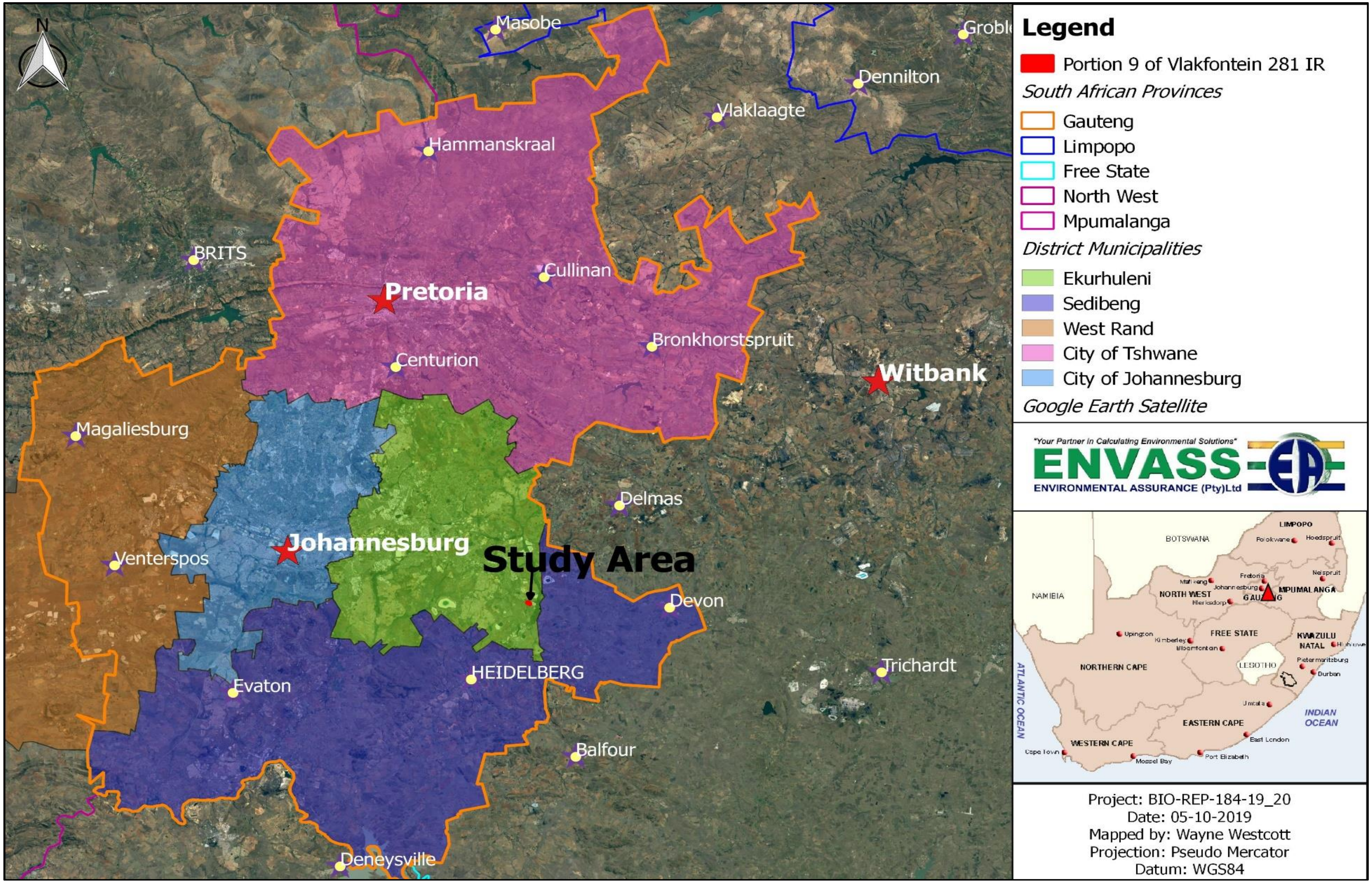

Figure 1: Locality map of the proposed development in relation to surrounding towns and municipal boundaries within the Gauteng Province, South Africa.

1.3 Applicable Legislation

This study was conducted and the relevant data and/or information obtained in accordance, or with consideration to, the following legislation (**Table 1**).

Table 1: Description of the legislation that was considered when drafting this biodiversity screening report.

LEGISLATION	DESCRIPTION
South African Constitution (Act no. 108 of 1996)	The constitution is the overarching framework of South African law. It provides a legal foundation for the existence of the republic, outlines the rights and responsibilities of South African citizens and it defines the structure of government. Chapter 2- Bill of rights (Section 24) Everyone has a right to an environment that is not harmful to their health or wellbeing and is protected through reasonable legislative or other measures. (Section 27) National government is the custodian of all the country's water resources.
National Environmental Management Act (NEMA): EIA Regulations (2014, as amended in 2017)	As the primary purpose of this assessment is to provide specialist input into the environmental management process associated with the proposed development the author has drafted this specialist report in accordance with the requirements listed under Appendix 6 of the NEMA: EIA Regulations (2014, as amended).
National Environmental Management Act: Biodiversity Act (NEM:BA) (Act No. 10 of 2004)	The objectives of the NEM:BA are (within the framework of NEMA) to provide for: (i) the management and conservation of biological diversity within the Republic and of the components of such biological diversity; (ii) the use of indigenous biological resources in a sustainable manner; and (iii) the fair and equitable sharing among stakeholders of benefits arising from bioprospecting involving indigenous biological resources.
Conservation of Agricultural Resource Act (CARA) No. 43 of 1983	This act deals with control of the over-utilization of South Africa's natural agricultural resources, and to promote the conservation of soil and water resources and natural vegetation. This includes wetland systems and requires authorizations to be obtained for a range of impacts associated with cultivation of wetland areas.
Gauteng Nature Conservation Management Act 1997 (No. 9 of 1997) as amended, 1999	This Act makes provision for the protection of the natural environment of the Gauteng province. The legislation lists protected and specially protected indigenous plants and legislation applicable to such. Provincial legislation generally prohibits certain conduct relating to protected species.

National Forests Act (Act no. 84 of 1998)	In terms of the National Forests Act of 1998, forest trees and/ or protected tree species may not be cut, disturbed, damaged and destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold – except under license granted by the Department of Water Affairs and Forestry (or a delegated authority). Applications for licenses are evaluated on merit and will be permitted in line with national policy and guidelines. Notice of the List of Protected Tree Species under the National Forests Act, 1998 (Act No.84 of 1998). (DAFF)

2 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations are relevant to this biodiversity screening:

- The study area was limited to the boundary of the existing South African Army golf course and did not require an assessment buffer around it.
- No drill plan was supplied to the ENVASS specialist prior to conducting the field survey relevant to this project.
- A once-off field assessment was conducted in September 2019 and therefore does not account for seasonal variations in ecological habitat characteristics. The fieldwork was conducted over a period of one day, and thus limits the accuracy of the field data.
- The spontaneous nature, varied life-cycle stages and seasonal and temporal fluctuation in the distribution of faunal and floral species limits the accuracy of once-off studies such as this, and thus it is unlikely that all faunal and floral species are identified within this report.
- As this study was a screening, full faunal and floral methodologies were not implemented.
- Only those plant species situated directly within the study area were identified within this study.
- The variations experienced in GPS precision will ultimately affect the accuracy of the GPS waypoints and consequently will affect the accuracy of the recorded Species of Conservation Concern (SCC). All sampling waypoints were recorded using a Garmin Montana 650 GPS and captured, analysed and geoprocessed utilising a GIS (i.e. QGIS and ArcGIS).
- The recommendation of mitigation measures was informed by the site-specific ecological issues identified during the field survey and based on the assessor's working knowledge and experience with similar projects. It must be noted that no construction method statement was provided, and thus used during the assessment of the perceived impacts.
- Evaluation of the significance of impacts with mitigation takes into account mitigation measures provided in this report and standard mitigation measures included in the project-specific Environmental Management Programme report (EMPr).

3 OBJECTIVES

The primary objective of this biodiversity screening was to determine if there were any areas of ecologically importance and/or sensitivity within the study area and if so, to formulate possible prevention and/or mitigation measures that must be implemented to avoid any negative impacts from acting on these areas. The identification of any faunal and floral Species of Conservation Concern (SCC) that may have the potential to occur within the study area also formed an integral part of this project. Subsequent to an analysis of the data gathered at a desktop and in-field level, a specialist opinion as to whether or not the proposed project should continue from a biodiversity perspective was to be provided, as well as recommendations of how best to conduct the project if it is authorised by the competent authority.

4 METHODOLOGY

This section details the different techniques and methods used to obtain the data for this report in order to finally assess the overall ecological integrity of the faunal and floral communities and identify appropriate mitigation and/or rehabilitation measures to implement in an effort to reduce the potential impact (if any) on the receiving biological environment.

4.1 Desktop Assessment

A desktop assessment will be undertaken, in which all the available data (e.g. government records and previous studies) pertaining to the study area will be sourced and subsequently utilised to determine the theoretical importance and sensitivity of the terrestrial ecosystems involved. Additionally, the study area will be digitally illustrated and mapped utilising Geographical Information Systems (GIS) (e.g. QGIS and/or ArcGIS) to better understand the layout and structure of the surrounding environment and camp site. During this process, all the relevant GIS shapefiles will be overlain onto Google Earth Satellite imagery to provide the reader with a holistic view of the study area. **Table 2** below presents the datasets that were utilised, their references and date of publication.

Table 2: Presentation of the datasets and available information that was utilised during the desktop study associated with this assessment.

DATA	SOURCE	APPLICATION TO PROPOSED DEVELOPMENT
Google Earth Pro™ Imagery	Google Earth Pro™	Up-to-date satellite imagery of the proposed development, area (size) determination, desktop watershed determination, desktop identification of catchment and Hydrogeomorphic (HGM) impacts.
South African Vegetation Map (GIS Coverage)	Mucina & Rutherford (2006/2012)	Determine the national vegetation type of the study area.

DATA	SOURCE	APPLICATION TO PROPOSED DEVELOPMENT
National Biodiversity Assessment (NBA) Threatened Ecosystems (GIS Coverage)	South African National Biodiversity Institution (SANBI) (2011)	Determine the national threat status of the terrestrial and aquatic (WetVeg) vegetation types.
South African Geological Map (GIS Coverage)	Geological Survey (1988)	Determine regional and study site geology and soil types.
Soil Classification and Erosion Factor	Schultze *et al*. (1992)	Determine the broad soil types and their associated erosion factors within the study area.
Plants of Southern Africa (POSA) online checklist	(SANBI, 2012)	Review of the plant species that may occur within the applicable Quarter Degree Grid Cells (QDGC) associated with the study area.
FrogMAP	South African Frog Atlas Project (SAFAP) (2016)	Determine what frog species may occur in the study area. Geographic distribution and the presence of suitable habitat were used to determine the likelihood of occurrence within the study area.
MammalMAP	The Mammal Atlas of Africa (2016)	Determine what mammal species may occur in the study area. Geographic distribution and the presence of suitable habitat were used to determine the likelihood of occurrence within the study area.
ReptileMAP	South African Reptile Conservation Assessment (SARCA) (2016)	Determine what reptile species may occur in the study area. Geographic distribution and the presence of suitable habitat were used to determine the likelihood of occurrence within the study area.
South African Bird Atlas Project 2	SABP 2 (2016)	Determine what avifaunal species may occur in the study area. Geographic distribution and the presence of suitable habitat were used to determine the likelihood of occurrence within the study area.
IUCN Red List of threatened Species	IUCN (2015)	Determine what red data species may occur in the study area. Geographic distribution and the presence of suitable habitat were used to determine the likelihood of occurrence within the study area.
South African National Red List	SANBI (2014)	Determine what SCC may occur in the study area. Geographic distribution and the presence of suitable habitat were used to determine the likelihood of occurrence within the study area.

DATA	SOURCE	APPLICATION TO PROPOSED DEVELOPMENT
National Freshwater Ecosystem Priority Areas (NFEPAs)	Driver et al. (2011)	Determine whether there are freshwater ecosystems of conservation concern within the study area.

4.2 Visual Inspection

During the fieldwork, a visual investigation of the proposed study area will be conducted to identify any impacts, from both the surrounding land-use activities and environmental processes, which may influence the overall health and functionality of the faunal and floral communities. The impacts observed and condition of the study area will be photographed, documented and related to professional experience. This will essentially provide a baseline for further, more detailed, studies and justify the sensitivity of each broad habitat type.

4.3 Field Survey

A field assessment of the study area was conducted on the 11th of the spring month of September 2019. The primary objectives of the field survey were to; 1) verify the accuracy of the desktop delineated vegetation communities (i.e. SANBI (2006-18)) and determine which floral communities may potentially be impacted on by the proposed development, 2) record the current ecological integrity of the surrounding ecosystems by identifying disturbances and areas of degradation in relation to the reference, or natural state, with specific focus on potential encroachment by Invasive Alien Plant Species (IAPS), 3) produce a general overview of the vegetation and faunal species that may occur within the study area.

5 DESKTOP ASSESSMENT

The following sections consist of information obtained during the desktop study of the study area and the surrounding catchment areas.

5.1 Hydrological Setting

The study area was observed to fall within quaternary catchment C21E, within the Downstream Vaal Dam Sub-Water Management Area (WMA) of the greater Upper Vaal WMA (**Figure 2**). The study area was recorded to have been situated in the C21E- 1442 Blesbokspruit Sub-Quaternary Reach (SQR), which was observed to have had a Present Ecological State (PES) score falling within Class C (Moderately modified) and have been of a moderate Ecological Importance and Ecological Sensitivity within the broader catchment area (DWS, 2012). The primary land-use practices that were observed to have impacted on the overall PES of the SQR were agricultural practices and gold mine towards the lower reaches (DWS, 2012).

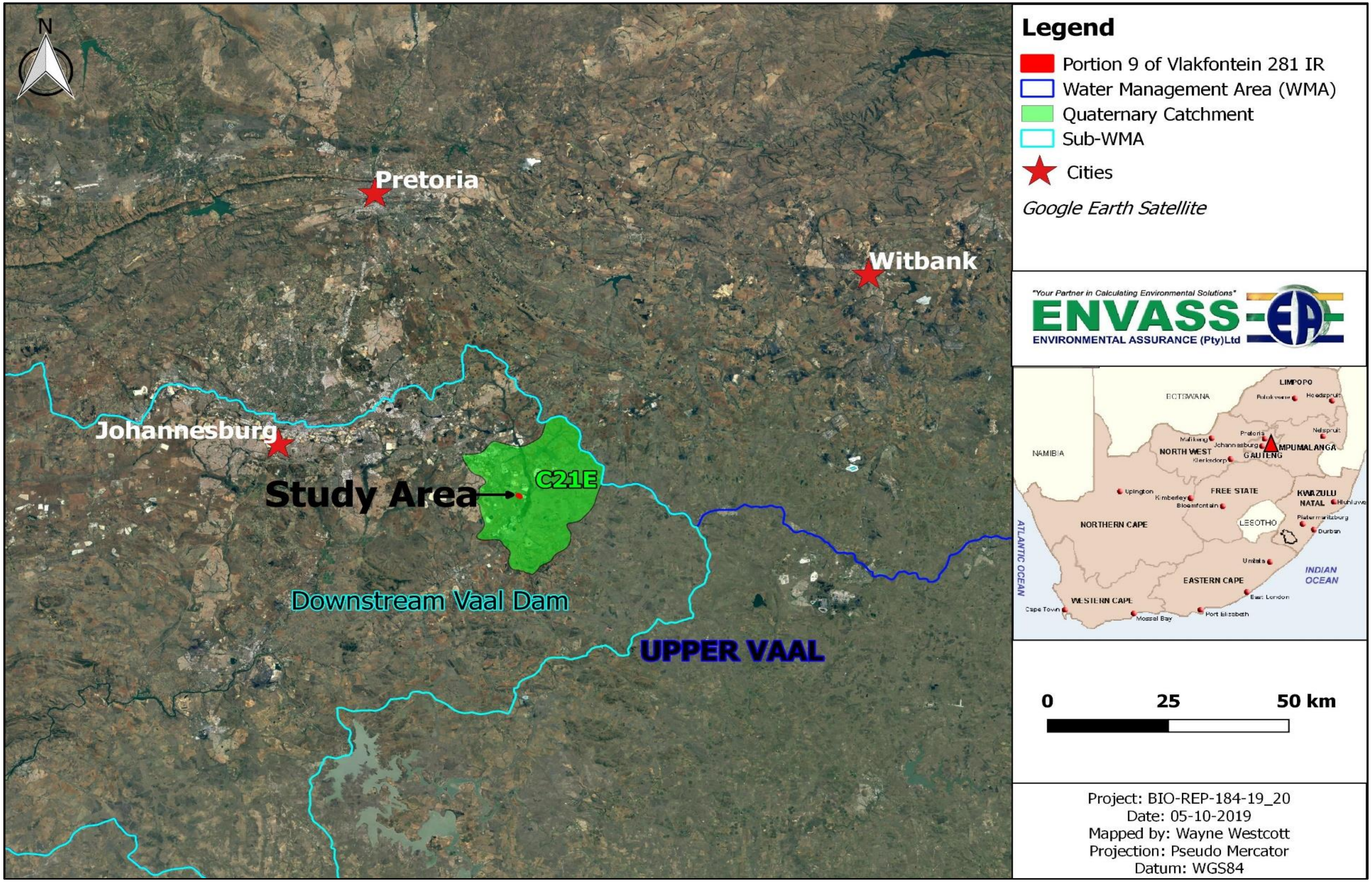

Figure 2: Presentation of the WMA, sub-WMA and catchments relevant to the study area (SANBI, 2017).

5.2 Ecoregion

According to the delineation provided by Dallas (2005), the level 1 ecoregion in which the proposed development was situated was the Highveld ecoregion (no. 11) (**Figure 3**). Kleynhans *et al*. (2005) describes the ecoregion to consist of a diverse range of morphological types with plains of moderate to low relief, covered by various grassland vegetation types, defining this high-lying region. The average altitude varied from 1100 to 2100 Mean Average Metres Above Sea Level (mamsl) and the major rivers that had cut through the landscape included: Vet, Modder, Riet, Vaal, Olifants, Steelpoort, Marico, Crocodile and Great Usutu. **Table 3** below presents the primary characteristics and data that have been collected for the Highveld ecoregion.

Table 3: Highveld Ecoregion attributes (Kleynhans *et al*., 2005)

MAIN ATTRIBUTES	HIGHVELD
Terrain morphology: Broad division (dominant types in bold (Primary)	**Plains; Low Relief; Plains; Moderate Relief;** Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to High Relief
Vegetation types (Dominant types in bold)	Mixed Bushveld (limited); Rocky Highveld Grassland; **Dry Sandy Highveld Grassland;** Dry Clay Highveld Grassland; **Moist Cool Highveld Grassland;** Moist Cold Highveld Grassland; North Eastern Mountain Grassland; Moist Sandy Highveld Grassland; Wet Cold Highveld Grassland (limited); Moist Clay Highveld Grassland; Patches Afromontane Forest (very limited)
Altitude (mamsl) (secondary)	1100-2100, 2100-2300 (very limited)
MAP (mm) (modifying)	400 to 1000
Coefficient of Variation (% of annual precipitation)	<20 to 35
Rainfall concentration index	45 to 65
Rainfall seasonality	Early to late summer
Mean annual temp. (°C)	12 to 20
Mean daily max temp. (°C) February	20 to 32
Mean daily max temp. (°C) July	14 to 22
Mean daily min. temp. (°C): February	10 to 18
Mean daily min. temp. (°C): July	-2 to 4
Median annual simulated runoff (mm) for quaternary catchment	5 to >250

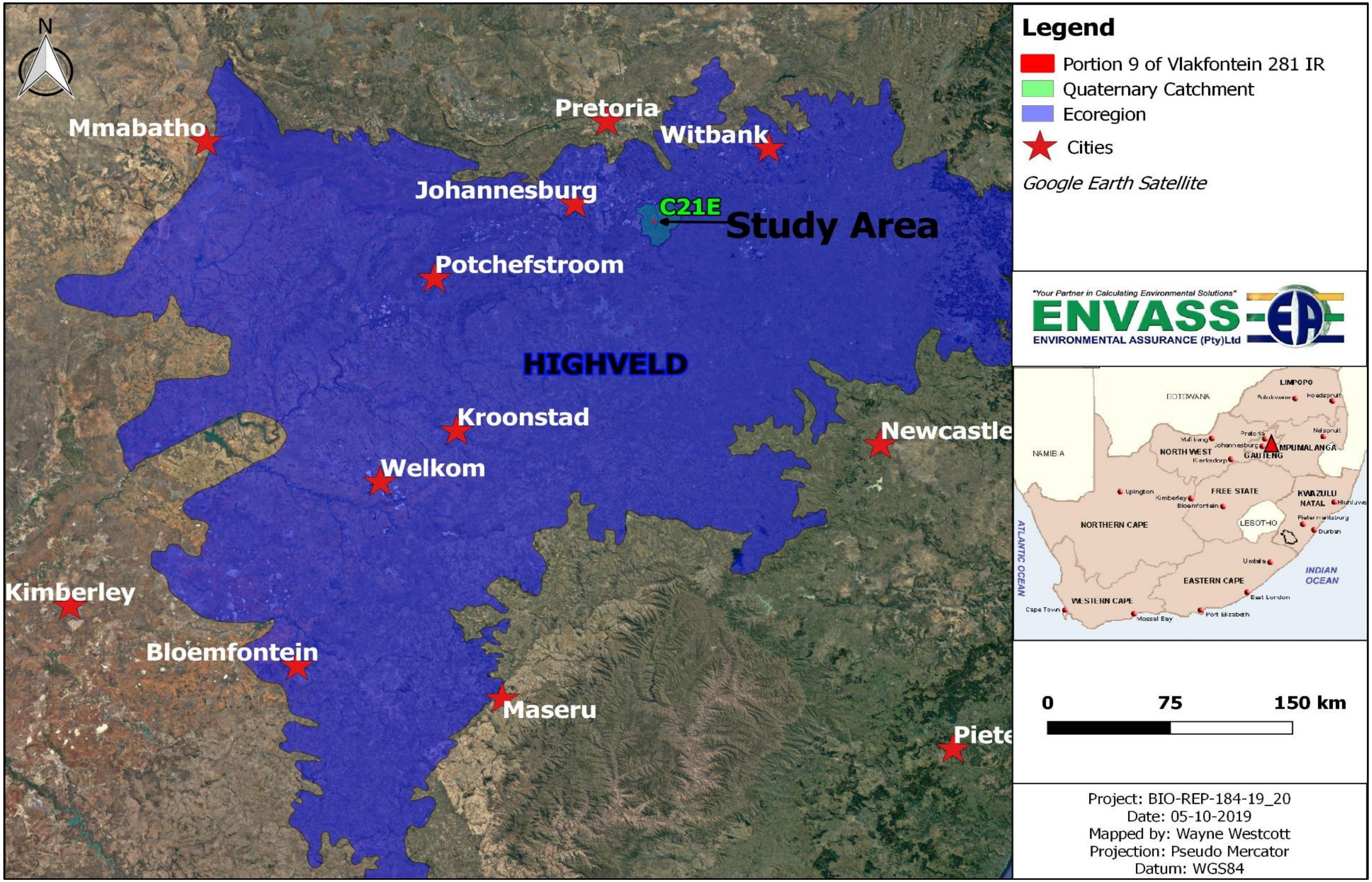

Figure 3: Ecoregion recorded to have been applicable to the study area (DWS, 2012).

5.3 Land Use

The dominant land uses associated with the project area were recorded to have been urban sports and golf course, plantations and grassland with intermittently placed water bodies, urban residential and degraded surfaces (**Figure 4**) Subsequent to *ground-truthing* the mapped land-cover it was observed that the majority of the woody vegetation present within the study area could be classified as plantation, and there was a greater footprint of grassland in the south west corner.

5.4 Vegetation

Vegetation types were identified and delineated on a national scale by Mucina and Rutherford (2006), and this terrestrial vegetation delineation has since been continually modified at five (5) year intervals to account for changes in land cover. The most recent version of the dataset at the time of this study was from 2018. As this delineation was at a national scale, the dataset used as a broad baseline against which the on-site land cover and vegetation condition was compared to in order to determine whether changes had occurred on-site, and if so to what do degree.

The study area associated with the proposed development was recorded to extend into the Tsakane Clay Grassland terrestrial vegetation type, which was classified as endangered at a national scale (Mucina & Rutherford, 2006/12; SANBI, 2006-2018) (**Figure 5**). The wetland vegetation type within the study area was recorded to be the Mesic Highveld Grassland Group 2, for which both the wetland ecosystem and vegetation unit was categorised as critically endangered (Driver *et al*., 2011). It must be noted that the conditions of the aforementioned vegetation types were observed to have been highly degraded as a result of an existing recreational golf course and associated infrastructure (e.g. fences, sand and water features, buildings and servitudes), which was recorded to have been situated on the entire site. The significant disturbance had resulted in severe encroachment by Invasive Alien Plant Species (IAPS), such as but not limited to: *Bidens pilosa* (Blackjack), *Ageratum conyzoides* (Common Ageratum), *Salix babylonica* (Weeping Willow) with the most dominant being *Pinus patula* (Pine Tree) and *Eucalyptus grandis* (Saligna Gum). These disturbances have drastically reduced the natural biodiversity within the study area. **Table 4** below describes the characteristics relevant to the terrestrial vegetation type.

Table 4: Characteristics of the relevant vegetation type found within the study area (SANBI, 2006/18).

ATTRIBUTE	TSAKANE CLAY GRASSLAND
Distribution	In patches extending in a narrow band from Soweto to Springs, broadening southwards to Nigel and continuing towards Vereeniging, as well as north of the Vaal Dam and between Balfour and Standerton in the Gauteng and Mpumalanga Provinces.
Altitude range	1,480 to 1,680 m
Conservation Status	Endangered. National conservation target is 24 %, however only 1.5 % has been conserved within statutory reserves.

ATTRIBUTE	TSAKANE CLAY GRASSLAND
Geology and Soils	The most significant rock is the basaltic lava of the Kliprivierberg Group (Ventersdorp Supergroup), together with the sedimentary rocks of the Madzaringwe Formation of the Karoo Supergroup.
Biologically Important Taxa	Herbs: *Helichrysum nudifolium var. nudifolium, H. rugulosum, Hermannia depressa.* Geophytic herbs: *Aspidoglossum ovalifolium* and *Hypoxis rigidula var. pilosissima*.

5.5 Biodiversity Sector plan: Gauteng Province

Biodiversity sector plans have been drafted by the Department of Agriculture and rural development (GDARD, 2011) to provide spatial planners with knowledge of an area through a simplified guide to systematic conservation assessments. Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA) buffers have been developed to outline areas of conservation concern. CBAs are areas which are irreplaceable often providing essential habitat for particular species (MBCP, 2006). A buffer of 100 m is recommended for any proposed activities in relation to CBA. ESAs are areas which provide ecological support to CBA, offering forage or often act as movement corridors for sensitive species, these include fish sanctuaries and registered freshwater and Wetland National Freshwater Ecosystem Priority Areas (NFEPAs) (MBCP, 2006; Nel *et al*., 2010). A buffer of 30 m is often recommended for ESAs (MBCP, 2006).

The study area was observed to have no conservation areas associated with it, aside from two (2) ESAs, which were recorded to have been water features on the gold courses (**Figure 6**). It must be noted that the aforementioned biodiversity priority areas were modelled at a desktop level on a provincial scale, and thus may not be accurate representations of the current on-site status of the relevant planning units. Thus, ground truthing of all the relevant at-risk biodiversity areas was conducted during the field survey to ascertain the current state, and thus the biodiversity value of the at-risk planning units. Subsequent to conducting the field survey, it was recorded that the two ESA planning units within the study area were moderately modified as a result of IAPS and several excavation and infill events that had occurred. These disturbances were recorded to have reduced the potential of these areas to provide natural biodiversity to the surrounding environment, however as these ESAs were water resources it will still be vital to conserve them in the current water-stricken climate.

5.6 Geology

Figure 7 below illustrates the geological units that were recorded to be underlying the study area, and consequently providing the parent material from which the overlying soils were created. It was evident that the study area was underlain by two (2) lithostratigraphic units, namely the: Dwyka Group overlain by the Vryheid Formation of the Karoo Group. The Dwyka Group was recorded to have been deposited between 280 and 310 millennia ago (ma) within the Palaeozoic Era of the Phanerozoic Eon and consists of diamictite with varved shale, mudstone with dropstone and fluvioglacial gravel towards the north. The Vryheid Formation, which forms part of the Ecca Group of the Karoo Supergroup, was recorded to be deposited between 260 and 279 ma within the Permian Period of the Palaeozoic Era within the Phanerozoic Eon. This lithostratigraphic unit consisted of fine to coarse-grained sandstone, shale and coal seams in the upper layers.

Both of the abovementioned lithostratigraphic units can be described at moderately-to-highly impermeable underlying sequences that weather to create low permeable soils that exhibit low-to-moderate particle cohesion, and thus low-to medium moisture retention properties.

5.7 Hydrological Soil Groups

Figure 8 below illustrates the soil groups that were recorded to be within the study area. It is evident that soil group C formed the majority of the material overlying the abovementioned lithostratigraphic units (Macfarlane & Bredin, 2016). This group exhibited characteristics of moderately-high inherent runoff potential, very slow infiltration rates and severely restricted permeability. This coupled with the impermeable sub-terrain geologies may result in subsurface flow occurring above the B soil horizon during and subsequent to heavy rainfall events.

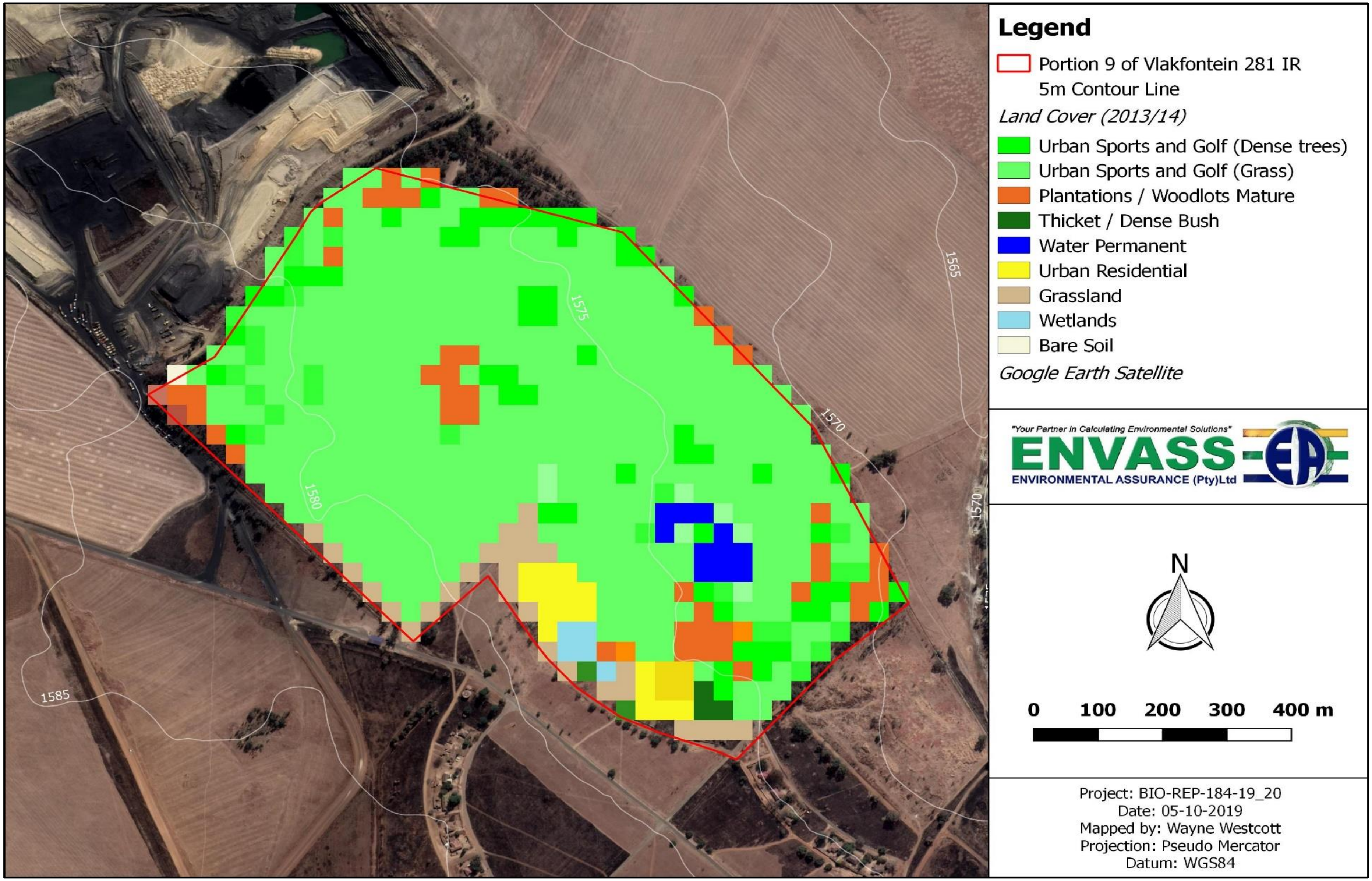

Figure 4: Land cover classes identified at a desktop level to be applicable to the study area (SANBI, 2013/14).

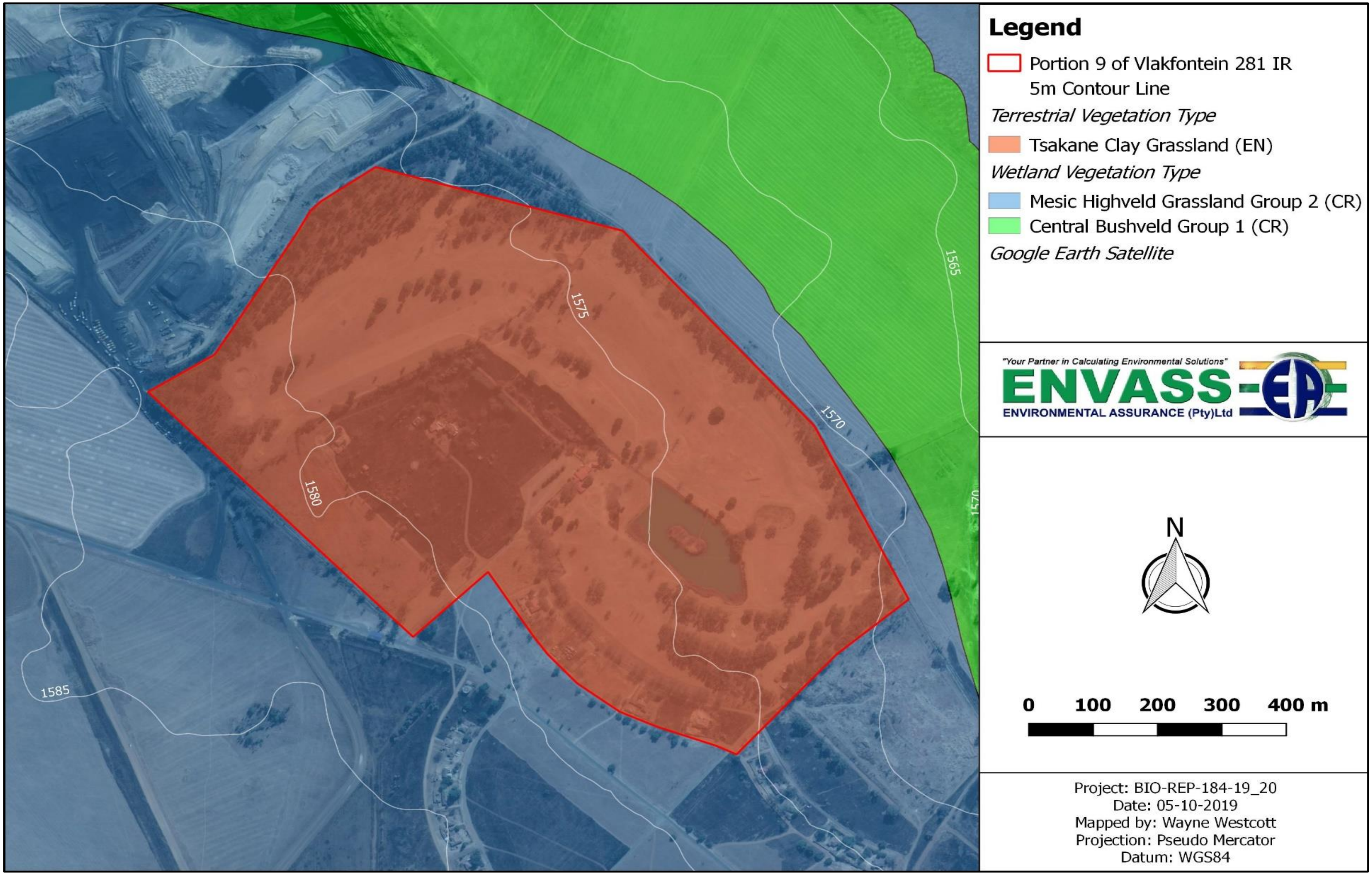

Figure 5: Terrestrial and wetland vegetation units that were relevant to the study area.

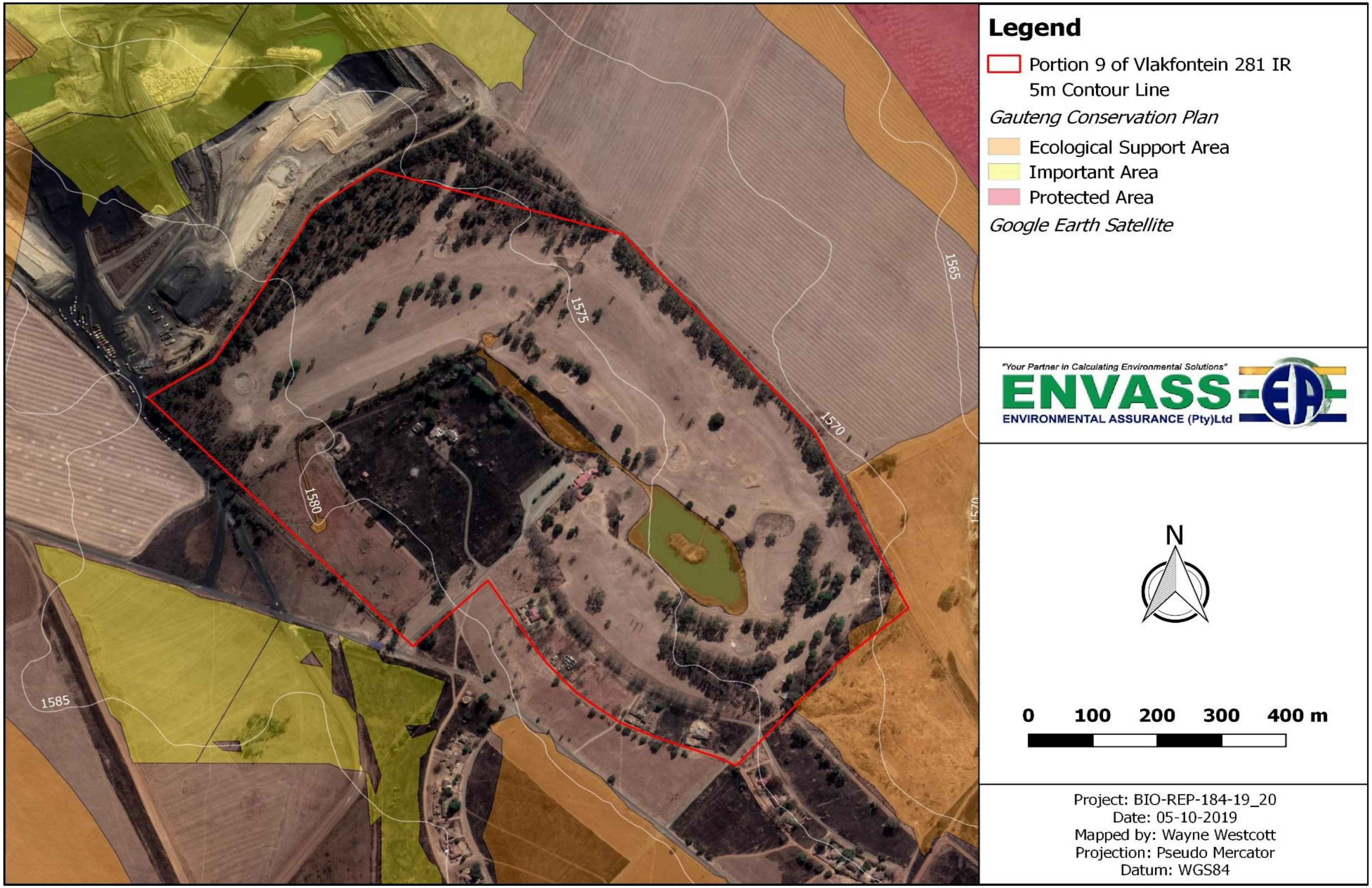

Figure 6: Biodiversity conservation planning units relevant to the study area.

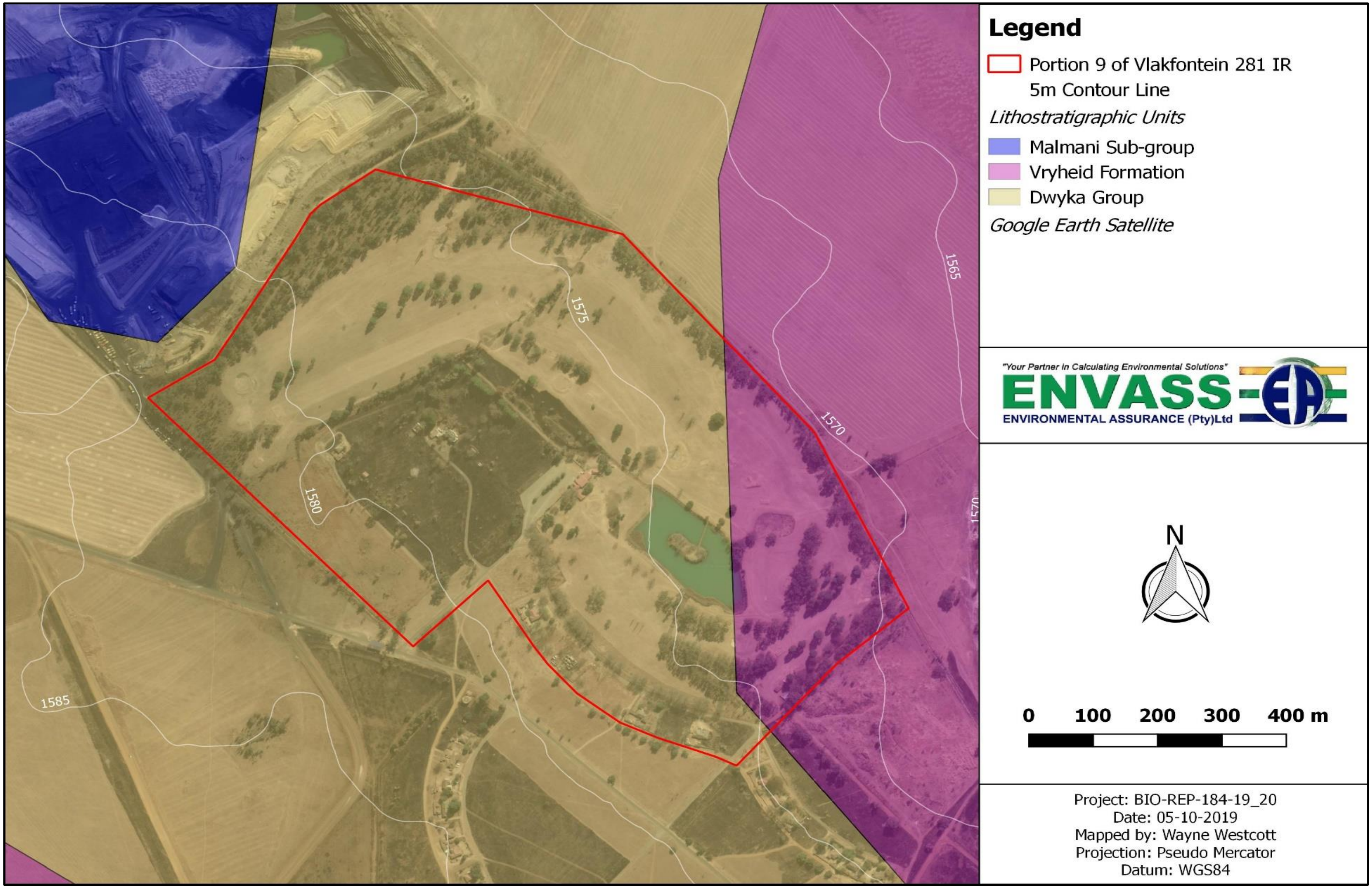

Figure 7: Lithostratigraphic units applicable to the study area (Council of Geoscience, 2008).

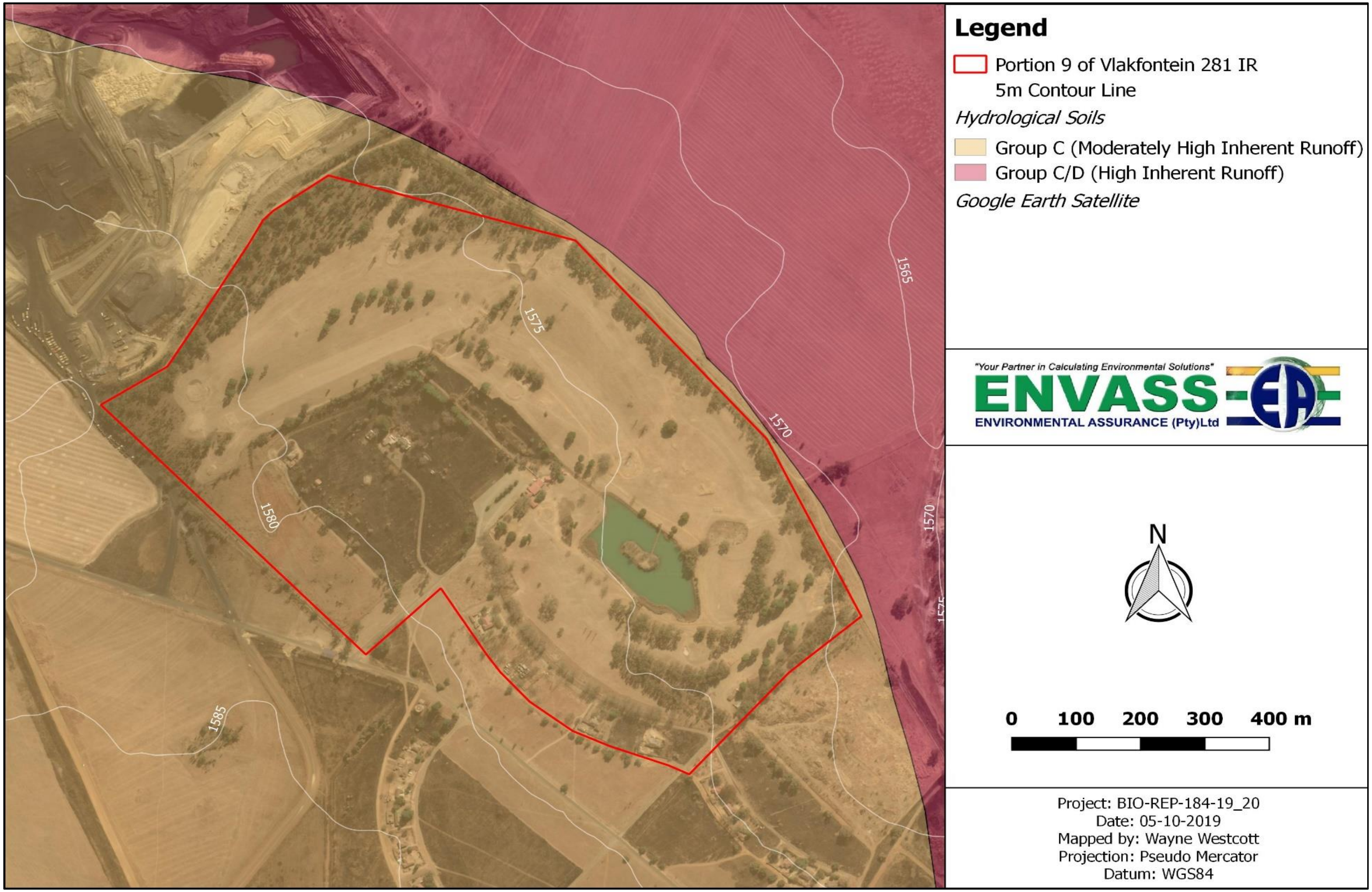

Figure 8: Hydrological soil classes and their inherent runoff potential within the study area (Macfarlane & Bredin, 2016).

6 RESULTS

The brief field survey associated with this screening report was conducted on the 11th September 2019. This section provides the findings of the various methodologies utilised during this assessment.

6.1 Flora

6.1.1 Vegetation Overview

The vegetation communities recorded to be within the study area were observed to have been significantly altered in comparison to the reference state, as formulated using the broad vegetation units presented in the SANBI (2006-18) dataset and discussed within Mucina and Rutherford (2006-12). Consequently, the vegetation recorded on-site can no longer be considered a true representation of the endangered Tsakane Clay Grassland vegetation unit. During the brief field survey, the recreational golf course that encompassed the entire study area was observed to have been dominated by grass species along the fairways and in the rough, with woody *Eucalyptus grandis* and *Pinus patula* tree species surrounding the site and intermittently spaced along the fairways (**Figure 9**). The grass species that were identified within the study area included; *Themeda triandra, Hyparrhenia hirta, Microchloa caffra, Heteropogon contortus, Elionurus muticus* and several *Eragrostis* species. The indigenous *Vachellia karroo* (Sweet Thorn) tree species was also recorded in three places within the study area, however no other indigenous tree species were identified within the site during the field survey. This can presumably be attributed to the IAPS being planted in the golf course prior to historical vegetation clearing and subsequent landscaping having occurred.

The IAPS that were identified on-site included, but were not limited to: *Bidens pilosa* (Blackjack), *Ageratum conyzoides* (Common Ageratum), *Salix babylonica* (Weeping Willow), *Pinus patula* (Pine Tree), *Eucalyptus grandis* (Saligna Gum), *Tagetes minuta* (Khaki Bos), *Lantana camara* (Common Lantana) and *Solanum mauritianum* (Bugweed). These species were observed to have drastically encroached throughout the site, specifically in the *rough* areas of the gold course. **Figure 9** overleaf presents images that were captured during the field survey, which visually substantiates the abovementioned species and the general condition of the study area.

Figure 9: Images presenting the overall condition and composition of vegetation on-site.

6.1.2 Species of Conservation Concern

No Species of Conservation Concern (SCC) or protected species were encountered at the time of the assessment and the probability of SCC or protected species occurring within the study area is considered to be very low due to the current transformed state of the vegetation. The successful rehabilitation of the natural vegetation community and possible re-establishment of SCC or protected species within the study area is considered highly unlikely due to the current land use surrounding and within the study area, and due to the expected loss of the indigenous seedbank following years of historic cultivation and subsequent construction of the current golf course. Although this is the case, the SCC that have the potential to occur within the study area was researched and is presented in **Table 5** below. If these species are identified within the study area during the construction/prospecting phase of the proposed development, should it be authorised, due care must be taken to not disturb these species, or their habitat. If the species are situated within the drilling transects, a suitably qualified botanist must be appointed to rescue and relocate the applicable species.

Table 5: The SCC that have the potential to occur within the study area, which is situated within Quarter Degree Square 2628AD (GDARD, 2014; Plants of Southern Africa, 2013; SANBI, 2017).

SPECIES	FLOWERING SEASON	SUITABLE HABITAT	CONSERVATION STATUS	OBSERVED ON-SITE
Adromischus umbraticola subsp. umbraticola	September-January	Rock crevices on rocky ridges, usually south-facing, or in shallow gravel on top of rocks, but often in shade of other vegetation.	Near Threatened	NO
Argyrolobium campicola	November-February	Highveld grassland.	Near Threatened	NO
Bowiea volubilis subsp. volubilis	September-April	Shady places, steep rocky slopes and in open woodland, under large boulders in bush or low forest.	Vulnerable	NO
Cineraria longipes	March-May	Grassland, on koppies, amongst rocks and along seepage lines, exclusively on basalt on south	Vulnerable	NO
Delosperma leendertziae	October-April	Rocky ridges; on rather steep south facing slopes of quartzite in mountain grassveld.	Near Threatened	NO
Delosperma purpureum	November-April	South facing slopes, grows in shallow soils among quartzitic rocks of crystalline or conglomerate type, in open or in broken shade, rarely in shade, in grassland with some trees.	Endangered	NO

SPECIES	FLOWERING SEASON	SUITABLE HABITAT	CONSERVATION STATUS	OBSERVED ON-SITE
Dioscorea sylvatica	OctoberJanuary	Wooded places with fair to reasonably good rainfall, such as the moister bushveld areas, coastal bush and wooded mountain kloofs	Vulnerable	NO
Eucomis autumnalis	November-April	Damp, open grassland and sheltered places.	Declining	NO
Eulophia coddii	Early December	Steep hillsides on soil derived from sandstone, grassland or mixed bush.	Vulnerable	NO
Gnaphalium nelsonii	October-December	Seasonally wet grasslands.	Rare	NO
Gunnera perpensa	October-March	In cold or cool, continually moist localities, mainly along upland streambanks.	Declining	NO
Habenaria barbertoni	February-March	In grassland on rocky hillsides.	Near Threatened	NO
Habenaria bicolor	January-April	Well-drained grasslands at around 1600m.	Near Threatened	NO
Habenaria kraenzliniana	February-April	Terrestrial in stony, grassy hillsides, recorded from 1000 to 1400m.	Near Threatened	NO
Habenaria mossii	March-April	Open grassland on dolomite or in black sandy soil.	Endangered	NO
Holothrix micrantha	October	Terrestrial on grassy cliffs, recorded from 1500 to 1800m.	Endangered	NO
Holothrix randii	September-October	Grassy slopes and rock ledges, usually southern aspects.	Near Threatened	NO
Hypoxis hemerocallidea	September-March	Occurs in a wide range of habitats, from sandy hills on the margins of dune forests to open rocky grassland; also grows on dry, stony, grassy slopes, mountain slopes and plateaux; appears to be drought and fire tolerant.	Declining	NO
Ilex mitis var. mitis	October-December	Riverbanks, streambeds, evergreen forests.	Declining	NO

SPECIES	FLOWERING SEASON	SUITABLE HABITAT	CONSERVATION STATUS	OBSERVED ON-SITE
Khadia beswickii	July-April	Open areas on shallow surfaces over rocks in grassland.	Vulnerable	NO
Kniphofia typhoides	February-March	Low-lying wetlands and seasonally wet areas in climax Themeda triandra grasslands on heavy black clay soils, tends to disappear from degraded grasslands.	Near Threatened	NO
Lithops lesliei subsp. lesliei	March-June	Primary habitat appears to be the arid grasslands in the interior of South Africa where it usually occurs in rocky places, growing under the protection of surrounding forbs and grasses.	Near Threatened	NO
Melolobium subspicatum	September-May	Grasslands.	Vulnerable	NO
Stenostelma umbelluliferum	September-March	Deep black turf in open woodland mainly in the vicinity of drainage lines.	Near Threatened	NO

6.2 Fauna

6.2.1 Faunal Overview

As previously mentioned, the portion of the Tsakane Clay Grassland vegetation unit in which the study area was situated was recorded to have been significantly degraded, and consequently encroached upon by several IAPS. As a result of the continued cutting of the grassland areas, open landscape, movement of machinery and humans within the study area the site did not present suitable habitat for faunal species to seek refuge in. Additionally, the lack of open water sources away from existing human disturbance and any rocky areas presumably limited the movement and likelihood of occurrence of amphibious and reptilian species within the site. The woody species on-site, such as *Eucalyptus grandis*, *Pinus patula* and *Vachellia karroo*, were however recorded to have provided refuge, to some degree, to several avifaunal species. It is recommended that these species remain, until such time as a change in land-use is evident, which may present an opportunity to rehabilitate the current floral composition to a near-natural state with the guidance of a rehabilitation plan.

A proactive approach could be adopted by the current land owner in an effort to comply with General Notice 864 (GG 40166, 2016), which was drafted under the National Environmental Management Plan: Biodiversity Act (Act no. 10 of 2004), to ensure that all alien and invasive species are eradicated. As *Eucalyptus grandis* is listed as a Category 1b in the Grassland Biome, as well as any area that has been listed for conservation in terms of a Bioregional Plan (i.e. the ESAs on-site). When adequate budget is available, it is recommended that indigenous tree and shrub species be planted intermittently in between and around the *Eucalyptis* species and the IAPS be cut down when the newly planted species have reached an adequate height (i.e. >3m). This will provide alternative refuge for faunal and avifaunal species within the study area. However, as the client does not have a responsibility on the study area under this project the abovementioned recommendation will need to be discussed separately with the land owner.

Due to the fact that the majority of faunal species are either nocturnal, hibernators, secretive and/or seasonal it is increasingly difficult to confirm their presence or absence by means of actual observations alone. Therefor a number of authoritative tomes such as field guides, databases and scientific literature were utilised to deduce the probable occurrence of faunal species. The Virtual Museum (http://vmus.adu.org.za/) was consulted to verify the records and occurrence of recorded mammal species within the QDSs 2628AD. The following sections will provide lists of potential mammals, herpetofauna (amphibians and reptiles) and invertebrate species that have the potential to occur within the study area. It must be noted that due to the briefness of the field survey for ground-truthing purposes, few species were recorded on-site.

6.2.2 Mammals

The occurrence of mammal species is largely dependent on the availability and diversity of habitats, such as vegetated areas, rocky outcrops, arboreal, wetlands and/or rivers, within the study area, or region. Therefore, the presence or potential for mammals to occur within a specific study area can be inferred by assessing the habitat types on-site considering their known distribution ranges. The lack of habitat availability and diversity within the study area associated with this project drastically reduced the probability of occurrence and refuge identified to provide suitably sleeping, breeding and forging for mammal species. As the proposed point-impact development would not result in a significant destruction of altered highly degraded habitat it would pose little risk to the sparse existing mammal population. However, in adopting the precautionary principle the mammal species that have the potential to occur within the study area were identified and their conservation status presented in **Table 6** below.

Table 6: Mammal species that have the probability to occur within the study area, as well as their IUCN conservation status (IUCN, 2017).

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	PROBABILITY OF OCCURENCE
Cryptomys hottentotus	Common African Mole-rat	LC	4
Amblysomus septentrionalis	**Highveld Golden Mole**	**NT**	**2**
Taphozous mauritianus	Mauritian Tomb Bat	LC	2
Atelerix frontalis	Southern African Hedgehog	LC	4
Leptailurus serval	Serval	LC	4

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	PROBABILITY OF OCCURENCE
Galago moholi	Southern Lesser Bushbaby	LC	4
Atilax paludinosus	Marsh Mongoose	LC	2
Galerella sanguineus	Slender Mongoose	LC	4
Cynictis penicillata	Yellow Mongoose	LC	3
Hystrix africaeaustralis	Cape Porcupine	LC	2
Lepus saxatilis	Cape Scrub Hare	LC	2
Elephantulus brachyrhynchus	Short-snouted Sengi	LC	2
Aethomys ineptus	Tete Veld Rat	LC	2
Aethomys namaquensis	Namaqua Rock Mouse	LC	2
Dasymys incomtus	African Marsh Rat	LC	2
Dendromus melanotis	Grey Climbing Mouse	LC	4
Dendromus mystacalis	Chestnut Climbing Mouse	LC	4
Gerbilliscus brantsii	Highveld Gerbil	LC	4
Gerbilliscus leucogaster	Bushveld Gerbil	LC	4
Lemniscomys rosalia	Single-striped Grass Mouse	LC	2
Mastomys coucha	Southern Multimammate Mouse	LC	4
Mastomys natalensis	Natal Multimammate Mouse	LC	3
Mus minutoides	Pygmy Mouse	LC	2
Rhabdomys pumilio	Four-striped grass mouse	LC	2
Steatomys pratensis	Common African Fat Mouse	LC	2
Otomys angoniensis	Angoni Vlei Rat	LC	3
Otomys irroratus	Southern African Vlei Rat	LC	2
Poecilogale albinucha	African Striped Weasel	LC	3
Mellivora capensis	**Honey Badger**	**NT**	**3**
Crocidura cyanea	Reddish-grey Musk Shrew	LC	3
Crocidura fuscomurina	Tiny Musk Shrew	LC	3
Crocidura hirta	Lesser Red Musk Shrew	LC	3
Crocidura mariquensis	Swamp Musk Shrew	LC	2
Myosorex varius	Forest Shrew	LC	2

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	PROBABILITY OF OCCURENCE
Suncus varilla	Lesser Dwarf Shrew	LC	3
Thryonomys swinderianus	Greater Cane Rat	LC	3
Neoromicia capensis	Cape Serotine Bat	LC	3
Scotophilus dinganii	African Yellow Bat	LC	3
Scotophilus viridis	Green House Bat	LC	2
Genetta genetta	Small-spotted Genet	LC	2
Genetta maculata	Common Largespotted Genet	LC	3

KEY: LC- Least Concern, NT- Near Threatened. Probability of Occurrence: 1- Not likely, 2- Low probability, 3- Medium probability, 4- High probability & 5- Confirmed.

6.2.3 Herpetofauna

The majority of herpetofauna species are nocturnal, poikilothermic secretive and seasonal, which makes it difficult to observe them during field surveys. Therefore, to determine the probability of occurrence of the amphibian and reptile species within the study area field guides, scientific literature, atlases, databases and respected books were consulted to obtain information relevant to the study area. It must be noted that the herpetofauna species were identified during the field survey. **Table 7** below presents the amphibian and reptile species that have the potential to occur within the study area, as well as their IUCN conservation status (IUCN, 2010). No SCC have the potential to occur within the study area, and none were observed during the field survey.

Table 7: Amphibian species that have the probability to occur within the study area, as well as their IUCN conservation status (IUCN, 2017).

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	PROBABILITY OF OCCURENCE
Schismaderma carens	Red Toad	LC	3
Amietophrynus rangeri	Raucous Toad	LC	2
Amietophrynus gutturalis	Guttural Toad	LC	3
Kassina senegalensis	Bubbling Kassina	LC	3
Xenopus laevis	Common Platanna	LC	3
Amietia fuscigula	Cape River Frog	LC	3
Amietia poyntoni	Poynton's River Frog	LC	4
Amietia quecketti	Queckett's River Frog	LC	4
Cacosternum boettgeri	Common Caco	LC	4
Pyxicephalus adspersus	Giant Bull Frog	LC	4

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	PROBABILITY OF OCCURENCE
Tomopterna cryptotis	Tremelo Sand Frog	LC	4
Tomopterna natalensis	Natal Sand Frog	LC	3

KEY: LC- Least Concern, NT- Near Threatened. Probability of Occurrence: 1- Not likely, 2- Low probability, 3- Medium probability, 4- High probability & 5- Confirmed.

6.2.4 Invertebrates

Invertebrate species are usually small, poikilothermic, and seasonal, which makes them difficult to observe during field surveys. As this survey was conducting in the beginning of spring, it was unlikely that a high abundance of invertebrate species would've been identified on-site. The primary habitat on-site that may be suitably to hemi-metabolous invertebrates to complete their lifecycle would be the artificial dam that was situated towards the south east, in which nymphs/juveniles could thrive. As this site will not be disturbed by the proposed development, these species may not be at risk of being impacted on by the associated activities. Only the endangered *Chrysoritis aureus* (Heidelberg opal) has the potential to occur within the study area, however none were observed during the field survey.

Table 8: Invertebrate species that have the probability to occur within the study area, as well as their IUCN conservation status (IUCN, 2017).

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	PROBABILITY OF OCCURENCE
Anax imperator	Blue Emperor	LC	4
Acraea horta	Garden Acraea	LC	4
Acraea neobule	Wandering donkey Acraea	LC	3
Actizera lucida	Rayed Blue	LC	3
Africallagma glaucum	Swamp Bluet	LC	4
Aloeides aranda	Aranda copper	LC	3
Aloeides dentatis	Roodepoort copper	LC	3
Aloeides henningi	Henning's copper	LC	3
Aloeides molomo	Molomo copper	LC	3
Aloeides taikosama	Dusky copper	LC	3
Aloeides trimeni	Trimen's copper	LC	3
Anthene amarah	Black striped hairtail	LC	3
Anthene definita	Common hairtail	LC	3
Anthene livida	Pale hairtail	LC	3
Axiocerses tjoane	Eastern scarlet	LC	3
Azanus jesous	Topaz babul blue	LC	3

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	PROBABILITY OF OCCURENCE
Azanus moriqua	Black-bordered babul blue	LC	3
Azanus ubaldus	Velvet-spotted babul blue	LC	3
Belenois aurota	Brown-veined white	LC	4
Belenois creona severina	African common white	LC	3
Bocchoris inspersalis		Not evaluated	3
Byblia ilithyia	Spotted joker	LC	4
Cacyreus marshalli	Common geranium bronze	LC	3
Cacyreus virilis	Mocker bronze	LC	3
Catacroptera cloanthe	Pirate	LC	3
Catopsilia florella	African migrant	LC	3
Chilades trochylus	Grass jewel	LC	3
Chrysoritis aureus	**Heidelberg opal**	**EN**	**3**
Coeliades forestan	Striped policeman	LC	3
Coeliades pisistratus	Two-pip policeman	LC	3
Colias electo	African clouded yellow	LC	3
Colotis euippe omphale	Smoky orange tip	LC	3
Colotis evagore antigone	Small orange tip	LC	3
Colotis evenina evenina	Orange tip	LC	3
Cupidopsis cissus	Common meadow blue	LC	3
Cupidopsis jobates	Tailed meadow blue	LC	3
Danaus chrysippus orientis	African monarch, Plain tiger	LC	3
Eicochrysops messapus mahallakoaena	Cupreous blue	LC	3
Eretis umbra umbra	Small marbled elf	LC	3
Euchrysops dolorosa	Sabie smoky blue	LC	3
Eurema brigitta	Broad-bordered grass yellow	LC	3
Eurema hecabe solifera	Lowveld yellow	LC	3
Gegenes niso	Common hottentot	LC	3
Gegenes pumilio gambica	Dark hottentot	LC	3
Hypolimnas misippus	Common diadem	Not Evaluated	3
Junonia hierta cebrene	Yellow pansy	LC	3
Junonia oenone	Blue pansy	LC	3

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	PROBABILITY OF OCCURENCE
Junonia orithya madagascariensis	Eyed pansy	LC	3
Kedestes barberae	Barber's ranger	LC	3
Kedestes lepenula	Chequered ranger	LC	3
Kedestes nerva	Scarce ranger	LC	3
Lampides boeticus	Pea blue	LC	3
Lepidochrysops ketsi ketsi	Ketsi blue	LC	3
Lepidochrysops patricia	Patricia blue	LC	3
Lepidochrysops plebeia	Twin-spot blue	LC	3
Leptomyrina henningi	Henning's black-eye	LC	3
Leptotes species	Zebra blue	LC	3
Metisella meninx	Marsh sylph	LC	3
Mylothris agathina	Common dotted border	LC	3
Orthetrum caffrum	Two-striped Skimmer	LC	4
Papilio demodocus	Citrus swallowtail	LC	3
Paternympha narycia	Spotted-eye brown	LC	3
Pinacopteryx eriphia	Zebra white	LC	3
Platylesches neba	Flower-girl hopper	LC	3
Pontia helice helice	Common meadow white	LC	3
Precis archesia archesia	Garden commodore	LC	3
Precis octavia sesamus	Gaudy Commodore	LC	3
Pseudagrion citricola	Yellow-faced Sprite	LC	4
Pseudagrion salisburyense	Slate Sprite	LC	4
Spialia asterodia	Star sandman	LC	3
Spialia diomus ferax	Common sandman	LC	4
Spialia mafa	Mafa sandman	LC	3
Spialia spio	Mountain sandman	LC	3
Sympetrum fonscolombii	Red-veined Darter or Nomad	LC	3
Tarucus sybaris	Dotted blue	LC	3
Telchinia rahira	Marsh acraea	LC	3
Teracolus agoye bowkeri	Speckled sulphur tip	LC	3
Teracolus eris	Banded gold tip	LC	3

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	PROBABILITY OF OCCURENCE
Teracolus subfasciatus	Lemon traveller	LC	2
Trithemis kirbyi	Orange-winged Dropwing	LC	4
Tsitana tsita	Dismal sylph	LC	3
Vanessa cardui	Painted lady	LC	2
Zintha hintza hintza	Hintza pierrot	LC	2
Zizeeria knysna	African grass blue	LC	3
Zizula hylax	Tiny grass blue	LC	3

KEY: LC- Least Concern, EN- Endangered. Probability of Occurrence: 1- Not likely, 2- Low probability, 3- Medium probability, 4- High probability & 5- Confirmed.

7 IMPACT STATEMENT

The proposed development will involve the drilling a total of ten (10) prospecting cores, which will be distributed across the study area (i.e. the golf course) in areas where accessibility via a drilling rig will be possible. This will require for a drilling rig to enter the study area via an existing tarred road and utilise existing gravel roads to traverse through the course thereafter. Only slight vegetation clearing may be required, and the only other disturbance to the receiving terrestrial environment will be compaction by the tyre tracks of the rig, noise and core excavation at the ten predetermined points. As the duration of the proposed drilling activities will presumably be one (1) day, and given the already highly degraded condition of the study area, any impacts that may be evident will be negligent.

8 SPECIALIST'S RECOMMENDATION AND CONCLUSION

Subsequent to conducting a brief once-off field survey of the study area on the 11th September 2019, the site was recorded to have been significantly degraded in comparison to its formulated reference state. It was assumed that the current land use as a recreational golf course stemmed from the historic clearing of natural vegetation, landscaping of the soil profile and subsequently planting of *Eucalyptus grandis*, *Pinus patula* and *Salix babylonica* woody species along and around the fairways and now dry water features. This has resulted in the drastic reduction of biodiversity within the study area and consequent destruction of potential faunal refugia, as well as severe encroachment by several IAPS. Overall, the state of the flora and fauna that was recorded within the study area was not representative of the reference conditions formulated through a review of the desktop information and during the ground-truthing exercise.

It is the specialist's recommendation that the proposed prospecting continue within the study area, provided that the following preventative and mitigation measures are implemented:

- Existing access roads must be utilised by the drilling rig and associated Trackless Mobile Machines (TMMs). If the TMMs traverse outside of the existing routes and cause disturbance and/or destruction of the vegetation, the disturbed areas must be tilled and revegetation with a mixture of indigenous grass species, such as *Themeda triandra*, or *Eragrostis curvula* which can both be obtained from a commercial nursery.

- The disturbance area at the proposed drilling sites must be limited to the core area, which must be encircled with orange barrier netting to avoid human and faunal species falling within the core holes, and all excess sediment around the mouth is to be backfilled in the holes. In instances where the excess sediment does not cover the mouth of a hole, the core hole must be capped with a wooden plank cut to just larger than the hole. This cap must be implemented by excavating the top layer of soil to an approximate depth of 200mm, inserting the cap, backfilling, compacting the surface slightly and revegetation using the grass species previously cleared from the site.
- All drilling activities must occur during the day time between the hours of 8am and 5pm to avoid continued disturbance to nocturnal faunal species.
- No indigenous woody species must be cut during the proposed development.

9 REFERENCES

ALEXANDER, G. J., MARAIS, J. A. 2007. Guide to the Reptiles of Southern Africa. Random House Struik, Cape Town. ISBN-13: 9781770073869.

ANIMAL DEMOGRAPHY UNIT. 2019. Virtual Museum. Accessed at http://vmus.adu.org.za/?vm.

APPS, P. (ed.). 2012. *Smither's Mammals of Southern Africa: A field guide*. Random House Struik. Cape Town, South Africa.

ALEXANDER, G. & MARAIS, J. 2007. *A Guide to the Reptiles of Southern Africa*. Struik Nature. Cape Town, South Africa.

BATES, M.F., BRANCH, W.R., BAUER, A.M., BURGER, M., MARAIS, J., ALEXANDER, G.J. & DE VILLIERS, M. S. 2014. *Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland*. Strelitzia 32. SANBI, Pretoria.

COLLINSON, W., PATTERSON-ABROLAT, C. 2016. The Road Ahead: Guidelines to mitigation methods to Address Wildlife Road Conflict in South Africa. The Endangered Wildlife Trust, Johannesburg, South Africa.

CRITICAL BIODIVERSITY AREAS MAPS (PER MUNICIPALITY) AND GIS DATA AVAILABLE FROM*: Biodiversity GIS (BGIS)*, South African National Biodiversity Institute (SANBI), Tel. +27 21 799 8739 or CapeNature, Tel. +27 21 866 8000. Or on the web at: http://bgis.sanbi.org/fsp/project.asp.

DEPARTMENT OF ENVIRONMENTAL AFFAIRS. 2007. *National Environmental Management: Biodiversity Act, 2004 (Act no. 10 of 2004): Publication of lists of Critically Endangered, Endangered, Vulnerable and Protected Species*. Government Gazette No. 29657, 23 February 2007, Pretoria: DEA.

DEPARTMENT OF ENVIRONMENTAL AFFAIRS. 2016. *National Environmental Management: Biodiversity Act (Act no 10 of 2004): Publication of lists of Alien and Invasive Species*, Government Gazette No. 40166, 29 July 2016, Pretoria: DEA.

DEPARTMENT OF ENVIRONMENTAL AFFAIRS. 2011. *National Environmental Management: Biodiversity Act, 2004 (Act no. 10 of 2004): National List of Ecosystems that are Threatened and in need of Protection,* Government Gazette No. 34809, 9 December 2011, Pretoria: DEA.

DU PREEZ, L. & CARRUTHERS, V. A. 2009. Complete Guide to the Frogs of Southern Africa. Struik Nature, Cape Town.

FRIEDMAN, Y. & DALY, B. 2004. Red data book of the mammals of South Africa: A conservation assessment. Johannesburg, CBSG-EWT.

GDARD. 2014. Technical Report for the Gauteng Conservation Plan (Gauteng C-Plan v3.3). Gauteng Department of Agriculture and Rural Development: Nature Conservation Directorate. 60 pages.

HENNING, G.A., TERBLANCHE, R.F. & BALL, J.B. 2009. South African Red Data Book: butterflies. South African National Biodiversity Institute Biodiversity Series 13: 63-64.

IUCN. 2017. The IUCN Red List of Threatened Species. Version 2017. <http://www.iucnredlist.org>. Downloaded on 16 October 2019.

LAWES, M.J. 2004. *Indigenous Forests and Woodlands in South Africa: Policy, People and Practice*. Durban, University of KwaZulu-Natal Press.

MUCINA, L. AND RUTHERFORD, M. C. (EDS). 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

RAIMONDO, D., VON STADEN, L., FODEN, W., VICTOR, J.E., HELME, N.A., TURNER, R.C. KAMUNDI, D.A. & MANYAMA, P.A. (Eds.). 2009. *Red list of South African plants 2009*. Strelitzia 25:1-668.

SHULZE, R.E. 2003.Climate. In: Cowling, R.M., Richardson, D.M., and Pierce, S.M. *Vegetation of Southern African.* Cape Town. Cambridge University Press. Pp21-41.

10 APPENDIX A: SPECIALIST'S QUALIFICATIONS

EMPLOYEE NAME	**WAYNE JOHN WESTCOTT**
POSITION	**SENIOUR ECOLOGIST**
DETAILS	**Office: 31 Valerie Road, Gillitts, Durban, 3610** **T: 012 460 9768; M: 079 491 8685; F: 012 460 3071** **E mail: Wayne@envass.co.za**

AREAS OF EXPERTISE

- Project Management
- Floral Assessments
- GIS Software and Analysis
- Environmental Impact Assessments
- Aquatic Ecology
- Wetland Ecology
- Rehabilitation Plans
- Academic Research

CAREER HISTORY

Employer	**ENVIRONMENTAL ASSURANCE (PTY) Ltd**
Period	November 2018 – Current
Position	**Business Unit Manager and Divisional Head: Wetland and Aquatic**
Responsibilities	Project management, proposal composition, budget tracking, marketing, Biodiversity Assessments, Wetland and Aquatic Impact Assessments, DWS Risk Assessment Matrix, Aquatic Biomonitoring Assessments, Water Quality Analysis

Employer	**KSEMS Environmental Consulting**
Period	August 2016 – November 2018
Position	**Project Manager: Specialist Division**
Responsibilities	Proposal composition, budget tracking, marketing, fieldwork and report planning, primary client liaison, Freshwater Habitat (wetlands and rivers) Impact Assessments, DWS Risk Assessment Matrix, Aquatic Biomonitoring

Employer	**Westfalia Technological Services**
Period	January 2016 – August 2016
Position	**Environmental Scientist**

Responsibilities Compilation and management of the Water Management Plan for South Africa, Wetland and Aquatic Delineation Assessments, Compilation and management of Environmental Action and Management Plans, Invasive Alien Species Control Plans, ensure compliance with Tesco, Woolworths and GlobalGap Standards

Employer **Rhodes University**

Period February 2015 – November 2015

Position **Research and laboratory assistant**

Responsibilities Fieldwork and data capture in the Kromme River catchment with Prof Fred Ellery to be included in the updated WET-Rehab guidelines;

Delineation, WET-Health and WET-Ecoservice assessments on the Ngciyo wetland for input into Prof Fred Ellery's research;

Conducting numerous GIS analyses, riverine vegetation transects and public participation (interviews); and

Dealing with various stakeholders.

Employer **Rhodes University**

Period June 2014 – November 2014

Position **Graduate Research Assistant**

Responsibilities Conducting vegetation assessment transects in KwaZulu-Natal and Transkei;

Conducting spatial analyses using GIS software (ArcGIS); and

Fieldwork involving survey distribution and conducting interviews in both English and Afrikaans.

Employer **Anglo America Platinum: Mogalakwena Platinum Mine**

Period June 2013 – July 2013

Position **Environmental Assistant**

Responsibilities Conducted a vegetation assessment of the grass species within the community game reserve;

Assisted with skills development within the reserve;

Assisted and participated in a permaculture course; and

Attended seminars conducted by the ex-environmental head of Anglo Platinum.

SKILLS

- Aquatic Biomonitoring (SASS5 accredited)
- Wetland Impact Assessments
- Environmental Impact Assessments
- Vegetation Impact Assessments
- Wetland and Aquatic Delineation Reports
- Water Use License Applications

- Ecological Assessments
- Water Quality Analysis
- Screening Reports
- River Impact Assessments
- Wetland and Aquatic Rehabilitation Plans
- DWS Risk Assessment Matric
- GIS Analysis (ArcGIS and QGIS)
- Environmental Control Audits
- Invasive Alien Plant Species Control Plans

EDUCATION AND QUALIFICATION

2015 **BSc Honours in Water Resource Management**
Department of Environmental Science, Rhodes University

2014 **BSc in Environmental Science and Geography/Geology**
Department of Environmental Science, Rhodes University

2010 **Matriculation (IEB Examination)**
Stanford Lake College, Limpopo

PROFESSIONAL AFFILIATIONS

Registered with the South African Council of Natural Scientific Professionals (SACNASP) (no. 117334)

Wetland Society of South Africa

EXTERNAL COURSES

2019 **Project Management Foundations**
University of Cape Town

2017 **Soil Classification and Land Capability**
Department of Agriculture, Forestry and Fisheries (DAFF), Cedara College

2017 **SASS5 Aquatic Biomonitoring Accreditation**
Department of Water and Sanitation (DWS)

2016 **Introduction Environmental Impact Assessments (EIA) Procedures**
Rhodes University, EOH Coastal and Environmental Services

2016 **Tools for Wetland Assessment**
Rhodes University (Presented by Prof. William 'Fred' Ellery)

2016 **South African Green Industries Council (SAGIC) Invasive Species Training**
SAGIC

2015 **ESRI GIS Conference Workshops and Seminars**
ESRI South Africa

2015 **Google Earth Pro Workshop**
Rhodes University Environmental Science Department

REFERENCES

CONTACT NAME	COMPANY	RELATIONSHIP	CONTACT DETAILS

Mark Vinnicombe	Nampak Africa	Past Client	Mark.vinnicombe@nampak.com
Peter Coombes	Anglo American	Past Employer	Pcoombes@gmx.com
Louise Zdanow	EnviroSwift	Professional Peer	Louise@enviroswift.co.za
Kelvin Fowler	Westfalia Fruit Estates	Past Employer	Kelvin@westfalia.co.za

PROJECT EXPERIENCE

TERRESTRIAL WORK				
Project	**Role**	**Description**	**Client**	**Year**
Biodiversity Screening for a Prospecting Right at the Vlakfontein Farm 281 IR, GP.	Lead author	Specialist botanical work	Ilangabi Investments	2019
Vegetation Impact Assessment of the Proposed Nhlabane Road Upgrade, KZN.	Lead author	Specialist botanical work	ACER Africa	2019
Vegetation Impact Assessment of the Proposed Mtunzini Sewer Reticulation System and WWTW, KZN.	Lead author	Specialist botanical work	ACER Africa	2019
Vegetation Impact Assessment of the Proposed D919 Road Upgrade, KZN.	Lead Author	Specialist botanical work	KZN DoT	2019
Vegetation Impact Assessment of the Proposed Eskom Sub-station and Powerline to the Lwala Mine, LP.	Lead Author	Specialist botanical work	ACER Africa	2019
Vegetation Impact Assessment of the Proposed Rhino Ridge tented camp within the Hluhluwe Nature Reserve, KZN.	Lead Author	Specialist botanical work	ACER Africa	2019
Vegetation Impact Assessment of the Proposed N2, Section 20 Auxiliary Roads and Material Sources, EC.	Internal reviewer	Specialist botanical work	SANRAL & Aurecon Group	2018
Vegetation Rehabilitation Plan for the Proposed N2, Section 20 Auxiliary Roads and Material Sources, EC.	Internal Reviewer	Rehabilitation work	SANRAL & Aurecon Group	2018
Vegetation Impact Assessment of the Proposed Verulam Housing Development, KZN.	Internal reviewer	Specialist botanical work	Cassandra Naidoo	2018

Ecological Impact Assessment for the Proposed Upgrade of the N8 Road between Thaba Nchu and Tweespruit and the use of the Eden and Devonshire Borrow Bits, FS.	Lead Author	Specialist botanical and faunal work	SANRAL & Royal HaskoningDHV	2017
Vegetation Impact Assessment of the Proposed Upgrade top the Magwaza Road (L2980) Road, KZN.	Co-author	Specialist botanical work	Samani Engineering Consulting	2016
Vegetation Impact Assessment of the Proposed Construction of the Mangwenya Pedestrian Bridge, KZN.	Lead Author	Specialist botanical work	Samani Engineering Consulting	2016
Vegetation Transect and Data Collection on the *Pheonix reclinate* Species within Willowvale, EC.	Field work and assessments	Research	Rhodes University	2015
Botanical Assessment of the Grass Species within the Mogalakwena Platinum Mine Community Game Reserve, Limpopo.	Lead Author	Research	Anglo Platinum	2014

WETLAND AND AQUATIC WORK				
Project	**Role**	**Description**	**Client**	**Year**
Biannual SASS5 Biomonitoring of the Singani Colliery Sites (Dry season- 2019).	Lead author	Specialist aquatic work	Canyon Resources	2019
Biannual SASS5 Biomonitoring of the Hakhano Colliery Sites (Dry season- 2019).	Lead author	Specialist aquatic work	Canyon Resources	2019
Biannual SASS5 Biomonitoring of the Khanye Colliery Sites (Dry season- 2019).	Lead author	Specialist aquatic work	Canyon Resources	2019
Biannual SASS5 Biomonitoring of the Bronkhorstspruit Siding Sites (Dry season- 2019).	Lead author	Specialist aquatic work	Canyon Resources	2019
Wetland Impact Assessment of the Rietkuil Siding, GP (dry season 2019).	Lead Author	Specialist wetland work	Canyon Coal	2019
Biannual SASS5 Biomonitoring of the Blinkpan Railway Siding, MP (dry season 2019).	Lead Author	Specialist aquatic work	Makoya Group	2019
Wetland Impact Assessment of the Ukufisa Colliery, GP (dry season 2019).	Lead Author	Specialist wetland work	Canyon Coal	2019
Biannual SASS5 Biomonitoring of the South Deep Gold mine (dry season 2019)	Lead Author	Specialist aquatic work	Goldfields	2019

Biannual SASS5 Biomonitoring of the Singani Colliery Sites (dry season 2019).	Lead Author	Specialist aquatic work	Canyon Resources	2019
Biannual SASS5 Biomonitoring of the Hakhano Colliery Sites (dry season 2019).	Lead Author	Specialist aquatic work	Canyon Resources	2019
Biannual SASS5 Biomonitoring of the Khanye Colliery Sites (dry season 2019).	Lead Author	Specialist aquatic work	Canyon Resources	2019
Biannual SASS5 Biomonitoring of the Bronkhorstspruit Siding Sites (dry season 2019).	Lead Author	Specialist aquatic work	Canyon Resources	2019
Quarterly SASS5 Biomonitoring of the Tronox Fairbreeze Mine (Quarter 2- 2019).	Lead Author	Specialist aquatic work	Tronox	2019
Quarterly SASS5 Biomonitoring of the Tronox Hillendale Mine (Quarter 2- 2019).	Lead Author	Specialist aquatic work	Tronox	2019
Quarterly SASS5 Biomonitoring of the Tronox Central Processing Plant (Quarter 2- 2019).	Lead Author	Specialist aquatic work	Tronox	2019
Freshwater Habitat Impact Assessment of the Proposed Woodmead Estate, KZN.	Lead Author	Specialist wetland and aquatic work	ACER Africa	2019
Freshwater Habitat Impact Assessment of the Proposed Hluhluwe Rhino Reserve, KZN.	Lead Author	Specialist wetland and aquatic work	ACER Africa	2019
Freshwater Habitat Impact Assessment of the Proposed Paling Manganese Mine, Northern Cape (NC).	Lead Author	Specialist wetland and aquatic work	PMG Mining	2019
Quarterly SASS5 Biomonitoring of the Tronox Fairbreeze Mine (Quarter 1- 2019).	Lead Author	Specialist aquatic work	Tronox	2019
Quarterly SASS5 Biomonitoring of the Tronox Hillendale Mine (Quarter 1- 2019).	Lead Author	Specialist aquatic work	Tronox	2019
Quarterly SASS5 Biomonitoring of the Tronox Central Processing Plant (Quarter 1- 2019).	Lead Author	Specialist aquatic work	Tronox	2019
Biannual SASS5 Biomonitoring of the Blinkpan Railway Siding, MP (wet season 2018).	Lead Author	Specialist aquatic work	Makoya Group	2019
Wetland Impact Assessment of the Ukufisa Colliery, GP (wet season 2018).	Lead Author	Specialist wetland work	Canyon Coal	2019
Biannual SASS5 Biomonitoring of the South Deep Gold mine (wet season 2018)	Lead Author	Specialist aquatic work	Goldfields	2018

Biannual SASS5 Biomonitoring of the Zululand Anthracite Colliery (wet season 2018).	Lead Author	Specialist aquatic work	Zululand Anthracite Colliery	2018
Biannual SASS5 Biomonitoring of the Singani Colliery Sites (wet season 2018).	Lead Author	Specialist aquatic work	Canyon Resources	2018
Biannual SASS5 Biomonitoring of the Hakhano Colliery Sites (wet season 2018).	Lead Author	Specialist aquatic work	Canyon Resources	2018
Bi-annual SASS5 Biomonitoring of the Khanye Colliery Sites (wet season 2018).	Lead Author	Specialist aquatic work	Canyon Resources	2018
Biannual SASS5 Biomonitoring of the Bronkhorstspruit Siding Sites (wet season 2018).	Lead Author	Specialist aquatic work	Canyon Resources	2018
Biannual SASS5 Biomonitoring of the East Plats Western Limb Sites (wet season 2018).	Lead Author	Specialist aquatic work	Eastern Platinum	2018
Biannual SASS5 Biomonitoring of the East Plats MB Sites (wet season 2018).	Lead Author	Specialist aquatic work	Eastern Platinum	2018
Quarterly SASS5 Biomonitoring of the Tronox Fairbreeze Mine (Quarter 4- 2018).	Lead Author	Specialist aquatic work	Tronox	2018
Quarterly SASS5 Biomonitoring of the Tronox Hillendale Mine (Quarter 4- 2018).	Lead Author	Specialist aquatic work	Tronox	2018
Quarterly SASS5 Biomonitoring of the Tronox Central Processing Plant (Quarter 4- 2018).	Lead Author	Specialist aquatic work	Tronox	2018
Biannual SASS5 Biomonitoring of the Lydenburg Smelter Sites (wet season 2018).	Lead Author	Specialist aquatic work	Glencore	2018
Updated Aquatic Impact Assessment for the Existing Tweefontein Waste Water Treatment Works.	Lead Author	Specialist aquatic work	Ix Engineering	2018
Freshwater Habitat Impact Assessment of the Proposed Construction of the Vulindlela Bulk Water Supply Pipeline, KwaZulu-Natal (KZN).	Lead Author	Specialist wetland and aquatic work	Umgeni Water	2018
Freshwater Habitat Impact Assessment of the Proposed National Route 2 (N2) Wild Coast Toll Highway, Section 20, Auxiliary Roads and Material Sources, Eastern Cape (EC).	Co-author	Specialist wetland and aquatic work	SANRAL & Aurecon Group	2018

Freshwater Habitat Impact Assessment of the Proposed Verulam Housing Development, KZN.	Lead Author	Specialist wetland and aquatic work	Cassandra Naidoo	2018
Freshwater Habitat Impact Assessment of the Proposed Umtshezi East Bulk Water Pipeline, KZN.	Lead Author	Specialist wetland and aquatic work	Acer Africa	2018
Wetland Rehabilitation and Monitoring Plan for the Cato Manor Sewage Pipeline Leakage within Bellair, KZN.	Co-author	Specialist rehabilitation works	eThekwini Metropolitan Municipality: Water and Sanitation	2018
Freshwater Habitat Impact Assessment of the Proposed Diesel Locomotive Workshop and Siding at the Richard's Bay Port, KZN.	Co-author	Specialist wetland and aquatic work	Transnet	2017
Wetland and Aquatic Rehabilitation Plan for the Proposed Diesel Locomotive Workshop and Siding at the Richard's Bay Port, KZN.	Co-author	Specialist wetland and aquatic work	Transnet	2017
Wetland and Aquatic Rehabilitation Implementation Plan for the Dube Precinct (Phase 1), KZN.	Lead Author	Specialist wetland and aquatic work	ACSA & Dube Tradeport (La Mercy Joint Venture)	2017
Freshwater Habitat Impact Assessment of the Proposed Upgrade of the Umbumbulu MR30 Road, KZN.	Lead Author	Specialist wetland and aquatic work	Nyeleti Engineering Consulting	2017
Eskom Road Emergency Maintenance, KZN	Internal reviewer	Specialist wetland and aquatic work	CBR Investments	2017
Freshwater Habitat Impact Assessment of the Proposed Upgrade to the National Route 8 (N8) between Thaba Nchu and Tweespruit and the use of the Eden and Devonshire Borrow Pits, Free State (FS).	Lead Author	Specialist wetland and aquatic work	SANRAL & Royal HaskoningDHV	2017
Freshwater Habitat Impact Assessment of the Proposed Upgrade of the National Route 2 (N2)	Lead Author	Specialist wetland and aquatic work	SANRAL & GIBB Engineering	2017

from the Durban Airport to the iLovu River, KZN.				
Freshwater Habitat Impact Assessment of the Proposed Construction of the Bloemfontein N8 Ring-road, FS.	Lead Author	Specialist wetland and aquatic work	The Free State Department of Police, Roads & Transport and Nyeleti Consulting	2016
Freshwater Habitat Impact Assessment of the Proposed Upgrade to the N2 Gwaaing River Bridge, Western Cape (WC).	Lead Author	Specialist wetland and aquatic work	SANRAL & GIBB Engineering	2016
Freshwater Habitat Impact Assessment of the Proposed Construction of the Mzimkhulwana Bridge, KZN.	Internal review	Specialist wetland and aquatic work	Samani Engineering Consulting	2016
Freshwater Habitat Impact Assessment of the Emergency Maintenance Work for the P197-3 Road Culverts, KZN.	Lead Author	Specialist wetland and aquatic work	Samani Engineering Consulting	2016
Freshwater Habitat Impact Assessment of the Proposed Keystone Petrol Filling Station, KZN.	Internal reviewer	Specialist wetland and aquatic work	Keystone Developments	2016
Freshwater Habitat Impact Assessment of the Kusa-kusa Irrigation Scheme, KZN.	Internal reviewer	Specialist wetland and aquatic work	Delta BEC	2016
Freshwater Habitat Impact Assessment of the Re-establishment of the P73 road Borrow Pits, KZN.	Internal reviewer	Specialist wetland and aquatic work	Samani Engineering Consulting	2016
Freshwater Habitat Impact Assessment of the Proposed Upgrade to the P740 and D985 Roads and Establishment of Two Borrow Pits, KZN.	Co-author	Specialist wetland and aquatic work	Samani Engineering Consulting	2016
Freshwater Habitat Impact Assessment of the Proposed Upgrade to the P728 District Road, KZN.	Co-author	Specialist wetland and aquatic work	Samani Engineering Consulting	2016
Freshwater Habitat Impact Assessment of the Proposed Baboyi River Bridge, KZN.	Co-author	Specialist wetland and aquatic work	Samani Engineering Consulting	2016

Wetland Delineation Report for the Proposed Ngyico Wetland Tourism Development, EC.	Lead Author	Specialist wetland work	Rhodes University	2015
Delineation and Assessment of Several Wetlands within the Kromme River Catchment, EC.	Field work and assessments	Research work	Rhodes University	2015

OTHER ENVIRONMENTAL WORK				
Project	**Role**	**Description**	**Client**	**Year**
Project Manager of Environmental Remediation Works on Three Nampak Flexible Sites in SA	Project manager	Management of all finances and construction related activities	Nampak Products Ltd.	2017-2018
Basic Assessment (BA) for the Proposed National Route 2 (N2) Wild Coast Toll Highway, Section 20, Auxiliary Roads and Material Sources, Eastern Cape (EC).	EAP/Lead Author	Environmental management	SANRAL & Aurecon Group	2018
Scoping and Environmental Impact Assessment (S&EIA) for the Proposed Establishment of the 28ha Dolerite Quarry Associated with the N2, Section 20, EC.	EAP/Lead Author	Environmental management	SANRAL & Aurecon Group	2018
Water Use License Application (WULA) for the Proposed National Route 2 (N2) Wild Coast Toll Highway, Section 20, Auxiliary Roads and Material Sources, Eastern Cape (EC).	EAP/Lead Author	Environmental management	SANRAL & Aurecon Group	2018
BA for the Proposed Construction of the Umbumbulu Pump Station, KZN.	EAP/Lead Author	Environmental management	Umgeni Water	2017
WULA for the Proposed Construction of the Umbumbulu Pump Station, KZN.	EAP/Lead Author	Environmental management	Umgeni Water	2017
Environmental Control Officer (ECO) Audits of the Upgrade to the N5 Road, KZN.	ECO	Compliance audit	SANRAL	2017
ECO Audits of the Upgrade to the D1252 District Road, KZN.	ECO	Compliance audit	Samani Engineering Consultants	2017

CERTIFICATION

I, **WAYNE JOHN WESTCOTT**

Declare that, to the best of my knowledge, all the information contained herein is true.

Signature: ______________________

On the____16th___ day of _October_ 2019

Appendix 9 : Cultural heritage desktop assessment

ARCHAEOLOGICAL DESKTOP STUDY

for the application of a prospecting right on a portion of Portion 9 of the Farm Vlakfontein 281 IR, Nigel, Gauteng

Author ©:

Tobias Coetzee, MA (Archaeology) (UP)

September 2019

Archaeological Desktop Study for the application of a prospecting right on a portion of Portion 9 of the Farm Vlakfontein 281 IR, Nigel, Gauteng

For: Environmental Assurance (Pty) Ltd

394 Tram Street

Nieuw Muckleneuk

Pretoria

0181

Report No: Marievale_Desktop_Heritage_3108191

Email: tobias.coetzee@gmail.com

- I, Tobias Coetzee, declare that –
- I act as the independent specialist;
- I am conducting any work and activity relating to the proposed Marievale Prospecting Project in an objective manner, even if this results in views and findings that are not favourable to the client;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have the required expertise in conducting the specialist report and I will comply with legislation, regulations and any guidelines that have relevance to the proposed activity;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this declaration are true and correct.

Coetzee

Date: 9 September 2019

Executive Summary

The author was appointed by Environmental Assurance (Pty) Ltd to undertake an Archaeological Desktop study for Ilangabi Investments 12 (Pty) Ltd on a portion of Portion 9 of the Farm Vlakfontein 281 IR within the Ekurhuleni Metropolitan Municipality. The study area is located 5 km east of Dunnottar, 8 km north of Nigel, 9 km south-southeast of Springs and follows the boundary of the former Marievale Engineers Golf Club. The aim of this report is to contextualise the general study area in terms of heritage resources and will provide the developers with general information regarding potentially sensitive areas. This will also shed light on what is to be expected during a Phase 1 Archaeological Impact Assessment and aid in interpreting finds.

The areas falling within the 50 m buffer should be avoided and care should be exercised when prospecting on the rest of the demarcated portion as the general study area is associated with historical infrastructure. It is also advised that once the drilling locations have been determined, a qualified archaeologist review the localities. Should any development that triggers an AIA result from the prospecting, a full Phase 1 AIA must be done.

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1. Project Background

1.1 Introduction

Environmental Assurance (Pty) Ltd appointed the author to undertake an Archaeological Desktop study for Ilangabi Investments 12 (Pty) Ltd on a portion of Portion 9 of the Farm Vlakfontein 281 IR within the Ekurhuleni Metropolitan Municipality (**Figures 1 & 2**). The study area is located approximately 5 km east of Dunnottar, 8 north of Nigel and 9 km south-southeast of Springs. The purpose of this study is to contextualise the demarcated study area in order to determine the scope of heritage resources that might be encountered during the prospecting phase and subsequent heritage studies, as well as to provide recommendations for the safeguarding of heritage resources during prospecting. The aim of this report is to provide the developer with information regarding heritage resources in the vicinity of the study area based on results from previous studies, written historical information, as well as historical aerial images and topographical maps.

In the following report, I provide a broad overview of the proposed sand, coal and clay prospecting and contextualise the study area in terms of heritage resources. The legislation section included serves as a guide towards the effective identification and protection of heritage resources and will apply to any such material unearthed during the prospecting phase.

1.2 Legislation

The South African Heritage Resources Agency (SAHRA) aims to conserve and control the management, research, alteration and destruction of cultural resources of South Africa and to prosecute if necessary. It is therefore crucially important to adhere to heritage resource legislation contained in the Government Gazette of the Republic of South Africa (Act No.25 of 1999), as many heritage sites are threatened daily by development. Conservation legislation requires an impact assessment report to be submitted for development authorisation that must include an AIA if triggered.

AIAs should be done by qualified professionals with adequate knowledge to (a) identify all heritage resources that might occur in areas of development and (b) make recommendations for protection or mitigation of the impact of the sites.

1.2.1 The EIA and AIA processes

Phase 1 Archaeological Impact Assessments generally involve the identification of sites during a field survey with assessment of their significance, the possible impact that the development might have, and relevant recommendations.

All Archaeological Impact Assessment reports should include:

a. Location of the sites that are found;

b. Short descriptions of the characteristics of each site;

c. Short assessments of how important each site is, indicating which should be conserved and which mitigated;

d. Assessments of the potential impact of the development on the site(s);

e. In some cases a shovel test, to establish the extent of a site, or collection of material, to identify the associations of the site, may be necessary (a pre-arranged SAHRA permit is required); and

f. Recommendations for conservation or mitigation.

This AIA report is intended to inform the client about the legislative protection of heritage resources and their significance and make appropriate recommendations. It is essential to also provide the heritage authority with sufficient information about the sites to enable the authority to assess with confidence:

a. Whether or not it has objections to a development;

b. What the conditions are upon which such development might proceed;

c. Which sites require permits for mitigation or destruction;

d. Which sites require mitigation and what this should comprise;

e. Whether sites must be conserved and what alternatives can be proposed to relocate the development in such a way as to conserve other sites; and

f. What measures should or could be put in place to protect the sites which should be conserved.

When a Phase 1 AIA is part of an EIA, wider issues such as public consultation and assessment of the spatial and visual impacts of the development may be undertaken as part of the general study and may not be required from the archaeologist. If, however, the Phase 1 project forms a major component of an AIA it will be necessary to ensure that the study addresses such issues and complies with Section 38 of the National Heritage Resources Act.

1.2.2 Legislation regarding archaeology and heritage sites

National Heritage Resource Act No.25 of April 1999

Buildings are among the most enduring features of human occupation, and this definition therefore includes all buildings older than 60 years, modern architecture as well as ruins, fortifications and Farming Community settlements. The Act identifies heritage objects as:

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens;
- visual art objects;
- military objects;
- numismatic objects;
- objects of cultural and historical significance;
- objects to which oral traditions are attached and which are associated with living heritage;
- objects of scientific or technological interest;
- books, records, documents, photographic positives and negatives, graphic material, film or video or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996), or in a provincial law pertaining to records or archives;
- any other prescribed category.

With regards to activities and work on archaeological and heritage sites this Act 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." (34. [1] 1999:58)

and

"No person may, without a permit issued by the responsible heritage resources authority:

(a) *destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;*

(b) *destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;*

(c) *trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or*

(d) *bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites."*(35. [4] 1999:58)

and

"No person may, without a permit issued by SAHRA or a provincial heritage resources authority:

(a) *destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;*

(b) *destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority;*

(c) *bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) and excavation equipment, or any equipment which assists in the detection or recovery of metals."* (36. [3] 1999:60)

On the development of any area the gazette states that:

"…any person who intends to undertake a development categorised as:

(a) *the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;*

(b) *the construction of a bridge or similar structure exceeding 50m in length;*

(c) *any development or other activity which will change the character of a site-*

   i. *exceeding 5000m² in extent; or*

   ii. *involving three or more existing erven or subdivisions thereof; or*

   iii. *involving three or more erven or divisions thereof which have been consolidated within the past five years; or* *iv. the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;*

(d) the re-zoning of a site exceeding 10000m² in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development." (38. [1] 1999:62-64)

and

"The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:

(a) The identification and mapping of all heritage resources in the area affected;

(b) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;

(c) an assessment of the impact of the development on such heritage resources;

(d) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;

(e) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

(f) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and

(g) plans for mitigation of any adverse effects during and after the completion of the proposed development." (38. [3] 1999:64)

Human Tissue Act and Ordinance 7 of 1925

The Human Tissues Act (65 of 1983) and Ordinance on the Removal of Graves and Dead Bodies (Ordinance 7 of 1925) protects graves younger than 60 years. These fall under the jurisdiction of the National Department of Health and the Provincial Health Departments. Approval for the exhumation and re-burial must be obtained from the relevant Provincial MEC as well as the relevant Local Authorities. Graves 60 years or older fall under the jurisdiction of the National Heritage Resources Act as well as the Human Tissues Act, 1983.

2. Study Area and Project Description

2.1 Location & Physical environment

The closest settlement to the study area is Dunnottar, located about 5 km to the west, while Nigel is located roughly 8 km to the south. The study area falls within the Ekurhuleni Metropolitan Municipality in the Gauteng Province. In terms of vegetation, the study area falls within the Grassland Biome, the Mesic Highveld Grassland Bioregion and on a local scale within Tsakane Clay Grassland. The Grassland Biome covers approximately 28% of South Africa. According to Mucina & Rutherfords (2006), the conservation status for Tsakane Clay Grassland is considered endangered. This vegetation unit is found in Mpumalanga and Gauteng in patches in a narrow band from Soweto to Springs. From Springs the band broadens in a southern direction to Nigel and Vereeniging and includes the area north of the Vaal Dam as well as the area between Balfour and Standerton. The conservation target for this vegetation unit is 24% and only 1.5% is conserved in statutory reserves and a small portion in private nature reserves. Cultivation, urbanisation, mining, dam-building and roads have transformed more than 60% of this vegetation unit. Built-up areas that were developed on Tsakane Clay Grassland include large portions of Alberton, Springs, Tsakane and Soweto. The increasing urbanisation of the southern suburbs of Johannesburg and the towns of the East Rand further threatens Tsakane Clay Grassland. Erosion in these areas are mostly very low (Mucina & Rutherfords 2006).

The average elevation for Tsakane Clay Grassland varies between 1480 and 1680 MASL (metres above sea level). The average elevation of the project area is 1585 MASL and slopes from the slightly more elevated western side towards the lower eastern side.

The study area falls within the summer rainfall region and the average annual rainfall is roughly 586 mm per year. The average maximum temperature for the study area ranges from 16.7 ºC in June to 26 ºC in January. The lowest temperatures occur during July when an average of 0.1 ºC is reached during the night (SA Explorer accessed 05/09/2019).

The study area falls within the C21E Quaternary Catchment that forms part of the Upper Vaal water management area. The closest major river to the study area is Blesbokspruit, a perennial river flowing 1.4 km to the east.

The demarcated study area follows the boundary of the former Marievale Engineers Golf Club. Since the closure of the golf club, however, the area has been used as a military base (Marievale Military Base). Agricultural land is found to the northeast and west of the demarcated study area, while historical mining development borders the area to the east and recent mining development to the northwest. The area to the south of the study area is characterised by a few houses and open veld.

2.2 Project description

Ilangabi Investments 12 (Pty) Ltd currently holds a mining right on the area to the northwest of the study area and wishes to expand their mining development to the southeast. The area demarcated for the prospecting of Clay, Coal and Sand covers an area of approximately 64 ha (**Table 1 & Figure 3**). Prospecting will consist of a high-level desktop study, studying historical data and existing maps, as well as the drilling of 10 prospecting holes.

Table 1: Property name & coordinates

Property	Portion	Map Reference (1:50 000)	Coordinates
Vlakfontein 281 IR	9	2628AD	S: -26.344369 E: 28.490955

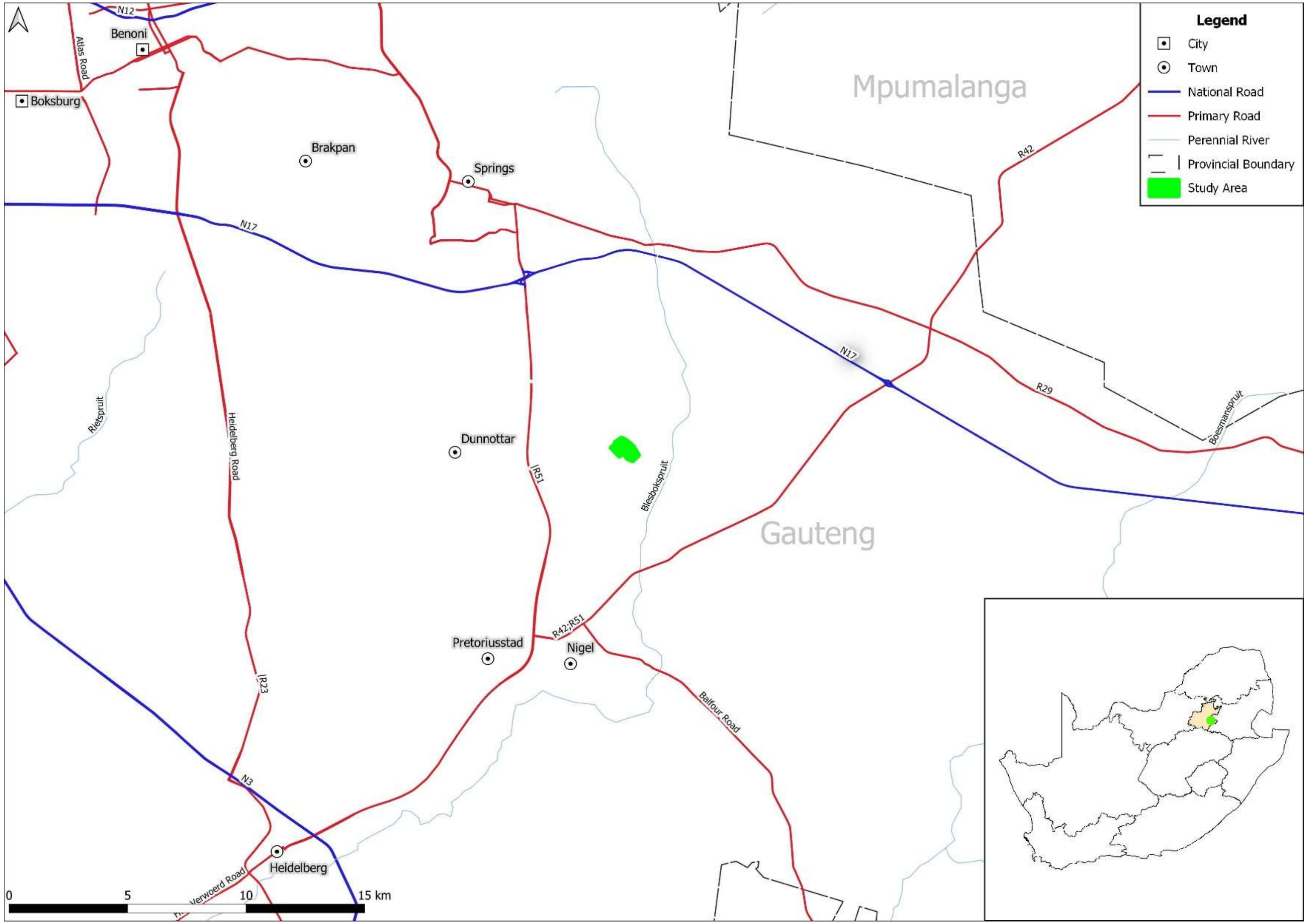

Figure 1: Regional and Provincial location of the study area.

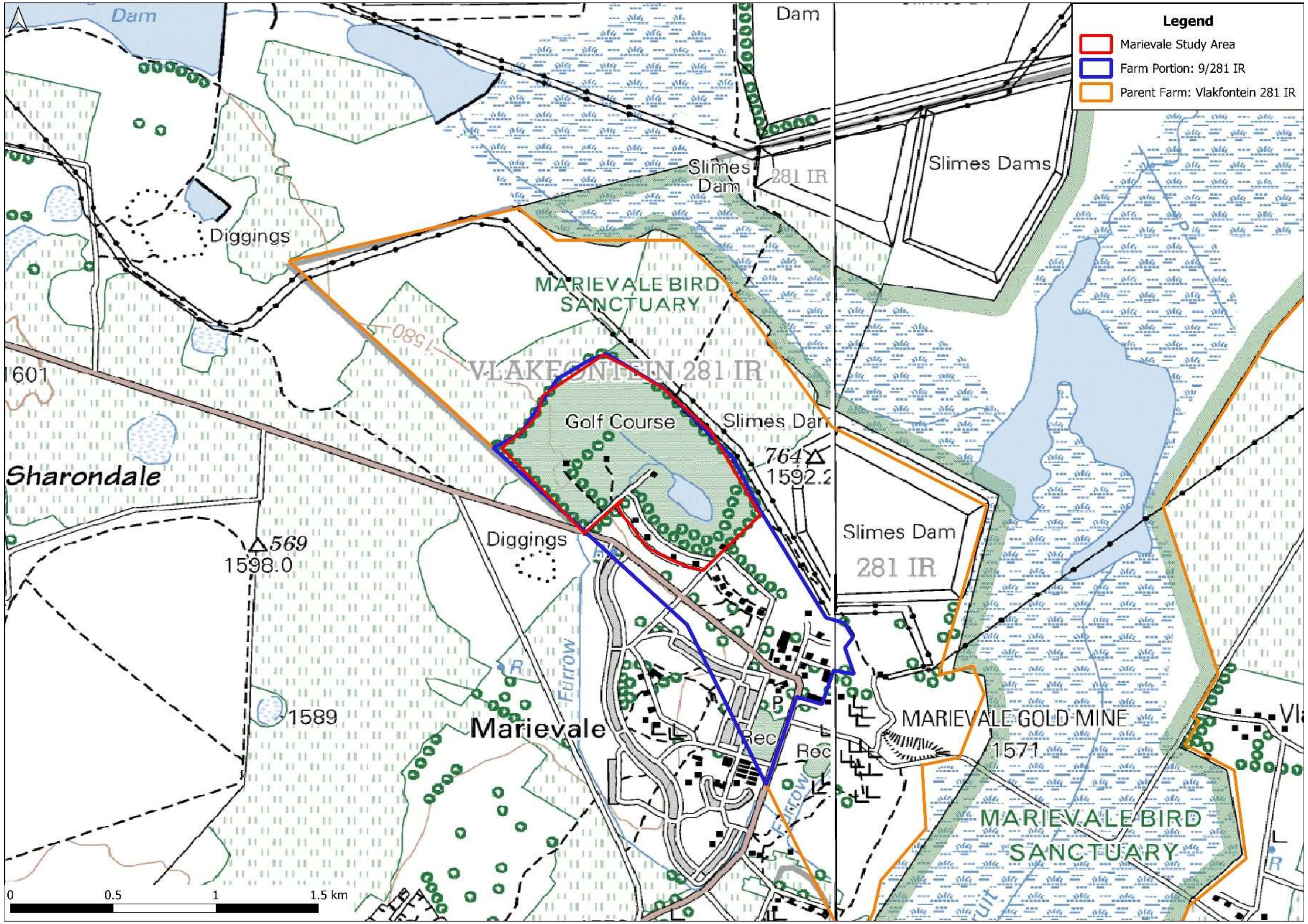

Figure 2: Segment of SA 1: 50 000 2628AD indicating the study area.

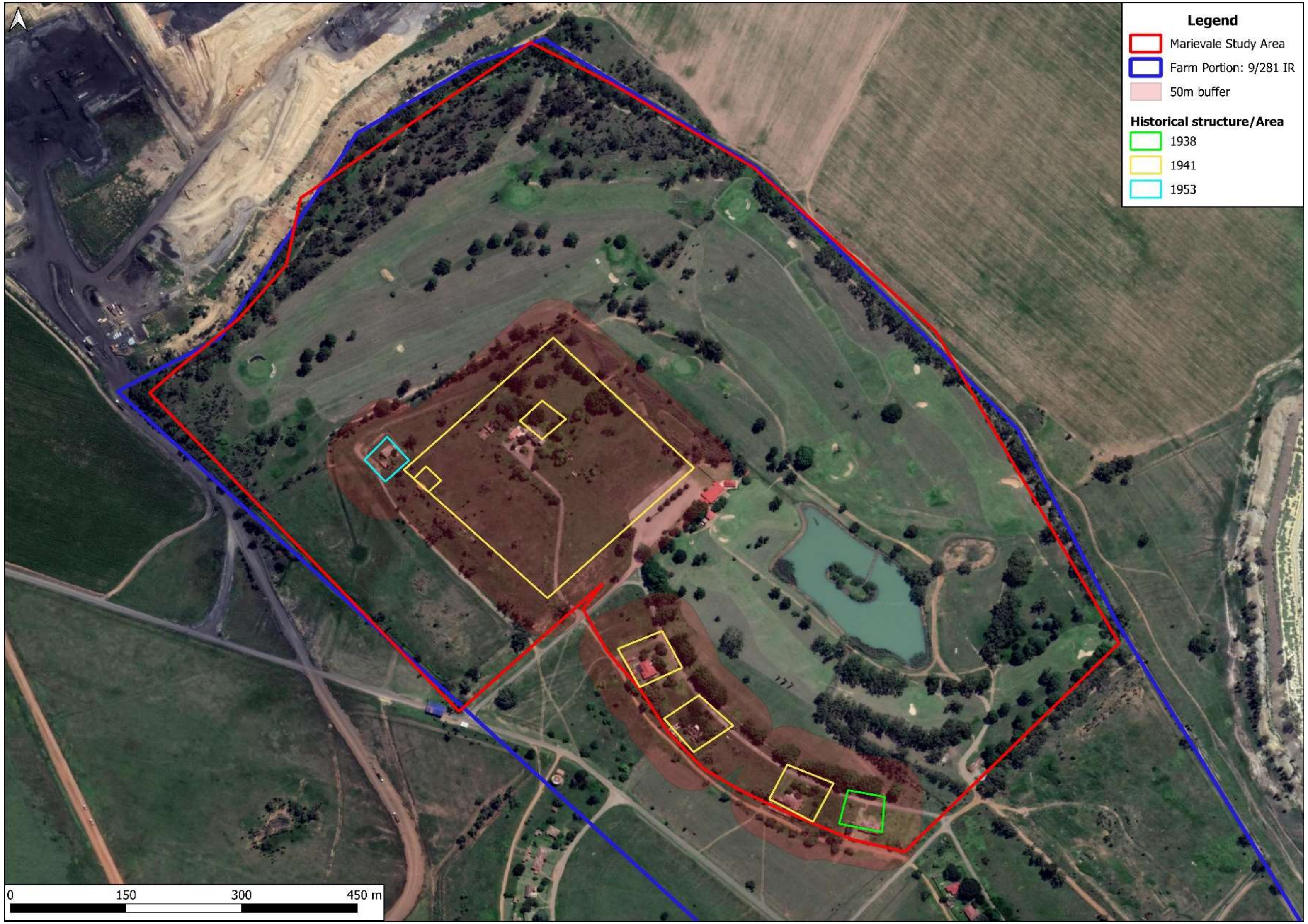

Figure 3: Proposed prospecting site on a 2019 aerial backdrop.

3. Archaeological Background

Southern African archaeology is broadly divided into the Early, Middle and Later Stone Ages; Early, Middle and Later Iron Ages; and Historical or Colonial Periods. This section of the report provides a general background to archaeology in South Africa.

3.1 The Stone Age

The earliest stone tool industry, the Oldowan, was developed by early human ancestors which were the earliest members of the genus *Homo,* such as *Homo habilis*, around 2.6 million years ago. It comprises tools such as cobble cores and pebble choppers (Toth & Schick 2007). Archaeologists suggest these stone tools are the earliest direct evidence for culture in southern Africa (Clarke & Kuman 2000). The advent of culture indicates the advent of more cognitively modern hominins (Mitchell 2002: 56, 57)

The Acheulean industry completely replaced the Oldowan industry. The Acheulian industry was first developed by *Homo ergaster* between 1.8 to 1.65 million years ago and lasted until around 300 000 years ago. Archaeological evidence from this period is also found at Swartkrans, Kromdraai and Sterkfontein. The most typical tools of the ESA are handaxes, cleavers, choppers and spheroids. Although hominins seemingly used handaxes often, scholars disagree about their use. There are no indications of hafting, and some artefacts are far too large for it. Hominins likely used choppers and scrapers for skinning and butchering scavenged animals and often obtained sharp ended sticks for digging up edible roots. Presumably, early humans used wooden spears as early as 5 million years ago to hunt small animals.

Middle Stone Age artefacts started appearing about 250 000 years ago and replaced the larger Early Stone Age bifaces, handaxes and cleavers with smaller flake industries consisting of scrapers, points and blades. These artefacts roughly fall in the 40-100 mm size range and were, in some cases, attached to handles, indicating a significant technical advance. The first *Homo sapiens* species also emerged during this period. Associated sites are Klasies River Mouth, Blombos Cave and Border Cave (Deacon & Deacon 1999).

Although the transition from the Middle Stone Age to the Later Stone Age did not occur simultaneously across the whole of southern Africa, the Later Stone Age ranges from about 20 000 to 2000 years ago. Stone tools from this period are generally smaller, but were used to do the same job as those from previous periods; only in a different, more efficient way. The Later Stone Age is associated with: rock art, smaller stone tools (microliths), bows and arrows, bored stones, grooved stones, polished bone tools, earthenware pottery and beads. Examples of Later Stone Age sites are Nelson Bay Cave, Rose Cottage Cave and Boomplaas Cave (Deacon & Deacon 1999).

3.2 The Iron Age & Historical Period

The Early Iron Age marks the movement of farming communities into South Africa in the first millennium AD, or around 2500 years ago (Mitchell 2002:259, 260). These groups were agro-pastoralist communities that settled in the vicinity of water in order to provide subsistence for their cattle and crops. Archaeological evidence from Early Iron Age sites is mostly artefacts in the form of ceramic assemblages. The origins and archaeological identities of this period are largely based upon ceramic typologies. Some scholars classify Early Iron Age ceramic traditions into different "streams" or "trends" in pot types and decoration, which emerged over time in southern Africa. These "streams" are identified as the Kwale Branch (east), the Nkope Branch (central) and the Kalundu Branch (west). Early Iron Age ceramics typically display features such as large and prominent inverted rims, large neck areas and fine elaborate decorations. This period continued until the end of the first millennium AD (Mitchell 2002; Huffman 2007). Some well-known Early Iron Age sites include the Lydenburg Heads in Mpumalanga, Happy Rest in the Limpopo Province and Mzonjani in Kwa-Zulu Natal.

The Middle Iron Age roughly stretches from AD 900 to 1300 and marks the origins of the Zimbabwe culture. During this period cattle herding appeared to play an increasingly important role in society. However, it was proved that cattle remained an important source of wealth throughout the Iron Age. An important shift in the Iron Age of southern Africa took place in the Shashe-Limpopo basin during this period, namely the development of class distinction and sacred leadership. The Zimbabwe culture can be divided into three periods based on certain capitals. Mapungubwe, the first period, dates from AD 1220 to 1300, Great Zimbabwe from AD 1300 to 1450, and Khami from AD 1450 to 1820 (Huffman 2007: 361, 362).

The Late Iron Age roughly dates from AD 1300 to 1840. It is generally accepted that Great Zimbabwe replaced Mapungubwe. Some characteristics include a greater focus on economic growth and the increased importance of trade. Specialisation in terms of natural resources also started to play a role, as can be seen from the distribution of iron slag which tend to occur only in certain localities compared to a wide distribution during earlier times. It was also during the Late Iron Age that different areas of South Africa were populated, such as the interior of KwaZulu Natal, the Free State, the Gauteng Highveld and the Transkei. Another characteristic is the increased use of stone as building material. Some artefacts associated with this period are knife-blades, hoes, adzes, awls, other metal objects as well as bone tools and grinding stones.

The Historical period mainly deals with Europe's discovery, settlement and impact on southern Africa. Some topics covered by the Historical period include Dutch settlement in the Western Cape, early mission stations, Voortrekker routes and the Anglo Boer War. This time period also saw the compilation of early maps by missionaries, explorers, military personnel, etc.

3.2.1 Historical Imagery, topographical maps and title deeds

Historical images and topographical maps dating to 1938, 1941, 1944, 1953 and 1960 (**Appendix A**) were used to determine the relative age of the structures present on the demarcated portion, the construction date of the golf course, as well as the presence of other potential heritage resources.

The aerial image dating to 1938 (**Appendix A: Figure 4**) indicates the presence of a building in the south-eastern corner of the demarcated study area, a road running from the northern boundary towards to the south-eastern boundary, as well as two natural water pans. The rest of the demarcated area, however, appears to be open veld. It should be noted that several similar structures are located outside of the demarcated study area towards the southeast. These buildings are therefore at least 81 years old.

At least five additional areas consisting of structures, as well as the general layout of the golf course, appear on the 1941 aerial image (**Appendix A: Figure 5**). Although not as clear as the 1938 aerial image, three structures/homesteads similar in appearance are visible to the northwest of the structure visible on the 1938 aerial image. Apart from these areas, two additional buildings within what appears to be a demarcated yard are shown in roughly the middle of the study area. It is assumed that these structures are associated with the construction of the golf course and/or the establishment of mining activity directly east of the demarcated study area. These additional structures and golf course demarcations visible on the 1941 aerial image, therefore, date to between 81 and 78 years ago.

When the 1944 topographical map is considered (**Appendix A: Figure 6**), only the structure just inside the south-eastern boundary of the demarcated study area that appears on the 1938 aerial image is indicated, while the historical structures/areas indicated on the 1941 aerial image are not shown. This topographical map indicates four additional structures located outside of the demarcated study area to the southeast and appear to be the same structures indicated on the 1938 aerial image. It should be noted that only one of the natural water pans visible on the 1938 aerial image is indicated and that the farm name is shown to be Vogelstruisbult. It appears that at this point, the topographical map has not been updated to reflect the structures visible on the 1941 aerial image.

On the 1953 aerial image (**Appendix A: Figure 7**), one additional structure/built-up area is visible just outside of the north-western corner of the demarcated yard that appears on the 1941 aerial image. The larger demarcated yard also appears more defined and although not clearly visible, additional structures might be present. The rest of the general area demarcated for prospecting shows the golf course markings more clearly. The structures that first appear on this aerial image, are therefore at least 66 years of age.

The first topographical map to reference the Marievale Golf Course, dates to 1960 (**Appendix A: Figure 8**). This topographical map indicates the structures within the demarcated study area along the southern boundary that first appear on the 1941 aerial image, as well as the structures in the vicinity of the centre of the demarcated study area. The building to the northwest of the yard that is visible on the 1953 aerial image is also indicated on the 1960 topographical map.

According to the title deed, Portion 9 of the Farm Vlakfontein 281 IR was originally transferred to Jacobus Stephanus Marais under Transfer dated 8th March 1867 and to Marievale Consolidated Mines, Limited under Deed of Transfer No. T. 9179/1935 dated 3rd July 1935 (**Appendix A: Figure 9**).

3.3 Previous Heritage Studies

Coal mining on the Farm Grootfontein 165 IR, District Nigel

A Cultural Heritage Impact Assessment, conducted by Francois Coetzee (2017) for a mining right application on the Farm Grootfontein 165 IR, revealed no material of heritage importance. According to the report, the survey area focused on Portions 23, 52 and 85 of the Farm Grootfontein 165 IR, as well as the remaining extent of the Farm Vogelstruisbult 127 IR and covered 170 hectares. Accordingly, the surveyed area borders the demarcated study area concerned in this report to the west and northwest.

Prospecting on slimes dams on the Farm Vlakfontein 281 IR

Digby Wells (Pty) Ltd undertook the Basic Assessment process for a prospecting right application for the 7L5 and 7L6 slimes dam project in the magisterial district of Nigel. The proposed study area is located on the remaining extent, Portion 1 and Portion 9 of the farm Vlakfontein 281 IR and deals with the extraction of low deposits of gold from the slimes dams deposited by less efficient historical mining methods. The demarcated slimes dams are located about 1.3 km to the northeast of the study area concerned in this project. The report found that some of the slimes dams were older than 60 years and are therefore protected by heritage legislation. However, according to the report the proposed prospecting activities did not threaten the historical character of the slimes dams (Higgitt 2015).

Project Phoenix Gold Plant and TSF, Ekurhuleni Metropolitan Municipality

Francois Coetzee (2014), conducted a Cultural Heritage Assessment for the Phoenix Gold Plant project and Sub-Nigel Tailings Facility on various portions of the farm Grootfontein 165 IR and Spaarwater 171 IR west of Nigel. The surveyed area is located roughly 6 km southwest of the study area concerned in this project. No Stone Age and Iron Age settlements, structures, features, assemblages or artefacts were recorded during the survey. Four sites with structures were noted, but did not exceed 60 years of age. Also, two large graveyards were recorded.

4. Evaluation

The significance of an archaeological site is based on the amount of deposit, the integrity of the context, the kind of deposit and the potential to help answer present research questions. Historical structures are defined by Section 34 of the National Heritage Resources Act, 1999, while other historical and cultural significant sites, places and features, are generally determined by community preferences.

A fundamental aspect in the conservation of a heritage resource relates to whether the sustainable social and economic benefits of a proposed development outweigh the conservation issues at stake. There are many aspects that must be taken into consideration when determining significance, such as rarity, national significance, scientific importance, cultural and religious significance, and not least, community preferences. When, for whatever reason the protection of a heritage site is not deemed necessary or practical, its research potential must be assessed and if appropriate mitigated in order to gain data / information which would otherwise be lost. Such sites must be adequately recorded and sampled before being destroyed.

5. Statement of Significance & Recommendations

5.1 Statement of significance

The study area: Portion of Portion 9 of the Farm Vlakfontein 281 IR (The former Marievale Engineers Golf Club)

As can be seen from previous research done in the area the general region is mostly significant from a heritage perspective in terms of mining history. Heritage sites are likely to include graveyards and historical buildings. Since heritage sites, such as graves, are not always clearly identifiable as it might consist of stone cairns, care must be exercised when prospecting.

Figure 3 indicates the study area on a recent aerial backdrop with structures/areas that are potentially sensitive from a heritage perspective indicated according to date first observed on aerial imagery. These areas were identified using historical areal imagery dating to between 1938 and 1953. The structures visible on the 1938 aerial image are at least 81 years old, the structures on the 1941 aerial image at least 78 years old and the 1953 structures at least 66 years old. All these structures, therefore exceed 60 years of age and are protected under Section 34 of the National Heritage Resources Act, 1999. Because the exact boundaries of these structures could not be established accurately from the aerial images, a conservation buffer of 50 m is recommended and indicated on **Figure 3** to prevent prospecting causing damage to the structures. The Marievale Golf Course also first appears on the 1941 aerial image, making the general area significant from a heritage perspective.

5.2 Recommendations

The following recommendations are made in order to avoid the destruction of heritage remains on the areas demarcated for prospecting:

- Care should be exercised when prospecting on the demarcated portion and areas falling within the 50 m buffer should be avoided.

- It is advised that once the drilling locations are established, the localities be reviewed by a qualified archaeologist to determine the impact the prospecting might have on heritage resources.

- A qualified archaeologist should be contacted whenever uncertainty regarding potential heritage remains are encountered.

- Prospecting should not take place in the vicinity of any building, ruin or any other potential heritage material and the general impact should be kept to a minimum.

- Should the prospecting outcome result in further development or construction, a full Phase 1 Archaeological Impact Assessment must be conducted on the affected area if triggered.

- Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the prospecting phase, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed, all activities must be suspended and the relevant heritage resources authority contacted (See National Heritage Resources Act, 25 of 1999 section 36 (6)).

6. Addendum: Terminology

Archaeology:

The study of the human past through its material remains.

Artefact:

Any portable object used, modified, or made by humans; e.g. pottery and metal objects.

Assemblage:

A group of artefacts occurring together at a particular time and place, and representing the sum of human activities.

Context:

An artefact's context usually consist of its immediate *matrix* (the material surrounding it e.g. gravel, clay or sand), its *provenience* (horizontal and vertical position within the matrix), and its *association* with other artefacts (occurrence together with other archaeological remains, usually in the same matrix).

Cultural Resource Management (CRM):

The safeguarding of the archaeological heritage through the protection of sites and through selvage archaeology (rescue archaeology), generally within the framework of legislation designed to safeguard the past.

Excavation:

The principal method of data acquisition in archaeology, involving the systematic uncovering of archaeological remains through the removal of the deposits of soil and other material covering and accompanying it.

Feature:

An irremovable artefact; e.g. hearths or architectural elements.

Ground Reconnaissance:

A collective name for a wide variety of methods for identifying individual archaeological sites, including consultation of documentary sources, place-name evidence, local folklore, and legend, but primarily actual fieldwork.

Matrix:

The physical material within which artefacts is embedded or supported, i.e. the material surrounding it e.g. gravel, clay or sand.

Phase 1 Assessments:

Scoping surveys to establish the presence of and to evaluate heritage resources in a given area.

Phase 2 Assessments:

In-depth culture resources management studies which could include major archaeological excavations, detailed site surveys and mapping / plans of sites, including historical / architectural structures and features. Alternatively, the sampling of sites by collecting material, small test pit excavations or auger sampling is required.

Sensitive:

Often refers to graves and burial sites although not necessarily a heritage place, as well as ideologically significant sites such as ritual / religious places. *Sensitive* may also refer to an entire landscape / area known for its significant heritage remains.

Site:

A distinct spatial clustering of artefacts, features, structures, and organic and environmental remains, as the residue of human activity.

Surface survey:

There are two kinds: (1) unsystematic and (2) systematic. The former involves field walking, i.e. scanning the ground along one's path and recording the location of artefacts and surface features. Systematic survey by comparison is less subjective and involves a grid system, such that the survey area is divided into sectors and these are walked ally, thus making the recording of finds more accurate.

7. References

Clarke, R.J. & Kuman, K. 2000. *The Sterkfontein Caves Palaeontological and Archaeological Sites*. Johannesburg: University of the Witwatersrand.

Coetzee, F.P. 2014. Cultural Heritage Impact Assessment of the proposed Project Phoenix Gold Plant and TSF (Sub-Nigel Tailings Facility), Ekurhuleni Metropolitan Municipality, Gauteng. Centurion.

Coetzee, F.P. 2017. Cultural Heritage Impact Assessment of the proposed Coal Mining on the Farm Grootfontein 165 IR, District Nigel, Ekurhuleni Metropolitan Municipality, Gauteng. Centurion.

Deacon, H. & Deacon, J. 1999*. Human beginnings in South Africa.* Cape Town: David Philip.

Higgitt, N. 2014. Prospecting Right and Environmental Authorisation Application for the 7L5 and 7L6 Slimes Dam on Vlakfontein 281 IR. Digby Wells Environmental.

Huffman, T.N. 2007. *Handbook to the Iron Age.* Pietermaritzburg: UKZN Press.

Mitchell, P. 2002. *The archaeology of southern Africa.* Cambridge: Cambridge University Press.

Mucina, L. & Rutherford, M. C. 2006. *The Vegetation of South Africa, Lesotho and Swazil*and. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Sa Explorer. Nigel Climate. http://www.saexplorer.co.za/south-africa/climate/nigel_climate.asp. Accessed 05-09-2019.

Toth, N. & Schick, K. 2007. *Handbook of paleoanthropology*. Berlin: Springer.

Human Tissue Act No. 65 of 1983, Government Gazette, Cape Town

National Heritage Resource Act No.25 of 1999, Government Gazette, Cape Town

Removal of Graves and Dead Bodies Ordinance No. 7 of 1925, Government Gazette, Cape Town

Appendix A

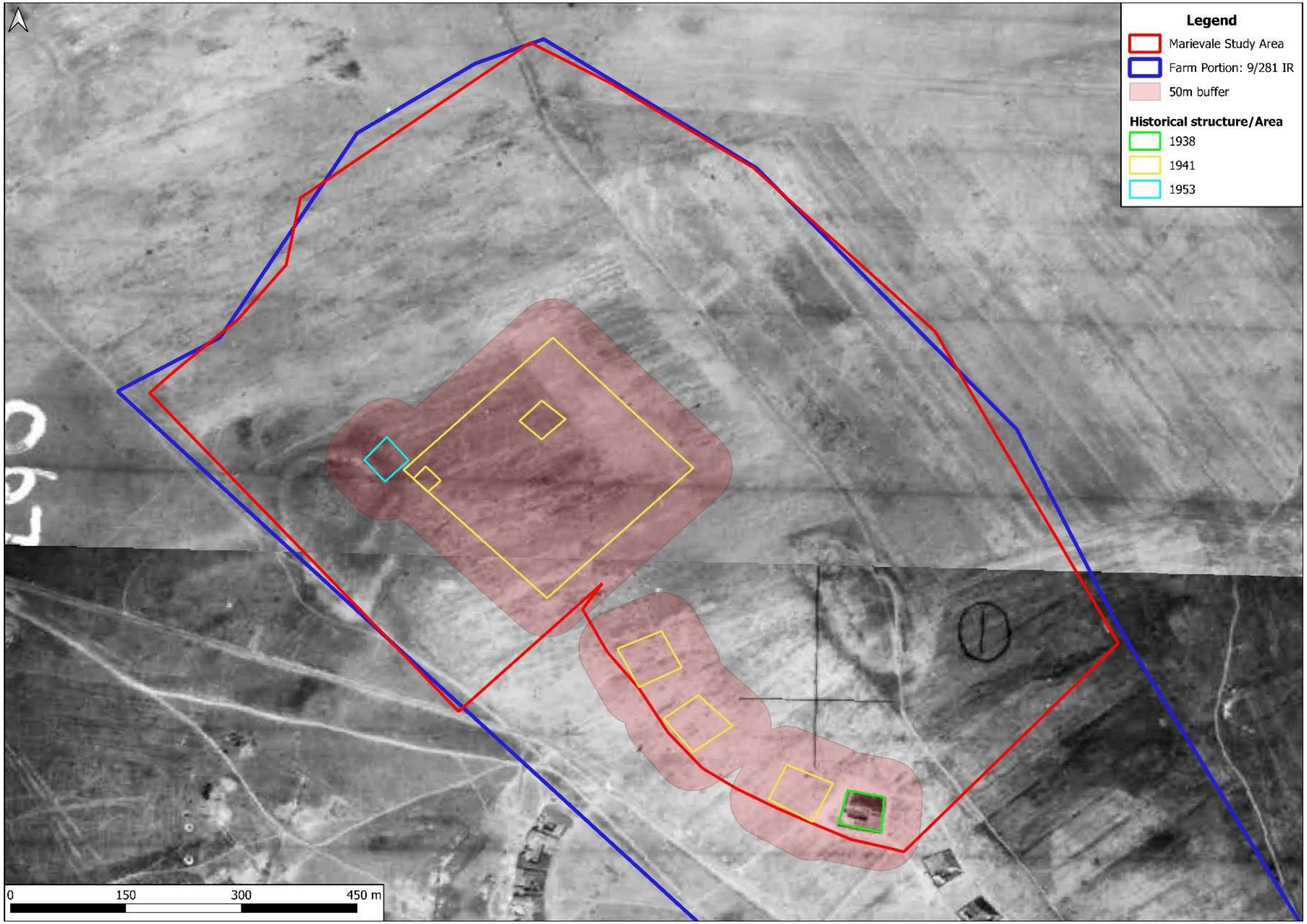

Figure 4: Proposed prospecting site on a 1938 aerial backdrop.

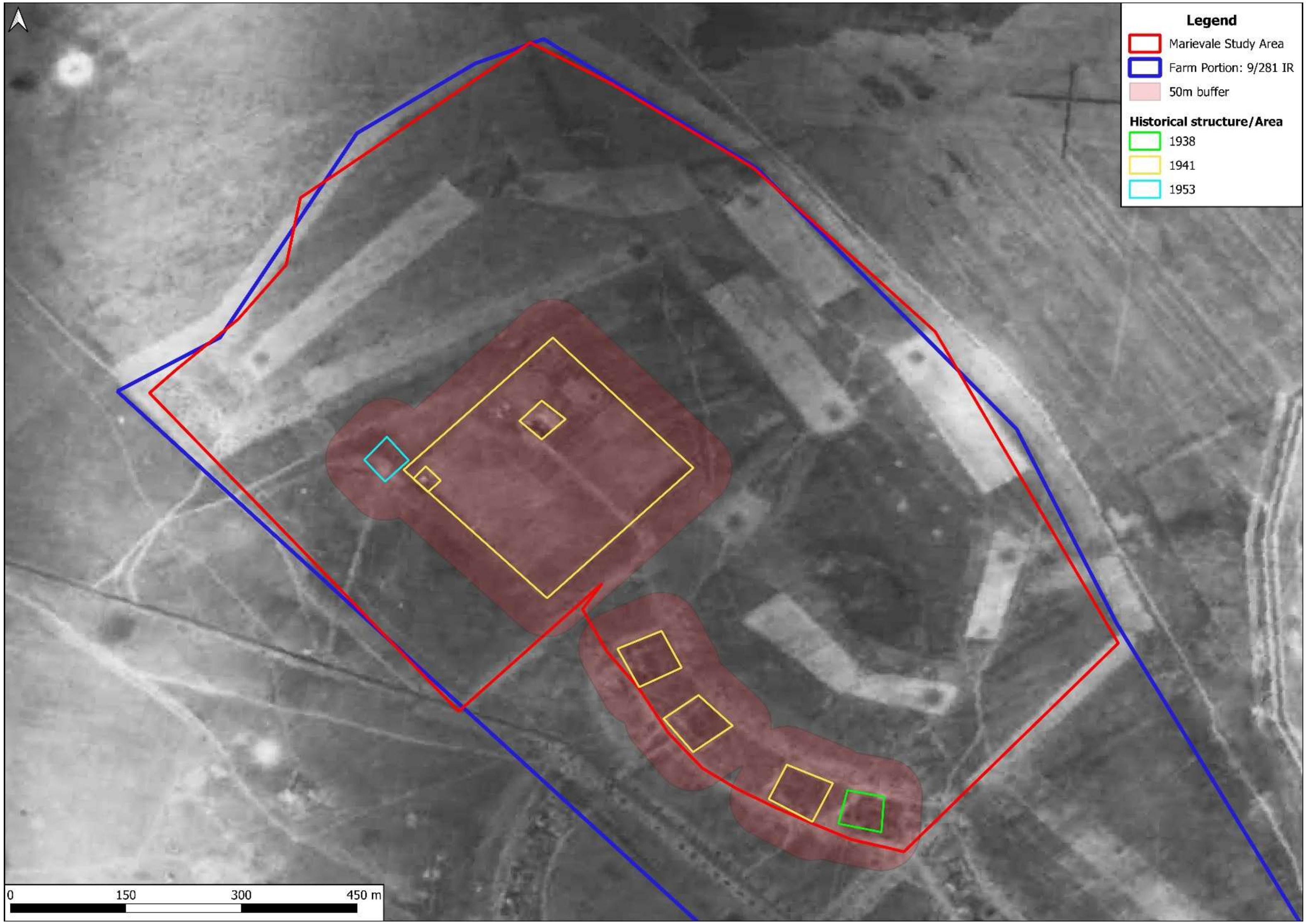

Figure 5: Proposed prospecting site on a 1941 aerial backdrop.

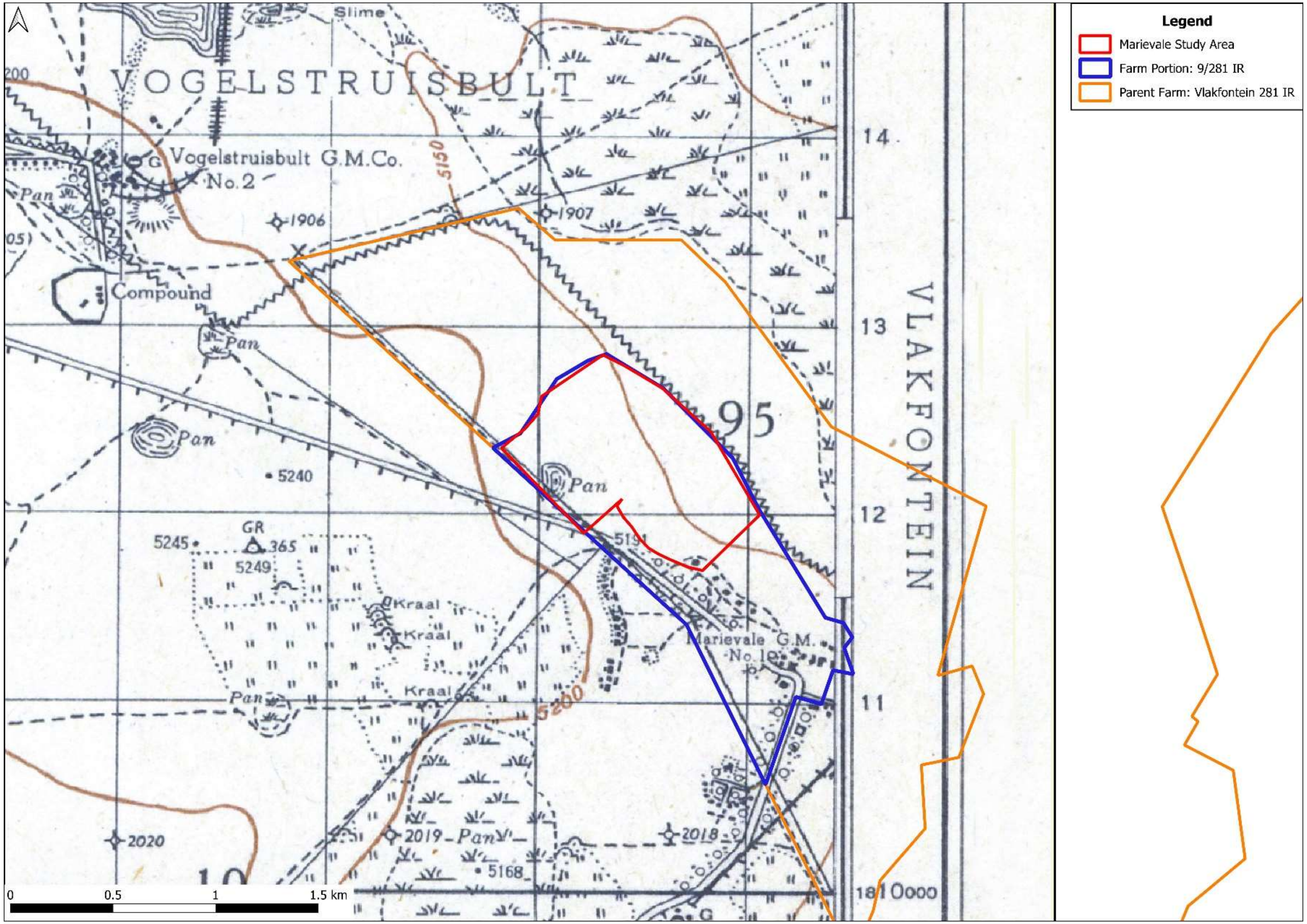

Figure 6: Segment of 1944 SA 1: 50 000 2628 AD indicating the study area.

Figure 7: Proposed prospecting site on a 1953 aerial backdrop.

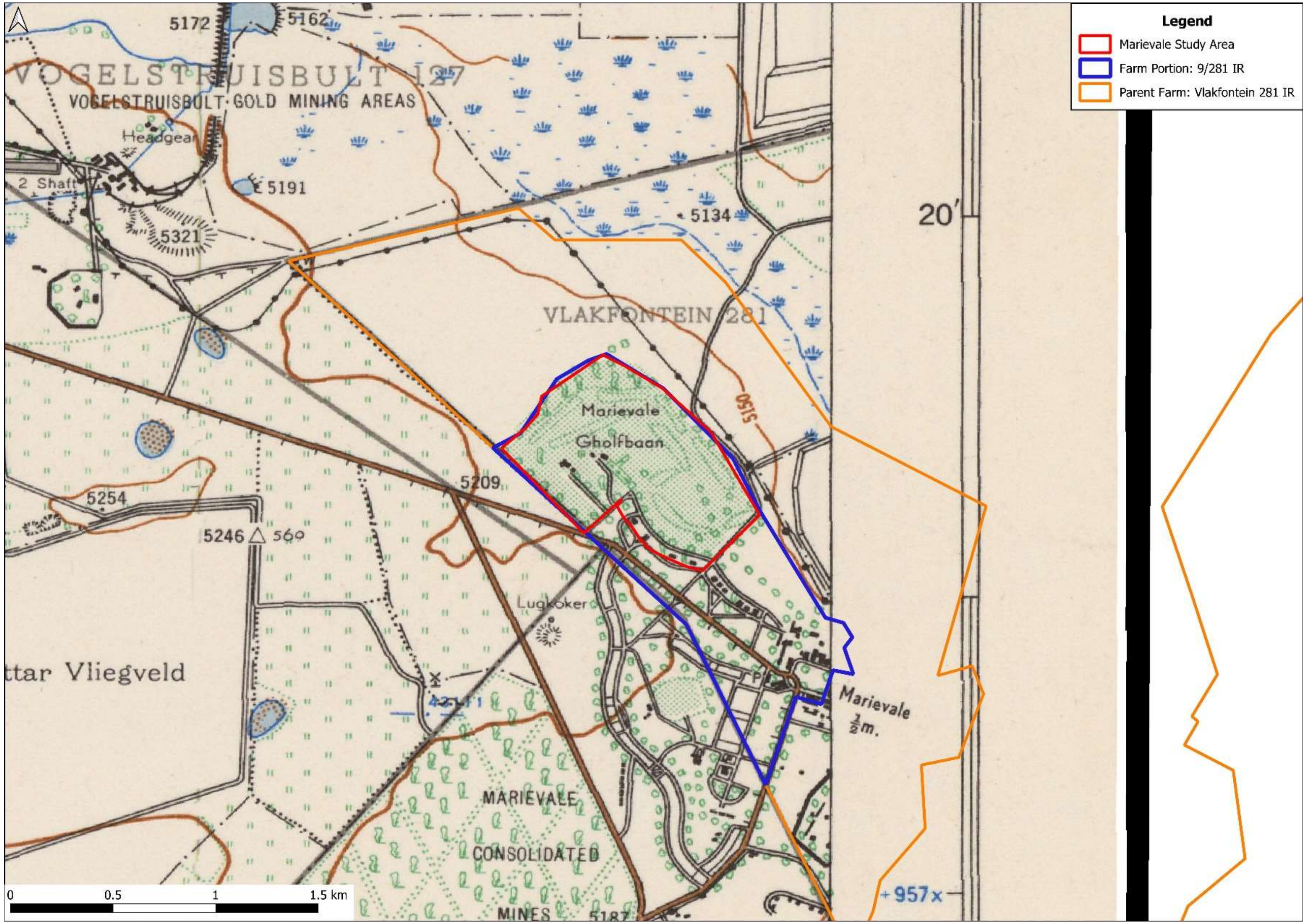

Figure 8: Segment of 1960 SA 1: 50 000 2628 AD indicating the study area.

hereby reserved to the said MARIEVALE CONSOLIDATED MINES LIMITED, and its successors in title to such rights.

(b) SUBJECT to Mynpacht 536, measuring 161,5890 (ONE HUNDRED AND SIXTY ONE COMMA FIVE EIGHT NINE NOUGHT) hectares in favour of MARIEVALE NIGEL GOLD MINES & ESTATE LIMITED.

AND FURTHER SUBJECT to such conditions as are mentioned or referred to in the aforesaid Deeds.

2\. PORTION 9 of the farm VLAKFONTEIN No. 281, Registration Division I.R., Transvaal,

WHITE GROUP
BLANKE GROEP

ORIGINALLY transferred to JACOBUS STEPHANUS MARAIS under Transfer dated 8th March 1867 and to MARIEVALE CONSOLIDATED MINES, LIMITED under Deed of Transfer No. T. 9179/1935 dated 3rd July 1935.

MEASURING 123,1133 (ONE HUNDRED AND TWENTY THREE COMMA ONE ONE THREE THREE) hectares, as will more fully appear from Diagram S.G. No. A. 6011/77 annexed hereto.

SUBJECT to the following conditions :

X (a) The former remaining extent of the farm VLAKFONTEIN No. 281, Registration Division I.R., Transvaal, measuring 3748,8428 (THREE THOUSAND SEVEN HUNDRED AND FORTY EIGHT COMMA EIGHT FOUR TWO EIGHT) hectares (of which the property hereby transferred forms a portion) is subject to a servitude to convey

\- electricity -

Figure 9: Title Deed.