DRAFT ENVIRONMENTAL IMPACT ASSESSMENT, ENVIRONMENTAL MANAGEMENT PLAN, WASTE MANAGEMENT LICENSE AND WATER USE LICENSE FOR VANADIUM, IRON ORE AND TITANIUM MINING RIGHT APPLICATION WITHIN THE MAGISTERIAL DISTRICT OF BOJANALA IN NORTH WEST PROVINCE

MARCH 2019

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WITHIN THE MAGISTERIAL DISTRICT OF BOJANALA IN NORTH WEST PROVINCE

MARCH 2019

Conducted on behalf of:

Matai Properties Pty Ltd

Compiled by:

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	Matai Mining (Proprietary) Ltd
	National Department of Agriculture, Forestry and Fisheries
	Department of Water and Sanitation (National)
	Department of Environmental Affairs (Provincial)
	Provincial Heritage Resources Agency (PHR)- North West
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List of Abbreviations

%	: Percent
°C	: Degrees Celsius
<	: Less than
>	: Greater than
BID	: Background Information Document
CARA	: Conservation of Agricultural Resources Act
cm	: Centimeter
CR	: Critically Rare
CSI	: Corporate Social Investment
CSR	: Corporate Social Responsibility
dB	: decibel
dBA	: Decibels (Weighted)
DEA	: Department of Environmental Affairs
DM	: District Municipality
DMR	: Department of Mineral Resources
DMS	: Dense Medium Separation
DWS	: Department of Water and Sanitation
EAP	: Environmental Assessment Practitioner

ECA	: Environment Conservation Act
EIA	: Environmental Impact Assessment
EIS	: Ecological Importance and Sensitivity analysis
EMP	: Environmental Management Plan/Programme
EN	: Endangered
ESR	: Environmental Scoping Report
Fax	: Facsimile
Ha	: Hectare
HIA	: Heritage Impact Assessment
I&APs	: Interested and Affected Parties
IDP	: Integrated Development Plan
IRR	: Issues and Response Register
IWUL	: Integrated Water Use License
IWULA	: Integrated Water Use License Application
IWWMP	: Integrated Water and Waste Management Plan
LED	: Local Economic Development
LM	: Local Municipality
LOM	: Life of Mine
m	: Metres

m^2	: Square Meters
m^3	: Cubic Metres
masl	: Metres Above Sea Level
MPRDA	: Mineral and Petroleum Resources Development Act
NEMA	: National Environmental Management Act
NEM:BA	: National Environmental Management: Biodiversity Act
NEM: WA	: National Environmental Management: Waste Act
NT	: Near Threatened
NWA	: National Water Act (Act No. 36 of 1998)
PCD	: Pollution Control Dam
PES	: Present Ecological State
PPP	: Public Participation Process
ROM	: Run of Mine
S&EIR	: Scoping and Environmental Impact Report
SAHRA	: South African Heritage Resource Agency
SANBI	: South African National Biodiversity Institute
SANRAL	: South African National Roads Agency Limited
SANS 10103	: South African National Standard 10103
SAWS	: South African Weather Service

SDF	: Strategic Development Framework
SLP	: Social and Labour Plan
sms	: Short Message Services
SWMP	: Storm-water Management Plan
t	: Ton
WMA	: Water Management Area
WULA	: Water Use License Application

Definitions of Terms

Affected Environment: The affected environment refers to those parts of the socio-economic and biophysical environment impacted on by the development.

Consultation: A two-way communications process between the applicant and the community or interested and affected party wherein the former is seeking, listening to, and considering the latter's response, which allows openness in the decision-making process.

Community: A group of historically disadvantaged persons with interests or rights in a particular area of land on which the members have or exercise communal rights in terms of an agreement, custom or law: Provided that, where as a consequence of the provisions of the Act negotiations or consultations with the community are required, the community shall include the members of the community or part of the community, directly affected by prospecting or mining, on land occupied by such members or part of the community.

Environment: The surroundings within which humans exist and that are made up of (i) the land, water and atmosphere of the earth; (ii) micro-organisms, plant and animal life; (iii) any part or combination of (i) and (ii) and the interrelationships among and between them; and the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being. This includes the economic, cultural, historical, and political circumstances, conditions and objects that affect the existence and development of an individual, organism or group.

Environmental Impact Assessment: A planning and management tool for sustainable development, aimed at providing decision-makers with information on the likely consequences of their actions.

Environmental Impact: The positive or negative effects on human well-being and/or on the environment.

Interested and affected parties: Individuals, communities or groups, other than the proponent or the authorities, whose interests may be positively or negatively affected by a proposal or activity and/or who are concerned with a proposal or activity and its consequences. These may include local communities, investors, business associations, trade unions, customers, consumers and environmental interest groups, Host Communities, Landowners (Traditional and Title Deed owners), Land Claimants, Lawful land occupier.

Mitigate: The implementation of practical measures to reduce adverse impacts.

Public Participation Process: A process in which potential interested and affected parties are given an opportunity to comment on or raise issues relevant to the proposed development.

Proponent: Any individual, government department, authority, industry or association proposing an activity (e.g. project, programme or policy).

Scoping: The process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addressed in an environmental assessment process. The main purpose of scoping is to focus the environmental assessment on a manageable number of important questions. Scoping should also ensure that only significant issues and reasonable alternatives are examined.

Study Area: The area that will be covered by the EIA process within which possible study corridors will be investigated.

Stakeholders: A sub-group of the public whose interests may be positively or negatively affected by a proposal or activity and/or who are concerned with a proposal or activity and its consequences. The term therefore includes the proponent, authorities (both the lead authority and other authorities) and all interested and affected parties (I&APs).

Iron Ore: a rock or mineral from which iron can be profitably extracted.

EXECUTIVE SUMMARY

Introduction

Matai Mining (Pty) Ltd (Matai Mining) holds the Prospecting Right with reference number NW30/5/1/1/2/11277PR that was granted in terms of the Mineral and Petroleum Resources Development Act 28 of 2002 as amended by Act 49 of 2008 ("MPRDA"). Matai Mining herewith apply for a Mining right for Vanadium, Titanium and Iron Ore in terms of the Section 23 (a), (b) and (c) read together with regulation 11(1) (g) of the MPRDA (ACT 28 of 2002).

Project Location

The Matai Mining Project is located in the Moses Kotane Municipality, Bojanala Platinum District Municipality, North West Province, South Africa, 10km south from the closest town Northam, approximately, 80km north east of Rustenburg and 220km north west of Johannesburg. The project is approximately centred on Geographic coordinates Latitude 25° 00′ 00" S, Longitude 27° 10′ 00" E.

Mining Right Application Properties

The application of mining right has been accepted by DMR in certain portion of farm Magazynskraal 3 JQ, certain portion of farm Haakdoorn 6 JQ, the farm Wildebeeskuil 7 JQ, certain portion of the remaining extent of portion 1, certain portion of the remaining extent of portion 2, certain portion of the remaining extent of portion 5, certain portion of 6, portions 11, 12 and 13 (portion of portion 2) and certain portion of the remaining extent of the farm Syferkuil 9 JQ, the remaining extent of portion 1, portion 2, portion 3 (a portion of portion 1), the remaining extent of the farm Middelkuil 8 JQ. The mining right will affect the following five (5) villages:

Mononono

Manamakgoteng

Legogolwe

Sefikile

Lesobeng

Cattle post

Description of the Scope of the Proposed Overall Activity.

The proposed activity will trigger the following listing activities, GNR 983 (Activity 13), GNR 983 (Activity 14), GNR 983 (Activity 24 (ii)), GNR 984 (Activity 9), GNR 984 (Activity 15), GNR 984 (Activity 17), GNR 984 (Activity 21), GNR 985 Activity 10 (f), GNR 985 (Activity 12 (a))GNR 178 Category B (Activity 10), GNR 178 Category B (Activity 11).

The proposed activities that Matai Mining is intending to undertake will include the excavation of an open cast mine. Datamine software was used to design the pit for the mine, to ensure that all waste within the ultimate pit can be accommodated throughout the life of Mine (LOM), a Waste Dump Design was completed. Apron Feeders will be utilised, as they deliver material at a uniform rate, which allows an optimal feeding to downstream equipment. Crushers will be used to reduce large rocks into smaller rocks, gravel, or rock dust. Conveyors will be used to transport material such as the ore and the overburden. It is assumed the water supply for the plant area will be obtained from the Municipal and other nearby water sources. The power supply will be supplied by Eskom. Gravel Surface roads will be constructed. For the purpose of administration, general buildings will be built. The Site Layout is presented in Figure 28.

Policy and legislative context

Several legislations and guidelines were used to compile this Scoping Report. However, there are not limited to the following;

Constitution of the Republic of South Africa, 1996 (Act 108 of 1996),

National Environmental Management Act (Act 107 of 1998) (NEMA). The Environmental Impact Assessment Regulation GNR. 982 dated 04 December 2014 as amended in April 2017,

Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002), Occupational Health and Safety Act (No. 85 of 1993), National Water Act (Act 36 of 1998) (NWA),

National Environmental Management Waste (No 59 of 2008) (NEM: WA),

National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004),

National Environmental Management: Biodiversity Act (No. 10 of 2004),

National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003 as amended), Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983) (CARA),

Restitution of Land Rights Act, 1994, Land Reform (Labour Tenants) Act, 1996 and the Extension of Security of Tenure Act, 1997,

National Heritage Resources Act (Act 25 of 1999),

Promotion of Access to Information Act, 2000 (Act 2 of 2000 as amended),

National Development Plan (NDP),

Bojanala Platinum District Municipality (BPDM) Integrated Development Plan (IDP) (2012/2017),

Moses Kotane Local Municipality (MKLM) Integrated Development Plan (IDP) (2016/17),

Environmental Management Frameworks (BPDM) and Environmental Management Frameworks (MKLM),

Spatial Development Framework (MKLM).

Need and Desirability of the Proposed Activities.

This Chapter focuses on the positive impacts that this proposed project will contribute to the communities and the country. Amongst other benefits, employment opportunities will be created, growth in the Gross Domestic Product (GDP), poverty alleviation and the minerals to be mined have a significate economic benefits to the industry.

Description of the process followed to reach the proposed preferred site.

The preferred activity is the mining of Vanadium, Titanium and Iron Ore and it will be extracted through open cast mining method. The selected site layout is represented in Figure 28, the selection was based on the position and of the mineral reserves to be exploited, land ownership, geo-hydrological impacts and the ease and available transport modes and routes. The ore will be mined from an open pit using excavators, bulldozers, trucks, bowl scraper and shovel. A tripper conveyor is proposed for the stacking method. The proposed technologies were based on their long-term success in terms of mining history, therefore no alternatives are indicated.

The operation aspects of the proposed mining involve the open cast mining, the processing plant, pollution control dams, workshops, material stockpiles, storage, excavations, access roads, diesel and wash bays. No feasible alternative operational aspect methods currently exist. The No-go option might be considered if the mining right application is rejected however, the applicant will lose the opportunity to utilise the reserves and the agricultural activity will continue.

Details of the public participation process followed

The Public Participation Process (PPP) was conducted to inform the Interested and Affected Parties (I&APs) of the proposed project and they were encouraged to be part of the process. I&APs will continuously be captured on a database. Public participation meeting was conducted in affected villages. The Background Information Documents (BIDs) were distributed, newspaper advertisement was placed in the Platinum Bushvelder and The Daily Sun both in English and Setswana and the site notices were placed at strategic places in all the affected villages. The Draft scoping report was distributed to all registered I&APs and state organs for review and comments. The I&APs will immediately be notified on the Competent Authority's decision about granting or rejecting the proposed project and they will be given the opportunity to appeal on the decision.

The Environmental Attributes Associated with the sites

Bakgatla-Ba- Kgafela Traditional Authority (BBKTA) is the traditional Authority that is responsible for the administrative tasks at a community level within the project area. The project is within Moses Kotane Local Municipality. Demographic profile of the affected area was assessed, which includes the population and growth trends, household size and composition, employment and income and health.

The biophysical environment that was discussed in the Chapter includes the Climate, Air quality, Noise, Blasting and Vibration, Traffic, Geology, Geohydrological setting, Topography, Soils, Heritage and Paleontology, Visual Baseline and Biodiversity. Specialist input was also incorporated into the description of the biophysical environment.

Description of Specific Environmental Features and Infrastructure on the site

This chapter discusses the present infrastructure that is available at the proposed mining area. The infrastructure includes the gravel roads, reservoirs, rails and water pipelines. The land uses were also highlighted which involves mining, rural communities, grazing areas and some portions of cultivated land.

IMPACTS IDENTIFIED

In this Chapter the anticipated impacts were assessed on a range of biophysical and socio-economic aspects of the environment. Impacts from the following environmental aspects were assessed and mitigation measures identified with specialist input. Impacts were grouped into construction phase, operational phase and decommissioning phase. Below are some of the identified impacts across all the phases

Air Quality

Emissions from the resuspension of loose material on the road surface. Vehicle-entrained dust emissions from the unpaved haul roads within the proposed Matai Mining Project mining area potentially represent the most significant source of fugitive dust for the mine. Sensitive receptors within a 10 km range of the Matai Mining Project open pit area include the residential areas of Sefikile, Mantserre, Mopyane, Mononono, Magong, Magalane, Kraaihoek and parts of Manamakhotheng. Proposed mitigation measures involve wet suppression and enforcement of 40km/hr vehicle speed

Terrestrial Ecology

The potential species that may occur within the project area were determined to be 66 in total. Of the 66 potential species, 11 were determined to be of conservation concern. Only two mammal species were confirmed on the site namely *Aepyceros melampus* (Impala) and *Canis mesomelas* (Black-backed Jackal). There were no mammal species of conservation concern identified within the project area. A total of 340 bird species is expected to occur within the project area; however, a total of 11 were considered to be of conservation concern. A total of 6 bird species was positively identified within the project area. No birds of conservation concern were identified within the project area. The desktop assessment identified 41 possible herpetofauna species within the project area. No herpetofauna of conservation concern was identified as occurring in the project area. There were no herpetofauna species identified during the field survey; however, there may be present. It is recommended that Matai implement buffer zones and avoid sensitive areas

Noise

Current noises sources is from easonal agricultural activities; traffic noise along the feeder roads; distant traffic noise from the abutting feeder roads; insects; birds and wind noise. During operation noise levels will increase as a result of processing plant, hauling of ore from the pit to the processing plant and conveyors. It is recommended that Matai service and maintain their mining equipment and vehicles on a regular basis and also to undertake monthly noise surveys for monitoring

Soil, Land Use and Land Capability Studies

Major impacts will comprise of the soil contamination from potential oil and fuel spillages, soil compaction resulting from heavy vehicles movement and soil erosion from vegetation clearance. It is recommended that Matai locate all soil stockpiles in areas where they will not have to be relocated prior to replacement for final rehabilitation, minimization of of the area to be occupied by mine infrastructure to as small as practicable

Groundwater

The mining activities and associated infrastructures are located on a well-developed (up to 100 mbgl) mafic and ultra-mafic rocks (Gabbro, Norite, Melanorite, Plagioclase, Olivine, Magnetite), laterally bounded in the south east by the acid rocks of the Pilanesberg outcrop.

Three dominants hydro-stratigraphic units (Alluvial deposits; Shallow weathered aquifer system; and Shallow and Deeper Localized fracture aquifer system) are found in the catchments

The depths to static groundwater level are up to 0.57 m below ground level. Such measured water levels are a function of the product of the combined saturated aquifers (weathered and fractured) thickness, the hydraulic conductivity (transmissivity) and effective aquifer recharge. This aquifer is unconfined to semi-confined and is recharged by rainfall. Literature review suggests that rock materials of the shallow weathered aquifer are of low permeability (0.05 to 5 m/d). The regional groundwater gradient is predominantly toward the Diphiri River (A24E) in the east, and the Bofule River in the west (A24D).

Potential impacts are groundwater contamination from oil and hydrocarbon spills, reduction of groudwater levels due to dewatering of pits during the operational phase and decanting which is likely to happeni during post closure The following mitigation measures are recommended; use of pollution control dams to prevent contaminated water seepage to the underground aquifers and monthly monitoring of the boreholes with regard to water levels and water quality

Surface Water

Considering the Water Resources of South Africa Manual WR2012 (WRC, 2012), the project area falls within the Limpopo Water management area (WMA) 1. Most of the project site falls within quaternary catchment A24E, lesser extent of the project site is located within the quaternary catchment A24D. The tributaries of the Brakspruit within the catchment A24E which drain through the MRA area east of the infrastructure footprint are the Sefahlane and the Lesobeng. These flow north from the Pilanesberg to a confluence, approximately 0.5 km south of the project area. On the west of the site within quaternary catchment A24D, is the Bofue river draining northwards. The mean annual precipitation determined for the site from the WRC2012 database is 579.8 mm. The following impacts are anticipated:sedimentation of watercourses due to exposing and loosening of soil as a result of vegetation clearing for the construction of infrastructure and pollution of watercourses due to hydrocarbon spillages;altered drainage paths and loss of catchment yield due to the construction of stormwater diversion berms;pollution of surrounding watercourses as a result of activities during the operational phase;

Heritage

The Phase I Archaeological and Cultural Heritage Impact Assessment for the proposed mining right of Vanadium, Titanium and Iron Ore has identified no significant impacts to archaeological or grave resources that will need to be mitigated prior construction. Despite that no archaeological objects were observed during the survey, and that the area is disturbed, the client is reminded that unavailability of archaeological material does not mean absentee, archaeological material might be hidden underground. It is thus the responsibility of the developer to notify contractors and workers about archaeological material (e.g., pottery, stone tools, remnants of stone-walling, graves, etc) and fossils that may be located underground. Furthermore, the client is reminded to take precautions during construction

Traffic

There is going to be an increase in traffic volumes on the mine and the surrounding feeder routes which might lead to an increase in road traffic accidents in the area and also traffic congestion. There are however plans to upgrade the access road to the proposed mine site to alleviate traffic congestion and measures to promote road safety have been recommended in the report

Socio-Economic

The district of Mankwe has been encountering challenges which range from economic, environmental, social and spatial challenges. At a regional scale, like other with various lagging municipalities, North West is faced with developmental challenges coupled with socio-economic problems such as unemployment, job creation, education, HIV prevalence, basic service delivery, inequality, poverty, economic growth, sectorial dependency and economic distribution. The introduction of the mine will create local employment and contribute to local economic development projects. Apart from positive contribution of the mine, there are also other negative impacts which comprise of grazing land, pressure on existing service delivery services in the area.

Methodology used in Determining the Significance of Environmental Impacts

The focus is on the methodology that is used to identify the significance of the impact. This was done by determining the extent and duration of the impact. The formula used is as follows;

Extent + Duration + Intensity= High/Medium/Low Impact

Advantages and disadvantages of open cast mining on the environment and community were compared with those of underground mining and the No- go option. The advantages of the layout, technology and operation alternatives were highlighted; presently no disadvantages and other alternatives were identified. The mitigation measures that could be applied were further discussed and their level of risk.

The Outcome of the Site Selection Matrix. Final Site Layout Plan

The selected site plan is represented in Figure 28.

Motivation where no alternative sites were considered

The proposed site was selected based on the presence of the minerals proposed to be mined, land ownership, Geo-hydrological impacts and the availability of transport modes and routes. If the Mining Right is not granted the only feasible alternative is the No go option.

Measures to avoid, reverse, mitigate, or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored

Measures to mitigate the identified impacts were provided and the extent of the residual risks which needs to be managed was determined with specialist input.

Environmental Management Plan (EMP)

An environmental management plan forms part of this EIA report and it addresses the management of environmental impacts identified in the EIA phase, the monitoring frequency, reporting frequency to DMR, responsible people with the implementation of the EMP at the mine, emergency plan and environmental awareness programmes and trainings.

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Appendix A : [SPECIALIST STUDIES]

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

ENVIRONMENTAL IMPACT ASSESSMENT 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 : **Matai Mining (Proprietary) Ltd**

Tel No : **+27 11 466 3966**

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Postal Address : **P.O Box 786163, Sandton, 2126**

Physical Address : **29 Impala Road, Chislehurston, Sandton, 2196**

File Reference Number Samrad : **NW 30/5/1/2/2/10147 MR**

IMPORTANT NOTICE

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

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 has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

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 ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

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

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

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

(c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

(d) determine the—-

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

(ii) degree to which these impacts—

(aa) can be reversed;

(bb) may cause irreplaceable loss of resources, and

(cc) can be avoided, managed or mitigated;

(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;

(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;

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

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

PART A

SCOPE OF ASSSSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1 INTRODUCTION AND BACKGROUND

Matai Mining is the holder of the prospecting right NW 30/5/1/1/2/11277 PR granted and issued in terms of Section 11(1) of the Mineral and Petroleum Resources Development Act 28 of 2002 as amended by Act 49 of 2008 ("MPRDA"). The primary right NW 30/5/1/1/2/2679 PR was originally granted to Rise Africa Mining and Exploration (Pty) Ltd on the 06 December 2011, which remained in force up until 05 December 2013. Rise Africa Mining and Exploration (Pty) Ltd applied in terms of section 102 of the MPRDA to amend the granted right to include iron ore and titanium, the application was granted on the 8th of September 2013. Rise Africa Mining and Exploration (Pty) Ltd applied for renewal of the right on the 18th of October 2013 and was granted on the 26th of August 2015, with reference number: NW 30/5/1/1/2/11277 PR. Rise Africa Mining and Exploration (Pty) Ltd applied for ministerial consent in terms of section 11 of the MPRDA of 2002, to cede the same right in favour of Matai Mining the consent was approved on the 3rd of November 2014. Matai Mining at the time owned by Yanbing Zhang -74% and Jayamma Zhang 26%. Matai Mining applied for ministerial consent in terms of section 11 of the MPRDA to have change in the shareholding by disposing all shares owned by Yangbing Zhang and transfer them to Camp Brave Limited; and consent was approved on the 09th of November 2015. Matai Mining hereby apply for a Mining right in terms of the Section 23 (a), (b) and (c) read together with regulation 11(1) (g) of the MPRDA (ACT 28 of 2002).

A scoping report was compiled as part of the first phase of a mining right application, submitted to the DMR Klerksdorp office and accepted on the 11th of January 2019. The applications for Environmental Authorisation, Waste Management License and Water Use License focuses only on the farm portions where mining operations and associated infrastructure will take place. The specialist studies that were done also focused on those portions.

2 CONTACT PERSON AND CORRESPONDENCE ADDRESS

2.1 *Details of the EAP*

Name of The Practitioner : Charles Chigurah

Tel No. : 011 312 9765

Fax No. : 011 312 9768

e-mail address : charles@kimopax.com

2.1.1 Expertise of the EAP. *(The qualifications of the EAP with evidence)*

Charles Chigurah holds an honours degree in Environmental Management from the Midlands State University in Zimbabwe. Postgraduate Diploma in Water Supply and Sanitation from the Institute of Water Supply, Sanitation and Development in Zimbabwe. He holds SAMTRAC and he is currently finalizing his NEBOSH International Diploma in Occupational Safety and Health. He is a Senior SHE Consultant and a member of International Association of Impact Assessors (IAIA), South African Council for Natural Scientific Professions (SACNASP). Charles is a member of Institute of Waste Management in Southern Africa (IWMSA) and he is registered with the South African Council for Project and Construction Management Professions (SACPCMP) as a Construction Health and Safety Manager (CHSM). He has more than 9 years working experience in the field of Construction, Waste Management, Environmental Management and Environmental Management Systems (EMS) Implementation and Auditing and has published a paper in Geographical Information Systems (GIS) and Remote Sensing. He has worked on a number of municipality projects and herewith is selected few completed projects:

a) Integrated Waste Management Plan for Nkonkobe Local Municipality

b) Integrated Waste Management Plan for Tokologo Local Municipality

c) Integrated Environmental Management Plan for Xhariep District Municipality

d) Environmental Management Framework for Amajuba District Municipality

e) Integrated Waste Management Plan for Tubatse-Fetakgomo Local Municipality

Apart from doing municipality projects, Charles has also managed more than fifty (50) Environmental Impact Assessment Projects both in Zimbabwe and South Africa. He has also worked as a Construction SHE Advisor and Consultant on a number of major construction projects across South Africa, among them include the construction of multi-storey buildings in Mpumalanga and Limpopo Provinces; the construction of gas pipelines for Sasol in Gauteng, the construction and upgrades of road networks in Limpopo Province as well the construction and upgrades of Bulk Water and Sewer Systems for

Ekurhuleni Metropolitan Municipality and was also a Safety Advisor for Eskom Hendrina Power Station responsible for managing sub-contractor's safety officers.

2.1.2 Summary of the EAP's past experience.

The EAP has experience in carrying out the following Mining Right Application projects:

a) Environmental Impact Assessment and Environmental Management Plan for Redwing Mine Gold Prospecting Project
b) Environmental Impact Assessment and Environmental Management Plan for Surrey Mine 24 Milling Project
c) Environmental Impact Assessment and Environmental Management Plan for Surrey Mine 24 Milling Project
d) Environmental Impact Assessment and Environmental Management Plan Coal Liquification Project
e) Environmental Impact Assessment for a Mining Right Application for Aerowind Properties in Thabazimbi, Limpopo Province
f) Environmental Impact Assessment for a Mining Right Application for Muhlava Mining in Tzaneen, Limpopo Province
g) Environmental Impact Assessment for a Mining Right Application for Ngwenya Mining in Hedielberg, Gauteng Province
h) Environmental Impact Assessment for a Mining Right Application for Woestalleen Colliery in Hendrina, Mpumalanga Province

2.2 *Description of The Property.*

Table 1 below gives a detailed description of the property

Table 1: Description of the property

Farm Name:	**North-West Province** Certain portion of Magazynskraal 3 JQ; Certain portion of Haakdoorn 6 LQ; Wildebeestkuil 7 JQ; Certain portion of the remaining extent of portion 1, certain portion of the remaining extent of portion 2, certain portion of the remaining extent of portion 5, certain portion of 6, portions 11, 12 and 13 (portion of portion 2) and certain portion of the remaining extent of the farm Syferkuil 9 JQ; and The remaining extent of portion 1, portion 2, portion 3 (a portion of portion 1), the remaining extent of the farm Middelkuil 8 JQ.
Application area (Ha)	9836.6652 hectares
Magisterial district:	Mankwe
Distance and direction from nearest town	It lies about 10km south from the closest town Northam, approximately, 80km north east of Rustenburg and 220km north west of Johannesburg, between the Pilanesberg Nature Reserve in the south (approx. 8km from the project), Pilanesberg Mines in the west (approx. 8km from the project) and Siyanda Resources Union Mine in the north (approx. 5km from the project).

21 digit Surveyor General Code for each farm portion	**Middelkuil 8JQ** Remaining Extent T0JQ00000000000800000 Portion 1 T0JQ00000000000800001 Portion 2 T0JQ00000000000800002 Portion 3 T0JQ00000000000800003 **Wildebeestkuil 7JQ** T0JQ00000000000700000 **Haakdoorn 6JQ** T0JQ00000000000600000 **Magazynskraal 3JQ** T0JQ00000000000300000 **Syferkuil 9JQ** Remaining Extent T0JQ00000000000900000 Portion 1 (RE) T0JQ00000000000900001 Portion 2 (RE) T0JQ00000000000900002 Portion 5 (RE) T0JQ00000000000900005 Portion 6 T0JQ00000000000900006 Portion 11 T0JQ00000000000900011 Portion 12 T0JQ00000000000900012 Portion 13 T0JQ00000000000900013

Land tenure and use of immediately adjacent land

The owners of the farm portions immediately adjacent to the Matai Mining site are listed in the Table 2 below. The adjacent land is mostly used for agricultural activities.

Table 2: Adjacent land owners of the site

Farm name	Portion number	Full names of owner	Title Deed Number	Contact details and address
Haakdoorn 6 JQ	Portion 6	National Government Republic of South Africa	T5990/1937BP	N/ I suggest you include the land affairs details
Wildebeestkuil 7 JQ	Portion 7	No Information available	-	
Magazynskraal 3 JQ	Full Farm	National Government Republic of South Africa	T34032/1946BP	N/A
Syferkuil 9 JQ	Portion 0	S A Native Trust	T5780/1937BP	N/A
	Portion 1	Republic of Bophuthatswana	T6932/1937BP	N/A
			T454/1979BP	
			T6933/1937BP	
			T455/1979BP	

Farm name	Portion number	Full names of owner	Title Deed Number	Contact details and address
	Portion 2	SA Native Trust	T5780/1937BP	N/A
		Evraz Highveld Steel & Vanadium Ltd	-	
	Portion 12	No Information available	-	
Middelkuil 8 JQ	Portion 1	National Government of the Republic of South Africa	T27247/1954BP	N/A
		Bakgatla-Ba-Kgafela Tribe	T28/1988BP	
		Republic of Bophuthatswana		
		Bakgatla-Ba-Ga Kgafela Stam		
	Portion 2	Nomaele Moses Ramphotho	T9287/1969BP	N/A
	Portion 0 (RE)	South African Native Trust	T18759/1937BP	

Farm name	Portion number	Full names of owner	Title Deed Number	Contact details and address
		National Government of the Republic of South Africa	T3712/1972BP	
		National Government of the Republic of South Africa	T71853/2009	
	Portion 8	No Information available		

2.3 *Locality map*

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

The locality of the proposed Matai Mining area is presented in Figure 1 below. The map shows the the farm portions on which the proposed activity will take place as well as the adjacent farm portions that may be affected by mining activities. The Matai Mining Project is located in the Moses Kotane Municipality, Bojanala Platinum District Municipality, North West Province, South Africa. It lies about 10km south from the closest town Northam, approximately, 80km north east of Rustenburg and 220km north west of Johannesburg, between the Pilanesberg Nature Reserve in the south (approx. 8km from the project), Pilanesberg Mines in the west (approx. 8km from the project) and Siyanda Resources Union Mine in the north (approx. 5km from the project). The project is approximately centred on Geographic coordinates Latitude 25° 00′ 00” S, Longitude 27° 10′ 00” E.

2.3.1 Magisterial District and Relevant local Authority

Study area is located in Mankwe Magestrial District in the Moses Kotane Local Municipality. Moses Kotane Local Municipality falls under Bojanala Platimun District Municipality of North West Province

2.3.2 Landowners and use of Immediately Adjacent Land

Landuses within the study area and its surrounds is made up of agricultural land and which involves cattle grazing, and small scale communal crop farming

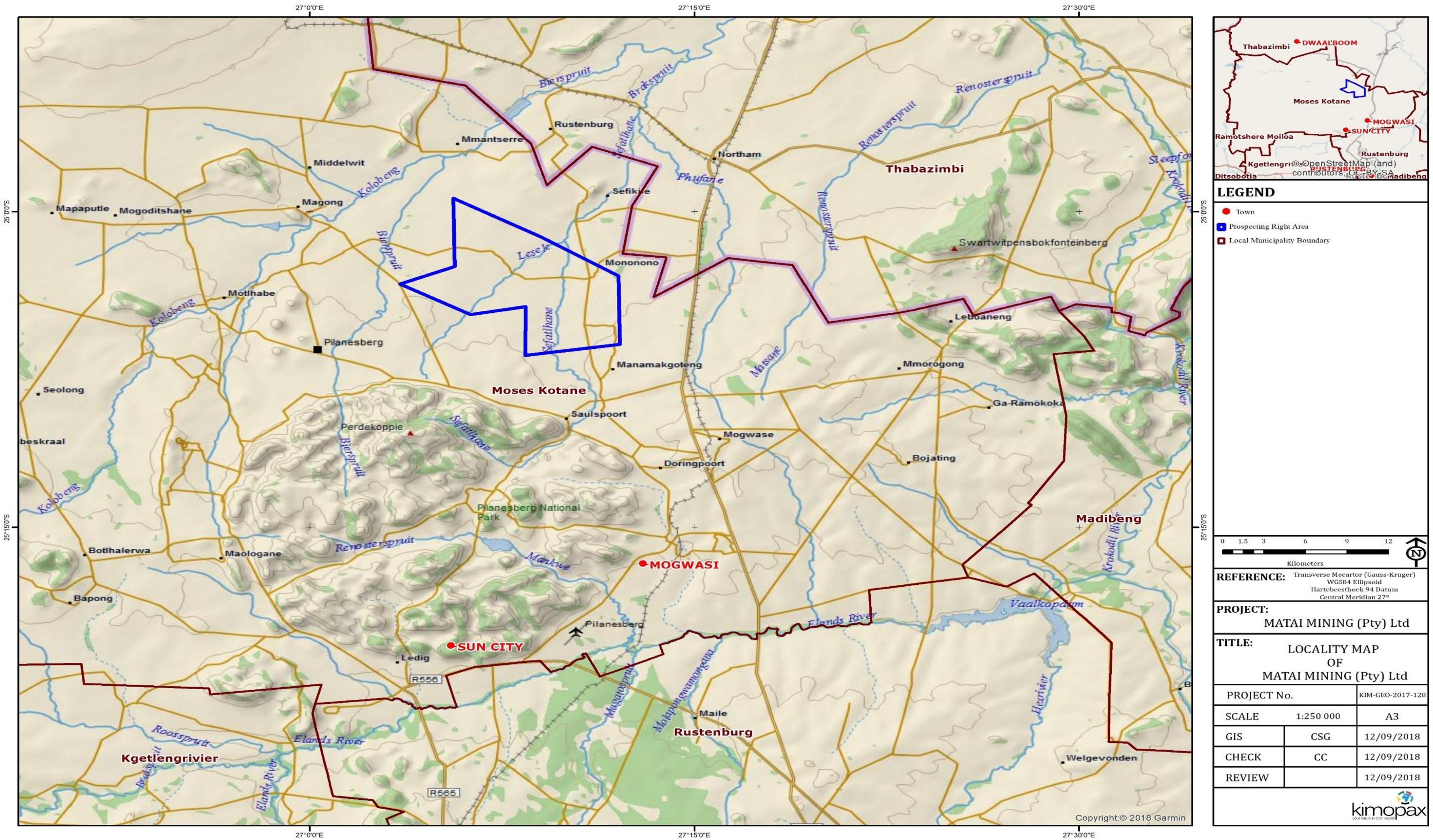

Figure 1: Location of Matai Mining Right Application Area

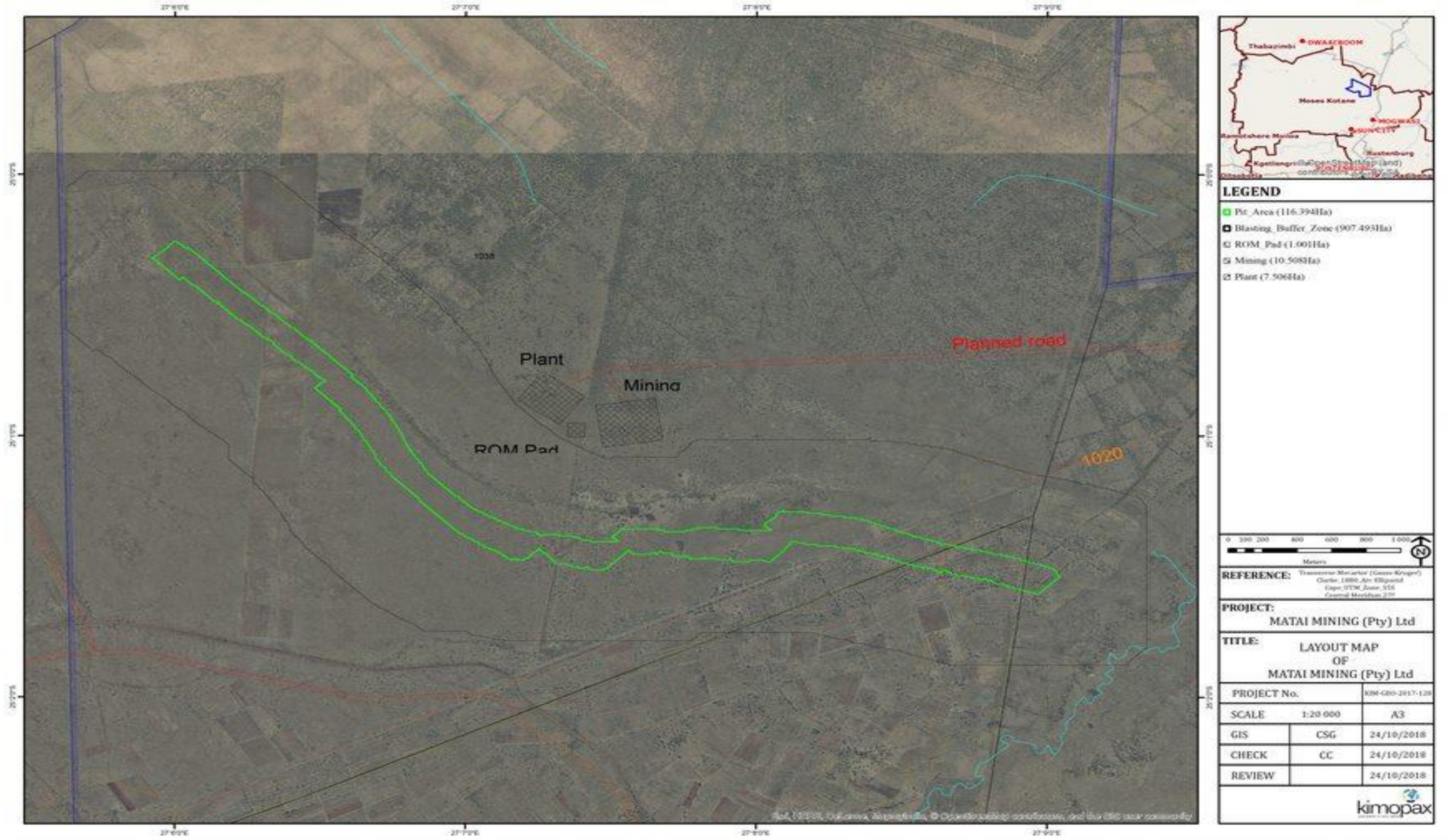

Figure 2: Locality of Matai Mine Infrastracture Area

3 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)

3.1 *Matai Mining Operation*

An open cast mining will be carried out through systematic formation of benches by drilling and blasting. All mining blocks will be mined by means of conventional open pit mining method. Mining will be at an average stripping ratio of 3: 1. Topsoil and overburden from the initial mining block will be stockpiled at the positions to be determined by Matai

Opencast mining will take place through series of drill and blast, supported by conventional truck and shovel operation, assisted by roll-over dozing, to allow for continuous backfilling and rehabilitation of the mined out area. The final void will be backfilled with the overburden from the initial mined block. Rehabilitation and final closure will be as specified in the EMPR to the DMR. The annual run-of-mine (ROM) production rate is estimated at 1.8 Mtpa, peaking to 2.4Mtpa. Mining will take place on a 2 shift, 6-day week basis, for which the required authorization will be applied for.

3.2 *Listed and specified activities*

a) **Conveyors**

The conveyor profiles were determined from the plant layout. Good engineering practice and industry accepted standards were used to calculate the conveyor widths and speeds for the various capacities. The conveyors include drives, idlers, pulleys, belting, take-ups, cleaners, steelwork, walkways, guards, and foundations.

b) **Stockpile stacking and reclaiming**

Various methods exist for stacking and extracting material from the stockpile, each with its' own advantages and disadvantages. In the effort to reduce the capital, a tripper conveyor is proposed for the stacking method. The mechanical components cost is essentially equivalent as for a conventional conveyor. Additional steel and civil work are required to extend the conveyor over the stockpile.

Bottom extraction was selected as the reclaim method of the stockpile. A tunnel underneath the stockpile houses a travelling rotary plough feeder and a conveyor. The capital required for this method is less than a conventional bucket or drum re-claimer, but more civil work is required due the construction of the tunnel. Due to the size of the operation, a small stacker/ re-claimer might be a viable alternative solution and should be investigated further.

c) **Water supply**

It is assumed that sufficient make-up water will be supplied to the perimeter of the plant area, either from municipal supply or other nearby water sources. Holding and settling dams are required to contain the water for water distribution.

d) **Power Supply**

It is assumed that sufficient power will be supplied at the perimeter of the plant area. The onsite power distribution will be done from the incoming substation through step-down transformers and via electrical reticulation to the various plant MCC's. Provision is included for a backup generator.

e) **Access and Plant Roads**

Secure access and fencing were included for the plant area, with access control via a single gate with guard houses and booms. 8m wide with 4m wide lanes were provided dual purpose roads and working areas within the main plant area. These will be as gravel surfaced roads. The final layer (wearing course) will comprise a suitable gravel material for plant type roads.

f) **General Buildings**

General buildings will be built for the plant and general administration sections. All visitors and employees of the mine will need to report to the security clearance area in the administration complex on arrival at the mine. Public buses and cars have access to the bus terminus and visitor parking areas respectively. All other access will be controlled by the security guard station with access control booms.

There will be a training section and clinic adjacent to the security offices for induction and training purposes, including emergency medical response. Once personnel or visitors have passed through security, they have immediate access to the plant change house facility or canteen. Personnel on lunch break or returning from their shift again have access to the canteen or change house facility before passing back through the security gates and returning home.

The plant and administrative offices are located across the road from the change house and canteen, with the possibility of direct road access via one of the gate-controlled access points with authorised plant vehicles. The road passes in front of the plant offices (with dedicated parking adjacent to the office building), continues first to the plant services area, and then to the various plant operational areas.

The plant services area contains the plant stores, capital spares yard/ laydown area and plant workshop (mechanical and electrical). All brick buildings are single-storey semi face brick buildings, with inverted box rib (“IBR”) galvanized roof sheeting. Internal walls are plastered and painted. All floors are tiled or covered with raised computer flooring.

Figure 3: Surface mine layout

Table 3: Listed and specified activities.

APPLICABLE LISTING NOTICE ***(GNR 544, GNR 545 or GNR 546)/Not Listed)***	**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, storm water control, berms, roads, pipelines, power lines, conveyors, etc...etc...etc.)***	**LISTED ACTIVITY** ***(Mark with an X where applicable or affected.)***
GNR 983 Activity 24 (ii)	**Planned road** "The development of- (ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;	X
GNR 983 Activity 13	**Storage** "The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic metres or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014".	X

APPLICABLE LISTING NOTICE ***(GNR 544, GNR 545 or GNR 546)/Not Listed)***	**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, storm water control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.)***	**LISTED ACTIVITY** ***(Mark with an X where applicable or affected.)***
GNR 983 Activity 14	**Hazardous Storage** "The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres".	
GNR 984 Activity 9	**Powerline** "The development of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex".	X
GNR 984	**Excavations**	X

APPLICABLE LISTING NOTICE ***(GNR 544, GNR 545 or GNR 546)/Not Listed)***	**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, storm water control, berms, roads, pipelines, power lines, conveyors, etc...etc...etc.)***	**LISTED ACTIVITY** ***(Mark with an X where applicable or affected.)***
Activity 15	"The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- The undertaking of a linear activity; or Maintenance purpose undertaken in accordance with a maintenance".	
GNR 984 Activity 17	**Processing plant** **"**Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) including-	X

APPLICABLE LISTING NOTICE ***(GNR 544, GNR 545 or GNR 546)/Not Listed)***	**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, storm water control, berms, roads, pipelines, power lines, conveyors, etc...etc...etc.)***	**LISTED ACTIVITY** ***(Mark with an X where applicable or affected.)***
	Associated infrastructure, structures and earthworks directly related to the extraction of a mineral resource; or…”	
GNR 984 Activity 21	**Processing plant** “Any activity including the operation of that activity associated with the primary processing of a mineral resource including winning, reduction, extraction, classifying, concentrating, crushing, screening and washing but excluding the smelting, beneficiation, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies**.”**	X
GNR 985 Activity 10 (f)	**Storage**	X

APPLICABLE LISTING NOTICE ***(GNR 544, GNR 545 or GNR 546)/Not Listed)***	**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, storm water control, berms, roads, pipelines, power lines, conveyors, etc...etc...etc.)***	**LISTED ACTIVITY** ***(Mark with an X where applicable or affected.)***
	"The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres".	
GNR 985 Activity 12 (a)	**Excavations** "The clearance of an area of 300 square metres or more indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan".	X
LISTED ACTIVITIES IN TERMS OF THE WASTE ACT		
GNR 178	**Processing plant**	X

APPLICABLE LISTING NOTICE ***(GNR 544, GNR 545 or GNR 546)/Not Listed)***	**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, storm water control, berms, roads, pipelines, power lines, conveyors, etc...etc...etc.)***	**LISTED ACTIVITY** ***(Mark with an X where applicable or affected.)***
Category B Activity 10	"Construction of facilities and associated structures and infrastructure (the construction of a facility for a waste management activity listed in Category B of this Schedule not in isolation waste management)".	
GNR 178 Category B Activity 11	**Stockpiles** "Residue stockpiles or residue deposits (the establishment or reclamation of a residue stockpile or residue deposit resulting from activity which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)".	X

3.3 *Description of The Activities to Be Undertaken*

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

3.3.1 Activities to be undertaken by Matai Mining (Pty) Ltd

Matai Mining is applying for a mining right on the farms, certain portion of farm Magazynskraal 3 JQ, certain portion of farm Haakdoorn 6 JQ, the farm Wildebeestkuil 7 JQ, certain portion of the remaining extent of portion 1, certain portion of the remaining extent of portion 2, certain portion of the remaining extent of portion 5, certain portion of 6, portions 11, 12 and 13 (portion of portion 2) and certain portion of the remaining extent of the farm Syferkuil 9 JQ, the remaining extent of portion 1, portion 2, portion 3 (a portion of portion 1), the remaining extent of the farm Middelkuil 8 JQ.

3.3.2 Mining Method

3.3.2.1 Stripping and Stockpiling of Topsoil

The project will entail excavation of an open cast during mining of the identified minerals. The proposed mining method commences with a box cut. Opencast mining is also known as an open-pit mining, open-cut mining, and strip mining, which basically refers to a method of extracting rock or minerals from the earth by removing the material from an open-pit. This activity will result in the transformation of the proposed site to mining use. The proposed site will be cleared off vegetation, followed by the removal of topsoil and the blasted overburden material. Mining will be at an average stripping ratio of 3: 1. Topsoil and overburden from the initial mining block will be stockpiled.

3.3.2.2 Excavation, Loading and Transport

The mining method applied will be a conventional open pit mining method where the scheduling unit (production block) is drilled, charged, blasted and loaded by excavators and hauled with dump trucks to the respective destinations. The drill and blast methodology for the project should minimise the impact on surrounding infrastructure and communities and achieve an appropriate fragmentation to minimise the re-handling of large boulders at the tip area. The drill and blast activity will be done by contractors. The base of the pit will be designed to accommodate a minimum mining width of 20m to ensure efficient manoeuvrability of the loading equipment in conjunction with the trucks. The average pit width and length will be approximately 400m and 250m respectively with a depth of 110m as illustrated in Figure 4 below.

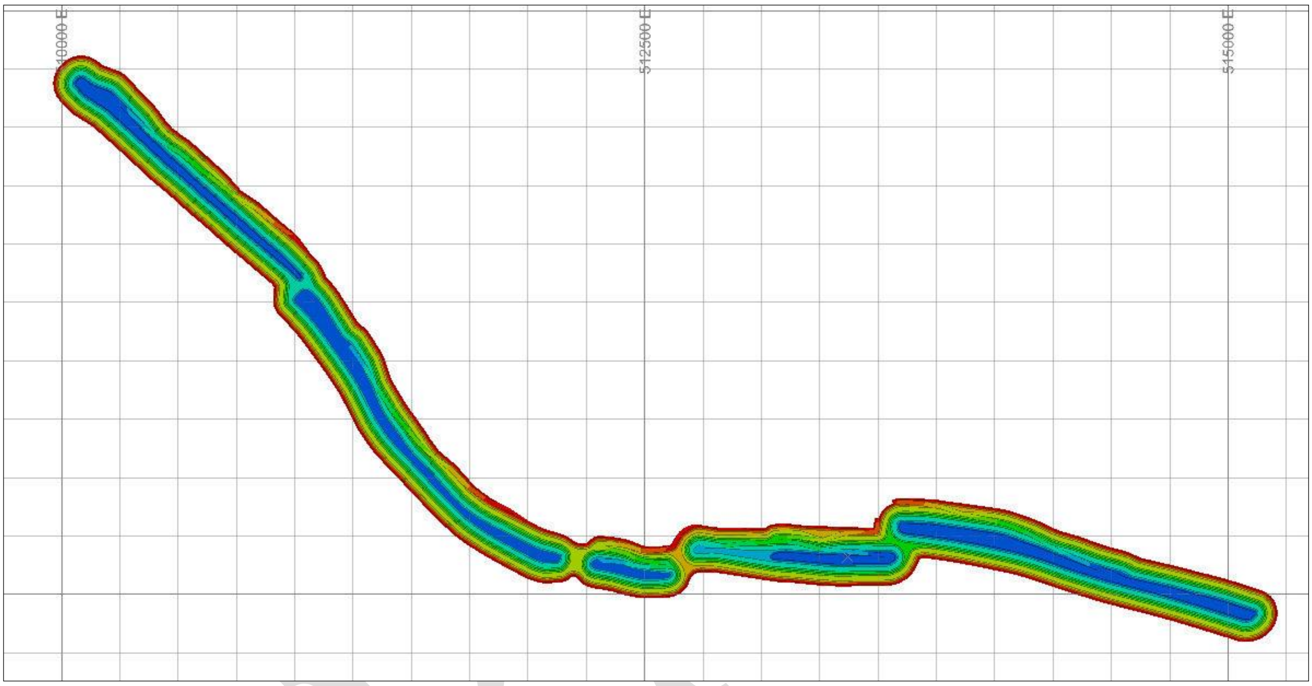

Figure 4: Plan view of pit design

3.3.2.3 Waste Dump and Overburden

The waste dump will be designed to ensure that all the waste within the ultimate pit limit can be accommodated throughout the life of the operation. The dumps will have a lift height of 10m, a 35° face angle and a step-back of 10m between benches.

Table 4: Waste dump design

Bench Height	10
Face Angle	35
Safety Berm	10

Number Benches	3
Base Length	1,000
Base Width	700

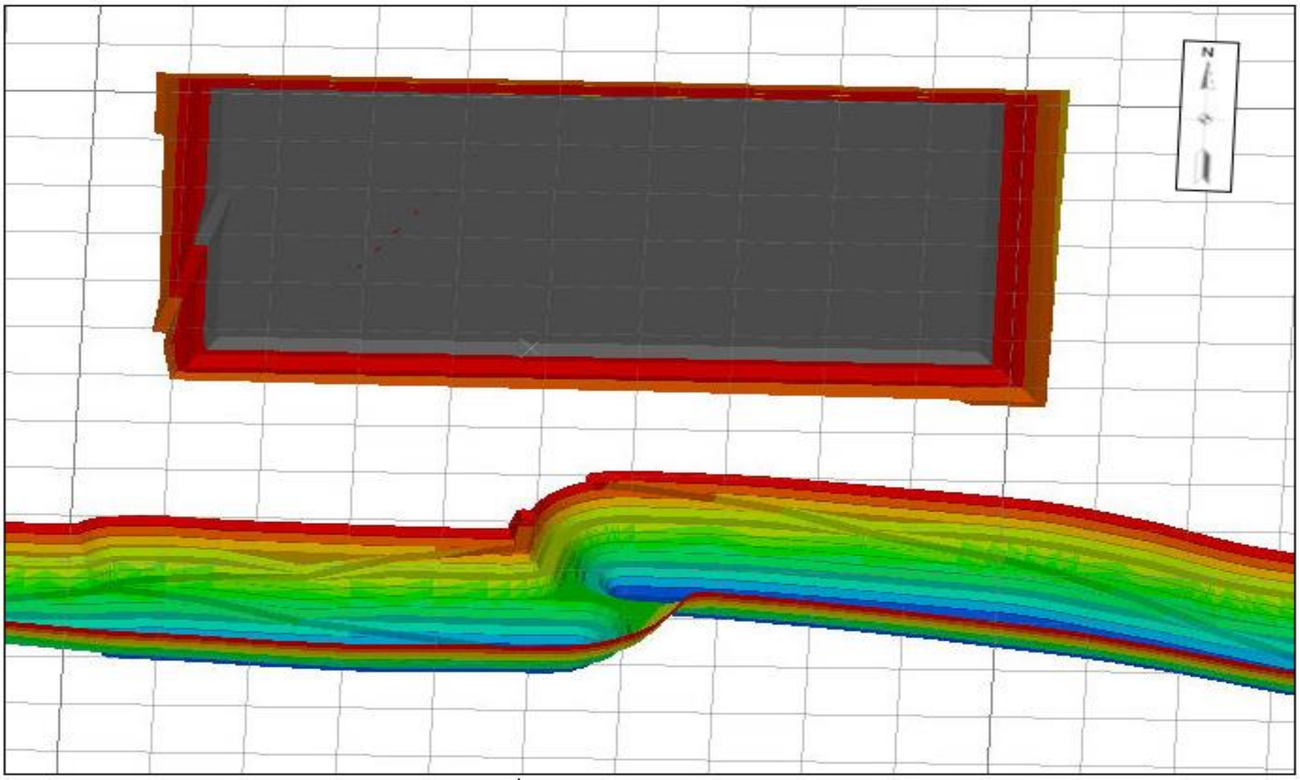

Figure 5: Isometric view of the pit and waste dump

3.3.2.4 Backfilling the Opencast Voids

A rollover mining technique will be practised, in such a case the topsoil and overburden from the initial cut of the opencast mine are stockpiled at the position of the final cut. As the opencast mine progresses, the overburden and topsoil from each successive cut will be backfilled into the void from the previous cut, the surface will then have shaped to be free from draining, topsoil will be analysed and treated appropriately, and the surface will be fertilised and revegetated with locally indigenous species of grass, shrubs and trees

3.3.2.5 Ore Processing

Based on the requirement for a 2 mtpa ROM feed and a simple lumpy DSO product without beneficiation, it is assumed that a typical iron ore ROM feed size distribution and a simulated a three-stage crushing, and screening circuit is viable as defined in the attached block flow.

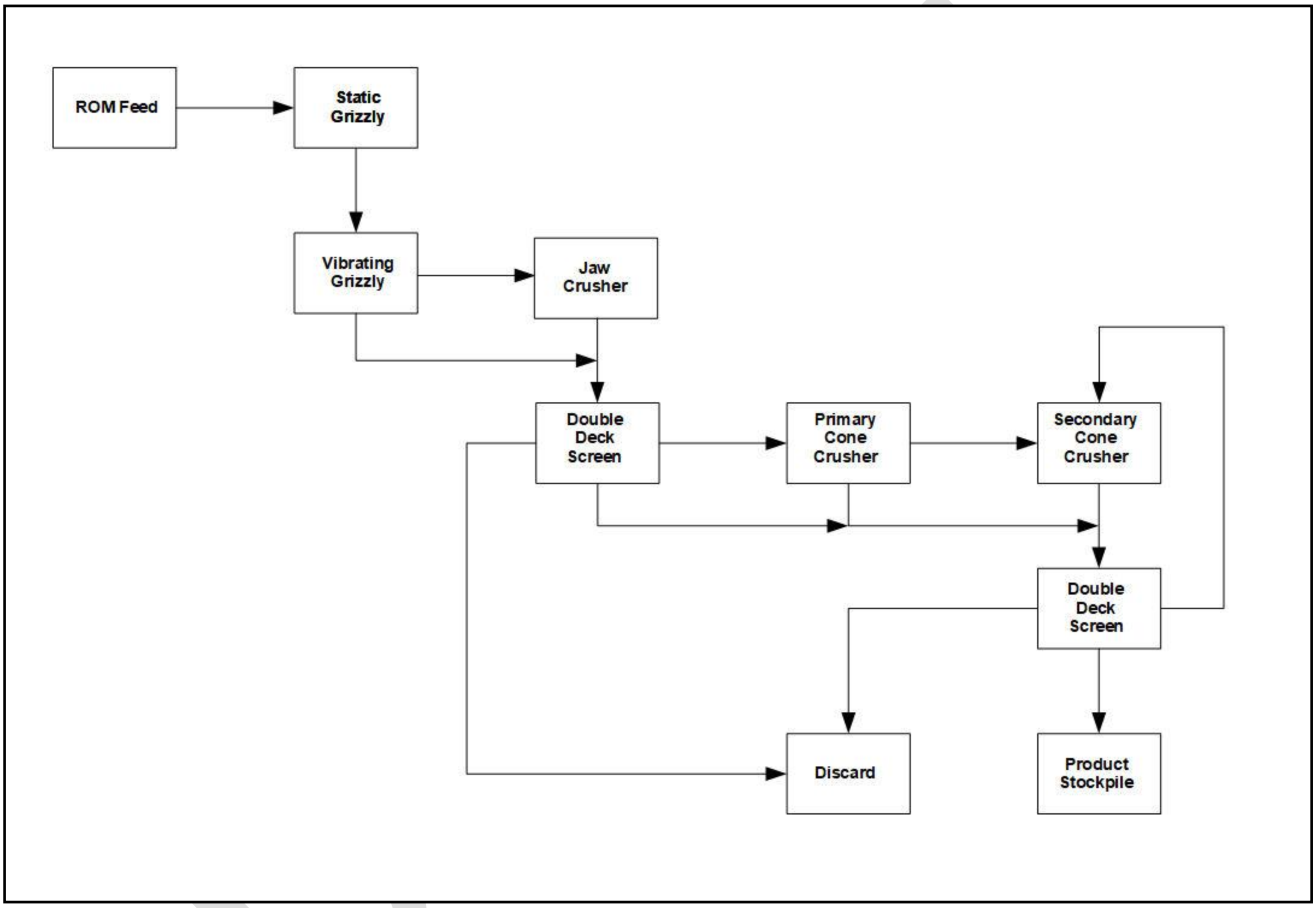

Figure 6: Ore processing flowchart

The ROM feed of 517tph includes about 40.6tph of -6 mm material and after three stages of crushing a further 59.6tph of -6 mm material is generated. The lumpy product of -32mm and +6mm amounts to an estimated 416.8 tph or 80.6% of ROM feed. The flow chart presented in Figure 6 above will be confirmed through additional crushing test work.

3.3.2.6 Crushing and Stockpiling

From the stockpile, ore will be recovered using FELs. The ore will be fed onto a scalping screen to remove undersize material prior to tertiary crushing. The screen oversize will feed into a bin from which the feed to the tertiary crusher will be controlled. The crusher product will be recycled back to the scalping screen. The screen undersize will be 32mm. A flopper gate system will be installed on the screen undersize. The flopper gate will be used to direct the ore to a direct shipping ore stockpile or a beneficiation feed stockpile using radial stackers

3.3.2.7 Product Handling

The Direct Shipping Ore (DSO) will be combined with the product of the dense medium circuit and then screened at 6mm into a lump (-32mm +6mm) and fines (-6mm) fraction. The lump fraction will be stockpiled using a radial stacker. The concentrate from the spiral circuit will be combined with the fines fraction and stockpiled using a radial stacker

3.3.2.8 Water Recovery

The magnetic separator effluent and cyclone overflow from the spiral circuit will be fed to the thickener. With the aid of flocculent, a high density underflow will be produced and clear water will be recycled to the process water tank for re-use in the plant

3.3.2.9 Product and Run of Mine

The ROM will be stockpiled on a ROM stockpile in close proximity to the ROM Primary crusher to be used for blending purposes and to eliminate production fluctuations. The product stockpile will be located at the plant and will consist of a Lump stockpile and a Fines stockpile

4 Policy and Legislative Context

Table 5: 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**
The Constitution of the Republic of South Africa, 1996 (Act 108 of 1996).	The Bill of Rights, in the Constitution of South Africa (No. 108 of 1996), Section 24 states that everyone has a right to an environment that is not harmful to health and wellbeing and requires that reasonable measures are applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development. These principles are embraced in NEMA and given further expression. The development will ensure that as little damage

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**
	as possible will be left on the surrounding environment and local community. This report is drafted to ensure compliance to this piece of legislation.
National Environmental Management Act (Act 107 of 1998) (NEMA). The Environmental Impact Assessment Regulation GNR. 982 dated 04 December 2014 as amended in April 2017.	The National Environmental Management Act (Act 107 of 1998 as amended on the 8th of December 2014) (NEMA) and the Regulations and associated listed activities identified under Regulations 982, 983, 984 and 985, is the key national legislation underpinning environmental Authorisations in South Africa.

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**
	NEMA requires that environmental authorisation is obtained for any development activity prior to its commencement. The Act requires that all environmental impacts (including social impacts) due because of the development are assessed and where possible, minimised or mitigated. NEMA and associated regulations are directly relevant to this authorisation Application
Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002)	Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) including-

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**
	Associated infrastructure, structures and earthworks directly related to the extraction of a mineral resource including activities for which an exemption has been issued in terms of section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
Occupational Health and Safety Act (No. 85 of 1993)	The employer needs to manage his/her staff and crew in strict accordance with the Occupational Health and Safety Act in order to prevent injuries to the staff.
National Water Act (Act 36 of 1998) (NWA).	In terms of Chapter 4 of the NWA, activities and processes associated with the proposed mine and associated infrastructure, are required to be

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**
	licensed by the Department of Water and Sanitation (DWS). The National Water Act, 1998 (Act No. 36 of 1998) (NWA) is primary legislation regulating both the use of water and the pollution of water resources. An Integrated Water Use Licence Application (IWULA) will be lodged with the DWS in terms of Section 21 of the NWA, which lists several waters use requiring authorisation. Matai Mining's proposed mining operations involves the following water uses: under section 21: a) taking water from a water resource; c) impeding or diverting the flow of water in a watercourse; disposing of waste in a manner which may detrimentally impact on a water resource; f)

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**
	discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit; g) disposing of waste in a manner which may detrimentally impact on a water resource i) altering the bed, banks, course or characteristics of a watercourse; and j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.
National Environmental Management Waste (No 59 of 2008) (NEM: WA).	In terms of section 18, Schedule 3 of the National Environmental Management: Waste Amendment Act, 2014 (Act No. 26 of 2014) (NEMWAA), by default the mining residues are classified as hazardous wastes. According to the Regulations GN R.632 and R.633, that was

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
	inaugurated on the 24 of July 2015, the mining residues must be characterised and classified, and the design and management of residue stockpiles and deposits must be based on an assessment of the potential impacts and risks.
National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).	The objectives of the Act are to reform the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres

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**
	of government; for specific air quality measures; and for matters incidental thereto.
National Environmental Management: Biodiversity Act (No. 10 of 2004).	The Act identifies that all people and organizations should act with due care to conserve and avoid negative impacts on biodiversity, and to use biological resources sustainably, equitably and efficiently. Biodiversity is defined to include "the number and variety of living organisms on earth, the millions of plants, animals, and microorganisms, the genes they contain, the evolutionary history and potential they encompass, and the ecosystems, ecological processes and landscapes of which they are integral parts.

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**
	Biodiversity thus refers to the life-support systems and natural resources upon which we depend". The National Environmental Management: Biodiversity Act provides for: The sustainable usage of resources, the fair and equitable sharing benefits arising from the use and application of genetic resources and material and the management and conservation of the biological diversity of South Africa.

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**
National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003 as amended)	To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes.
Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983) (CARA)	CARA provides for control over the utilization of the natural agricultural resources of the Republic of South Africa to promote the conservation of soil, water sources and vegetation and the combating of weeds and invader plants.
Restitution of Land Rights Act, 1994,	Department of land affairs confirmed that there are no existing claims on the affected properties.

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**
Land Reform (Labour Tenants) Act, 1996 and the Extension of Security of Tenure Act, 1997	
National Heritage Resources Act (Act 25 of 1999).	The National Heritage Resources Act requires all developers (including mines) to undertake cultural heritage studies for any development exceeding 0.5 ha. It also provides guidelines for impact assessment studies to be undertaken where cultural resources may be disturbed by development activities.

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**
	The document will be approved by The South African Heritage Resources Agency (SAHRA) as part of the impact assessment process.
Promotion of Access to Information Act, 2000 (Act 2 of 2000 as amended)	To give effect to the constitutional right of access to any information held by the State and an information that is held by another person and that is required for the exercise or protection of any rights.
National Development Plan (NDP)	The Province of North-West published its latest Provincial Development Plan (PDP) in 2016. This document is aimed at interventions to eliminate poverty and social inequality by 2030.

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**
Bojanala Platinum District Municipality (BPDM) Integrated Development Plan (IDP) (2012/2017	To ensure a better life for all communities through local economic development and job creation.
Moses Kotane Local Municipality (MKLM) Integrated Development Plan (IDP) (2016/17)	Its strategy to address the main causes of unemployment and poor economic development must focus on a number of sectors, amongst the few mentioned is the mining sector.
Environmental Management Frameworks (BPDM) and Environmental Management Frameworks (MKLM)	The MKLM and BPDK EMF share the common goal of balancing economic development, social development and environmental resource management.

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
Spatial Development Framework (MKLM)	To ensure sustainable Spatial Development with integrated human settlement.

Please note, the applicable legislations and guidelines are not only limited to the above mentioned.

5 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).

The mining project forms part of a larger scheme for the alleviation of poverty within the local municipality, which will not only improve the living standards for several previously disadvantaged communities, but also potentially allow for the future development of this area.

The project will provide positive impacts in the form of employment opportunities and skills development, skills transfer and ultimately resulting to Gross Domestic Product (GDP) growth, therefore eradicating poverty in such a case stimulating Local Economic Development. Not only that, the business opportunities will be encouraged through infrastructural development such as roads which will be constructed and improved to access the mining area, this will assist in increasing the demand for goods and services in the affected area/s in a long term. According to the outcomes of the IDP Moses Kotane (2016 -2021), community consultation meetings conducted, the main issue that was raised was the need for Local Economic Development, with unemployment as the main concern highlighted in all the different wards within the local Municipality. In the strive to poverty alleviation, the municipality greatly consider employment generation as a required tool and might be achieved through developments similar to the proposed mining project.

Since the local labour from adjacent farm communities such as Manamakgotheng, Legogolwe, Lesobeng, Mononono and Sefikile will be employed by the mine. This will have a positive impact on the wellbeing of employees with a multiplier effect on households of the employed. Moreover, the development will encourage development of Black Economic Empowerment (BEE) opportunities during construction, operation and eventual closure and rehabilitation

a) The economic use of the products that will be mined are discussed below:**Vanadium**

b) One of the most important industrial uses of vanadium is in the making of steel alloys. Vanadium steel uses the strength, toughness and anti-corrosive properties that vanadium adds to it. This steel (ferrovanadium) is used to make special tools and equipment. The equipment is used in cars for gears, crank shafts, pipes and tubes in the chemical industry (ScienceStruck, 2018).**Iron Ore**

c) Iron is primarily used to make steel which is used in the manufacturing of automobiles, locomotives, ships, beams used in buildings, furniture, paper clips, tools, reinforcing rods for concrete, bicycles etc, therefore the need of Iron mining remains high and can only be fulfilled through mining of ore. **Titanium**

Moreover, due to titanium's low density and ability to withstand extreme temperatures it is used as an alloying agent with many metals including aluminium, molybdenum and iron. It is mainly used in aircraft, spacecraft, missiles, watches and laptop computers.

5.1 *Period for which environmental authorisation is required*

Authorisation is required for a period of the Life of Mine which is 30 years

5.2 *Process followed to reach preferred site*

Mining can take place only within the area for which a mining right is obtained and no alternative site for mining is possible. Several alternative sites and layouts for the supporting infrastructure are possible and were explored in detail in section 6 below, taking into consideration economic viability, practicality and environmental characteristics.

6 MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE INCLUDING A FULL DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE

PROPOSED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE.

6.1 *Details of The Development Footprint 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.

The intension of identifying alternatives in the Matai proposed project is to provide a basis for choice among other options available. It should be noted that the examination of these alternatives will allow for the incorporation of more practical, feasible, relevant, reasonable, technologically and the least environmentally impacting options available, and reducing or avoiding potentially significant negative impacts at the same time meeting the need and purpose of the proposed projects.

As per the Department of Environmental Affairs (DEA) Criteria for Determining Alternatives in EIA Guideline (2004), the types or categories of alternatives, including:

6.2 *Activity Alternative*

The proposed and preferred option to mine Vanadium, Titanium and Iron ore is thus far, the most preferred activity owing to the presence of these minerals within the proposed site. The mining opportunity will by far economically and socially empower and uplift the local communities. The land is presently utilised for agricultural purpose including grazing activities.

Furthermore, opencast mining method is the preferred option in comparison to underground mining. This is due to the shallow nature of Iron Ore, Vanadium and Titanium deposit that can easily be mined by means of opencast mining. Underground mining has a greater safety risk to the miners as compared to the open cast mining method. Underground mining method may be considered in future when the commodity priced get favourable and near surface resources are depleted.

6.3 *Layout Alternative*

The design or layout of the activity entails the consideration of the different options to place project mine. The site was selected based on the geographic location of the potentially underling required mineral reserves. The layout of the site was however selected based on considerations made for the surrounding environment where possible, ease of operations and mining activities on site as well as minimal disturbance to the community near the site. The site/land area for run of activity was selected based on the size (according to the geology of the area), and position and of the mineral reserves to be exploited. The preferred layout was more considered more importantly owing to the availability of the Vanadium, Titanium and Iron Ore minerals, the land ownership, the geo-hydrological impacts and the ease and available transport modes and routes therefore the proposed layout is therefore the most suitable and economically/environmental viable option for the open pit mining.

6.4 *The technology alternative*

The project will entail excavation of an open cast during mining of the identified minerals. Mining will be performed with the use of bulldozers, trucks, bowl scraper and shovel. Gyratory crushers are normally used in high capacity iron ore primary crushing applications as they are beneficial in cost and operation when the capacities are higher than what a single jaw crusher can handle, the civil and structural work becomes too expensive for lower capacities. The conveyor profiles were determined from the plant layout. Good engineering practice and industry accepted standards were used to calculate the conveyor widths and speeds for the various capacities. The conveyors include drives, idlers, pulleys, belting, take-ups, cleaners, steelwork, walkways, guards, and foundations. A tripper conveyor is proposed for the stacking method.

In terms of the technologies proposed, these have been chosen based on their long-term success in terms of mining history, therefore no alternatives are indicated.

6.5 *Operation aspects of the activity*

The operations of the proposed mining involve the open cast mining, the processing plant, pollution control dams, workshops, material stockpiles, storage, excavations, access roads diesel, and wash bays. No feasible alternative operational aspect methods currently exist.

6.6 *The option of not implementing the activity.*

Should the mining right application be rejected, there will be a significant loss to valuable information regarding the mineral status present on these properties. In addition to this, should economical reserves be present, and the applicant does not have the opportunity to mine, the opportunity to utilize these reserves for future phases will be lost and the limited agricultural activities currently undertaken will continue.

7 DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED.

According to Section (2)(4)(f) and (o) of the NEMA:

a) The participation of all interested and affected parties (I&APs) in environmental governance must be promoted and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured, and
b) The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage.

7.1 *Approach*

The Public Participation Process (PPP) is a vital component of EIA, and it is a regulatory requirement for an environmental authorisation process. It is conducted in terms of Regulations 39 to 44 of the Environmental Impact Assessment (EIA) Regulations GN R.982 (December 2014). PPP is intended to ensure a joint effort of the Interested and affected parties, the stakeholders, technical specialists, the authorities and the proponent/developer who work together to produce better decisions than if they had acted independently. The Scoping Phase enables the I&AP to raise issues of concern and suggestions for enhanced benefits to ensure that their issues have been considered; and assists in identifying reasonable alternatives; allows for comment on the plan of the specialist studies to be undertaken during the impact assessment phase and most importantly allows for the I&APs to contribute relevant local information and traditional knowledge to the environmental assessment.

The public participation process followed for this environmental authorisation is an integrated and comprehensive process with the purpose to provide I&APs with sufficient and accessible information in an objective manner to assist them to:

***During the Pre-application and Scoping Phase*:**

a) Raise comments and make recommendations to be considered during the impact assessment phase **(All comments raised were addressed on the Scoping report);**
b) Provide comments on project alternatives and the proposed process of assessment;
c) Verify that their issues were recorded and understood; and
d) Contribute appropriate local information and indigenous knowledge to the EIA process

During the Impact Assessment Phase

a) Verify that their comments have been considered in the EIA investigations; and
b) Comment on the findings of the specialist studies and the EIA.

During the Decision-Making Phase

a) Advise I&APs of the outcome of the environmental authorization (i.e. DMR decision), and the appeals process and procedure.

7.2 *Compilation of Interested and Affected Parties' Database*

The compilation of the interested and affected parties' database commenced during the pre-consultation process before the lodgement of the application form and it continued during scoping phase. Matai also provided details of adjacent property owners to include in the database.

Publication of newspaper adverts in the Platinum Bushvelder and The Daily Sun saw other interested parties request to be added to the I&APs database.

7.3 *Notification of Interested and Affected Parties of the Project*

Pre-consultation meetings with the affected communities were held on different dates and venues to advise them of the intention of Matai Mining to submit the Mining Right application on the prospecting right area. Same meetings communities will be consulted during the EIA phase on different dates and different venues as well.

7.4 *Consultation Meetings with Interested and Affected Parties*

During the meetings Background Information Documents (BIDs) were distributed to all the meeting attendees and a presentation on the EIA Phase and the outcome of the specialist studies done was presented by Kimopax.

7.5 *Newspaper Advertisements*

A newspaper advertisement was placed in the Platinum Bushvelder and The Daily Sun both in English and Setswana.

Details of the press advert included:

a) Project name and description
b) Details of the client and the Environmental Practitioner
c) Project locations
d) Dead line for Comments

7.6 *Site Notices*

Laminated A3 site notices in English and Setswana were erected with the assistance of the communities in all key position on the around the proposed area.

7.7 *Public Review of EIR/EMP Report*

Draft EMP/ EIR report will be distributed to all registered I&APs and also state organs for review and comments.

7.8 *Public Participation Tasks That Will be Undertaken During the Environmental Impact Assessment Process*

Public participation process during the EIA process includes the review of the EIA findings that are presented in the draft EIA Report, EMPr and the specialist reports. These reports will be made available to the stakeholders for commenting for a period of 30 days from… March 2019 to…April 2019. They will be made available at the following public places:

a) BBKTA Tribal Offices in Moruleng

b) Moses Kotane Municipality

c) To include name of schools

d) Moses Kotane Library ?

Copies of the draft report will also be hand delivered to Department of Water and Sanitation, Department of Agriculture, Forestry and Fisheries and North-West Department of Rural, Environmental and Agricultural Development.

All comments received during the 30day commenting period will be added to the comments and response report that will accompany the final EIA report.

Lead Authority's decision

As soon as the DMR has taken a decision on the proposed project, Kimopax will immediately notify I&APs of this decision and also, they will be given the opportunity to appeal. The registered I&AP will be provided with a letter summarising the competent authority's decision and where ever they disagree to the decision of the authority, they can lodge an appeal. Moreover, the Authorities decision will be published through Platinum Bushveld and Daily Sun newspaper advertisements.

7.9 *Summary of Issues Raised by I&APS*

To be populated during the consultation phase

Conclusions of the PPP

The Public Participation exercise has provided adequate information to enable an understanding of what the Matai Mining Right entails and to address the concerns and comments received during the process. Comments raised before, during and after the public meeting are captured in **Error! Reference source not found.** below.

7.10 *Summary of issues raised by I&Aps*

To be populated during the consultation phase

8 THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT FOOTPRINT ALTERNATIVES.

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

8.1 *Baseline Environment*

The Information in this section has been obtained from the South African Weather Services (SAWS) and previous studies that were undertaken within the Moses Kotane Local Municipality.

8.1.1 Climate

8.1.1.1 Regional Climate

The mining right area falls within the Highveld Climatic Zone. According to the Safaribookings (2018), Moses Kotane Local Municipality is located within an area of summer rainfall, which is characterised by afternoon thunderstorms. Winter (May to September) is the dry season and has moderate daily temperatures and cool nights. There is virtually no rainfall during winter, and the humidity is very low.

As indicated in Figure 7, the temperatures gradually drop in the month of May, marking the beginning of winter. Average temperatures vary from 7°C/45°F in the mornings to 23°C/73°F in the afternoons. During the months of June, July and August skies are sunny and clear with daytime temperatures averaging 22°C/72°F. In September the average temperatures are a mild and pleasant 27°C/81°F during the day with cooler mornings (10°C/50°F).

As illustrated in Figure 8 wet season is notable from October to April. The regular rains break up the heat. They usually come in the form of afternoon storms, but sometimes it drizzles for a longer period. Average daytime temperatures are around 29°C/84°F. The month of October and November gets warmer and the first rains clear the haze in the sky. It rains more as the season progresses. Temperatures range from a typical 15°C/59°F in the morning to 29°C/84°F in the afternoon. December and January are the wettest months, characterised by torrential downpours in the afternoon. Daytime temperatures are typically around 30°C/86°F.

In March and April, the rainfall decreases and slowly gets colder. It further continues in April, which has lovely, clear weather and few clouds. The nights get a bit colder at about 13°C/55°F. Daytime temperatures are pleasant, around 27°C/81°F (Safaribookings, 2018).

8.1.1.2 Temperature

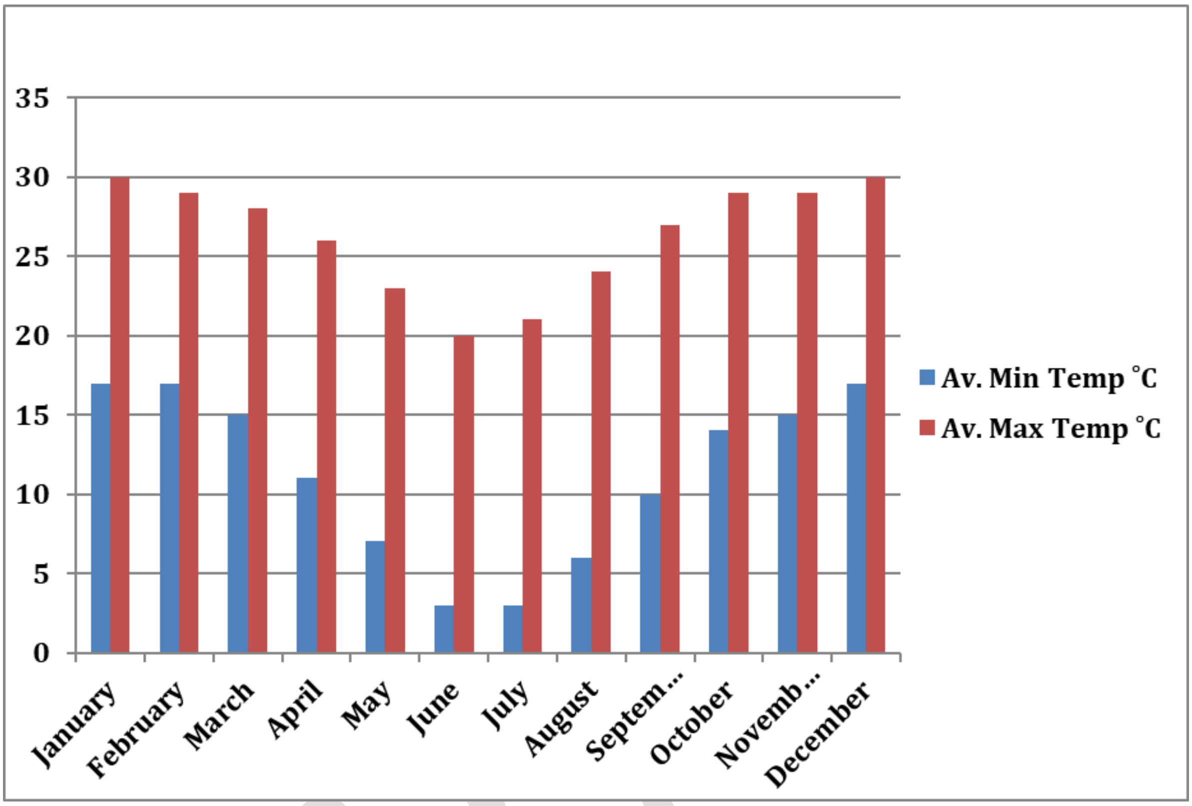

Figure 7: Average Monthly Temperature (Safaribookings, 2018)

8.1.1.3 Rainfall

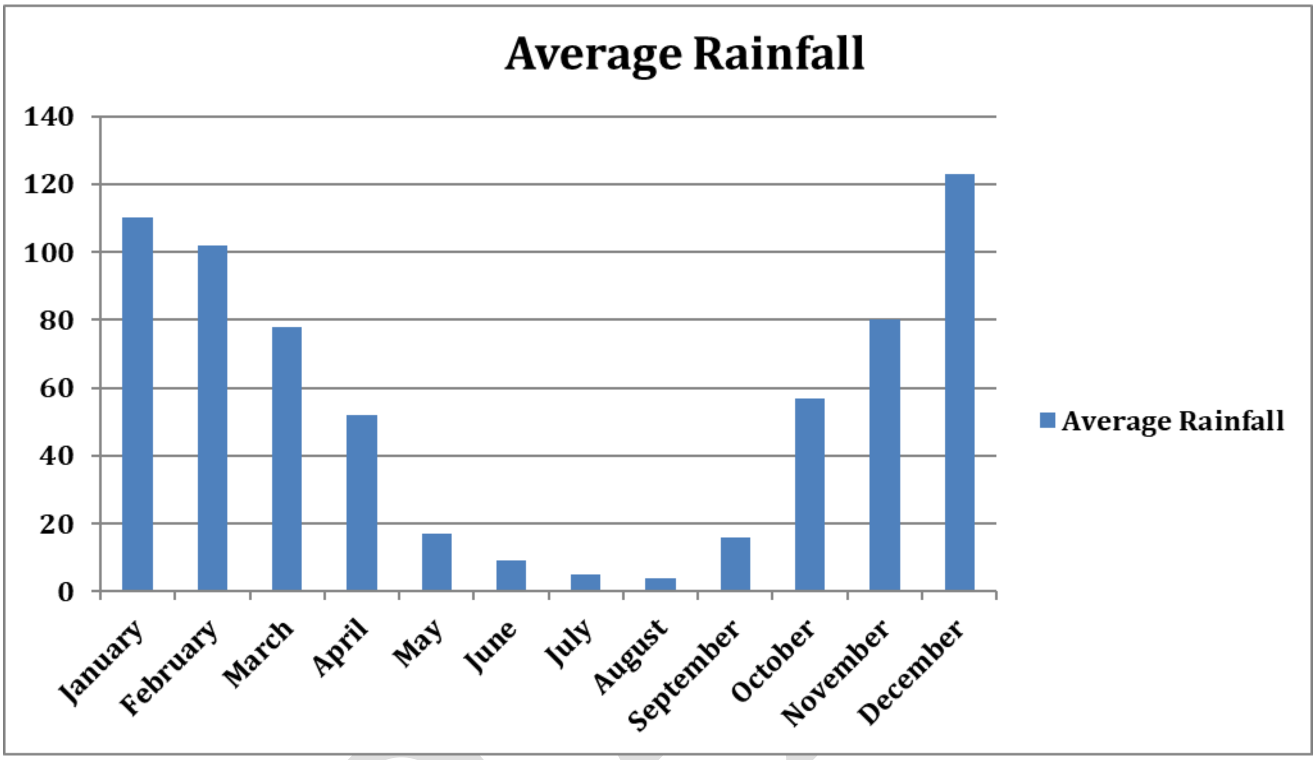

Figure 8: Total Monthly Precipitation (Safaribookings, 2018)

8.1.1.4 Wind Speed

One of the aspects that favour the suspension and resuspension of loose particulates in the atmosphere is the intensity of the wind speed regime. Wind speed greater than 5.4 m/s leads to erosion of loose dust PM and the degree of dispersion across the landscape (South African Weather Services, 2018).

8.1.1.5 Ambient Air 863435

The proposed Matai Mining Project is located in the Bojanala Platinum District, in the North West Province. This forms part of the declared Waterberg-Bojanala Priority Area (WBPA) for Air Quality. The Minister declared the WBPA on 15 June 2012 as the third National Priority Area (Government Notice No. 494, 2012). Although pollution levels in the WBPA are not continuously exceeding National Standards, the declaration is in line with the precautionary principle of the National Environmental

Management Act (Act No. 107, 1998) that negative impacts on the environment and on people's environmental rights should be anticipated and prevented (van Basten & van Nierop, 2019).

The Waterberg-Bojanala Priority Area Air Quality Management Plan and Threat Assessment (WBPA AQMP) found that mining contributes the greatest proportion (over 70%) of PM10 emissions in the area. Industry contributions are lower but still significant at 27%. However, historically (i.e. between 2008 and 2011), only 3.45% and only 0.004% of the Bojanala DM PM10 emissions originated from industries and from mining activities respectively in the Moses Kotane Municipality (Government Notice No. 1207, 2015). Ambient air quality monitoring is relatively limited in the WBPA. The closest monitoring station, run by the North West Provincial Government, is situated in Phokeng which lies approximately 62 km south of the proposed mining area. This is too far to give an indication of ambient air quality in the area of the proposed Matai Mining Project (van Basten & van Nierop, 2019).

Sources that may contribute to ambient concentrations of PM10 and PM2.5 in the area include: the mining activities of the Rustenburg Platinum – Union Mines, the Pilanesberg Platinum mine, Kalaka Mining and Dishaba Mine; domestic fuel burning; vehicle entrainment from untarred road surfaces; biomass burning; and wind-blown dust from open areas and stockpiles (van Basten & van Nierop, 2019).

8.1.1.5.1 Health Effects of Particulate Air Pollutants

With regards to health effects, the World Health Organisation (WHO) confirms that particulate air pollution is often associated with complaints of the respiratory system (WHO, 2000). PM size is relevant in terms of health as it is responsible for where in the respiratory system a given particle is deposited. There are an increasing number of research studies highlighting the impact of gases and air pollutants on humans. Many of these emissions, even in small quantities, have adverse effects on workers and neighbouring residents alike.

Particles can be classified by their aerodynamic properties into coarse particles, PM_{10} and fine particles, $PM_{2.5}$ (Harrison & Van Grieken, 1998). The fine particles contain the secondarily formed aerosols such as sulphates and nitrates, combustion particles and re-condensed organic and metal vapours. The coarse particles contain earth crust materials and fugitive dust from roads and industries (Fenger, 2002).

In terms of health effects, particulate air pollution is associated with respiratory and cardiovascular morbidity, such as aggravation of asthma, respiratory symptoms and an increase in hospital admissions. Inhalable PM also leads to increased mortality from cardiovascular and respiratory diseases and from lung cancer (WHO, 2013). Particle size is important for health because it controls where in the respiratory system a given particle is deposited. Fine particles are thought to be more damaging to human health than coarse particles, as they are able to penetrate deeper into the lungs (Manahan, 1991). Larger particles are deposited into the extrathoracic part of the respiratory tract while smaller particles are deposited into the smaller airways leading to the respiratory bronchioles (WHO, 2000).

In the past, daily particulate concentrations were in the range 100 to 1000µg/m^3 whereas in more recent times, daily concentrations are between 10 and 100µg/m^3. Overall, exposure-response can be described as curvilinear, with small absolute changes in exposure at the low end of the curve having similar effects on mortality to large absolute changes at the high end (WHO, 2000). Both short-term and long-term exposure to particulate matter in the air can have health impacts (Table 6).

Table 6: Short-term and long-term health effects associated with exposure to PM (WHO, 2004).

Pollutant	Short-term exposure	Long-term exposure
Particulate matter	❧ Lung inflammatory reactions ❧ Respiratory symptoms ❧ Adverse effects on the cardiovascular system ❧ Increase in medication usage ❧ Increase in hospital admissions ❧ Increase in mortality	❧ Increase in lower respiratory symptoms ❧ Reduction in lung function in children ❧ Increase in chronic obstructive pulmonary disease ❧ Reduction in lung function in adults ❧ Reduction in life expectancy ❧ Reduction in lung function development

8.1.1.6 Local Meteorology

Horizontal dispersion of atmospheric pollutants is a function of the prevailing wind characteristics at any site, while the vertical dispersion of pollution is largely a function of the stability of the atmosphere and the depth of the surface mixing layer. By day, vertical mixing due to incoming solar radiation is most efficient at dispersing pollutants. At night a surface temperature inversion may develop which decreases the dispersion potential. Pollutants tend to accumulate near the point of release under these conditions, particularly if they are released close to ground level. The dispersion potential is generally poorer on winter nights than on summer nights. Mechanical turbulence is another contributor to dispersion of pollutants. Mechanical turbulence is a function of a combination of the wind speed and surface roughness. Thus, higher wind speeds facilitate the vertical dilution of pollutants as well as the distance of downwind transport (van Basten & van Nierop, 2019).

The preferred data for modelling would be data collected on site. This, however, is very seldom feasible given that three years of both surface and upper air meteorological data is required. To substitute for, or supplement measured data, data from numerical models may be used. For this project AERMET pre-processed Weather Research and Forecasting Model (WRF) meteorological data was used. The WRF is a next-generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting applications which reflects recent advances in physics, numerics, and data assimilation contributed by developers from the expansive research community (van Basten & van Nierop, 2019).

Wind roses graphically present wind conditions over a period of time at a specific location. Wind roses for the project are presented in Figure 9 to Figure 10 below. In the wind roses, the length of each spoke represents the percentage of time that the wind blew from that direction during the period. The percentage scale is presented on the concentric grey lines (the circle scale increment is indicated on each of the wind roses). Each spoke is divided by colour into wind speed ranges (van Basten & van Nierop, 2019).

The predominant wind direction at the Matai Mining site (as given by the WRF data for the period from 2015 to 2017 for the project area) is from the south-south-easterly (for approximately 10.7 % of the time) (Figure 9). However, the highest number of winds with speeds greater than 6.5 m/s are expected from a northerly direction. The average hourly wind speed predicted by the WRF model is approximately 1.41 m/s. Calm conditions (wind speeds below 0.5 m/s) are predicted for approximately 4.68 % of the time (van Basten & van Nierop, 2019).

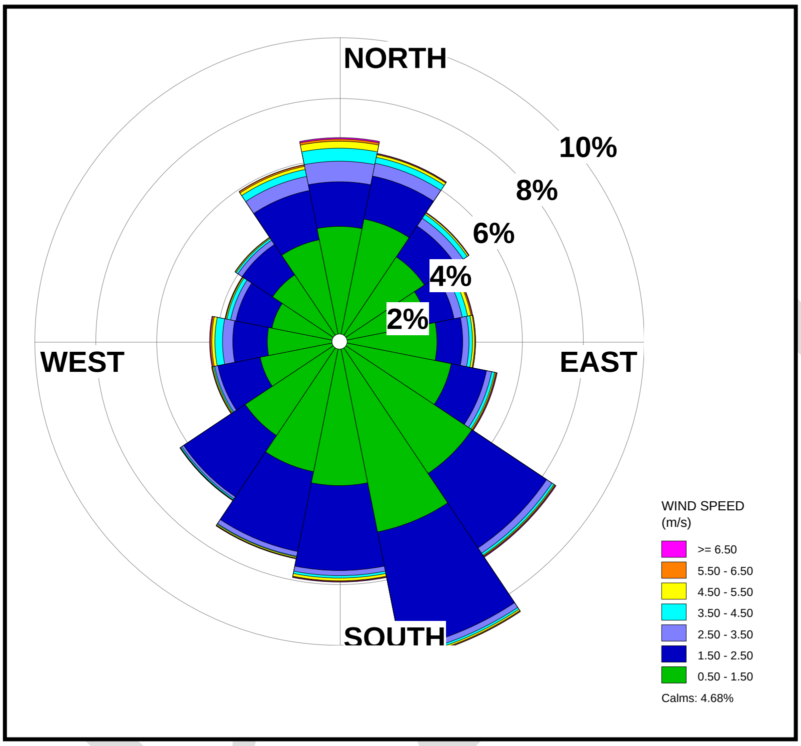

Figure 9: Wind rose of the average winds produced by the WRF model for the Matai Mining Project site, for the years 2015-2017.

There is a clear diurnal variation in both wind direction and wind speed at the Matai Mining Project site. During the warmer hours of the day, calm conditions are expected for approximately 9.24 % of the time, and average wind speeds are 1.36 m/s. Wind speeds above 6.5 m/s are expected for approximately 0.4 % of the time. The most frequent wind directions are from the northerly and north-north-easterly directions. During the night, calm conditions are expected for approximately 0.13 % of the time, and average wind speeds are 1.45 m/s. The winds tend to blow more from the south-south-westerly to south-easterly quadrant (Figure 10).

Day Night

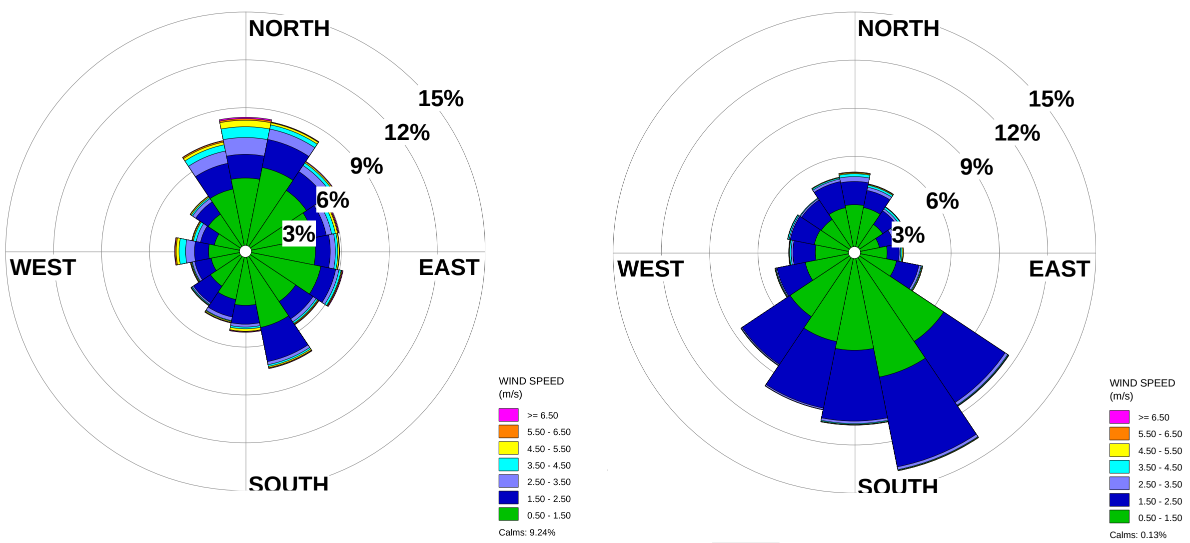

Figure 10: Diurnal wind roses predicted by the WRF model for the Matai Mining Project site, for the years 2015-2017.

The seasonal variations in wind direction for the Matai Mining Project site are illustrated in Figure 11. The highest number of wind speeds above 6.5 m/s are experienced in Summer, while the highest average wind speeds occur in Spring. The maximum number of calm conditions are experienced in Winter.

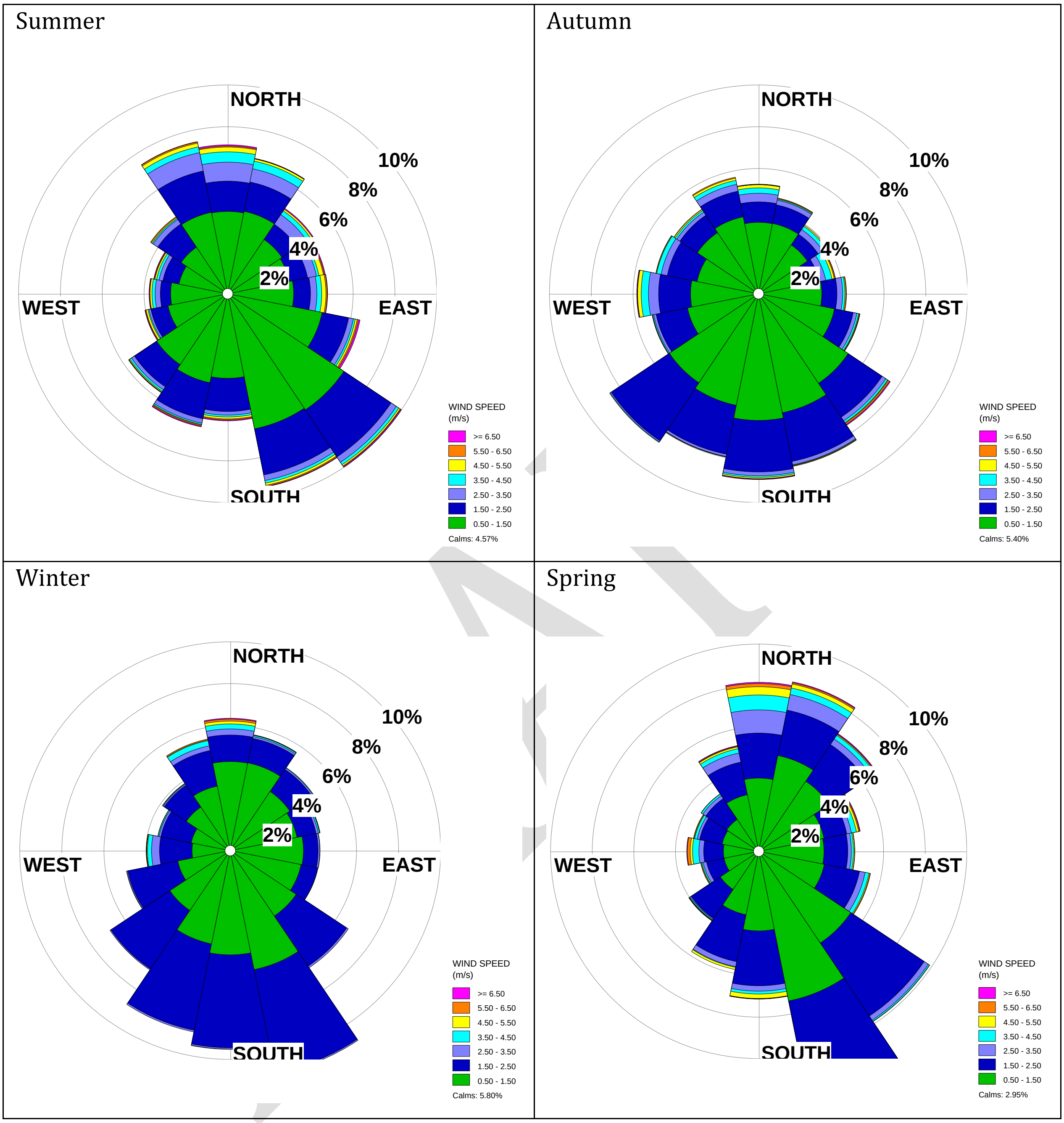

Figure 11: Seasonal wind roses of winds predicted by the WRF model for the Matai Mining Project site, for the years 2015-2017

8.1.2 Noise

8.1.2.1 Current Noise Sources

Noise is part of our daily exposure to different sources which is part of daily living and some of these physical attributes which may at times be intrusive forms part of the ambient levels that people get used to without noticing the higher levels. A Noise specialist conducted a site inspection. The following are noise sources in the vicinity of and the boundaries of the study area (Van der Merwe, 2019):

b) Seasonal agricultural activities;
c) Traffic noise along the feeder roads;
d) Distant traffic noise from the abutting feeder roads;
e) Insects;
f) Birds; and
g) Wind noise.

8.1.2.2 Atmospheric Conditions During Noise Survey

The noise readings were carried out at the different measuring points and the prevailing atmospheric conditions i.e. wind speed, wind direction and temperature were taken into consideration. The readings were done away from any large vertical structures, which may influence the outcome of the readings. The following meteorological conditions were recorded on the 28th of February 2019 (Van der Merwe, 2019):

Daytime

a) Wind speed – less than 2.0m/s;
b) Temperature – 34.5oC – No strong temperature gradient occurred near the ground;
c) Cloud cover – High cloud cover;
d) Wind direction – The wind was blowing from a north-westerly direction; and
e) Humidity – 30 % humidity.

Night time

a) Wind speed – less than 0.8m/s;
b) Temperature – 19.5°C ;
c) Cloud cover – No cloud cover;
d) Wind direction – The wind was blowing from a south-westerly direction; and
e) Humidity – 20 % humidity.

8.1.3 Blasting and Vibration

Blasting activity will be performed in the proposed mining project for rock excavation. As part of the process, the explosive energy is exhibited in the form of elastic waves. These waves travel in all directions from the blasting area, thereby giving rise to ground vibrations, which in excess may cause damage to the nearby structures. Hence, a Blasting and Vibration studies will be undertaken to assess the impacts that the mining activity and its associated activities will exhibit to the environment and mitigation measures will be therefore be provided.

8.1.4 Traffic

A site access road will be required to link the site to the road network system. The nearest major road is the R510 which is approximately 15 km to the east of the site.

8.1.4.1 Existing Road Network

This site enjoys very good regional accessibility via the R510, which is a regional route that connects to the Thabazimbi in the north (approximately 75 km from site) and to Rustenburg in the south (approximately 90 km from site). **R510** can be described as a primary distributor (Class 2), i.e. a road that: "...forms the primary network for the urban area as a whole. All long-distance traffic movements to, from and within the city should be focused onto such roads. Characteristics are high volumes, restricted access and fairly high speeds. Continuity of route is important."

Figure 12: Surrounding road network and site location

It is a national road and strategically connects the North West and Limpopo provinces, it also offers network connectivity to the surrounding areas. The R510 is a single carriageway with separate turning lanes at some of its intersection with the minor street networks. The road has paved pedestrian sidewalks as well as demarcated pedestrian crossing areas (Mukanyima, 2019) (Pienaar, 2019)

Figure 13: R510 Intersection with gravel road A

Road A (Figure 13) can be classified as a class 4 providing a link from R510 from the surrounding areas. It forms a T-intersection with R510 which is controlled by a one way stop on Road A. The road is gravel and is a single carriageway (Mukanyima, 2019)

Swartklip road (Figure 14) can be classified as a class 3 as it links the surrounding townships and developments. The road is a single carriageway with a one lane per direction. It has an intersection with Road A near the Ga-Ramosidi settlement and it is proposed to link this intersection with the mine link road to form a 4-way intersection (Mukanyima, 2019)

Figure 14: Swartklip road

8.1.5 Geology

8.1.5.1 Regional Geology

According to available geological maps, the proposed Matai project is located on the Bushveld Igneous Complex (BIC) that is estimated to have developed approximately 2,060 million years ago. The mafic rock sequence of the BIC, the Rustenburg Layered Suite (RLS), is the world's largest known mafic igneous layered intrusion containing approximately 90% of the world's known platinum group metals (PGMs) reserves. In addition to the PGM's, extensive deposits of iron, tin, chromium, titanium, vanadium, copper, nickel and cobalt also occur.

The Bushveld Complex extends approximately 450 km east to west and approximately 250 km north to south. It underlies an area of some 65 000 km^2, spanning parts of the Limpopo, North West, Gauteng and Mpumalanga Provinces. The Bushveld Complex consists of four distinct igneous suites, namely, in age order, early mafic sills, the Rooiberg Group felsites, multiple mafic and ultramafic layers of the Rustenburg Layered Series which host platinum group element mineralisation and the latest Lebowa Granite Suite which cross-cuts the 110 km thick Rustenburg Series. Covering of the Bushveld by younger sediments and intrusion of later magmas means that the outcrop of the Rustenburg Layered Series is limited to two basin-like lobes to the west and east and a linear lobe to the north.

8.1.5.2 Local Geology

The study area is underlain by the Bierkraal Magnetite Gabbro (BMG) from the Rustenburg Layered Suite of the Bushveld Complex (geological map 2526 Rustenburg 1:250 000). The Bierkraal Magnetite Gabbro (BMG) is classified as a ferrogabbroic Upper Zone according to the Standard zonal subdivision (Johnson & Thomas, 2006). The BMG of the Rustenburg Layered Suite consists of magnetite gabbro, diorite and a magnetite layer. The surface layer is shown in Figure 15 below.

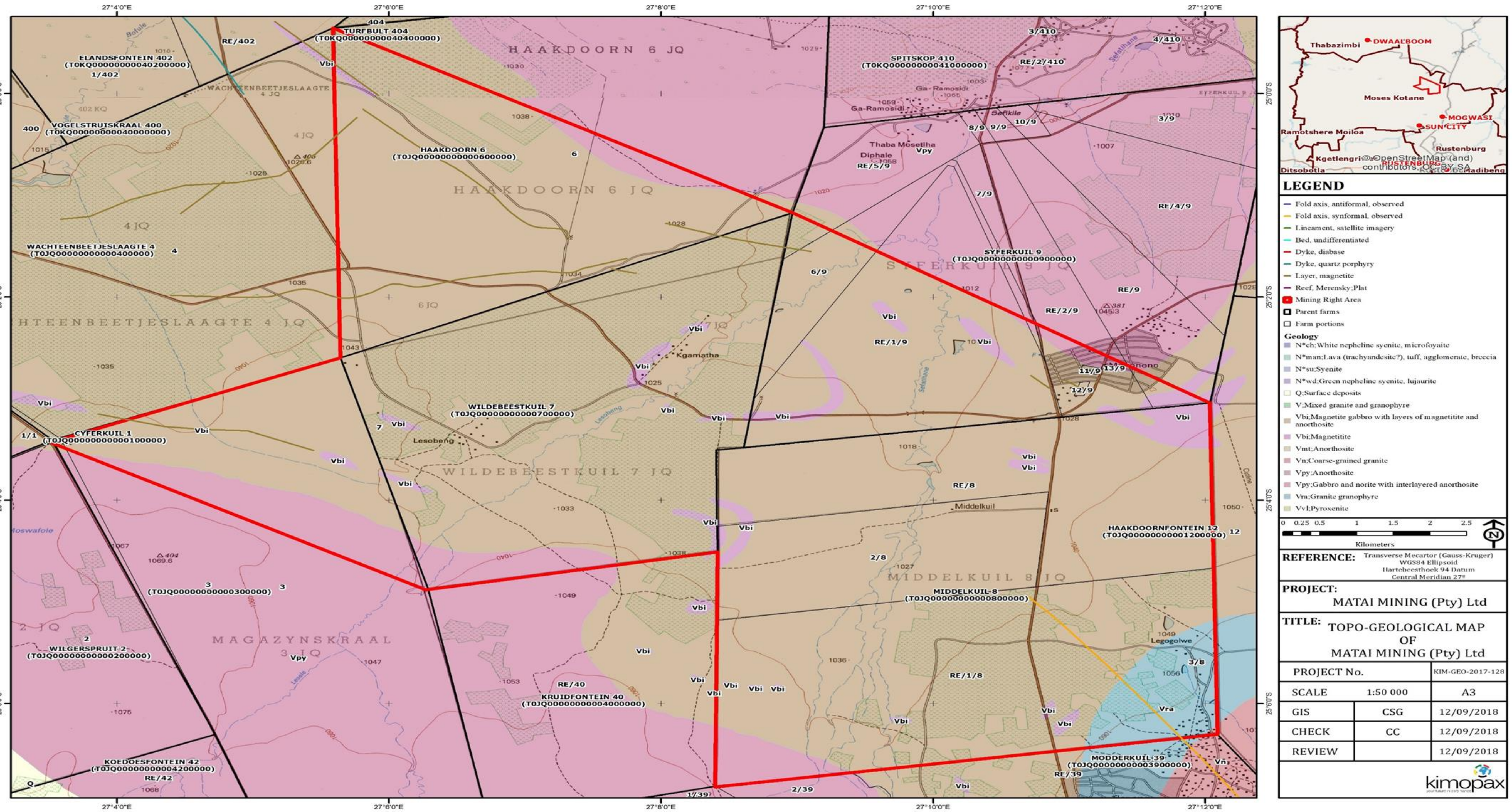

Figure 15: Geological map of the area

8.1.6 Geohydrological Setting

The 1:500 000 Geohydrological Map of Johannesburg (2526), developed by the Department of Water and Sanitation (DWS), characterise the underlying aquifers present on site as "Inter-granular" and "Fractured Type" aquifer.

The Matai area is classified as having a moderate potential for groundwater occurrence with typical borehole yields between 0.5 and 2.0 L/s being reported. Higher-yielding boreholes are usually related to regional linear geological features like lineaments, fractures or faults.

According to the Surface and groundwater Report compiled by Kimopax (2018), there is no significant or irreversible groundwater impact expected, however, a potential risk of spillage of hydrocarbons from construction machines during the construction phase might occur. The water contamination may occur due to the runoff resulting from the contaminated surfaces within the dirty mine areas infiltrating into the surrounding streams. This, if there are no measures that will be put in place to contain the dirty water. Due to the percentage of pyrite encountered in some of the geological logs, the exposed rock piles and discard dumps might have a potential to generate acid, the groundwater quality might be negatively impacted due leaching from exposed rock piles, discard dumps and Waste Rock Dumps (WRD). Mining activities will expose the pyrite to oxidising agents such as oxygen and ferric iron. This will lead to the formation of acidic conditions and the subsequent water quality deterioration due to heavy metal transport and salt loading, as the buffering capacity of the natural rock is utilised. Mine dewatering might result in lowering of the water table within the site. This can impact on water users in the area that rely on groundwater. Many ecological systems also rely on groundwater, and a lowered water table can negatively impact on certain species. Mitigation will only be required in the event of accidents or incidents of spillage. Typical mitigation would involve, for example, containment of fluids, notifying relevant authorities, and clean-up of the site (Kimopax, 2018).

8.1.6.1 Hydrological Setting

The project site falls within quaternary catchment No. A24E which forms part of the catchment of the Crocodile River which ultimately feeds into the Limpopo. Figure 17 shows the surface water drainage system around Matai area. Watercourses over the site are likewise classified as non-perennials flowing only during the wet season or after rainfall events. The 1:50,000 topographic map for the site indicates the presence of a few small dams, while the National Freshwater Ecosystems Priority Areas (NFEPA) map illustrates the presence of fringe wetland areas associated with the dams on the site.

One primary non-perennial rivers drain the site, namely; the Phufane River to the east (Refer to Figure 17. The larger Phufane River is associated with a number of tributaries adding to the total catchment area drained by this river. Both of the aforementioned rivers intersect the site before they join the Sefathlane River, which in turn drains into the Brakspruit River. The Brakspruit River is the primary river associated with quaternary catchment A24E into which the site falls. Quaternary catchment A24E has its headwaters in the Pilanesberg situated to the south of the site.

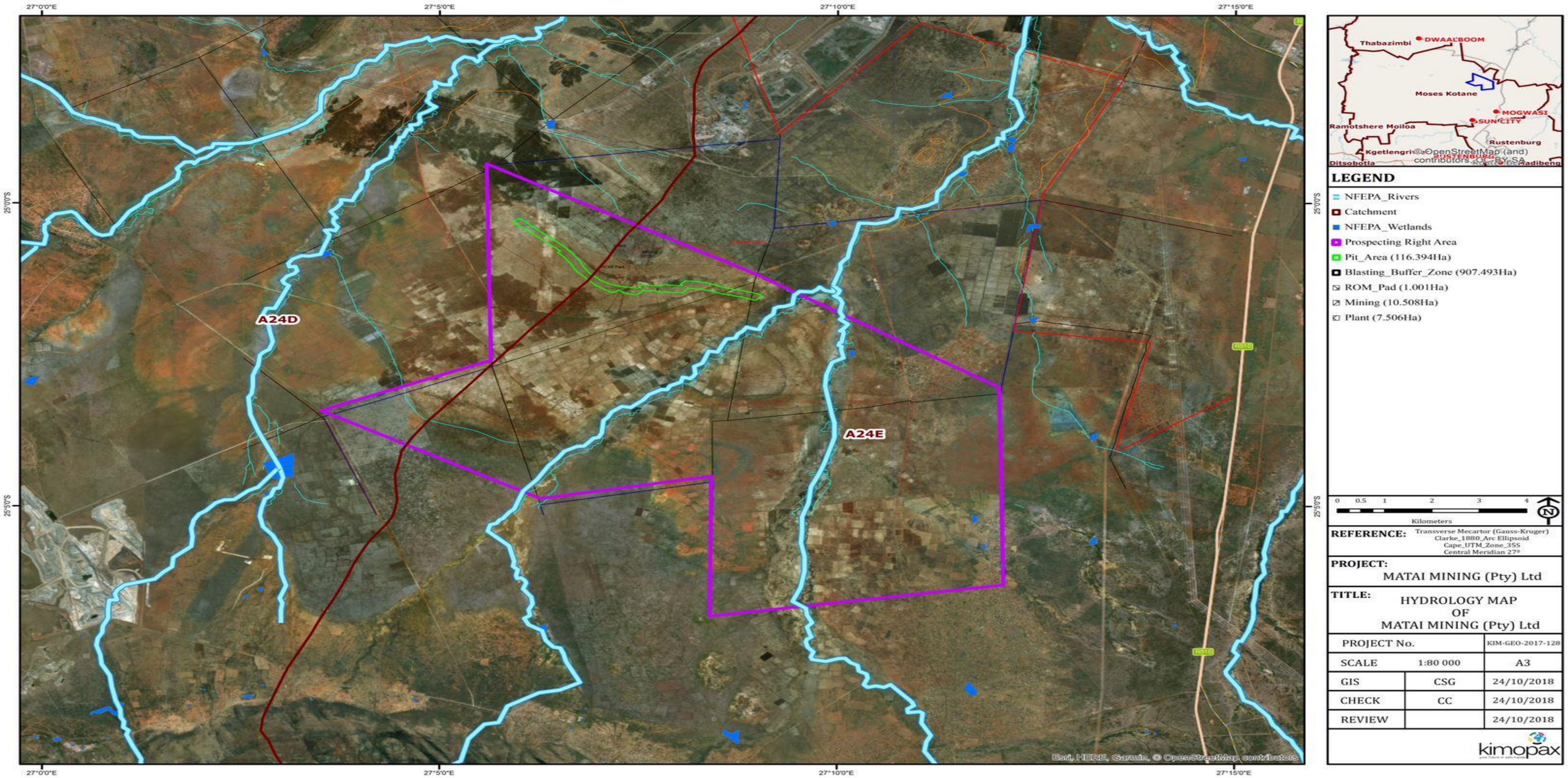

Figure 16: Geohydrological map

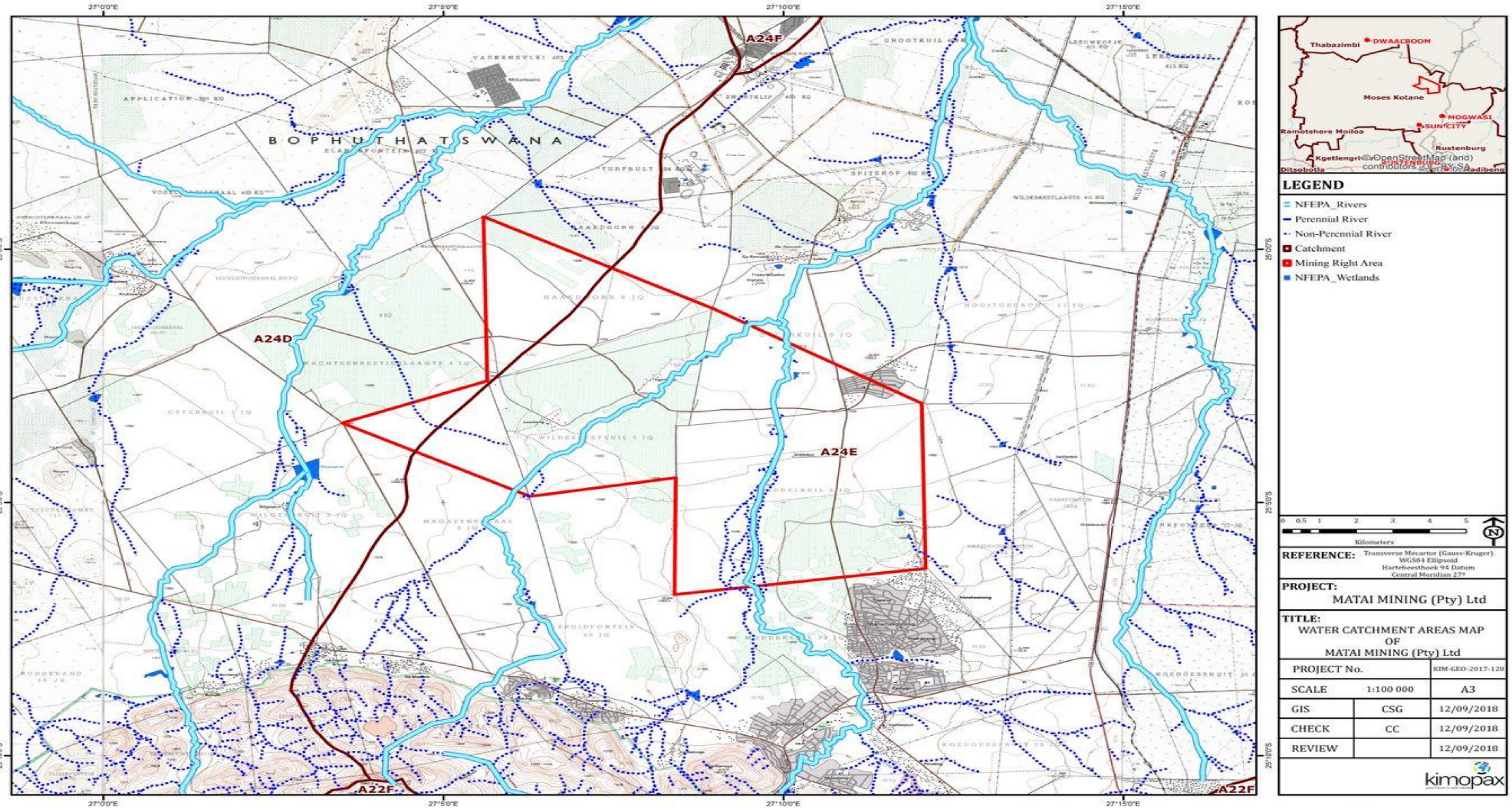

Figure 17: Drainage map

8.1.7 Topography

The project site is relatively flat, at an average elevation of 1040 metres above mean sea level (mamsl), with various non-perennial drainage lines crossing the site. The topographic relief can be described as relatively gently sloping towards the north-east, while the topographic elevation varies between 1075 mamsl in the north-east of the project site to 1015 mamsl in the north. To the south of the project site is the Pilanesberg Mountain Range and the associated hills that vary between 1330 and 1534 mamsl.

8.1.8 Soils

Soils are a significant component of most ecosystems. As an ecological driver, soil is the medium in which most vegetation grows, and a range of vertebrates and invertebrates exist. In the context of mining operations, soil is even more significant if one considers that mining is a temporary land use where-after rehabilitation (using soil) is the key to re-establishing post closure land capability that will support post-closure of land uses. The concentrations of natural salts and stores of nutrients within soils are a sensitive balance due to the extremes of rainfall, wind and temperature. The ability of a soil to retain moisture and nutrients and in turn influence the sustainability of vegetative growth and dependence of animal life is determined by the consistency and degree of soil moisture retention within the profile but out of the influence of evaporation. These conditions and the sensitivity of these variables must be noted, and their importance to the overall bio-diversity balance understood if the sustainability equation is to be managed and mitigated.

Mining projects have the potential to damage the soil resource through physical loss of soil and/or the contamination of soils, thereby impacting on the soils ability to sustain natural vegetation and altering land capability. Contamination of soils may, in turn. contribute to the contamination of surface and groundwater resources. Loss of the topsoil resource reduces chances of successful rehabilitation and restoration.

8.1.8.1 Valsrivier (Va) form (24ha)

The Valsrivier soil form is present on the eastern side of the area assessed. It is a duplex soil that consists of an orthic A horizon, overlying a pedocutanic B horizon which is underlain by unconsolidated material without signs of wetness. This profile consists of a clay loam (60 to 100 cm in the study area), formed in gneissic colluvium, containing nodules of secondary lime in the B horizon and showing no evidence of wetness at depth. The B-horizon have become enriched in clay by illuviation (a pedogenic process which involves downward movement of fine materials by, and deposition from, water to give rise to cutanic character) and that have developed moderate or strong blocky character (Pienaar, 2019).

Such soils can be productively used under irrigation, but the duplex nature means that artificial drainage would have to be taken into consideration. Hard setting and erodibility are two physical conditions to be taken into consideration when stockpiling topsoil during mining activities. The Valsrivier soil form has grazing land capability and is considered highly sensitive to surface disturbance as a result of its ability to easily erode (Pienaar, 2019).

8.1.8.2 Glenrosa (Gs) Form (20ha)

The Glenrosa soil form consists of an orthic A horizon underlain by a hard lithocutanic B horizon. The lithocutanic B horizon (distinguished from hard rock by not only consistence and degree of weathering but also tonguing and cutanic character) may itself be 'hard or not hard' (Soil Classification Working Group 1991). To be called hard, more than 70% must be parent rock, fresh or partly weathered with a hard consistence in the dry, moist and wet states. The cutanic character of the B horizon of the Glenrosa soil form as was visible in open profiles in the study area, take the form of tongues of topsoil extending into the partly weathered parent rock. The Glenrosa soil profiles on site are shallow to very shallow and occur in two pockets in the north-west and south of the pit area. Topsoil stripping for stockpiling will result in very little topsoil to be stored for rehabilitation purposes (Pienaar, 2019).

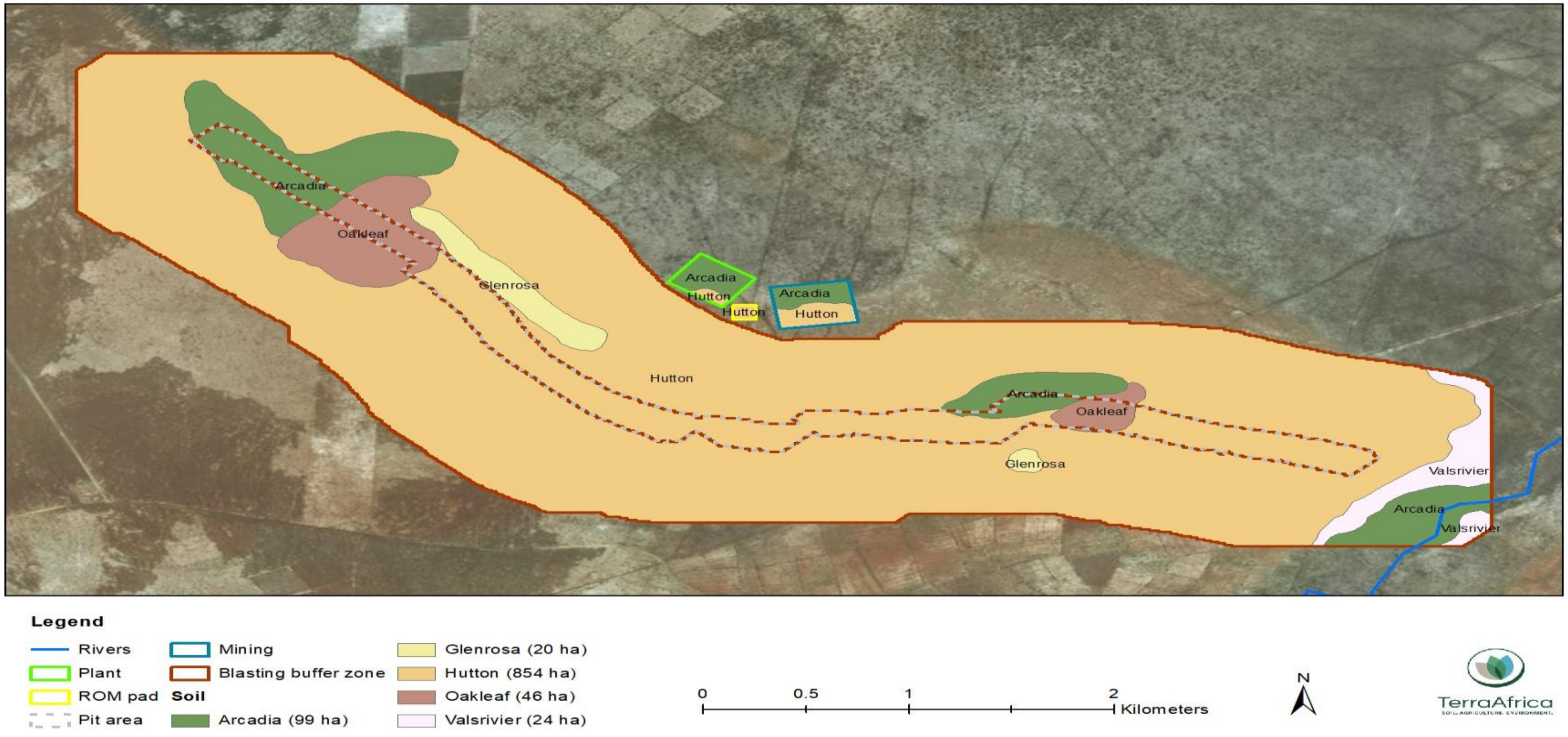

Figure 18: Soil map of the areas of proposed infrastructure and impact of the Matai Mining Project (Pienaar, 2019)

8.1.9 Land Types

Following the consideration of the Land Type classification data, the entire Prospecting Right area is dominated by Land Type Ae64 with a few smaller pockets of Land Type Ea70 in between (Figure 20). The geology of both land types has been described as predominantly norite and pyroxenite of the Bushveld complex. Land Type Ae64 can also be underlain by hornfels, slate, shale and quartzite of the Pretoria Group while Land Type Ea70 may have red syenite of the Pilanesberg Complex in places. Below is a description of each of the land types and the dominant soil forms that are present within them (Pienaar, 2019).

8.1.9.1 Land type Ae64

The mid-slope (slope between 4% and 25%) and flat plain positions (slope between 0% and 4%) are represented by number 3 and 4 in Figure 19. These terrain units are dominated by deep soil of the Hutton form interspersed with smaller areas of the Arcadia form. The soil profiles in these areas are between 60 and 120 cm deep and the clay content ranges between 15% and 35%. The rest of this land type consists of rocky outcrops on the hilltops (Terrain unit 1) and Valsrivier and Arcadia forms at the depressions in the landscape (Terrain unit 5). Both Terrain Units 1 and 5 only has slight slope (not more than 4%) (Pienaar, 2019).

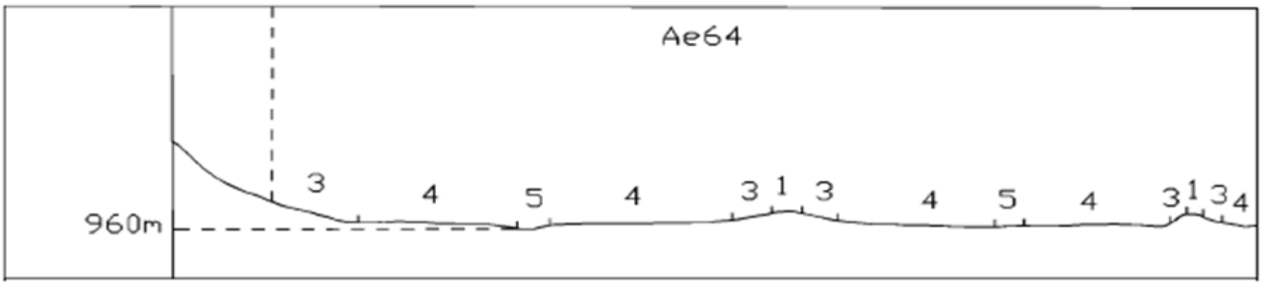

Figure 19: Illustration of the terrain units of Land Type Ae64

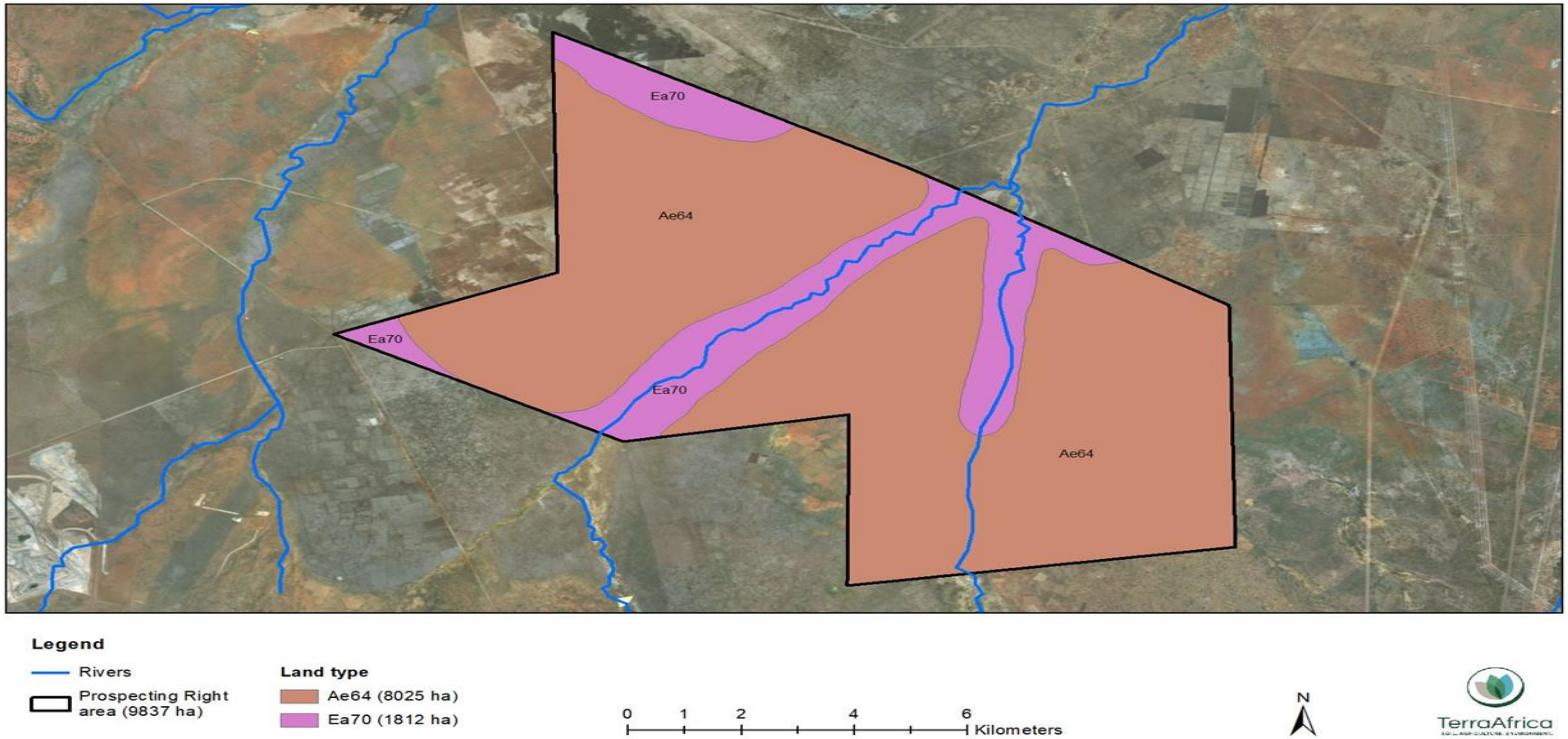

Figure 20: Land type map of the Matai (Pty) Ltd Prospecting Right area (Pienaar, 2019)

8.1.9.2 Land Type Ea70

The entire land type is dominated by the Arcadia form with only Terrain Unit 5 (Figure 20) having equal possibility to have the hydromorphic Rensburg form. As this landscape position represents the lowest point in the landscape, water accumulates here more easily that can lead to the development of hydromorphic (wetland) properties such as mottling. Small areas of the apedal Hutton form or the red structured Shortlands form may also occur within this land type (Pienaar, 2019).

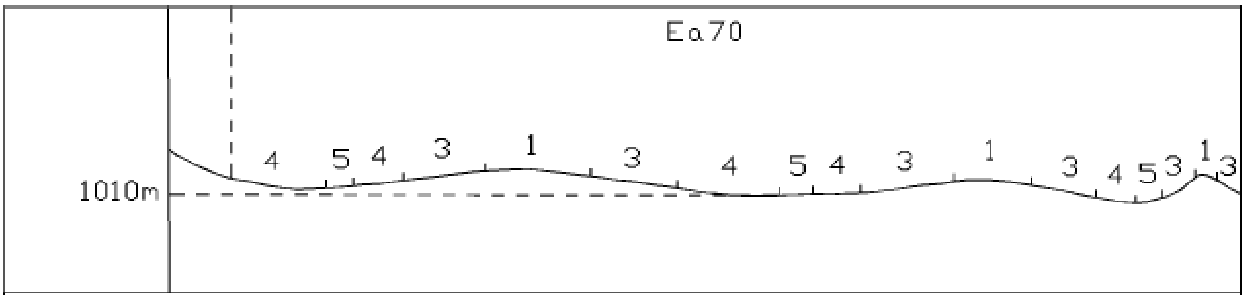

Figure 21: Depiction of the terrain forms of Land Type Ea70

8.1.10 Heritage and Paleontology

Stone Age

The larger region of the North West Province has been inhabited by humans since Early Stone Age (ESA) times. Most of the tools dating to this period are mostly, found in the vicinity of channels. The original dating and evolutionary scheme for the development of tools during this early period is based on a study of the river terrace gravels. The oldest of these tools are known as choppers, roughly produced from large pebbles found in the river. Later, *Homo erectus* and early *Homo sapiens* people made tools shaped on both sides, called bifaces. Biface technology is known as the Acheulean tradition, from St Acheul in France, where bifaces were first identified in the mid-19th century. This type of tools is very well presented in the Magaliesberge and to the north in the more mountainous regions (Magoma, 2019).
The Middle Stone Age (MSA) times spanning to some (C. 150 000 – 30 000 BP) saw people became more mobile, occupying areas formerly avoided. The MSA is a period that still remains somewhat murky, as much of the MSA lies beyond the limits of conventional radiocarbon dating. However, the concept of the

MSA remains useful as a means of identifying a technological stage characterized by flakes and flake-blades with faceted (Magoma, 2019).

Open sites were still preferred near watercourses. These people were adept at exploiting the huge herds of animals that passed through the area, on their seasonal migration. As a result, tools belonging to this period also mostly occur in the open or in erosion dongas. Similar to the ESA material, artefacts from these surface collections are viewed not to be in a primary context and have little or no significance. Late Stone Age (LSA) people had even more advanced technology than the MSA people and therefore succeeded in occupying even more diverse habitats. Also, for the first time we now get evidence of people's activities derived from material other than stone tools. Ostrich eggshell beads, ground bone arrowheads, small bored stones and wood fragments with incised markings are traditionally linked with the LSA. LSA people preferred, though not exclusively, to occupy rock shelters and caves and it is this type of sealed context that make it possible for us to learn much more about them than is the case with earlier periods. Probably as a result of this absence of sites that were occupied on a long-term basis, even fewer sites containing rock art are known from the region (Magoma, 2019).

Iron Age

Iron Age people started to settle in southern Africa c. AD 300, with one of the oldest known sites at Silver Leaves south east of Tzaneen dating to AD 270. One of the better-known sites, Broederstroom, is located on the southern side of the Hartebeestpoort Dam. Here archaeological excavations have revealed that early farmer people were living here by AD 470, growing a range of different crops and that they were smelting iron. Having only had cereals (sorghum, millet) that need summer rainfall, Early Iron Age (EIA) people did not move outside this rainfall zone, and neither did they occupy the central interior highveld area. Because of their specific technology and economy, Iron Age people preferred to settle on the alluvial soils near rivers for agricultural purposes, but also for firewood and water (Magoma, 2019).

The occupation of the larger geographical area (including the study area) did not start much before the 1500s. To understand all of this, we have to take a look at the broader picture. Towards the end of the first millennium AD, Early Iron Age communities underwent a drastic change, brought on by increasing trade on the East African coast. This led to the rise of powerful ruling elites, for example at Mapungubwe. The abandonment of Mapungubwe (c. AD 1270) and other contemporaneous settlements show that widespread drought conditions led to the decline and eventual disintegration of this state Huffman (2005).

This period of consistently high rainfall started in about AD 1780. At the same time, maize was introduced from Maputo and grown extensively. Given good rains, maize crops yield far more than sorghum and millets. This increase in food production probably led to increased populations in coastal area as well as the central highveld interior by the beginning of the 19th century. This wet period came to a sudden end sometime between 1800 and 1820 by a major drought lasting 3 to 5 years. The drought must have caused an agricultural collapse on a large, subcontinent scale. This was also a period of great military tension. Armed Qriqua and Korana raiders on horseback were active in the Northern Cape and Orange Free State by about 1790 (Magoma, 2019).

The Xhosa were raiding across the Orange River about 1805. Military pressure from Zululand spilled onto the highveld by at least 1821. Various marauding groups of displaced Sotho-Tswana moved across the plateau in the 1820s. Mzilikazi raided the plateau extensively between 1825 and 1837. The Boers trekked into this area in the 1830s. Due to their specific settlement requirements, Late Iron Age people preferred to settle on the steep slope of a mountain, possibly for protection, or for cultural considerations such as grazing for their enormous cattle herds. Because of the lack of trees, they built their settlements in stone (Magoma, 2019).

8.1.11 Visual Baseline

Mining-related activities have the potential to alter the landscape character of the site and surrounding area through the establishment of both temporary (such as pits, mineral processing infrastructure and support facilities) and permanent infrastructure (such as the tailings storage facility and waste rock dumps). As a baseline, this section provides an understanding of the visual aspects of the area against which to measure potential change as a result of mine infrastructure and activities.

In describing the visual landscape, a number of factors will be considered, including landscape character, sense of place, scenic quality, and sensitive views. It is important to note that the area defined for the visual study is a 15km radius around the mine area; because beyond this distance, the project components would be 'absorbed' into the landscape setting. A Visual Impact Specialist will conduct a field study.

8.1.11.1 Landscape Character

The landscape character of the study area is defined by relatively flat plains, punctuated by isolated hills in the west and the dominant hills associated with the Pilanesberg National Park (PNP) in the south. While the plains have been disturbed by anthropogenic activities, the hills are relatively 'untouched' with a dense vegetation cover of bushveld species associated with the Dwaalboom vegetation type. Current land uses in and adjacent to the study area is a combination of grazing, crops, mining, residential and general community activities.

8.1.11.2 Visual Receptors

Public views (sensitive viewing areas) to the mine could be experienced by people living and visiting the adjacent communities, employees travelling to work, as well as tourists visiting the attractions in the area or travelling through the area to other destinations.

8.1.12 Biodiversity

In the broadest sense, biodiversity provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. The known value of biodiversity and ecosystems is as follows:

a) Soil formation and fertility maintenance;
b) Primary production through photosynthesis, as the supportive foundation for all life;
c) Provision of food and fuel;
d) Provision of shelter and building materials;
e) Regulation of water flows and water quality;
f) Regulation and purification of atmospheric gases;
g) Moderation of climate and weather;
h) Control of pests and diseases; and
i) Maintenance of genetic resources.

The establishment of mining-related infrastructure and support facilities have the potential to result in the loss of vegetation, habitat and related ecosystem functionality through physical disturbance and/or contamination of soil and/or water resources.

8.1.12.1 Vegetation

As a baseline, this section provides an outline of the type of vegetation occurring in the study area and the status of the vegetation, highlights the occurrence of sensitive ecological environments including sensitive/ endangered species (if present) that require protection and/or additional mitigation should they be disturbed.

The region, in which the study area is located, is typical of the Dwaalboom Thornveld, which is a component of the Savanna Biome as illustrated in Figure 22. The Savanna Biome covers a large area and is subdivided into various components, with the Dwaalboom Thornveld comprising a part of the Central Bushveld Bioregion. The features of this vegetation type include plains with layers of scattered, low to medium-high, deciduous microphyllous trees and shrubs with a few broad-leaved tree species, and an almost continuous herbaceous layer dominated by grass species. The conservation status of this vegetation type is considered Least Threatened, and the nationally set conservation target is 19%, with 6% statutorily conserved, mostly in the Madikwe Nature Reserve and Pilanesberg Nature Reserve.

This vegetation is typified by an open canopy of *A. tortilis* (Umbrella Thorn); *Acacia* species and an abundance of *Dichrostachys cinerea* (Sickle Bush). The understory consisted mainly of grasses: *Aristida bipartita* (Rolling Grass); *Bothriochloa insculpta* (Pinhole Grass); *E. rigidior* (Broad Curly Leaf) and *Panicum maximum* (Guinea Grass) as well as dominant forbs *Asparagus laricinus* (Cluster-leaf asparagus); *Hibiscus trionum* (Bladder Hibiscus); *Nidorella anomala* (Mulder, July 2015).

The plant species identified within the project is tabulated in

Table 7 (Dlamini, 2019).

Table 7: Plant species observed in study area

Species name	Common name	Conservation status	Area observed
Themeda triandra	Red grass		Pit area, Project area
Vacheilia tortilis	Umbrella thorn three		Pit area, Project area
Vachelia nilotica	Gum Arabic tree		Pit area, Project area
Combretum imberbe	Leadwood	Nationally protected	Project area
Cymbopogon pospischilii.	Turpentine grass		Pit area, Project area
Digitaria eriantha	Rhodes grass		Pit area, Project area
Eragrostis curvula	Weeping love grass		Pit area, Project area
Crinum spp.	Crinum		Pit area, Project area
Searsia lancea	Karee tree		Project area
Ziziphus mucronata	Buffalo thorn		Project area

Senegalia erubescens	Blue thorn		Pit area, Project area

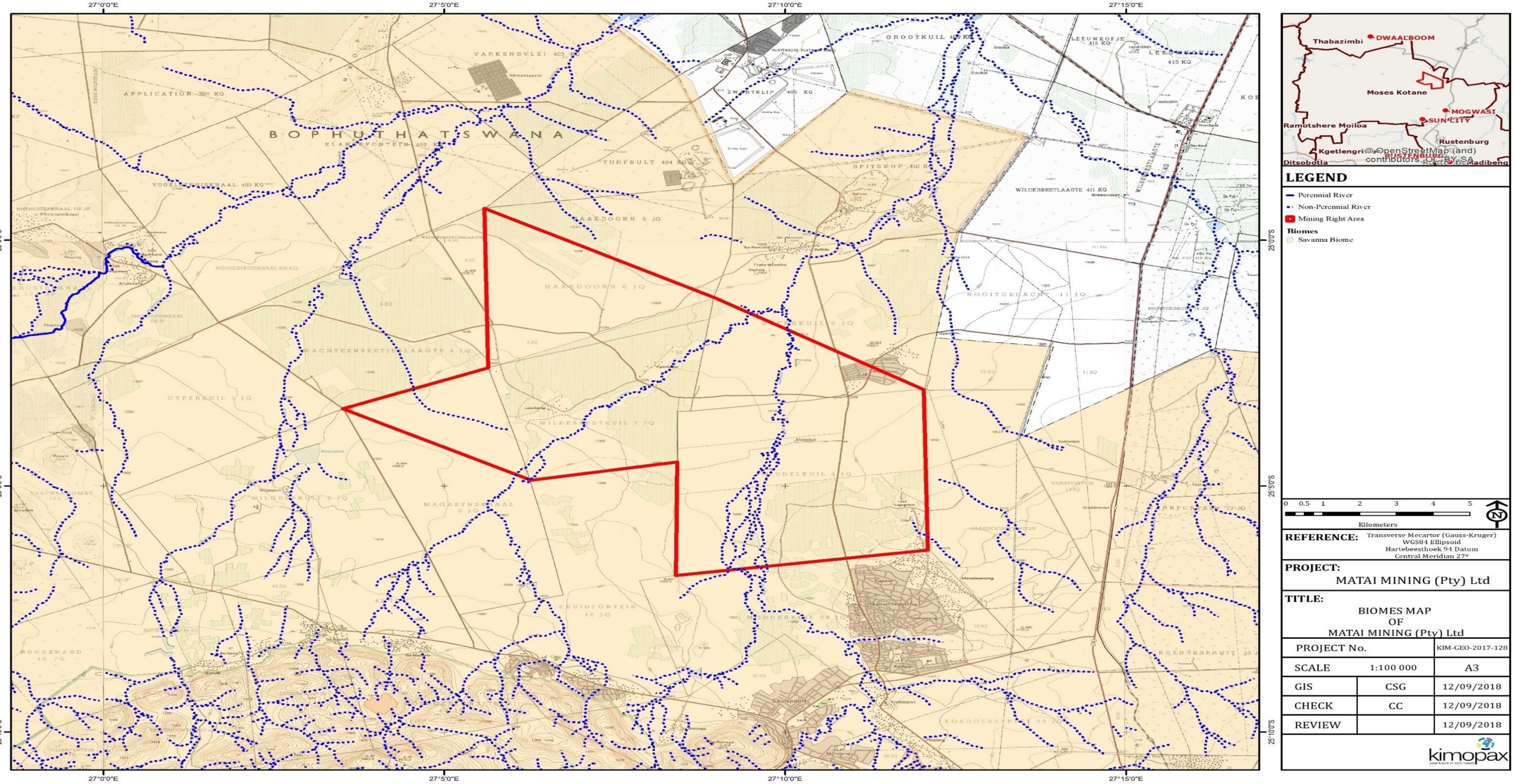

Figure 22: Biomes map

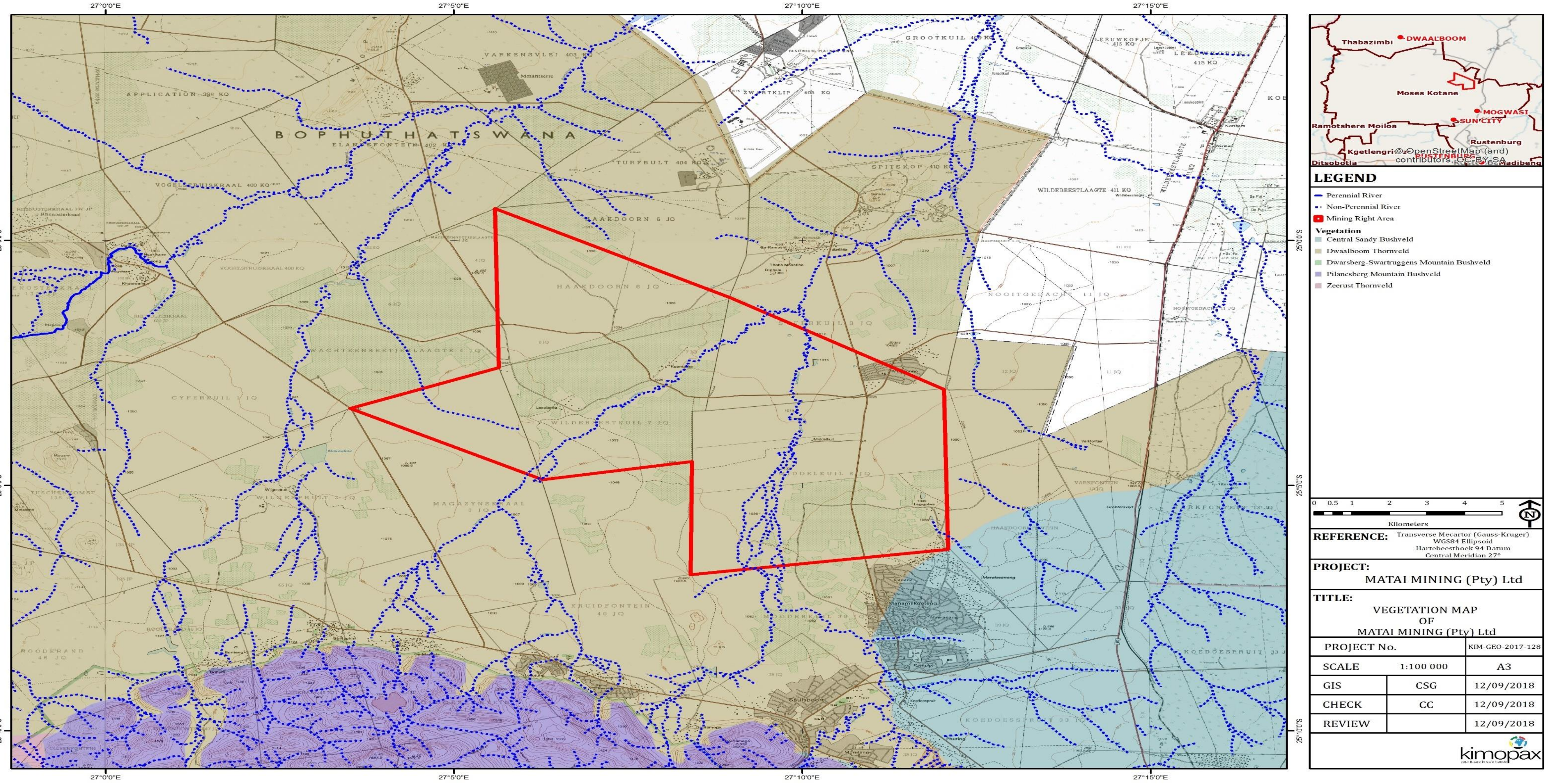

Figure 23: Vegetation Map

8.1.12.2 Faunal Assessment

8.1.12.2.1 *Mammals*

The assessment for mammal species was conducted at desktop level and field investigation to determine the probability of occurrence of faunal species. The potential species that may occur within the project area are listed in Table 8. It must be noted that the possible species list is at desktop level and may include species that were previously recorded in the area and are no longer occurring.

Table 8: The possible mammal species occurring within the project area

Family	Scientific name	Common name	Conservation Status
Bovidae	*Aepyceros melampus*	Impala	LC
Bovidae	*Alcelaphus buselaphus*	Hartebeest	LC
Bovidae	*Alcelaphus buselaphus caama*	Red Hartebeest	LC
Bovidae	*Antidorcas marsupialis*	Springbok	LC
Bovidae	*Connochaetes sp.*	African Antelopes and Gnus	LC
Bovidae	*Connochaetes taurinus*	Blue Wildebeest	LC
Bovidae	*Connochaetes taurinus taurinus*		LC
Bovidae	***Damaliscus lunatus lunatus***	**(Southern African) Tsessebe**	**VU**
Bovidae	***Hippotragus niger niger***		**VU**
Bovidae	*Kobus ellipsiprymnus*	Waterbuck	
Bovidae	*Kobus ellipsiprymnus ellipsiprymnus*		LC
Bovidae	*Oreotragus oreotragus*	Klipspringer	LC
Bovidae	*Oryx gazella*	Gemsbok	LC
Bovidae	*Raphicerus campestris*	Steenbok	LC
Bovidae	*Redunca arundinum*	Southern Reedbuck	LC
Bovidae	*Redunca fulvorufula*	Mountain Reedbuck	LC
Bovidae	*Sylvicapra grimmia*	Bush Duiker	LC
Bovidae	*Syncerus caffer*	African Buffalo	LC
Bovidae	*Taurotragus oryx*	Common Eland	LC
Bovidae	*Tragelaphus scriptus*	Bushbuck	LC
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	LC
Canidae	*Canis mesomelas*	Black-backed Jackal	LC
Canidae	***Lycaon pictus***	**African wild dog**	**EN**
Cercopithecidae	*Chlorocebus pygerythrus*	Vervet Monkey	LC

Family	Scientific name	Common name	Conservation Status
Cercopithecidae	*Chlorocebus pygerythrus pygerythrus*	Vervet Monkey (subspecies pygerythrus)	LC
Cercopithecidae	*Papio ursinus*	Chacma Baboon	LC
Elephantidae	*Loxodonta africana*	African Bush Elephant	LC
Emballonuridae	*Taphozous (Taphozous) mauritianus*	Mauritian Tomb Bat	LC
Equidae	*Equus quagga*	Plains Zebra	LC
Erinaceidae	***Atelerix frontalis***	**Southern African Hedgehog**	**NT**
Felidae	***Acinonyx jubatus***	**Cheetah**	**VU**
Felidae	*Caracal caracal*	Caracal	LC
Felidae	***Felis nigripes***	**Black-footed Cat**	**VU**
Felidae	*Felis silvestris*	Wildcat	LC
Felidae	***Leptailurus serval***	**Serval**	**NT**
Felidae	*Panthera leo*	Lion	LC
Felidae	***Panthera pardus***	**Leopard**	**VU**
Giraffidae	*Giraffa camelopardalis camelopardalis*	Nubian Giraffe	LC
Giraffidae	*Giraffa camelopardalis giraffa*	South African Giraffe	LC
Gliridae	*Graphiurus (Graphiurus) murinus*	Forest African Dormouse	LC
Herpestidae	*Helogale parvula*	Common Dwarf Mongoose	LC
Herpestidae	*Herpestes sanguineus*	Slender Mongoose	LC
Hippopotamidae	*Hippopotamus amphibius*	Common Hippopotamus	LC
Hyaenidae	***Crocuta crocuta***	**Spotted Hyaena**	**NT**
Hyaenidae	***Hyaena brunnea***	**Brown Hyena**	**NT**
Hyaenidae	*Proteles cristata*	Aardwolf	LC
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	LC
Leporidae	*Lepus sp.*	Hares	LC
Leporidae	*Lepus saxatilis*	Scrub Hare	LC
Molossidae	*Sauromys petrophilus*	Roberts's Flat-headed Bat	LC
Muridae	*Aethomys ineptus*	Tete Veld Aethomys	LC
Muridae	*Aethomys namaquensis*	Namaqua Rock Mouse	LC
Muridae	*Gerbilliscus brantsii*	Highveld Gerbil	LC
Muridae	*Gerbilliscus leucogaster*	Bushveld Gerbil	LC
Muridae	*Lemniscomys rosalia*	Single-Striped Lemniscomys	LC
Muridae	*Mastomys sp.*	Multimammate Mice	LC
Muridae	***Otomys auratus***	**Southern African Vlei Rat**	**NT**
Muridae	*Thallomys paedulcus*	Acacia Thallomys	LC

Family	Scientific name	Common name	Conservation Status
Mustelidae	*Mellivora capensis*	Honey Badger	LC
Nesomyidae	*Steatomys pratensis*	Common African Fat Mouse	LC
Procaviidae	*Procavia capensis*	Cape Rock Hyrax	LC
Rhinolophidae	*Rhinolophus simulator*	Bushveld Horseshoe Bat	LC
Sciuridae	*Paraxerus cepapi*	Smith's Bush Squirrel	LC
Suidae	*Phacochoerus africanus*	Common Warthog	LC
Viverridae	*Civettictis civetta*	African Civet	LC
Viverridae	*Genetta tigrina*	Cape Genet (Cape Large-spotted Genet)	LC

The field investigation was conducted by traversing the project area by vehicle and on foot. The faunal activity was determined to be low within the project area and may result from the current lack of water within the area. Only two faunal species were confirmed within the project area as presented in Table 9. There were no fauna of conservation concern identified within the project area.

Table 9: Identified faunal species within project area

Family	Scientific name	Common name	Conservation Status
Bovidae	*Aepyceros melampus*	Impala	Least Concern
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern (2016)

8.1.12.2.2 Avifauna

A desktop avifaunal investigation was conducted to determine the bird species that may occur within the project area. A total of 340 bird species is expected to occur within the project area however, a total of 11 were considered to be of conservation concern as listed in Table 10.

Table 10: : Avifaunal species that may occur within the project area

Common name	Species name	Conservation Status
Bustard, Kori	*Ardeotis kori*	VU
Eagle, Martial	*Polemaetus bellicosus*	VU

Common name	Species name	Conservation Status
Eagle, Tawny	*Aquila rapax*	VU
Falcon, Lanner	*Falco biarmicus*	NT
Marsh-harrier, African	*Circus ranivorus*	VU
Oxpecker, Red-billed	*Buphagus erythrorhynchus*	NT
Secretarybird, Secretarybird	*Sagittarius serpentarius*	NT
Stork, Yellow-billed	*Mycteria ibis*	NT
Vulture, Cape	*Gyps coprotheres*	VU
Vulture, Lappet-faced	*Torgos tracheliotus*	VU
Vulture, White-backed	*Gyps africanus*	VU

The field survey was conducted by traversing the project area by vehicle and on foot. Visual observations and calls are the main identifiers of bird activity, with focus placed on areas around open water and tree canopies. The bird survey determined that avifaunal activity was low within the project as a result of the lack of water. In most instances watercourses such as rivers and streams make for ideal birding locations; in this instance the rivers were dry and did not attract bird species. The bird species that were observed and positively identified within the project area are listed in Table 11.

Table 11: Identified bird species within the project area

Common name	Species name	Conservation Status
Guineafowl, Helmeted	*Numida meleagris*	LC
Bunting, Cape	*Emberiza capensis*	LC
Pipit, African	*Anthus cinnamomeus*	LC
Olive-pigeon, African	*Columba arquatrix*	LC
Widowbird, Long-tailed	*Euplectes progne*	LC
Plover, Common Ringed	*Charadrius hiaticula*	LC
Robin-chat, Cape	*Cossypha caffra*	LC

8.1.12.2.3 Herpetofauna

The herpetofauna survey consisted of a desktop study and the field investigation. The desktop study determined that the species listed in Table 12. There were no herpetofauna of conservation concern expected for the project area.

Table 12: The possible herpetofauna within the project area

Family	Scientific name	Common name	Conservation Status
		Reptiles	
Agamidae	*Acanthocercus atricollis*	Southern Tree Agama	LC
Agamidae	*Agama aculeata distanti*	Distant's Ground Agama	LC
Agamidae	*Agama atra*	Southern Rock Agama	LC
Chamaeleonidae	*Chamaeleo dilepis*	Common Flap-neck Chameleon	LC
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	LC
Colubridae	*Dispholidus typus viridis*	Northern Boomslang	Not evaluated
Colubridae	*Philothamnus semivariegatus*	Spotted Bush Snake	LC
Cordylidae	*Cordylus vittifer*	Common Girdled Lizard	LC
Elapidae	*Dendroaspis polylepis*	Black Mamba	LC
Elapidae	*Naja mossambica*	Mozambique Spitting Cobra	LC
Gekkonidae	*Hemidactylus mabouia*	Common Tropical House Gecko	LC
Gekkonidae	*Lygodactylus capensis capensis*	Common Dwarf Gecko	LC
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	LC
Lacertidae	*Nucras intertexta*	Spotted Sandveld Lizard	LC
Lamprophiidae	*Limaformosa capensis*	Common File Snake	LC
Lamprophiidae	*Psammophylax tritaeniatus*	Striped Grass Snake	Least Concern (SARCA 2014)
Pelomedusidae	*Pelomedusa galeata*	South African Marsh Terrapin	Not evaluated
Pelomedusidae	*Pelusios sinuatus*	Serrated Hinged Terrapin	LC
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	LC
Scincidae	*Trachylepis varia sensu lato*	Common Variable Skink Complex	LC
Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise	LC
Varanidae	*Varanus albigularis albigularis*	Rock Monitor	LC
Varanidae	*Varanus niloticus*	Water Monitor	LC
Viperidae	*Bitis arietans arietans*	Puff Adder	LC
		Frogs	
Brevicepitidae	*Breviceps adspersus*	Bushveld Rain Frog	LC
Bufonidae	*Schismaderma carens*	Red Toad	LC
Bufonidae	*Sclerophrys garmani*	Olive Toad	LC

Family	Scientific name	Common name	Conservation Status
Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	LC
Bufonidae	*Sclerophrys poweri*	Power's Toad	LC
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	LC
Microhylidae	*Phrynomantis bifasciatus*	Banded Rubber Frog	LC
Phrynobatrachidae	*Phrynobatrachus natalensis*	Snoring Puddle Frog	LC
Pipidae	*Xenopus laevis*	Common Platanna	LC
Ptychadenidae	*Ptychadena anchietae*	Plain Grass Frog	LC
Ptychadenidae	*Ptychadena mossambica*	Broadbanded Grass Frog	LC
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	LC
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	LC
Pyxicephalidae	*Tomopterna sp.*		LC
Pyxicephalidae	*Tomopterna cryptotis*	Tremelo Sand Frog	LC
Pyxicephalidae	*Tomopterna natalensis*	Natal Sand Frog	LC
Rhacophoridae	*Chiromantis xerampelina*	Southern Foam Nest Frog	LC

There were no herpetofauna species identified during the field investigation. Owing to the brevity of field investigation, the disturbed nature of the project area and the current climate conditions, it is anticipated that these species may have relocated for lack of adequate habitat. It must be noted that occurrence of these species within the project is highly likely.

8.2 *Socio-Economic Environment*

8.2.1 Administrative setting

There is a dual system of governance in the province i.e. the political structures of governance and the traditional authorities, each of the administrative structures is briefly described below.

8.2.1.1 Administrative Authorities

The application falls within the jurisdiction of Moses Kotane Local Municipality. The Municipality covers an area of approximately 5 719km^2 and is mostly rural in nature, comprising 107 villages and two formal townships of Mogwase and Madikwe with an estimated population of 242 553. The 2011 Census report's estimate that there are 75 193 households. Moses Kotane Local Municipality is one of the five constituent local municipalities of Bojanala Platinum District Municipality in North West Province of the Republic of South Africa. It shares borders with Rustenburg, Kgetleng Rivier, Ramotshere Moiloa and Thaba Zimbi Local Municipalities

8.2.1.2 **Tribal Authorities**

Traditional authorities refer to mainly rural areas whereby chiefs and their councils are responsible for administrative tasks at a community level and in mobilising local communities if there are any investment Projects within their area of jurisdiction. The Matai Mining proposed project is located within a traditional area, namely Bakgatla-Ba- Kgafela Traditional Authority (BBKTA), however, there are other traditional authority/ lies in close proximity to the proposed project area namely Bathalerwa and Baphalane Traditional Authorities which share immediate borders with the BBKTA jurisdiction and Mmatsere Traditional Authority (MTA) and Bakubung Ba Ratheo (BBR) (Development, 2014).

The BBKTA community consists of 32 villages and is located in the North West province along the Western Bushveld Complex, the world's largest known platinum reef, and as such is greatly influenced by the platinum mining industry. The area is also impacted by the demographic and economic realities of neighbouring communities. This includes urban areas in Gauteng, provincial developments in the North West and Limpopo, market activity in southern Botswana, and interactions with other traditional authorities

8.2.2 Economic Activity

The economy of Moses Kotane is mainly characterised by tourism, mining and agriculture, owing to its location within the major tourism and mining belt of the North West province, namely Pilanesberg and Sun City. Industry and social services also form a critical part of the local economy

8.2.3 Socio-Economic Profile

This section describes the socio-economic characteristics of the potentially affected area in order to develop an understanding of the broad social and economic conditions of the environment. The proposed project has the potential to result in both positive and negative socio-economic impacts. As such, it is essential that the socio-economic baseline conditions are understood to ensure accurate identification and assessment of potential impacts associated with the proposed project.

The data used in this socio-economic analysis was obtained from the MKLM 2017/2018, BPDM 2017/2022 IDP, Statistics South Africa, 2011, Community Survey, 2016 and BBKTA Masterplan

8.2.4 Demographic Profile

8.2.4.1 Population and Growth Trends

According to StatsSA (Census 2011), NWP has a population of approximately 242 554. According to the 2011 Census, Moses Kotane Local Municipality has a total population of 242 554 people, of which 98,3% are black African, 0,8% are white, with the other population groups making up the remaining 0,9 %. Of those aged 20 years and older, 9,3% have no schooling, 17,1% have some primary school education, 35,3% have some secondary education, 27,4% have completed matric, and 5,3% have some form of higher education. An average household size of 3.2.

NWP has a population of approximately 3,5 million residents, with an average household size of 3.2 and a growth rate of 1,6%. The BPDM population constitutes 42% of the provincial population with an average household size of 2.9 and 2,2% growth rate. MKLM population constitutes approximately 16% of the District Municipality population with an average household size of 3.2 (same as the province) and 0,2% growth rate (Census, 2011).

The population of NWP, BPDM and MKLM is also young with an average of 58% being under 35 years of age (Census 2011). There are also more men in the Province (50,7%) and in BPDM (57,8%). Contrary to the Province and District municipality, there are marginally more females in MKLM (50,2%). Black Africans compromise the majority population group in the Province (90%) followed by Whites (7,3%), Coloureds (2%), and Indian/Asians (0,6%). A similar pattern is also observed at the municipal levels. The majority of the population in NWP, BPDM and MKLM (64,7%, 68% and 63%, respectively) is within the working age group. Dependency ratios in NWP, BPDM and MKLM are estimated at 54,5%, 47,3% and 58,6% respectively (StatsSA (Census, 2011). **Error! Reference source not found.** below present statistical information for the wards located within the Project area.

Table 13: **Moses Kotane Local Municipality Wards 7, 8 and 22 Population Information**

Aspect	Ward 7	Ward 8	Ward 22
Population	4 227	1 999	10 842
Males	55%	52.1%	50.2%
Females	45.1%	47.9%	49.8%
Black Africans	99.5%	99%	99.6%
Whites	0.0%	0.4%	0.1%
Other Races	1%	0.6%	1%

Source: Stats SA (Census, 2011)

The Bakgatla Ba Kgafela tribe consists of approximately 350 000 people. The total number of people living in the BBKTA jurisdiction in 2012 was estimated to be 117 000. This is approximately 35% of the total population in the MKLM. Therefore, it is assumed that only one-third of the Bakgatla Ba Kgafela tribe reside permanently in the BBKTA jurisdiction. This low level of residency is attributed to local joblessness which forces many community members to leave the area in search of employment (Development, 2014).

8.2.4.2 Household Size and Composition

The socio-economic survey conducted by BBKTA reveals that each household in the BBKTA jurisdiction accommodates an average of 4.2 people. Approximately 54.5% of residents are female. This high female to male ratio is attributed to the limited economic opportunities in the region which force many men to leave in search of employment as well as the higher life expectancy among women. As a result, the majority of households in the jurisdiction are headed by females. This results in socioeconomic consequences including lower incomes, a greater number of dependants and, as a result, higher levels of poverty (Development, 2014).

8.2.4.3 Employment and Income

The unemployment rate in the BBKTA is approximately 49% which is higher than the 37,9% unemployment rate for the MKLM. The mining sector is the largest employer of Bakgatla community members. Approximately 48% of employed Bakgatla residents work in the mines. The second largest employer is the retail sector accounting for approximately 12% of the local workforce, and 8%, 6%, 5%, 4% and 2% in social services, domestic work, government, manufacturing, construction and tourism respectively. Approximately 77% of residents earn less than R 3 000 per month with 39% of residents in the R 750 to R 1 500 bracket (Development, 2014).

8.2.4.4 Education Levels

The level of school attendance and educational achievement in a study area is an important indicator of development as well as the potential for economic growth. The socio-economic survey found that 26% of household members are currently full-time students. The rate of attendance was the highest among primary school-aged children (99%) but dropped steadily as ages increased. This indicates that many students drop out of school prior to finishing their matric, likely as a result of limited motivation, support and post-graduation opportunities. The highest level of education achieved by local residents according to the socio-economic survey is illustrated in Figure 24 It shows that approximately one-quarter of residents have no formal schooling while 57% have some schooling. It should be noted however that, although this lack of schooling is problematic, the rate of non-attendance is higher among those outside of the working age population (the very young and old population) (Development, 2014).

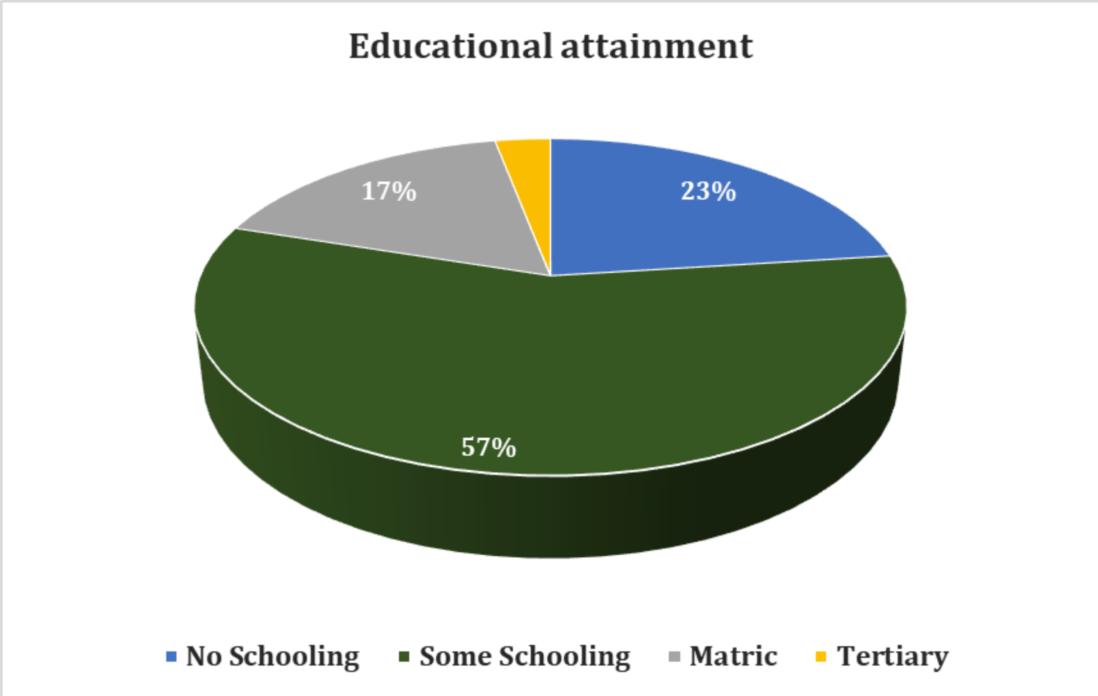

Figure 24: Educational attainment (Development, 2014)

More problematic, however, regarding economic development, is the low percentage of residents that have completed matric (17%) and/or tertiary studies (3%), as well as the fact that less than 1% of the population is currently enrolled in a tertiary institution. This is attributed to high levels of out-migration among the educated as well as a lack of local emphasis on educational attainment. It is therefore important that the BBKTA emphasis attendance at local high schools and FET colleges, as well as encourage educated ex-community members and other professionals to move to the area. These interventions are deemed imperative for the successful implementation of planned socio-economic projects, many of which require a semi-skilled workforce (Development, 2014).

8.2.4.5 Health

The BBKTA jurisdiction, as with much of rural South Africa, is home to a large proportion of elderly residents as well as low-income households. These demographics combined with the prevalence of HIV/AIDS and the lack of access to hospitals and high-quality clinics contribute to poorer health statistics. This, in turn, limits the potential for economic growth, lowers quality of life, and increases the burden on caregivers. The socio-economic survey questioned residents about their health and the health of those in their households the results of which are illustrated in Figure 25. It was revealed that only 66% of residents are deemed to be in good health, with 12% considered in poor health. Interestingly these figures varied widely throughout the BBKTA jurisdiction with regions in the central and northern area reporting significantly poorer health than those located closer to clinics and hospitals. More specifically the level of poor health increased to 15% in Mopyane and as high as 28% in Motlhabe. The relatively high instance of ill health is also related to the overall lack of health insurance. In total, only 7% of households surveyed had a health insurance plan contributing an average of R600 per month. Approximately three-quarters of those with health insurance received coverage through their employer, which was most common among government and mine workers (Development, 2014).

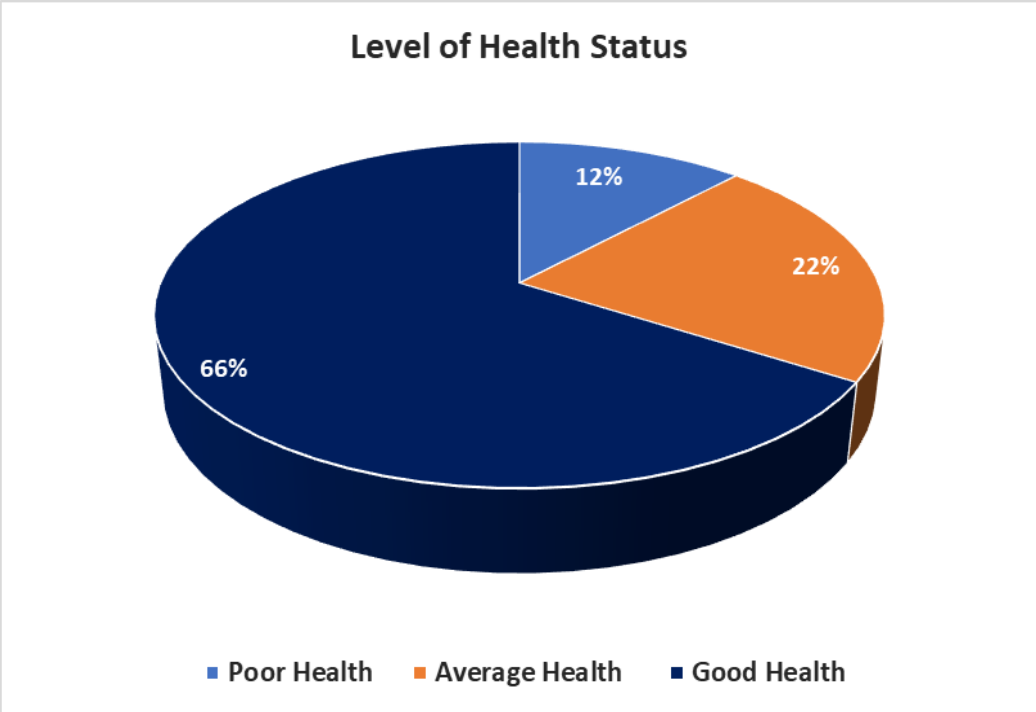

Figure 25: Level of health status (Development, 2014).

8.2.5 Sewerage and Sanitation

The availability of sanitation facilities not only improves the dignity of people, but also promotes their health. Areas without proper sanitation systems give rise to water borne diseases like cholera, diarrhoea, and typhoid. It is therefore important that as a municipality, prioritisation should be given to this service, particularly taking into account any backlogs.

Sewerage and Sanitation						
Green Drop Score	n/a	n/a	n/a	n/a	0	0
Is the municipality responsible to provide?	Yes	Yes	Yes	Yes	Yes	Yes
Does the municipality have infrastructure to provide?	Yes	Yes	Yes	Yes	Yes	Yes
Does the municipality actually provide?	Yes	Yes	Yes	Yes	Yes	Yes
Is the service outsourced/commercialised?	No	No	No	No	No	No
Number of households and non-domestic customers to which provided	25 219	25 219	24 219	24 219	18 494	18 494
Number of households using:						
Flush toilet - public sewerage	6 793	6 793	6 793	6 793	6 793	6 793
Flush toilet - septic tank	0	0	0	0	0	0
Ventilated pit latrine	18 185	18 185	17 185	17 185	11 460	11 460
Bucket system	0	0	0	0	0	0
Other	0	0	0	0	0	0
Domestic households with access to free basic service	1 190	1 033	965	911	785	727

The following chart shows the sanitation facilities that are available in the MKLM. 79% of the households in MKLM mostly rely on pit latrines for sanitation purposes.

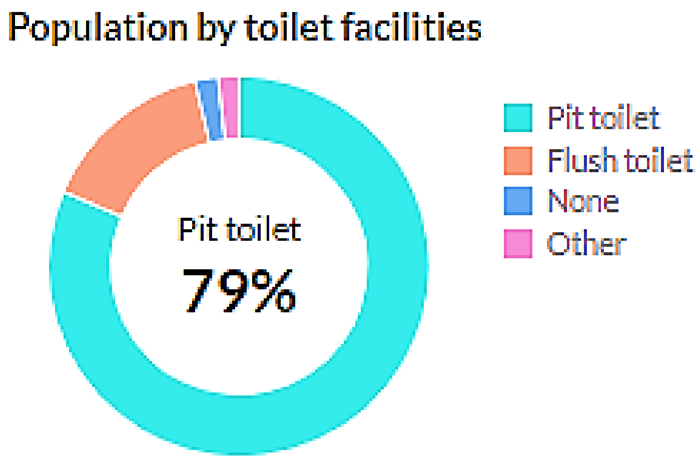

Figure 26: Population by toilet facilities

8.2.6 Refuse Removal

South Africa generates 19 million tons of waste per year and this is often harmful to the environment and people's health. According to Section 24 of the national constitution, all South Africans have the right to an environment that is not harmful to a person's health and wellbeing. The pollution and waste management act gives the local municipalities the responsibility on waste removal.

Solid Waste Services						
Is the municipality responsible to provide?	Yes	Yes	Yes	Yes	Yes	Yes
Does the municipality have infrastructure to provide?	Yes	Yes	Yes	Yes	Yes	Yes
Does the municipality actually provide?	Yes	Yes	Yes	Yes	Yes	Yes
Is the service outsourced/commercialised?	No	No	No	No	No	No
Number of households and non-domestic customers to which provided	75 193	75 193	63 000	63 000	63 000	63 000
Domestic households with access to free basic service	20 591	18 212	965	911	785	727

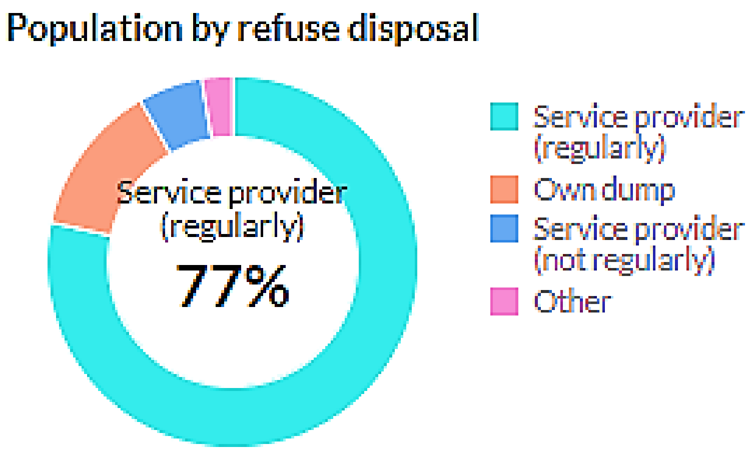

Figure 27: Population by refuse disposal

8.2.7 Housing

The Moses Kotane housing market has experienced an increase in housing due to the mining industry in the neighbouring towns. The mining towns provide stable incomes, new housing investment, and in particular, a thriving housing market. This is likely due to continued growth and expansion of the mining sector and jobs along the Platinum District, and the increasing urbanisation of previously undeveloped or rural areas within the municipality. Recent growth has surged a bit, creating an opportunity for markets to be carefully assessed in order to best position the next wave of growth.

According to the Community Survey 2016, there are approximately 80 654 households in MKLM of which approximately 77% are considered formal settlements a decrease of 4% since 2011. The number of households has increased from 75 195 recorded in the 2011 census. 10.9% live in informal settlements (i.e. shacks) which is more the half of the percentage of households that are informal dwellings in Bonjala District Municipality (26.8%). The IDP (2018-2019) has reported that the municipality is experiencing shortages of houses. The Community Survey of 2016 indicated that 79.9% of the households are either fully owned or being paid off with is 25% high than the rate for the Northwest Province.

The majority of households are headed by men (59%) and it is estimated that 425 households are headed by children under the age of 18 years. Of the child-headed households approximately 26.8% live in informal dwellings, which is comparable to the rates in Bojanala (28.8%). The majority of child-headed households (72%) are headed by boys.

The average household income is about half the average found in Bojanala at R14 600. The majority of the households (84%) earn less the R 75 000 on average. Almost all the households (91%) have access to a cell phone (used to access the internet) and the majority of homes also have access to a fridge (80%), stove (84%) and TV (80%). A limited number of households had access to a car (22%) and computers (13%).

9 Description of specific environmental features and infrastructure on the site.

9.1 *Infrastructure*

9.1.1 Powerlines and Pipelines

Eskom has got an existing powerline that traverses the site on the eastern portion of the proposed pit area. Magalies water have an existing water pipeline that also traverse the site on the eastern portion of the pita area. (Figure 28Refer to Figure 28).

9.1.2 Access Road

A site access road is required to link the site to the national road system. The nearest national road is the R510 which is approximately 15 kilometers ("km") to the east of the site. The current gravel road (9km) requires upgrading.

There is an existing powerline, water pipeline, resevior, gravel roads, and rails that traverse the site as illustrated in Figure 28 site below. The nearest national road is the R510 which is approximately 15km from the site.

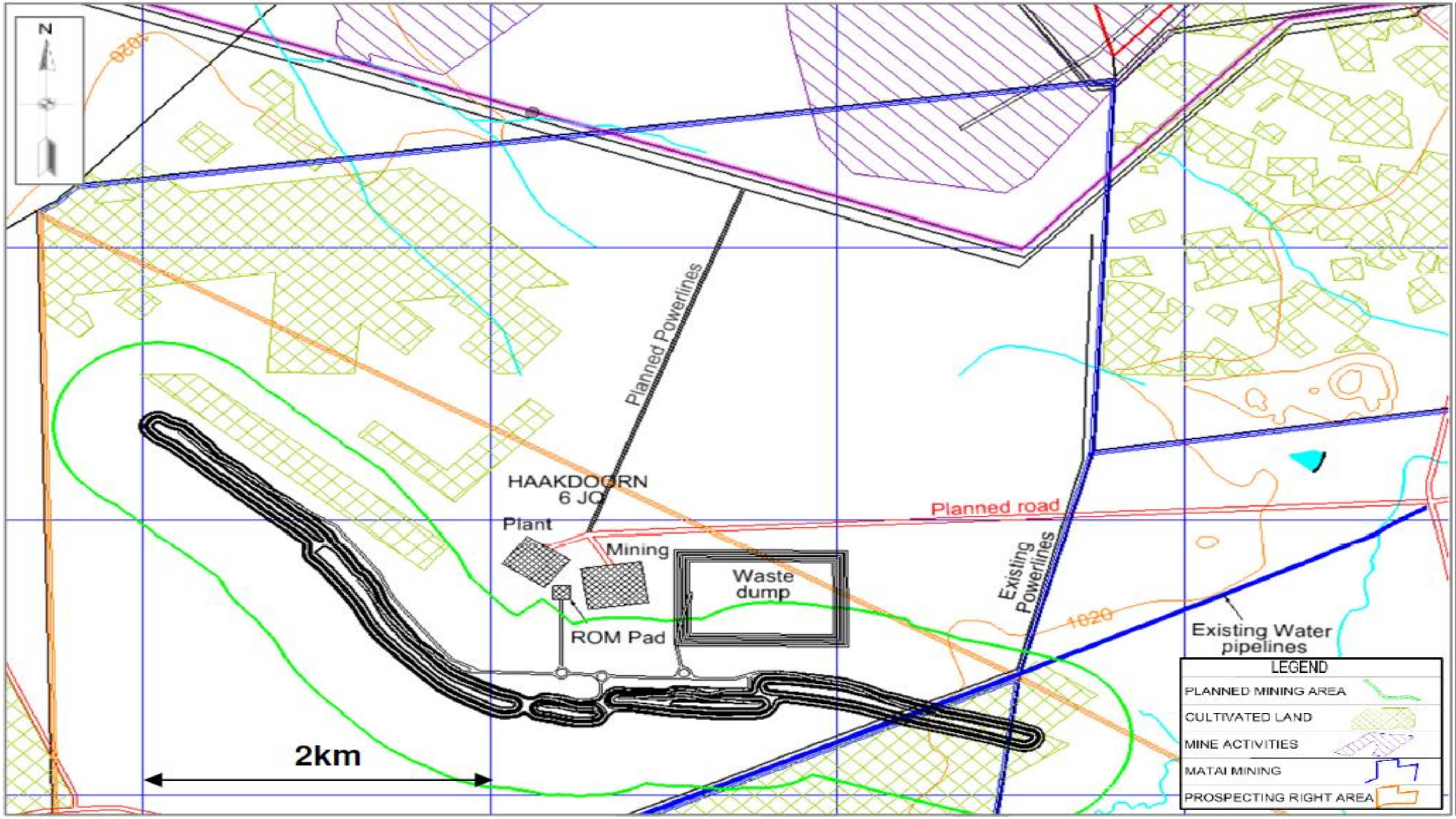

Figure 28: Proposed and existing infrastructure on site

9.2 *Environmental and Current Land Use Map.*

(Show all environmental, and current land use features)

The proposed mining site is an agricultural area and is characterized by farming and mining activities, generally the land use is open veld and wilderness as illustrated in Picture 1.

Picture 1: Property used for grazing

The properties have also been used for subsistence crop farming as illustrated in Picture 2

Picture 2: Evidence of cultivation

Although there is evidence of past agricultural use, the current land use is largely natural veld interspersed with some exotic plant species. Woodlands is identified on the farm in the higher altitude areas.

9.3 *Environmental and Current Land Use Map.*

(Show all environmental and current land use features)

The mining right area is characterised by mining, rural communities, grazing areas and portions of cultivated land as illustrated in Figure 29: Land-use map.

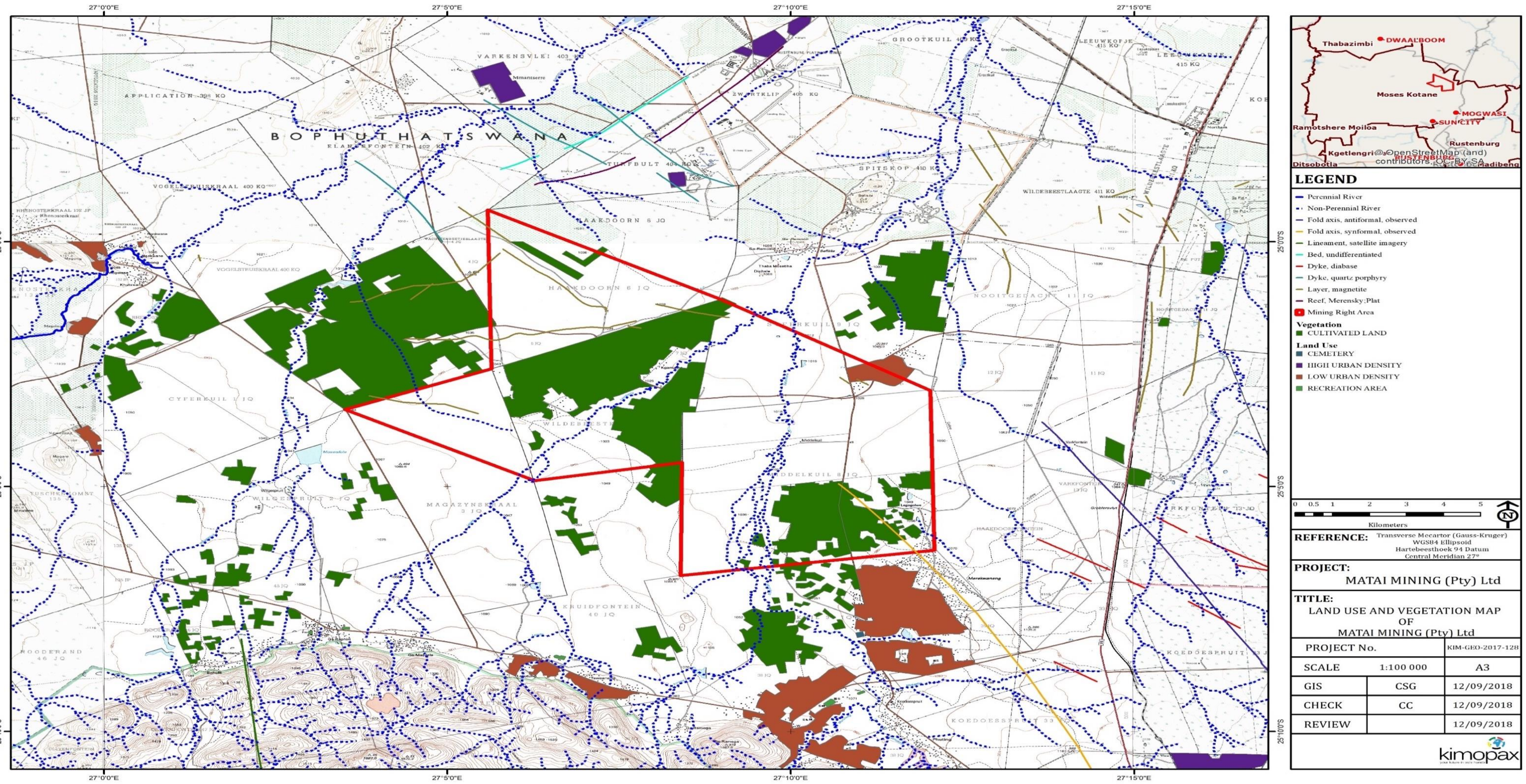

Figure 29: Land-use map

10 POTENTIAL IMPACTS IDENTIFIED

During the scoping phase the following impacts were identified:

a) Ground water

Groundwater abstraction from pits for safety of mine workers and equipment will result in the reduction of groundwater yield.Seepage from tailings facility and spillages of hydrocarbons will contribute to groundwater contamination During the mining phase, the project could have medium to significance impact on the groundwater regime.

b) Surface water

Stormwater run-off from the plant, tailings facility, workshop area and stockpiles could contain high concentrations of metals, sulphate, hydrocarbons and silt. These high concentrations could lead to the contamination of nearby surface water bodies. The mining operations could have a medium to high impact significance on the surface water bodies if not properly managed.

c) Ecology

The mine will result in the permanent and temporary removal of vegetation within the mine and infrastructure footprint. This in turn will result in the destruction of faunal habitats and the temporary migration of fauna until suitable habitat has been restored after the mine closure. This impact could result in a high significance during the mining operations.

d) Air Quality

Release of fugitive emissions in the form of PM_{10} particulates N2O, CH4 and CO2 impact on air quality within and near the project area, particularly in the downwind direction during drilling, blasting, excavations, transporation and from overburden could have a medium impact significance on ambient air quality during the mining operations

e) Noise

General increase in ambient noise levels during drilling, blasting, hualing and operation of the plant could result in high to medium significance impact during operational phase if properly managed.

f) Visual

The proposed mining area is characterised by a flat terrain which will increase visibility of the mine and its infrastructure without vegetation screening. This impact will have a high impact significance in close proximity to the mine.

g) Cultural and Heritage

The area does not have any structures or remnants of Heritage or Cultural importance It is however possible that unmarked graves could, be unearthed during excavations . Nonetheless the impact significance will be medium during operational phase.

h) Socio-economics

The mine will contribute to employment opportunities in the affected villages and also contribute to local economic development projects as well as alleviate household poverty levels. The impact is positive which will have a high significance in the affected communities

11 EIA PROCESS AND METHODOLOGY

The EIA process and methodology that was followed during the scoping phase was based on the best practise guidelines and the requirements of the NEMA and MPRDA The approach used comprised of the following:

a) A gap analysis of existing studies that were done in the same area by different consultants
b) Project definition and the analysis of alternatives which involved data review and sensitivity mapping and also the analysis of identified alterntaives
c) Screening which involved the review orf identified environmental, water and mining legislations applicable to the study
d) Site visit to collect baseline information on the environmental conditions that could be affected by the mine
e) Public Participation was done through out the whole scoping phase to capture comments that were raised by different communities. Issues raised were also used to formulate terms of references for other specialist studies.

During the EIA phase the following activities will be done:

a) Integrating of specialist reports into the EIA focusing mainly on the specialist findings, identified impacts mitigatory measures and recommendations
b) Preparation of the EIR which will present all the findings of the impact assessment. Report will be distributed for public participation.
c) Public participation will continue throughout the EIA phase to ensure that comments and issues raised by communities are addressed.

11.1*Scoping Methology*

Scoping phase methodology comprised of the following:

a) Pre-application meetings were held with communities
b) Submission of EA application form after pre-application public participation

c) Site visit to establish baseline environmental conditions on site

d) Literature review of previous studies done in the study area

e) Public participation to capture and address comments and issues raised by the community.

f) Distribution of the draft report for public to review

g) Compilation and submission of the final scoping report

11.2 *Impact Assessment Methodology*

Impact significance of each identified impact was determined using the methodology explained in Table 14

Table 14: Methodology to determine the extent of the impact

PARAMETERS	DESCRIPTIONS
Extent	Refers to the physical or geographical size that is affected by the impact. It can be categorised into the following ranges: • Onsite – Within specific site boundary (weight value – 1) • Local – Within municipal boundary (weight value – 2) • Regional – Outside municipal boundary (weight value – 3)
Duration	Time span associated with impact: a) Short term – 1 Year or less (weight value – 1) b) Medium term – 1-5 Years (weight value –2) c) Long term – Longer than 5 Years (weight value – 3

PARAMETERS	**DESCRIPTIONS**
Intensity and reversibility	The severity of an impact on the receiving environment: a) Low – Natural and/or cultural processes continue in a modified way and is reversible (weight value – 1) b) Medium – Natural and/or cultural processes stop and is partially reversible (weight value – 2) c) High – Natural and/or cultural processes disturbed to an irreversible state (weight value – 3)
Impact Significance/Consequence	Adding the extent, duration and intensity together provides the significance of the impact (High, Medium or Low). Extent + Duration + Intensity = High/Medium/Low Impact
Probability	The likelihood of an impact occurring: a) Unlikely – 0% - 45% chance of the potential impact occurring (weight value – 1) b) Possible – 46% - 75% chance of the potential impact occurring (weight value – 2) c) Likely - >75% chance of the potential impact occurring (weight value – 3)
Environmental Risk Refer to table below	Multiplication of the significance of the impact by the probability of the impact occurring produces a final conclusion of the overall risk that an impact poses to the surrounding environment.

PARAMETERS	DESCRIPTIONS
	High/Medium/Low Impact X Probability = High/Medium/Low Environmental Risk

	Risk Assessment Matrix			
	Low Impact (1 -5)	Medium (6-8)	High Impact (9)	
Probability	Definite/Very Likely (3)	9 - 15 L-M	18-24 M-H	27 H
	Possible (2)	6-10 L-M	12-16 M	18 M-H
	Unlikely (1)	3-5 L	6-8 L	9 L

ENVIRONMENTAL RISK	Guidelines for Control Strategies
(H)-High	Proactively reduced risk level, short term response
(M-H) -Medium High	Proactively reduce risk level, short term response
(M)-Medium	Management strategies to reduce risk level, short to medium term response
(L-M) Low -Medium	Management strategies to reduce risk level, short to medium term response, operational control and housekeeping
(L) Low	Operational Control

11.3 *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)

Table 15: Positive and Negative impact of the proposed activity

Alternative		**Advantages**	**Disadvantages**
Activity alternatives (mining method alternatives)	Prefered Alternative (Opencast mining methods)	The shallow nature of Iron Ore, Vanadium and Titanium deposit can easily be mined by means of opencast mining. Economically and socially empowerment of the local communities	Opencast mining methods may result in direct and indirect impacts on several aspects of the environment including: Soil (compaction), flora (clearance and dust), fauna (habitat destruction, noise), air quality (dust, vehicle emissions), noise (animal life and surrounding communities), and surface- and groundwater (spillages, inadequate separation of clean and dirty water, potential leaching of water)
	Alternative 1 (Underground mining method)	In comparison to the preferred alternative, if underground mining would have been feasible there could be less surface-related environmental impacts that would have resulted from mining.	Underground mining has greater safety risk to the miners as compared to the open cast mining method. Owing to the shallow nature of the proposed minerals it is not feasible to undertake underground mining.
No-go versus Open cast mining	Open cast Mining	Mining activity was prefered on the proposed site based on the availability of Vanadium, Titainium and Iron–Ore reserves within the area. The open cast mining is prefered such that the shallow nature of the mineral deposit	**Visual impacts** The development of the mine will have a visual impact on the proposed area due to the dust generation and construction activies resulting to the mining activities.

Alternative		Advantages	Disadvantages
		can easily be mined by means of opencast mining. If the mining right is granted local communities will be positively impacted through employment opportunities that will arise and the proposed area's economy will grow through trading activities associated with mining activities like transport, increase in health facility as well as an increase turnover in hospitality and tourism sectors. Most importantly the proposed mining project will create skills development and community building opportunities to the local community therefore eradicating poverty in such a case stimulating Local Economic Development.	**Dust** The excavation activities and the use of the access dusty roads will result in the emission of dust into the surrounding atmosphere. This will not only impact on the surrounding communities but also the plants surrounding the area as the dust is deposited on the leaves. This interferes with the photosynthesis process of the plants. Furthermore, animals that feed on the plants will be impacted upon as this will affect their forage. **Noise** Noise pollution will be generated from the mining activities, namely through the movement of trucks and vehicles, machinery operations, trenching activities. Depending on the

Alternative		Advantages	Disadvantages
		Not only that, the business opportunities will be encouraged through infrastructural development as roads will be constructed, this will assist in increasing the demand of goods and services in the affected area/s in a long term. The project will contribute directly and indirectly to the Country's GDP. Moreover, the development will encourage income generation in the area as well as the development of BEE opportunities during construction, operation and eventual closure and rehabilitation	size, noise levels of the trucks and excavators may cause the noise to be localised in the specific site. **Soil contamination** Soil pollution due to the leakages of oil and other industrial liquids from the trucks and machineries. This is a potential risk of soil contamination, which will change the soil chemistry and soil nutrients of the affected soil. Ultimately this could also potentially affect the vegetation growth in the contaminated areas. **Impact on heritage resources** The mining activity could result in danger of negatively impacting on unidentified heritage resources during site assessment however, the possibility of the impact is very

Alternative		Advantages	Disadvantages
			minimal as education and training on heritage resources will be given to mine employees. **Fauna disruption** Due to the impacts of noise, dust, movement and operation of trucks and vehicles, the potential loitering of the employees and the trenching itself will disrupt the surrounding animals. This disruption can further lead to injury or death in cases where animals fall into the trenches. **Stripping (Removal of vegetation)** While all means will be applied to minimise disturbance, removal of vegetation cannot be avoided altogether. Deforestation will occur to clear the land for the opencast mining, this will leave the ground bare and prone to erosion.

Alternative		Advantages	Disadvantages
			Soil erosion Erosion of the soil will occur through runoff and wind. **Habitat destruction** The habitat that support the animal within the project site will be disturbed and destructed by the movement and operations during the mining activities. This could possibly cause the relocation of some of the animals, and result in habitat fragmentation. **Waste generation** Debris (slimes), waste rock, litter and other solid waste will be generated and deposited in and around the site. This could potentially attract nuisance and affect the natural scenery of the site. The slimes and waste rock will be used to backfill the

Alternative		**Advantages**	**Disadvantages**
			trenches. This will be undertaken in a concurrent rehabilitation manner. **Surface and ground water impacts** The hazardous chemical spills may lead to surface water containation and ground water due to the leakages.
	No-go Alternative	The implementation of the no-go option would result in the continuation of the current land uses (farming). Therefore, no additional impacts on the bio-physical environment will occur, besides those that are currently occurring, and / or which may potentially occur if the areas are not managed appropriately.	It is also very important to note that the implementation of the no-go option may not necessarily prevent the mining of these resources on the property, as other companies may apply to mine the resources, unless the DMR sterilizes the reserves.
Prefered Layout	The Layout plan presented in Figure 28**Error!**	The site was selected based on the geographic position of the potentially underling required Vanadium, Titanium and Iron reserves, ease of	No disadvantanges have been identified presently

Alternative		Advantages	Disadvantages
(No Layout Alternative was identified)	**Reference source not found.**	operations and mining activities on site as well as minimal disturbance to the community near the sit.e	
Technology Prefered (No techology Alternative was identified).	Excavators, apron feeders, bulldozers, trucks, bowl scraper, crushers, conveyors and shovels	The technologies have a long-term success in terms of mining history. According to Mclanahan (2018), due to their long service life with low-maintenance applications, apron feeders are a popular feeder choice	No disdvantanges have been identified presently
Operation Prefered (No Operation Alternative was identified)	The operation includes the open cast mining, the processing plant, pollution control dams, workshops, material	The mine and its related activies will generate employment opportunies.	Relocation and loss of cattle grazing area for the herders at the Cattle post, overcrowding of the area in search of greener pastures.

Alternative		Advantages	Disadvantages
	stockpiles, storage, excavations, access roads diesel and wash bays		

11.4 *The Possible Mitigation Measures and the Level of Risk.*

a) Air Quality

The main impacts on air quality will be from material handling (soil, waste rock, ore), vehicle entrainment from unpaved roads and from conveyors. Proposed mitigation measures that will be employed include: drop height reduction, avoidance of temporary storage piles, covering and/or enclosure of all transfer points and wet suppression. The main aim will be to maintain low dust concentrations

b) Terrestrial Ecology

Common impacts will comprise of vegetation clearance, habitat destruction, encroachment of alien invasive plant species and loss of species of conservation concern.. Implementation of alien invasive plant management plan during decommissioning to prevent the growth of invasive plants on rehabilitated areas to a low level and the rehabilitation of site with indigenous vegetation that occurs in the vicinity of project area. This will help restore the site to its pre-mining condition

c) Groundwater

Pit dewatering and groundwater contamination from hydrocarbon spillages and decant during post closure will have a high significant impact if not managed. The following mitigation measures if implemented will result in a low impact:

- Store the dewatered water in PCDs and ensure that the dams will have enough storage volume
- If that is not possible, re-introduce treated water into the streams after ensuring that they meet the required standards as per the WUL or river quality objectives
- Supply equal volumes and better-quality water to affected user if proven that there is an impact on specific users
- Monitoring of groundwater water levels and groundwater inflow rates
- Monitoring groundwater levels, decant rates and qualities

d) Surface Water

There is no river that will be affected within the study area where the mine and infrastructure will be located. The closest river is approximately 2.5km from pit and mine infrastructure area. However the possibility of surface water contamination could result due to:

- Clearing the surface and site preparations, for the mine infrastructure will result in exposure of soil surfaces to erosion factors. When a large area of vegetation is cleared and topsoil disturbed, exposing a large area of loose material, susceptible to erosion. During rainfall events, runoff from the exposed site will transport the eroded soil material in to the nearby watercourses.
- Uncontrolled spills of contaminants such as fuel and oils, and subsequent washing away of these into the surface water resources

This will be reduced to a lower level if the following measures are implemented:

- Waste storage facilities should be on a hard parked, roofed and bunded facility.
- Storm water management measures such as diversion berms, trenches and PCDs should be monitored and maintained fairly regularly.
- Prevent and contain hydrocarbon spillages that may wash off into nearby watercourses

e) Soil, land use and land capability

Soil chemical pollution as a result of spills of fuel and lubricants by vehicles and machinery as wells as the accumulation of domestic waste, is considered to be a moderate deterioration of the soil resource. This impact will be localised within the site boundary and have medium-high significance on the soil resource. Another major impact will be soil compaction will be a measurable deterioration that will occur as a result of the weight of the topsoil and overburden stockpiles stored on the soil surface as well as the movement of vehicles on the soil surfaces (including access and haul roads). Impact significant will be lower if the following measures are implemented:

- Locate all soil stockpiles in areas where they will not have to be relocated prior to replacement for final rehabilitation

- To minimise compaction associated with stockpile creation, it is recommended that the height of stockpiles be restricted between of 4 – 5 metres maximum
- A low process or storage inventory must be held to reduce the potential volume of material that could be accidentally released or spilled

f) Noise

The vibration and over-air pressure levels during blasting will result in an increase in the prevailing noise level when blasting take place. The same physical attributes such as distance, topography and wind direction will play a role on how the receptors will perceive the over-air pressure and ground vibration levels which last for up to 3-seconds per blast. The risk level of noise will be medium to members of the public who will be exposed. Proposed mitigation measures will involve the following:

- Regular noise monitoring on site and the surrounding areas
- Locating topsoil and overburden stockpiles to act as acoustic barriers between the opencast mine and receptors where practical; and
- Enclosing noisy equipment, such as crushers, in buildings clad with sound-absorbing materials where necessary.

g) Heritage and Cultural Aspects

The Phase I Archaeological and Cultural Heritage Impact Assessment for the proposed mining right of Vanadium, Titanium and Iron Ore has identified no significant impacts to archaeological or grave resources that will need to be mitigated prior construction. Despite that no archaeological objects were observed during the survey, and that the area is disturbed due to agricultural activities, the client is reminded that unavailability of archaeological material does not mean absentee, archaeological material might be hidden underground. It is thus the responsibility of the developer to notify contractors and workers about archaeological material (e.g., pottery, stone tools, remnants of stone-walling, graves, etc) and fossils that may be located underground to keep the impact low. Furthermore, the client is reminded to take precautions during construction.

12 SITE SELECTION MATRIX AND FINAL SITE LAYOUT PLAN

12.1*Mining Layout*

The layout of the opencast mining areas and the infrastructure areas as shown on Figure 3is dictated by the mining costs, which are in turn determined by the thickness of the overburden, the depth and grade of the ore, the ratio of waste rock to ore and the mining equipment chosen. The in-pit haul roads will move around as the pit geometry develops, but the locations of the exterior haul roads are dictated by the perimeter of the final open pits. Topsoil and overburden berms will be constructed between the perimeter of the open pits and adjacent public roads.

13 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED.

The pit site for the proposed open-cast mining operations was selected based on availability of Vanadium, Titanium and Iron- Ore reserves to be mined. Minerals can only be mined where there are identified and verified, therefore it was not practical to select any other sites. The No-Go option is the only other alternative identified during the Scoping phase. If the proposed operation were not to proceed, the land may or may not be utilized for agricultural, or grazing activities in the future. It is worth noting that as much as the no go option may result in the protection of the environment in situ; the consequences of not proceeding with the proposed operation will include the forfeiture of a mining opportunity and therefore the loss of support towards the Moses Kotane municipality. It would further suggest that no new employment opportunities would be created as well as any resultant community upliftment and development programs would likely take place in the surrounding communities.

If an alternative resource cannot be identified this will limit the development of the proposed mine. The site is therefore regarded as the preferred site and alternative sites are not considered

14 STATEMENT MOTIVATING THE PREFERRED SITE.

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

The location of the proposed mining activity was influenced by the following factors;

a) Availability of the Vanadium, Titanium and Iron Ore;
b) Land ownership;
c) Geo-hydrological impacts; and
d) Available transport modes and routes.

The proposed layout is therefore the most suitable and economically/environmental viable option for the open pit mining

15 ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objectives of the EIA process are to understand the consequence of these potential impacts and to determine to what extent they can be minimised. Based on experience with past studies on similar mining operations, supported by site-specific specialist studies, it should be possible to predict the impacts on noise, heritage, soils, surface water, groundwater, air quality, the ecology and the local socio-economic and to formulate appropriate mitigation measures.

15.1. *Project Phases*

The environmental impacts of the project were considered and assessed for the following phases:

a) Construction;
b) Operational; and
c) Closure and rehabilitation

15.1.1 Construction Phase

According to the Golder and Associates for Smarty Musina Copper project construction phase will comprise of the following:

a) Site survey and putting up pegs to mark the mine and infrastructure footprint
b) Vegetation clearing within the footprint
c) Construction of stormwater facilities
d) Construction of mine infrastructure (worskhops, PCDs, office buildings and plant area)
e) Dermacate mining area and topsoil, overburden and waste rock storage areas

15.1.2 Operational Phase (Mining Phase)

Activities will include the following:

a) Stripping and stockpiling of topsoil and overburden ahead of pit opening

b) Drilling and blasting
c) Open cast mining of the ore
d) Transportation of the mined ore to the processing plant
e) Crushing , and screeining of the ROM
f) Tranportation of processed product off site
g) Equipment and vehicle maintenance at the mine workshop

15.1.3 Closure and Rehabilitation

Activities of closure and rehabilitation will involve:

a) Dismantling of the ore processing plant and removal of all metal structures;
b) Demolition of buildings and other infrastructure and disposal of the rubble;
c) Shaping of tailings facility
d) Emptying and backfilling of PCDs
e) Revegetating the backfilled areas
f) Post-closure monitoring of surface water, groundwater and vegetation

15.2 *Air Quality*

With regards to health effects, the World Health Organisation (WHO) confirms that particulate air pollution is often associated with complaints of the respiratory system (WHO, 2000). PM size is relevant in terms of health as it is responsible for where in the respiratory system a given particle is deposited. There are an increasing number of research studies highlighting the impact of gases and air pollutants on humans. Many of these emissions, even in small quantities, have adverse effects on workers and neighbouring residents alike.

Particles can be classified by their aerodynamic properties into coarse particles, PM_{10} and fine particles, $PM_{2.5}$ (Harrison & Van Grieken, 1998). The fine particles contain the secondarily formed aerosols such as sulphates and nitrates, combustion particles and re-condensed organic and metal vapours. The coarse particles contain earth crust materials and fugitive dust from roads and industries (Fenger, 2002).

In terms of health effects, particulate air pollution is associated with respiratory and cardiovascular morbidity, such as aggravation of asthma, respiratory symptoms and an increase in hospital admissions. Inhalable PM also leads to increased mortality from cardiovascular and respiratory diseases and from lung cancer (WHO, 2013). Particle size is important for health because it controls where in the respiratory system a given particle is deposited. Fine particles are thought to be more damaging to human health than coarse particles, as they are able to penetrate deeper into the lungs (Manahan, 1991). Larger particles are deposited into the extrathoracic part of the respiratory tract while smaller particles are deposited into the smaller airways leading to the respiratory bronchioles (WHO, 2000).

In the past, daily particulate concentrations were in the range 100 to 1000µg/m^3 whereas in more recent times, daily concentrations are between 10 and 100µg/m^3. Overall, exposure-response can be described as curvilinear, with small absolute changes in exposure at the low end of the curve having similar effects on mortality to large absolute changes at the high end (WHO, 2000). Both short-term and long-term exposure to particulate matter in the air can have health impacts (Table 16).

Table 16: Short-term and long-term health effects associated with exposure to PM (WHO, 2004).

Pollutant	Short-term exposure	Long-term exposure
Particulate matter	Lung inflammatory reactions Respiratory symptoms Adverse effects on the cardiovascular system Increase in medication usage Increase in hospital admissions Increase in mortality	Increase in lower respiratory symptoms Reduction in lung function in children Increase in chronic obstructive pulmonary disease Reduction in lung function in adults Reduction in life expectancy

		Reduction in lung function development

15.2.1 Short-term Exposure

There is good evidence that short-term exposure to particulate matter is associated with health effects (WHO, 2013). Health effects associated with short-term exposure to particulates include increases in lower respiratory symptoms, medication use and small reductions in lung function. Susceptible groups with pre-existing lung or heart disease, as well as elderly people and children, are particularly vulnerable. For example, exposure to particulate matter affects lung development in children, including reversible deficits in lung function as well as chronically reduced lung growth rate and a deficit in long-term lung function (WHO, 2011). There is no evidence of a safe level of exposure or a threshold below which no adverse health effects occur (WHO, 2013).

15.2.2 Long-term Exposure

Long-term exposure to low concentrations (~10µg/m^3) of particulates is associated with mortality and other chronic effects such as increased rates of bronchitis and reduced lung function (WHO, 2000). Studies have indicated an association between lung function, chronic respiratory disease and airborne particles. Relative risk estimates suggest an 11% increase in cough and bronchitis rates for each 10µg/m^3 increase in annual average particulate concentrations (WHO, 2000). Based on studies conducted in the USA, Europe and Canada, mortality is estimated to increase by 0.2–0.6% per 10 µg/m^3 of PM_{10} (WHO, 2005; Samoli, et al., 2008). $PM_{2.5}$ is a higher risk factor than the coarse part of PM_{10} (particles in the 2.5–10 µm range), especially as a consequence of long-term exposure. Long-term exposure to $PM_{2.5}$ is associated with an increase in the long-term risk of cardiopulmonary mortality by 6–13% per 10 µg/m^3 of $PM_{2.5}$ (Beelen, et al., 2008; Krewski, et al., 2009; Pope III, et al., 2002).

15.2.3 Emissions Rates

Emissions from each of the activities at the proposed Matai Mining Project were quantified by using the above set of emission factors and equations in combination with site-specific parameters for the mine area. The relative emissions of PM_{10} from mining activities at the proposed Matai Mining Project are summarised in pie chart format in Figure 30 (uncontrolled) and Figure 31 (mitigated). The pit emissions include emissions from haul trucks carrying material to the backfill areas. Haul roads and the crushing and screening activities represent the biggest sources of PM. Both of these sources can be mitigated efficiently, resulting in a substantial reduction in emissions. This is illustrated in Figure 32.

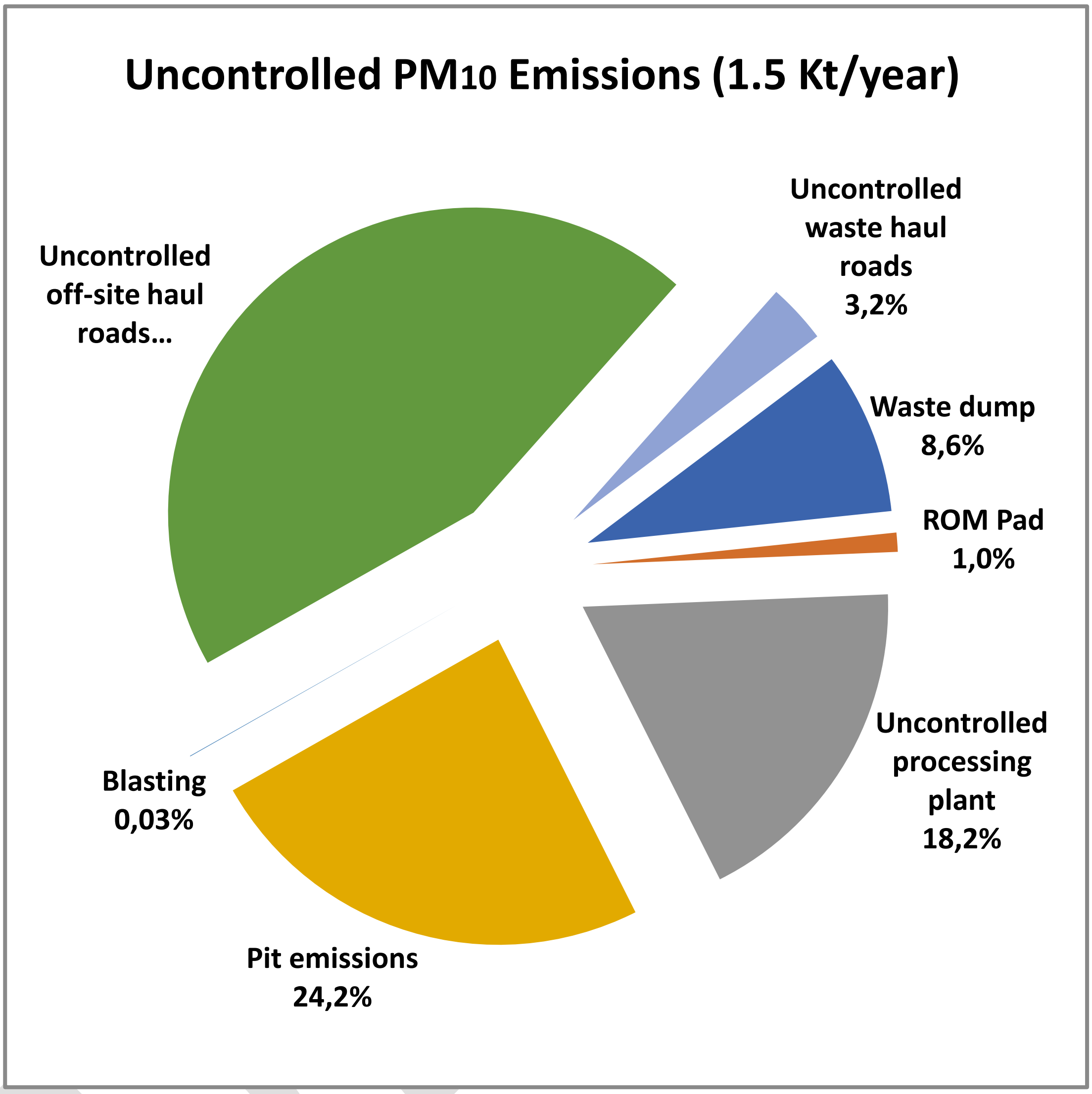

Figure 30: Relative uncontrolled emissions of PM10 from mining activities for year 6.

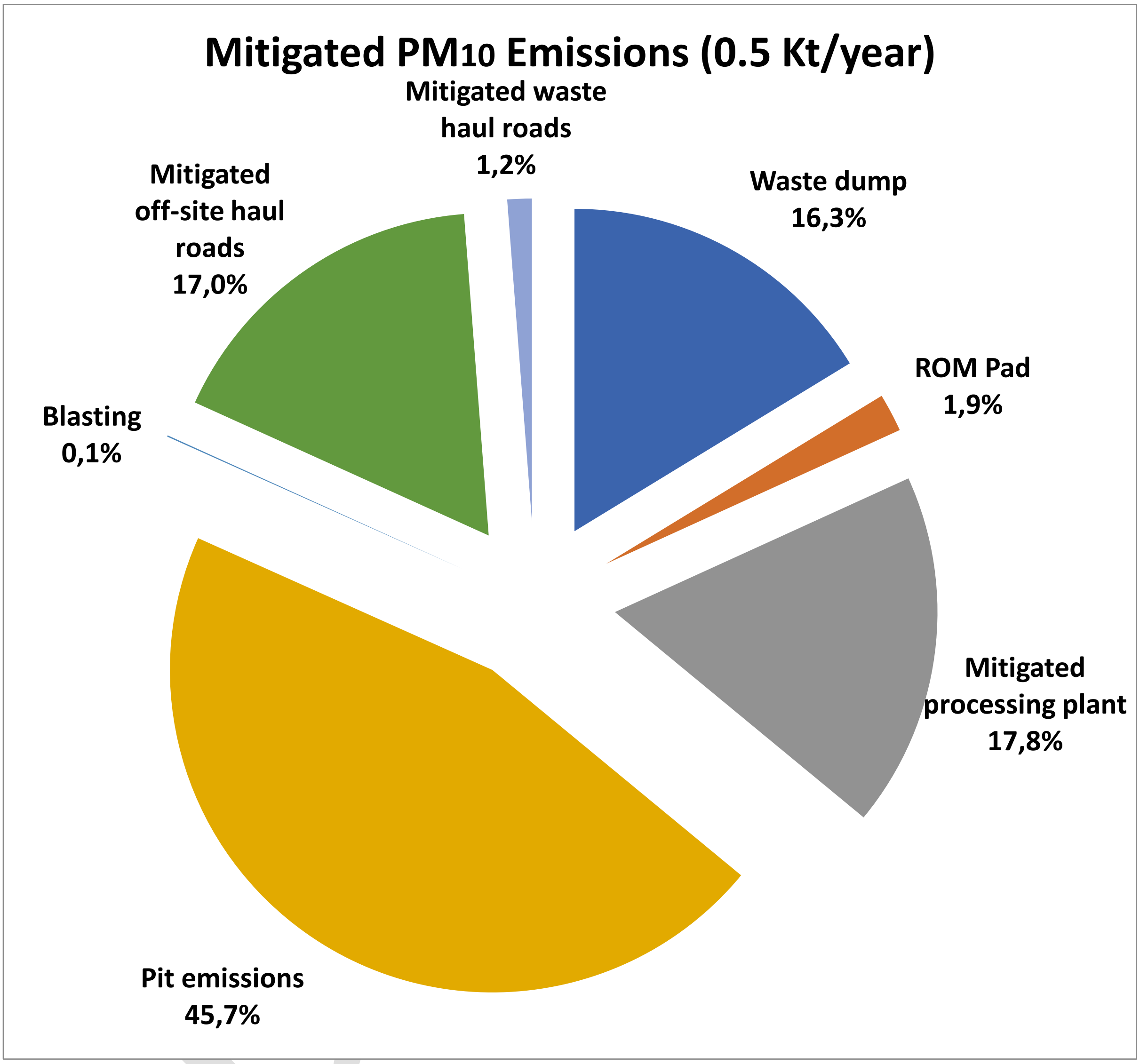

Figure 31: Relative mitigated emissions of PM10 from mining activities for year 6.

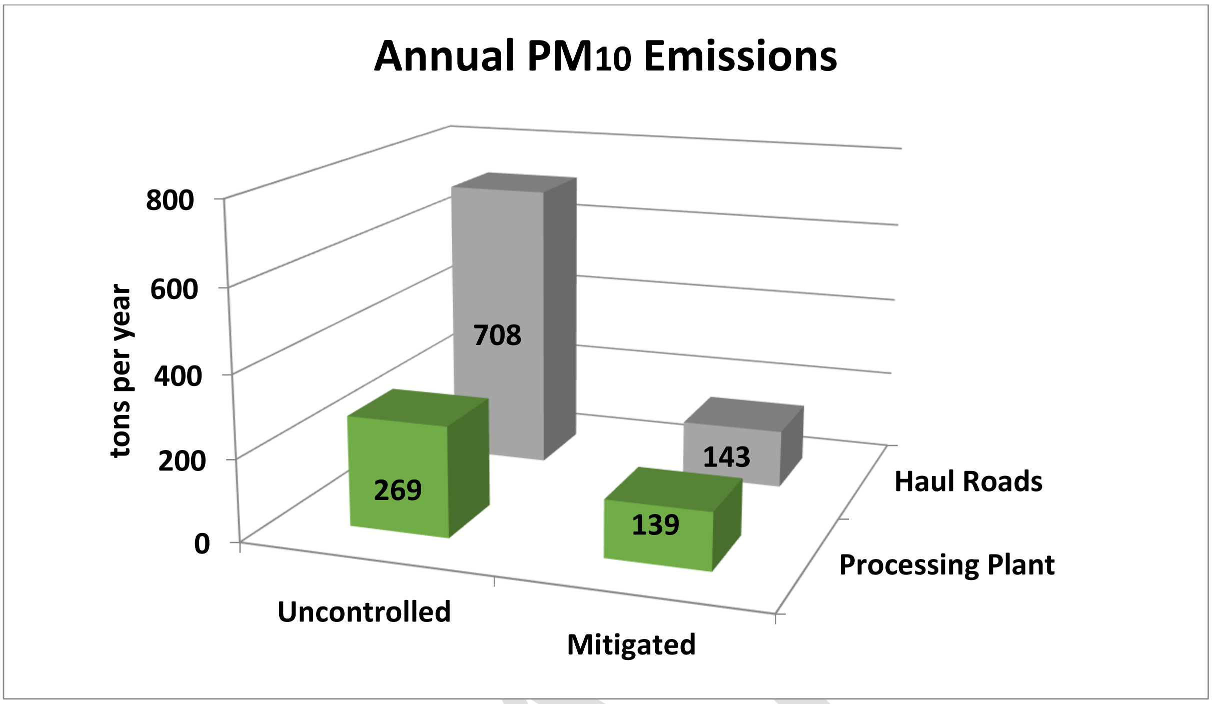

Figure 32: Annual PM10 emissions of uncontrolled and mitigated haul roads and the processing plant at the proposed Matai Mining Project.

15.2.4 Modelling

Dispersion simulations were undertaken to determine ambient concentrations of $PM_{2.5}$ and PM_{10} resulting from all operations at the proposed Matai Mining Project. Three scenarios were simulated – an uncontrolled scenario; a scenario taking into account emission reductions possible by implementing mitigation measures on all haul roads, conveyor transfer points and the processing plant; and a scenario with the added mitigation measure of tarring the access road off site.

Dispersion simulations were executed incorporating all significant sources for the mining area. The waste dump, the ROM pad and the Processing Plant were all simulated as area sources. Activities in the pit (drilling, bulldozing, primary crushing, loading and unloading of haul trucks, loading of conveyors, hauling to the backfill area and wind erosion of exposed areas) were simulated as a single, open pit source, with the advantage that an area below ground level could be simulated by AERMOD. Roads were simulated as adjacent volume sources as recommended by the US EPA haul road workgroup (US EPA, 2012).

The dispersion of pollutants was modelled up to a distance of 40 km from the proposed site. The isopleths are given in Figure 33 to Figure 44 below. Isopleths higher than the National Standards have not been included in the figures below – all areas within the red coloured isopleth can be expected to experience exceedances of the National Standards. It should be noted that isopleth plots reflecting the 24-hour averaging periods contain the average of the fifth-highest predicted ground level concentrations, over the three-year period for which simulations were undertaken. In other words, the model calculates the fifth-highest concentration at each receptor for each year modelled, averages those fifth-highest concentrations at each receptor across the three years of meteorological data, and then selects the highest across all receptors, of the three-year averaged fifth-highest values for plotting. This is in line with the NAAQS which allows for four exceedances per year. Concentrations are presented in μg m^{-3}

PM10 Modelling Results (Year 6)

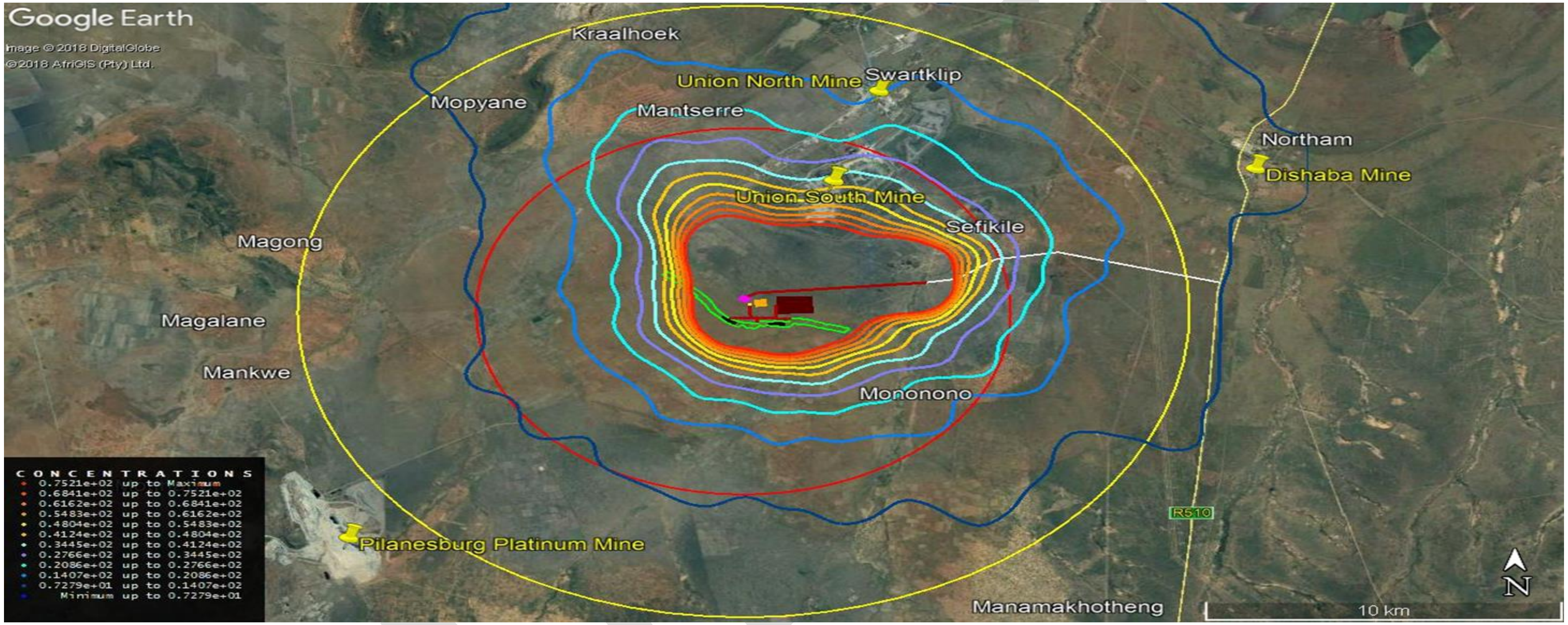

Figure 33: Modelled prediction of highest 24-hour average PM10 concentrations, without mitigation measures, resulting from the proposed Matai Mining Project.

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PM10 Modelling Results (Year 6)

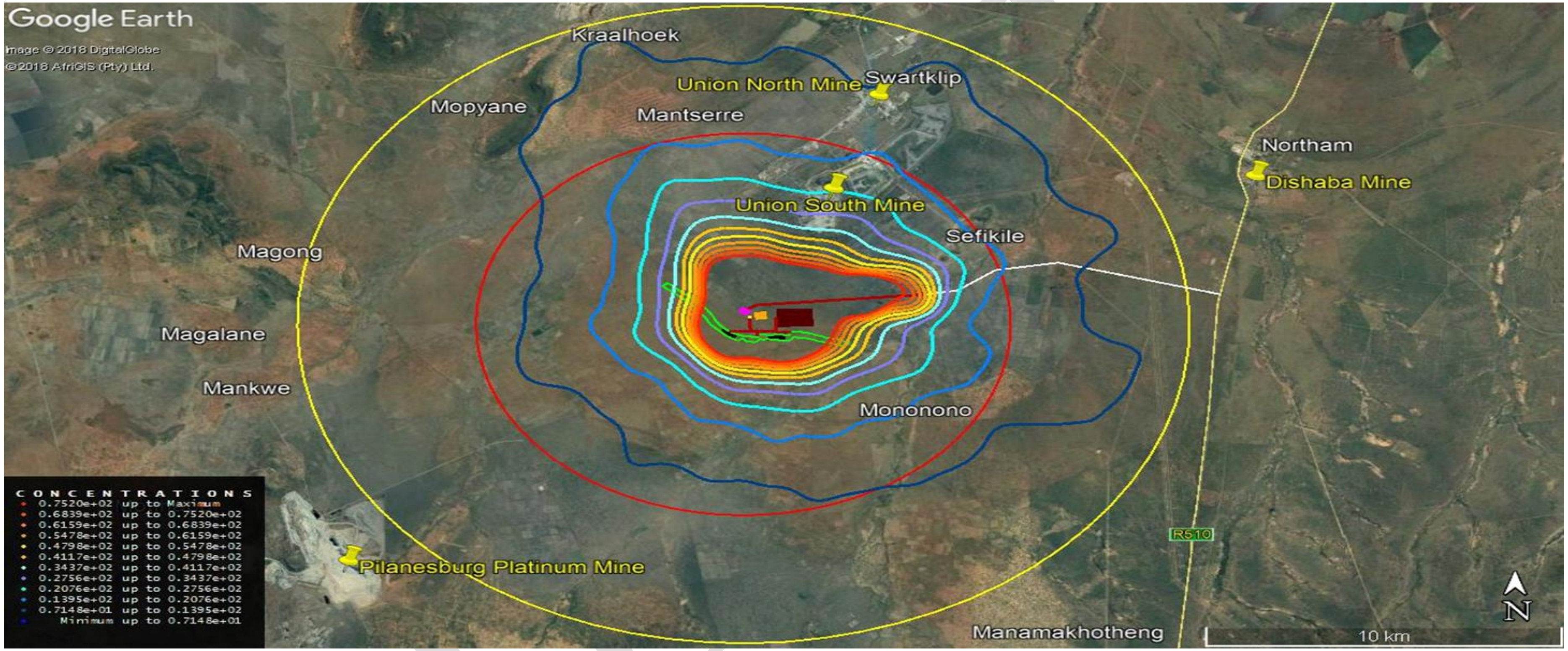

Figure 34: Modelled prediction of highest 24-hour average PM10 concentrations, with mitigation measures, resulting from the proposed Matai Mining Project

PM10 Modelling Results (Year 6)

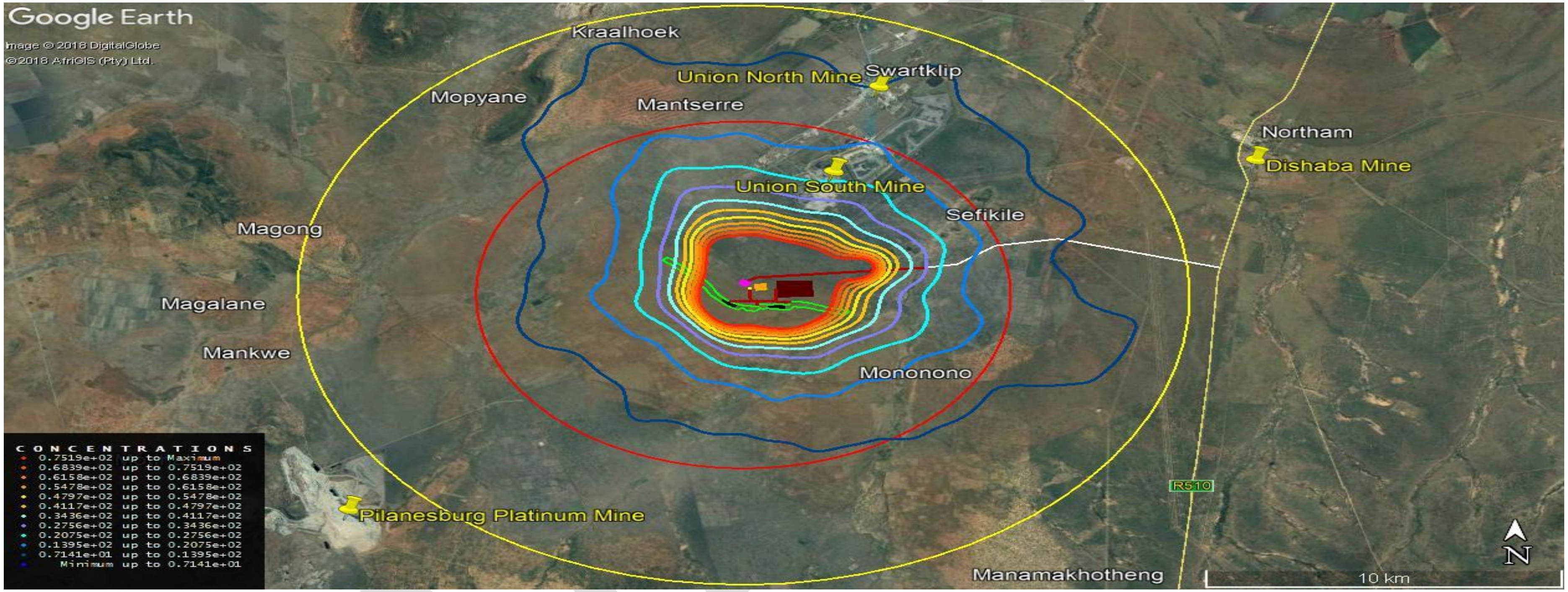

Figure 35: Modelled prediction of highest 24-hour average PM10 concentrations, with mitigation measures (including tarred off-site roads), resulting from the proposed Matai Mining Project.

PM10 Modelling Results (Year 6)

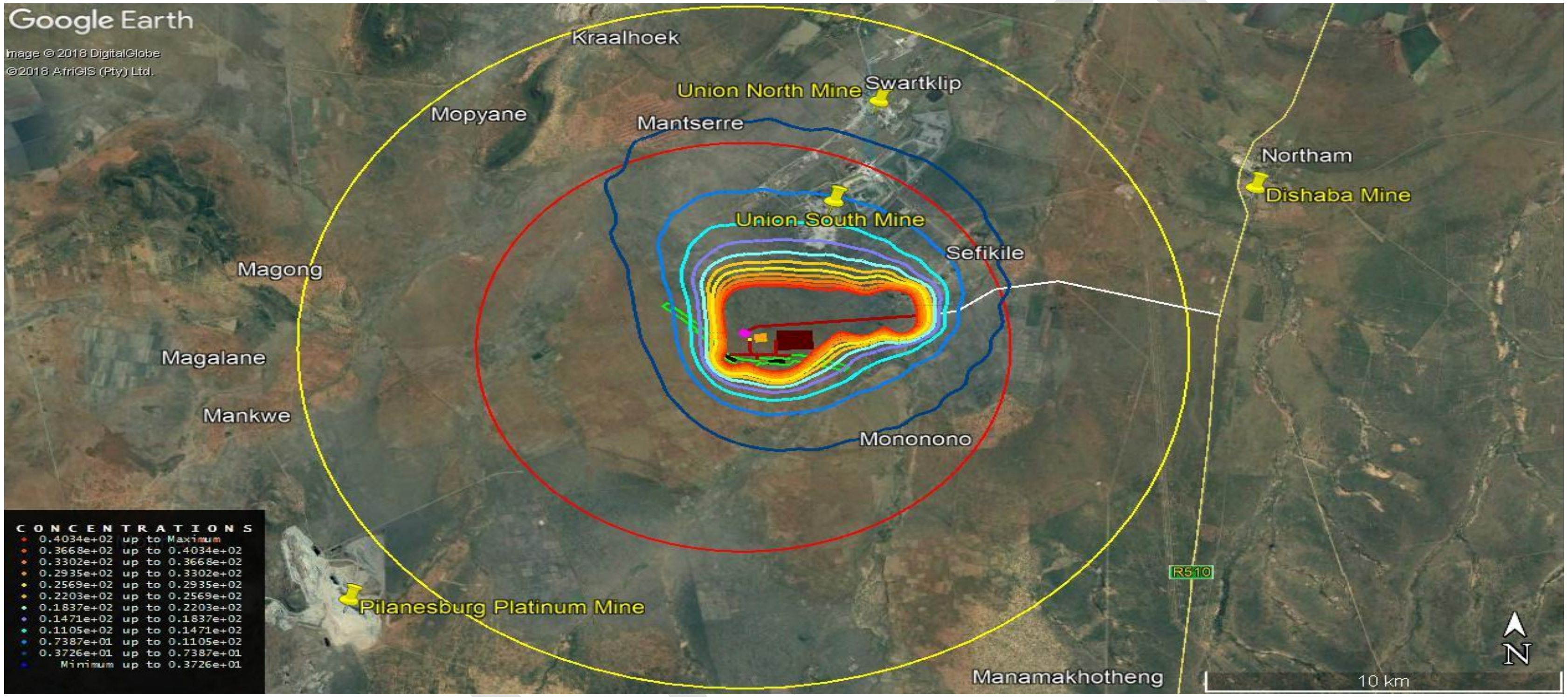

Figure 36: Modelled prediction of annual average PM10 concentrations, without mitigation measures, resulting from the proposed Matai Mining Project.

PM10 Modelling Results (Year 6)

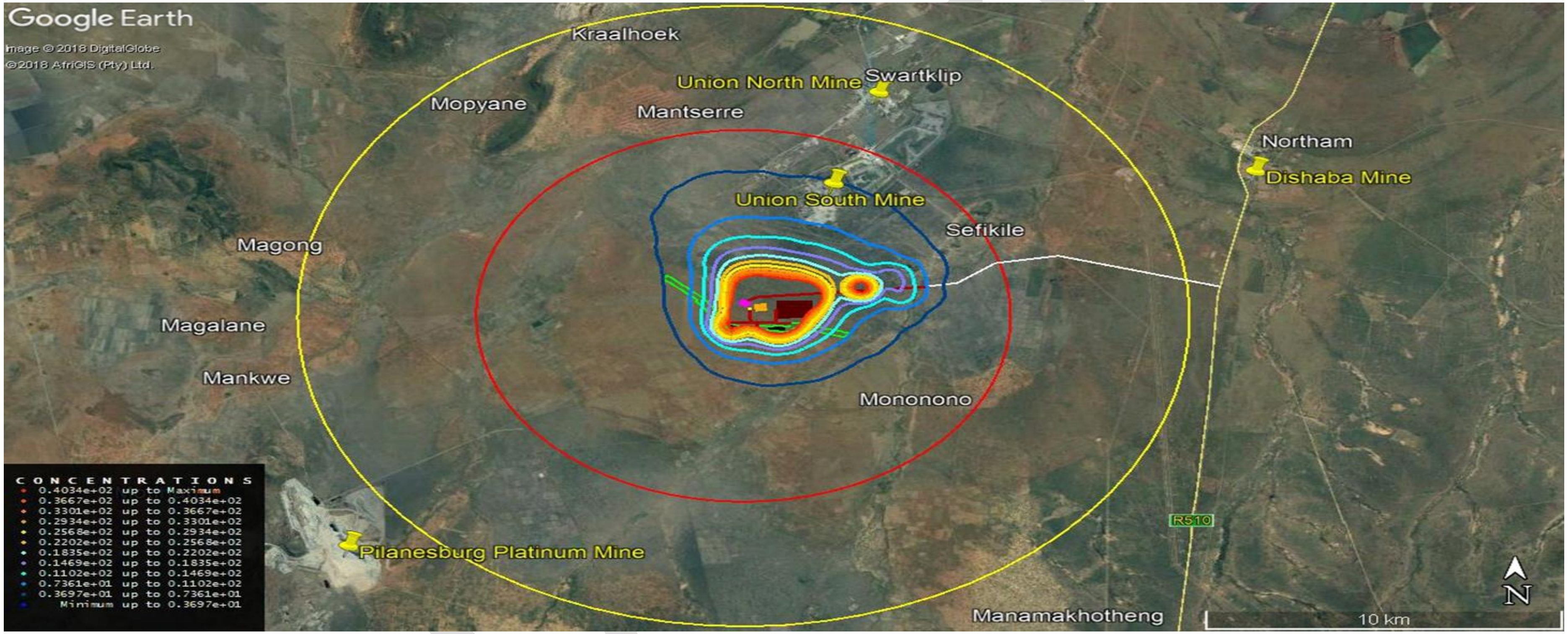

Figure 37: Modelled prediction of annual average PM10 concentrations, with mitigation measures, resulting from the proposed Matai Mining Project

PM10 Modelling Results (Year 6)

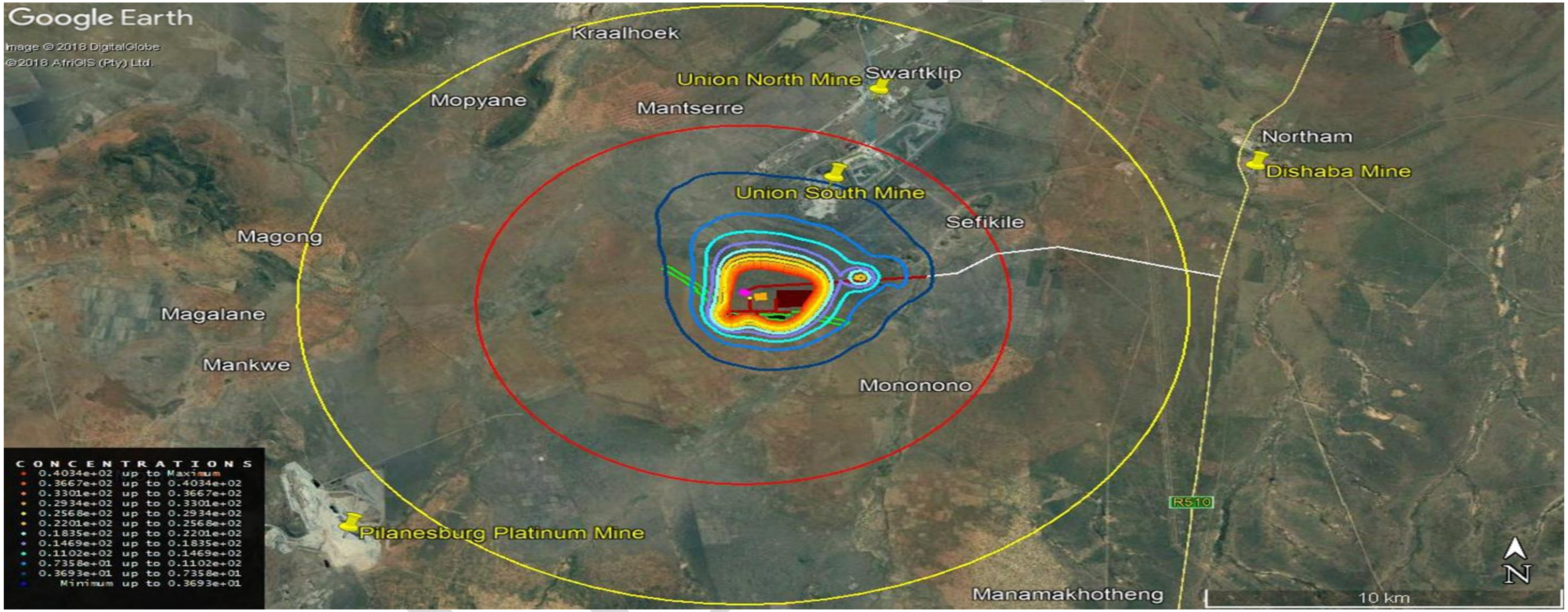

Figure 38: Modelled prediction of annual average PM10 concentrations, with mitigation measures (including tarred off-site roads), resulting from the proposed Matai Mining Project

PM$_{2.5}$ Modelling Results (Year 6)

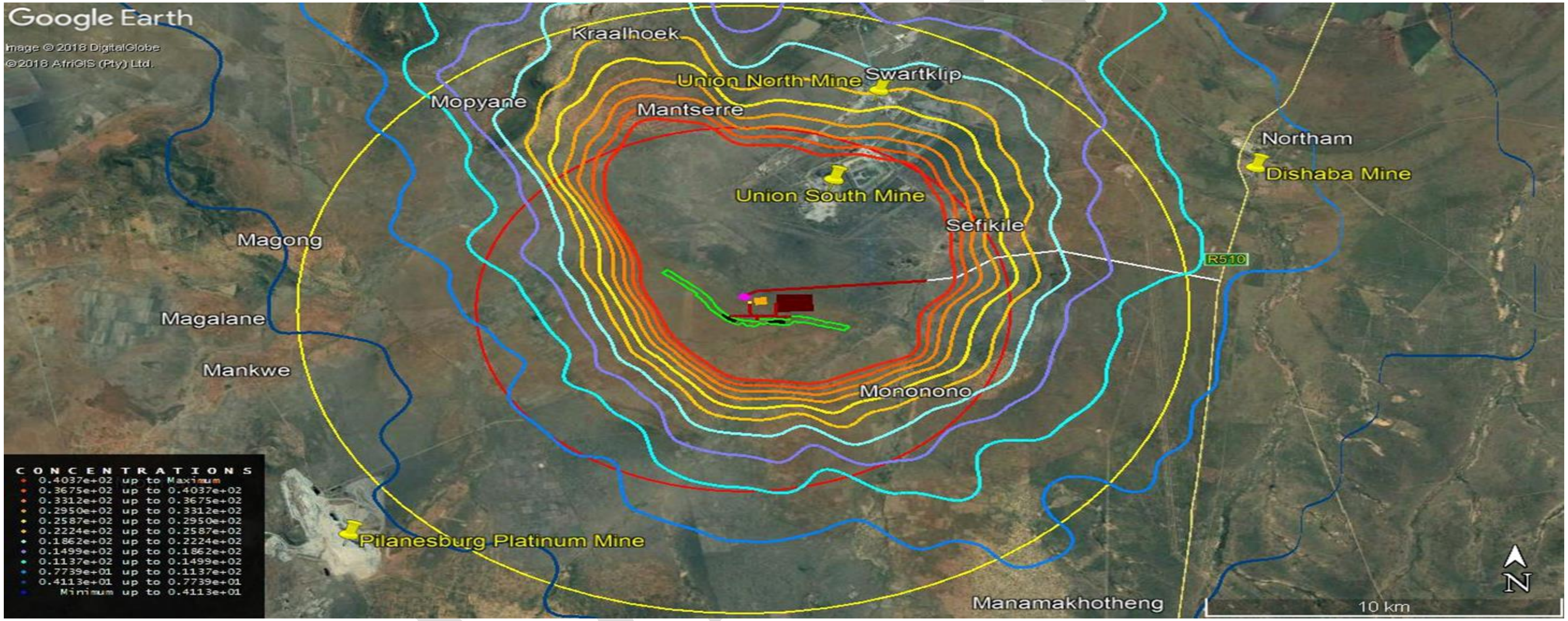

Figure 39: Modelled prediction of highest 24-hour average PM2.5 concentrations, without mitigation measures, resulting from the proposed Matai Mining Project

PM$_{2.5}$ Modelling Results (Year 6)

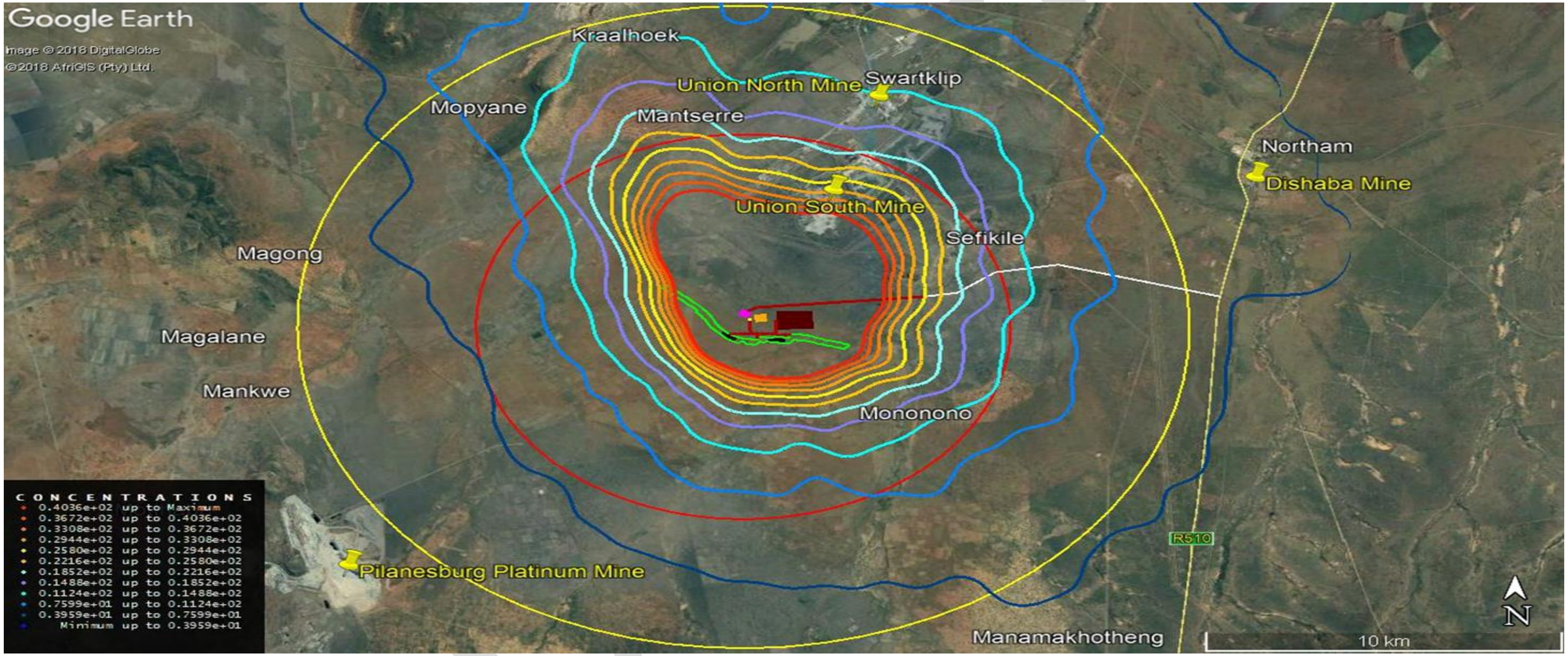

Figure 40: Modelled prediction of highest 24-hour average PM2.5 concentrations, with mitigation measures, resulting from the proposed Matai Mining Project.

PM$_{2.5}$ Modelling Results (Year 6)

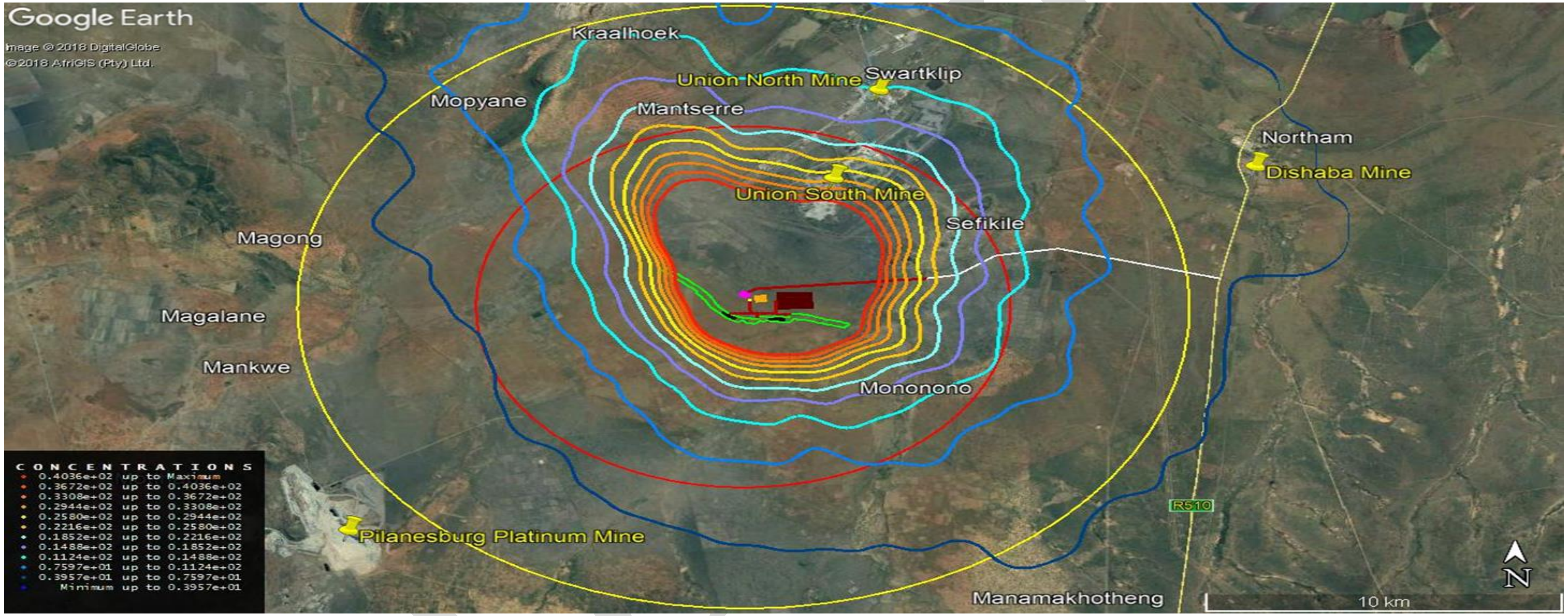

Figure 41: Modelled prediction of highest 24-hour average PM2.5 concentrations, with mitigation measures (including tarred off-site roads), resulting from the proposed Matai Mining Project.

$PM_{2.5}$ Modelling Results (Year 6)

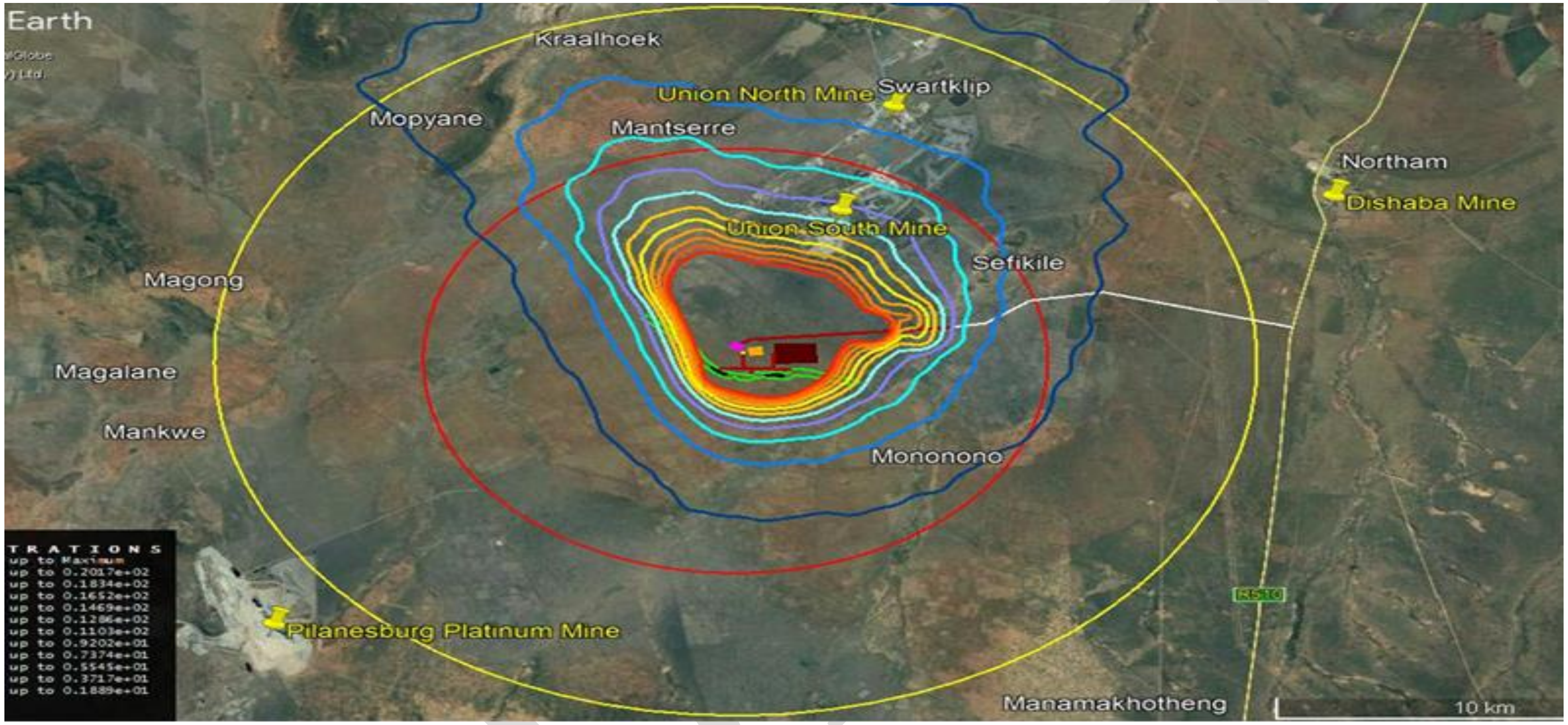

Figure 42: Modelled prediction of annual average PM2.5 concentrations, without mitigation measures, resulting from the proposed Matai Mining Project

PM$_{2.5}$ Modelling Results (Year 6)

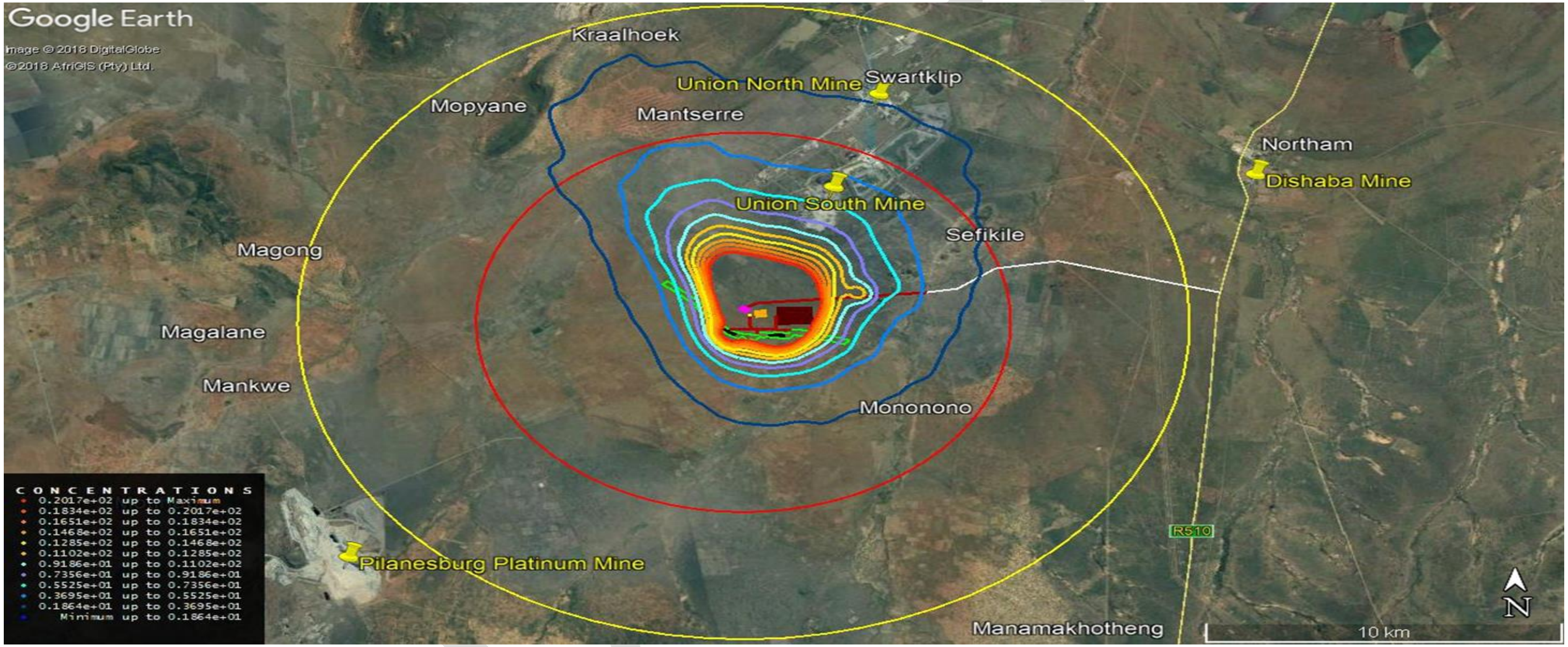

Figure 43: Modelled prediction of annual average PM2.5 concentrations, with mitigation measures, resulting from the proposed Matai Mining Project

PM$_{2.5}$ Modelling Results (Year 6)

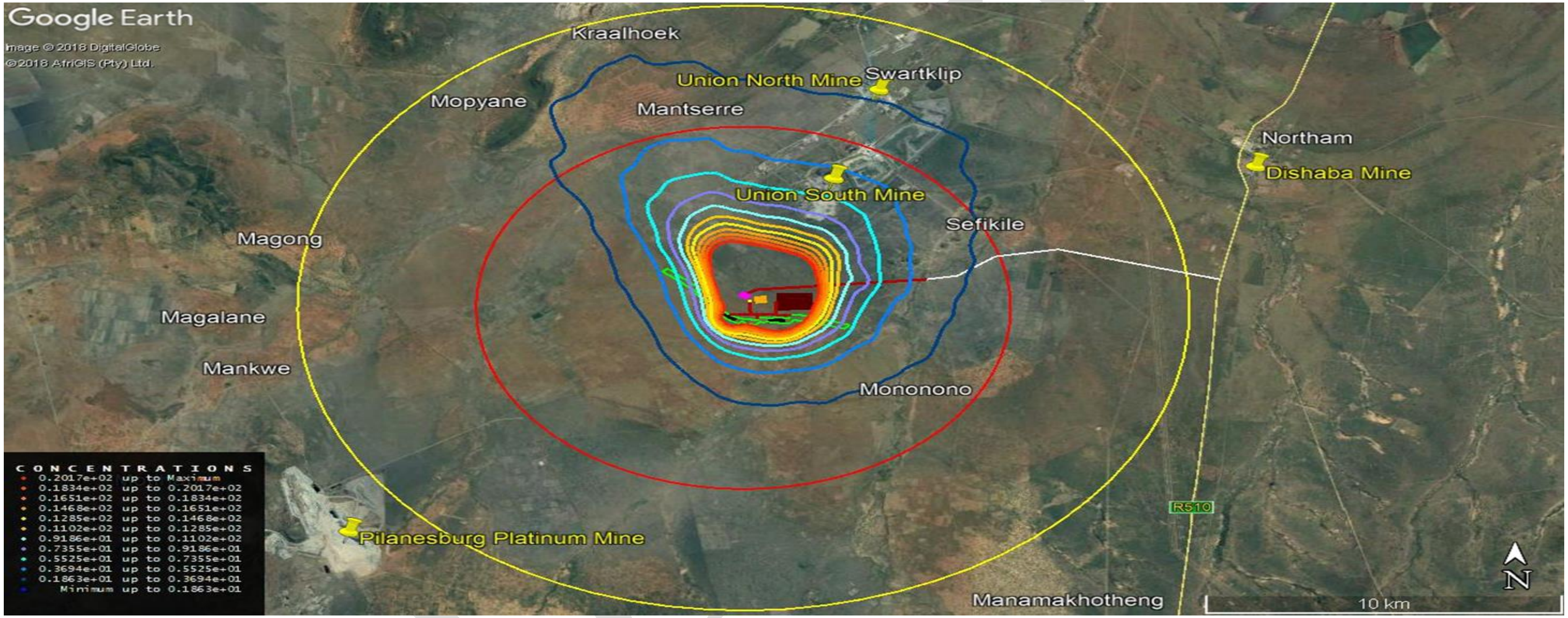

Figure 44: Modelled prediction of annual average PM2.5 concentrations, with mitigation measures (including tarred off-site roads), resulting from the proposed Matai Mining Project

15.2.5 Impact Assessment

Table 17: Air quality impacts assessment

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		Construction	
Vegetation clearing	Dust emissions due to the erosion of open storage piles and exposed areas occur when the threshold wind speed is exceeded (Cowherd, Muleski, & Kinsey, 1988; US EPA, 1995).	a) Wet suppression, applied sparingly, to ensure the absence of visible dust; b) Wet suppression is about 50% effective on unpaved roads, but chemical binders such as Dustex or Dust-ASide may also be used; c) Enforce low vehicle speeds on unpaved areas (< 40 km/h); d) Use of shade cloth where necessary, to reduce wind speeds and reduce travel distance of dust;	Medium

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		e) Vegetate the berm and other surfaces that were laid bare as a result of construction with a locally indigenous grass species where practicable, as soon as possible; and f) Requiring contractors to maintain construction vehicles in good condition	
Vehicle movement on haul roads	Same as above	Haul road mitigation measures include: a) Tarring or paving, wet suppression and chemical surface treatments. b) Regular, light watering of the road is needed for water spraying to be effective in reducing particulate emissions. c) Other surface treatments include the use of chemicals such as calcium chloride or	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		magnesium chloride. These chemicals attract moisture – drawing moisture out of the air during periods of high humidity, and also reducing the evaporation rate of water during hot periods.	
Operational			
Drilling and Blasting	Emissions from drilling are a relatively minor component of the overall emission from an open pit mine. The only available emission factor for drilling is a simple uncontrolled TSP emission factor of 0.59kg/hole for overburden	a) Efficiency will be applied to reduce wastage and unnecessary fuel consumption; b) Carbon offsets will be considered if required; c) Concurrent best practice rehabilitation and vegetation monitoring will be applied to allow for the restoration of some the carbon sink functionality within the mining right area.	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		d) Avoid blasting under windy conditions as far as practicable	
Processing Plant	The moisture content of the material processed can have a substantial effect on emissions	Surface wetness causes fine particles to agglomerate on, or to adhere to, the faces of larger chunks of ore, with a resulting dust suppression effect. However, as new fine particles are created by crushing and attrition, and as the moisture content is reduced by evaporation, this suppressive effect diminishes and may disappear	Low
Vehicle Movement	Vehicle entrainment from unpaved roads	a) Enforcement of a 40 km/hour speed restriction on unpaved haul roads; b) Wet suppression on haul roads, with the addition of a chemical binder if necessary	Medium

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Crushing and screening	Crushing and screening operations represent significant dust-generating sources if uncontrolled. The large percentage of fines in this dustfall material enhances the potential for it to become airborne. It was assumed that primary crushing (crushing to achieve particles of <300 mm) will take place in the pit to reduce the ore to a transportable size for the conveyor system.	Wet suppression will be used for both the secondary and tertiary crushing stages	Low
Materials handling	Materials handling operations which are predicted to result in significant fugitive dust emissions from mining operations include the transfer of material by means of loading and offloading of trucks, loading and offloading conveyors, transfer from one conveyor to another and bulldozing. The quantity of dust which will be generated will depend on various	a) Reduced tipping and drop heights where practicable; b) Regular clean-up at loading areas and on paved surfaces to prevent entrainment by wind or vehicles;	Medium

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
	non-climatic parameters such as the nature (moisture content and silt content) and volume of the material handled.	c) Use of shade cloth where necessary, to reduce wind speeds and reduce travel distance of dust; d) Covering of exposed areas with coarsely crushed rock or aggregate material where practicable; e) Maintaining all vehicles in good condition at all times; and f) Continuous dust and fine particulate monitoring should be implemented to monitor compliance with the NAAQS	
Decommissioning and Rehabilitation			

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Demolition of infrastructure and backfilling of pits	Particulate mobilisation can be caused by the demolition of buildings and handling of the rubble, backfilling of the storm water dam and “dirty” water collection channels and ripping and shaping of compacted areas	a) Wet suppression during landscaping and materials handling activities; b) Enforcement of low vehicle speeds on unpaved areas (< 40 km/h); c) Use of shade-cloth where necessary, to reduce wind speeds and reduce travel distance of dust; d) Vegetation of bare surfaces with a locally indigenous grass species as soon as possible; e) Continue dust fall monitoring until vegetation cover is well established; and f) Requiring contractors to maintain construction vehicles in good condition	Medium

15.3 *Terrestrial Ecology*

The Matai project area is located within the Dwaalboom Thornveld vegetation unit (Mucina and Rutherford, 2006) within the Central Bushveld bioregion. The vegetation unit occurs in the Limpopo and North-West Provinces, stretching from the flats north of the Dwarsberge to the Nietverdiend area and Northam. The vegetation unit occurs in altitudes of 900m – 1200m above sea level.

The vegetation unit is considered to be in a dry climate with a summer rainfall and very dry winters. The Mean Annual Precipitation (MAP) ranges between 500mm to 600mm. The vegetation unit has the highest mean annual potential evaporation of savanna units outside the two Kalahari bioregions. In winter, frost is highly expected throughout the unit.

The unit is characterised by plains with scattered low to medium high trees and shrubs and a grass layer. *Vechelia tortillis* and *Vechelia nilotica* are dominant in the soils with higher clay content through the unit. The dominant soils within the unit are vertic black utramafic clays. The underlying geology is an Archaean granite-gneiss terrane of the Swazian Erathem.

The vegetation unit is considered as Least threatened in terms of the conservation status. Approximately 6% of the vegetation unit is statutorily conserved within the Madikwe Game Reserve with the conservation target set at 19%. An approximate 14% of the vegetation unit has been transformed by cultivation and cattle grazing throughout the unit. The expected species within the project area include the species listed in Table 18. There were no plants of conservation concern expected within the project area.

Table 18: The expected plant species within the project area

Family	Species	Conservation status
Acanthaceae	*Crossandra greenstockii*	LC
Aizoaceae	*Zaleya pentandra*	LC
Amaranthaceae	*Hermbstaedtia odorata var. albi-rosea*	LC
Anacardiaceae	*Searsia magalismontana subsp. magalismontana*	LC
Anacardiaceae	*Searsia dentata*	LC

Family	Species	Conservation status
Apocynaceae	*Huernia transvaalensis*	LC
Asteraceae	*Hirpicium bechuanense*	LC
Asteraceae	*Aspilia mossambicensis*	LC
Bryaceae	*Brachymenium acuminatum*	LC
Convolvulaceae	*Merremia palmata*	LC
Cucurbitaceae	*Cucumis hirsutus*	LC
Euphorbiaceae	*Euphorbia schinzii*	LC
Euphorbiaceae	*Jatropha schlechteri subsp. setifera*	LC
Fabaceae	*Sesbania transvaalensis*	LC
Fabaceae	*Rhynchosia holosericea*	LC
Fabaceae	*Indigastrum costatum subsp. macrum*	LC
Fabaceae	*Tephrosia burchellii*	LC
Fabaceae	*Senegalia erubescens*	LC
Fabaceae	*Senegalia mellifera subsp. detinens*	LC
Hyacinthaceae	*Ledebouria atrobrunnea*	LC
Iridaceae	*Gladiolus oatesii*	LC
Malvaceae	*Grewia bicolor var. bicolor*	LC
Malvaceae	*Corchorus asplenifolius*	LC
Malvaceae	*Hermannia umbratica*	LC
Malvaceae	*Malvastrum coromandelianum*	LC
Malvaceae	*Hibiscus micranthus var. micranthus*	LC
Menispermaceae	*Antizoma angustifolia*	LC
Oxalidaceae	*Oxalis smithiana*	LC
Poaceae	*Eriochloa fatmensis*	LC
Poaceae	*Setaria incrassata*	LC
Poaceae	*Echinochloa crus-galli*	LC
Poaceae	*Sporobolus fimbriatus*	LC
Poaceae	*Bothriochloa bladhii*	LC

Family	Species	Conservation status
Poaceae	*Dinebra retroflexa var. condensata*	LC
Poaceae	*Eragrostis curvula*	LC
Poaceae	*Eleusine coracana subsp. africana*	LC
Poaceae	*Brachiaria nigropedata*	LC
Poaceae	*Themeda triandra*	LC
Poaceae	*Eragrostis rigidior*	LC
Poaceae	*Brachiaria brizantha*	LC
Poaceae	*Panicum schinzii*	LC
Poaceae	*Eragrostis cilianensis*	LC
Poaceae	*Digitaria eriantha*	LC
Poaceae	*Eragrostis barbinodis*	LC
Poaceae	*Cymbopogon sp.*	LC
Poaceae	*Panicum maximum*	LC
Poaceae	*Cenchrus ciliaris*	LC
Poaceae	*Brachiaria eruciformis*	LC
Poaceae	*Sorghum versicolor*	LC
Poaceae	*Panicum coloratum*	LC
Poaceae	*Ischaemum fasciculatum*	LC
Poaceae	*Schmidtia pappophoroides*	LC
Poaceae	*Eragrostis biflora*	LC
Pteridaceae	*Cheilanthes nielsii*	LC
Talinaceae	*Talinum arnotii*	LC
Vitaceae	*Cyphostemma sulcatum*	LC

15.3.1 Field Investigation

The field investigation consisted of random sampling throughout the prospecting area with more focused sampling within the opencast pit area and plant area. The vegetation within the project area was largely uniform and represented the Dwaalboom Thornveld vegetation unit as presented in Figure 45. The unit has; however, been altered from the natural state. The tree layer was dominated by *Vechelia totilis* and *Vechelia nilotica*. The grass layer was dominated by *Digitaria eriantha* in some parts and *Cymbopogon pospischilii.* in other parts as can be seen in Figure 46. Large areas of bare soil were observed within the project area (Figure 47). These bare areas seemed to be a natural occurrence as there were no signs of clearing and the bare areas were frequent and widespread. The overall plant diversity within the project area was considered low.

Figure 45: The vegetation within the project area

Figure 46: The different grasslands within the project area a) *Cymbopogon* dominated grassland b) *Digitaria* dominated grassland

Figure 47: Bare areas of soil within project area

15.3.2 Fauna

15.3.2.1 Mammals

The assessment for mammal species was conducted at desktop level and field investigation to determine the probability of occurrence of faunal species. The potential species that may occur within the project area are listed in Table 19. It must be noted that the possible species list is at desktop level and may include species that were previously recorded in the area and are no longer occurring.

Table 19: The possible mammal species occurring within the project area

Family	Scientific name	Common name	Conservation Status
Bovidae	*Aepyceros melampus*	Impala	LC
Bovidae	*Alcelaphus buselaphus*	Hartebeest	LC
Bovidae	*Alcelaphus buselaphus caama*	Red Hartebeest	LC
Bovidae	*Antidorcas marsupialis*	Springbok	LC

Family	**Scientific name**	**Common name**	**Conservation Status**
Bovidae	*Connochaetes sp.*	African Antelopes and Gnus	LC
Bovidae	*Connochaetes taurinus*	Blue Wildebeest	LC
Bovidae	*Connochaetes taurinus taurinus*		LC
Bovidae	***Damaliscus lunatus lunatus***	**(Southern African) Tsessebe**	**VU**
Bovidae	***Hippotragus niger niger***		**VU**
Bovidae	*Kobus ellipsiprymnus*	Waterbuck	
Bovidae	*Kobus ellipsiprymnus ellipsiprymnus*		LC
Bovidae	*Oreotragus oreotragus*	Klipspringer	LC
Bovidae	*Oryx gazella*	Gemsbok	LC
Bovidae	*Raphicerus campestris*	Steenbok	LC
Bovidae	*Redunca arundinum*	Southern Reedbuck	LC
Bovidae	*Redunca fulvorufula*	Mountain Reedbuck	LC
Bovidae	*Sylvicapra grimmia*	Bush Duiker	LC
Bovidae	*Syncerus caffer*	African Buffalo	LC
Bovidae	*Taurotragus oryx*	Common Eland	LC
Bovidae	*Tragelaphus scriptus*	Bushbuck	LC
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	LC
Canidae	*Canis mesomelas*	Black-backed Jackal	LC
Canidae	***Lycaon pictus***	**African wild dog**	**EN**
Cercopithecidae	*Chlorocebus pygerythrus*	Vervet Monkey	LC
Cercopithecidae	*Chlorocebus pygerythrus pygerythrus*	Vervet Monkey (subspecies pygerythrus)	LC
Cercopithecidae	*Papio ursinus*	Chacma Baboon	LC
Elephantidae	*Loxodonta africana*	African Bush Elephant	LC

Family	Scientific name	Common name	Conservation Status
Emballonuridae	*Taphozous (Taphozous) mauritianus*	Mauritian Tomb Bat	LC
Equidae	*Equus quagga*	Plains Zebra	LC
Erinaceidae	***Atelerix frontalis***	**Southern African Hedgehog**	**NT**
Felidae	***Acinonyx jubatus***	**Cheetah**	**VU**
Felidae	*Caracal caracal*	Caracal	LC
Felidae	***Felis nigripes***	**Black-footed Cat**	**VU**
Felidae	*Felis silvestris*	Wildcat	LC
Felidae	***Leptailurus serval***	**Serval**	**NT**
Felidae	*Panthera leo*	Lion	LC
Felidae	***Panthera pardus***	**Leopard**	**VU**
Giraffidae	*Giraffa camelopardalis camelopardalis*	Nubian Giraffe	LC
Giraffidae	*Giraffa camelopardalis giraffa*	South African Giraffe	LC
Gliridae	*Graphiurus (Graphiurus) murinus*	Forest African Dormouse	LC
Herpestidae	*Helogale parvula*	Common Dwarf Mongoose	LC
Herpestidae	*Herpestes sanguineus*	Slender Mongoose	LC
Hippopotamidae	*Hippopotamus amphibius*	Common Hippopotamus	LC
Hyaenidae	***Crocuta crocuta***	**Spotted Hyaena**	**NT**
Hyaenidae	***Hyaena brunnea***	**Brown Hyena**	**NT**
Hyaenidae	*Proteles cristata*	Aardwolf	LC
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	LC
Leporidae	*Lepus sp.*	Hares	LC
Leporidae	*Lepus saxatilis*	Scrub Hare	LC
Molossidae	*Sauromys petrophilus*	Roberts's Flat-headed Bat	LC

Family	Scientific name	Common name	Conservation Status
Muridae	*Aethomys ineptus*	Tete Veld Aethomys	LC
Muridae	*Aethomys namaquensis*	Namaqua Rock Mouse	LC
Muridae	*Gerbilliscus brantsii*	Highveld Gerbil	LC
Muridae	*Gerbilliscus leucogaster*	Bushveld Gerbil	LC
Muridae	*Lemniscomys rosalia*	Single-Striped Lemniscomys	LC
Muridae	*Mastomys sp.*	Multimammate Mice	LC
Muridae	***Otomys auratus***	**Southern African Vlei Rat**	**NT**
Muridae	*Thallomys paedulcus*	Acacia Thallomys	LC
Mustelidae	*Mellivora capensis*	Honey Badger	LC
Nesomyidae	*Steatomys pratensis*	Common African Fat Mouse	LC
Procaviidae	*Procavia capensis*	Cape Rock Hyrax	LC
Rhinolophidae	*Rhinolophus simulator*	Bushveld Horseshoe Bat	LC
Sciuridae	*Paraxerus cepapi*	Smith's Bush Squirrel	LC
Suidae	*Phacochoerus africanus*	Common Warthog	LC
Viverridae	*Civettictis civetta*	African Civet	LC
Viverridae	*Genetta tigrina*	Cape Genet (Cape Large-spotted Genet)	LC

The field investigation was conducted by traversing the project area by vehicle and on foot. The faunal activity was determined to be low within the project area and may result from the current lack of water within the area. Only two faunal species were confirmed within the project area as presented in Table 20. There was no fauna of conservation concern identified within the project area.

Table 20: Identified faunal species within project area

Family	Scientific name	Common name	Conservation Status
Bovidae	*Aepyceros melampus*	Impala	Least Concern
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern (2016)

15.3.3 Avifauna

A desktop avifaunal investigation was conducted to determine the bird species that may occur within the project area. A total of 340 bird species is expected to occur within the project area (Appendix A of the Biodiversity Report); however, a total of 11 were considered to be of conservation concern as listed in Table 21

Table 21: Avifaunal species that may occur within the project area

Common name	Species name	Conservation Status
Bustard, Kori	*Ardeotis kori*	VU
Eagle, Martial	*Polemaetus bellicosus*	VU
Eagle, Tawny	*Aquila rapax*	VU
Falcon, Lanner	*Falco biarmicus*	NT
Marsh-harrier, African	*Circus ranivorus*	VU
Oxpecker, Red-billed	*Buphagus erythrorhynchus*	NT
Secretarybird, Secretarybird	*Sagittarius serpentarius*	NT
Stork, Yellow-billed	*Mycteria ibis*	NT
Vulture, Cape	*Gyps coprotheres*	VU
Vulture, Lappet-faced	*Torgos tracheliotus*	VU
Vulture, White-backed	*Gyps africanus*	VU

The field survey was conducted by traversing the project area by vehicle and on foot. Visual observations and calls are the main identifiers of bird activity, with focus placed on areas around open water and tree canopies. The bird survey determined that avifaunal activity was low within the project as a result of the lack of water. In most instances watercourses such as rivers and streams make for ideal birding locations; in this instance the rivers were dry and did not attract bird species. The bird species that were observed and positively identified within the project area are listed in Table 22.

Table 22: Identified bird species within the project area

Common name	Species name	Conservation Status
Guineafowl, Helmeted	*Numida meleagris*	LC
Bunting, Cape	*Emberiza capensis*	LC
Pipit, African	*Anthus cinnamomeus*	LC
Olive-pigeon, African	*Columba arquatrix*	LC
Widowbird, Long-tailed	*Euplectes progne*	LC
Plover, Common Ringed	*Charadrius hiaticula*	LC
Robin-chat, Cape	*Cossypha caffra*	LC

15.3.4 Herpetofauna

The herpetofauna survey consisted of a desktop study and the field investigation. The desktop study determined that the species listed in Table 23. There were no herpetofauna of conservation concern expected for the project area.

Table 23: The possible herpetofauna within the project area

Family	Scientific name	Common name	Conservation Status
Reptiles			
Agamidae	*Acanthocercus atricollis*	Southern Tree Agama	LC
Agamidae	*Agama aculeata distanti*	Distant's Ground Agama	LC
Agamidae	*Agama atra*	Southern Rock Agama	LC
Chamaeleonidae	*Chamaeleo dilepis*	Common Flap-neck Chameleon	LC

Family	**Scientific name**	**Common name**	**Conservation Status**
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	LC
Colubridae	*Dispholidus typus viridis*	Northern Boomslang	Not evaluated
Colubridae	*Philothamnus semivariegatus*	Spotted Bush Snake	LC
Cordylidae	*Cordylus vittifer*	Common Girdled Lizard	LC
Elapidae	*Dendroaspis polylepis*	Black Mamba	LC
Elapidae	*Naja mossambica*	Mozambique Spitting Cobra	LC
Gekkonidae	*Hemidactylus mabouia*	Common Tropical House Gecko	LC
Gekkonidae	*Lygodactylus capensis capensis*	Common Dwarf Gecko	LC
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	LC
Lacertidae	*Nucras intertexta*	Spotted Sandveld Lizard	LC
Lamprophiidae	*Limaformosa capensis*	Common File Snake	LC
Lamprophiidae	*Psammophylax tritaeniatus*	Striped Grass Snake	Least Concern (SARCA 2014)
Pelomedusidae	*Pelomedusa galeata*	South African Marsh Terrapin	Not evaluated
Pelomedusidae	*Pelusios sinuatus*	Serrated Hinged Terrapin	LC
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	LC
Scincidae	*Trachylepis varia sensu lato*	Common Variable Skink Complex	LC
Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise	LC
Varanidae	*Varanus albigularis albigularis*	Rock Monitor	LC
Varanidae	*Varanus niloticus*	Water Monitor	LC

Family	Scientific name	Common name	Conservation Status
Viperidae	*Bitis arietans arietans*	Puff Adder	LC
Frogs			
Brevicepitidae	*Breviceps adspersus*	Bushveld Rain Frog	LC
Bufonidae	*Schismaderma carens*	Red Toad	LC
Bufonidae	*Sclerophrys garmani*	Olive Toad	LC
Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	LC
Bufonidae	*Sclerophrys poweri*	Power's Toad	LC
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	LC
Microhylidae	*Phrynomantis bifasciatus*	Banded Rubber Frog	LC
Phrynobatrachidae	*Phrynobatrachus natalensis*	Snoring Puddle Frog	LC
Pipidae	*Xenopus laevis*	Common Platanna	LC
Ptychadenidae	*Ptychadena anchietae*	Plain Grass Frog	LC
Ptychadenidae	*Ptychadena mossambica*	Broadbanded Grass Frog	LC
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	LC
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	LC
Pyxicephalidae	*Tomopterna sp.*		LC
Pyxicephalidae	*Tomopterna cryptotis*	Tremelo Sand Frog	LC
Pyxicephalidae	*Tomopterna natalensis*	Natal Sand Frog	LC
Rhacophoridae	*Chiromantis xerampelina*	Southern Foam Nest Frog	LC

There were no herpetofauna species identified during the field investigation. Owing to the brevity of field investigation, the disturbed nature of the project area and the current climate conditions, it is anticipated that these species may have relocated for lack of adequate habitat. It must be noted that occurrence of these species within the project is highly likely.

15.3.5 Impact Assessment

Table 24: Biodiversity impact assessment

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Construction Phase			
Site clearance for establishment or access roads, infrastructure and pit area	Clearing of vegetation	Avoid sensitive areas and implement buffer zones	Low
	Loss of plant SSC	Limit the footprint area to the pit and infrastructure Avoid areas of remaining indigenous vegetation	Low
	Displacement of fauna species	Avoid high biodiversity sensitivity areas (natural vegetation, watercourses & wetlands) and comply to prescribed buffer zones	Low
	Loss of faunal SSC	Avoid areas in which plant species of conservation concern may occur;	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		If some areas cannot be avoided implement rescue of plant species of conservation concern	
Operational Phase			
Operation of mine and access roads	Alien plant establishment	Implementation of alien invasive plant management plan needs to be continued during operation to prevent the growth of invasive on cleared areas	Medium
	Disturbance/Displacement of Faunal species	Minimise footprint area Work only in clearly demarcated areas	Medium
	Disturbance of vegetation communities	Minimise footprint area Work only in clearly demarcated areas	Medium
	Habitat fragmentation	Minimise footprint area Work only in clearly demarcated areas	Medium

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
	Killing of faunal species	Minimise footprint area Work only in clearly demarcated areas	Medium
Decommissioning and Rehabilitation Phase			
Shaping of landscape	Loss of species of conservation concern	All infrastructure that could have a negative impact on faunal species (powerlines etc) needs to be decommissioned and removed	Medium
Revegetation of landscape	Impact on the growth and health of both fauna and flora	Implement rehabilitation strategy and rehabilitation interventions	Medium
Monitoring of plant species establishment	Establishment of vegetation	Implement rehabilitation monitoring plan and remedy actions	Medium
	Habitat reconstruction	Implement rehabilitation monitoring plan and remedy actions	Medium
	Habitat stabilisation	Implement rehabilitation monitoring plan and remedy actions	Low

15.4 *Noise Impact*

The World Bank in the Environmental Health and Safety Guidelines has laid down the following noise level guidelines:

a) Residential area – 55.0dBA for the daytime and 45.0dBA for the night-time period; and
b) Industrial area – 70.0dBA for the day- and night-time periods.

The difference between the actual noise and the ambient noise level and the time of the day and the duration of the activity, will determine how people will respond to sound and what the noise impact will be. In order to evaluate such, there must be uniform guidelines to evaluate each scenario. SANS 10103 of 2008 has laid down sound pressure levels for specific districts and has provided the following continuous noise levels per district as given in Table 25 (Van der Merwe, 2019).

Table 25: Recommended noise levels for different districts

Type of district	Equivalent continuous rating level ($L_{Req.T}$) for ambient noise - dBA					
	Outdoors			Indoors, with open windows		
	Day-night L_{Rdn}	Daytime L_{Reqd}	Night-time L_{Reqn}	Day-night $L_{R.dn}$	Daytime $L_{Req.d}$	Night-time $L_{Req.n}$
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with some workshops, with business premises and with main roads	60	60	50	50	50	40
e) Central business district	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

For industrial districts, the $L_{R.dn}$ concept does not necessarily hold. For industries legitimately operating in an industrial district during the entire 24h day/night cycle, $L_{Req.d} = L_{Req.n}$ = 70dBA can be considered as typical and normal.

15.4.1 Results of the Noise Survey

In Table 26 are the different prevailing ambient noise levels for the specific areas, which include all the noise sources currently in the area such as domestic, traffic noise, distant mine noise and natural noise sources. Leq is the average noise level for the specific measuring point over a period of time, the Lmax is the maximum noise level and the Lmin is the minimum noise level registered during the noise survey for the specific area in dBA (Van der Merwe, 2019).

Table 26: Noise levels for the day and night in the study area

Position	Day time				Night time			
	Leq - dBA	Lmax (Fast) - dBA	Lmin (Fast) - dBA	Remarks	Leq - dBA	Lmax (Fast) - dBA	Lmin (Fast) - dBA	Remarks
1	44.9	63.0	28.6	Distant traffic, domestic & birds.	48.9	61.6	38.7	Without traffic 40.9dBA, insects & domestic.
2	34.2	62.7	22.9	Distant traffic, domestic & birds.	35.3	51.7	21.4	Insects.
3	37.3	63.4	27.2	Distant birds.	35.4	53.9	20.6	Insects.
4	36.2	63.0	24.9	Distant traffic, domestic & birds.	44.4	54.7	41.2	Insects and distant traffic.
5	36.2	63.6	23.1	Distant traffic, domestic & birds.	44.7	55.5	40.0	Insects and distant traffic.
6	43.0	58.4	30.3	Distant traffic, domestic & birds.	44.4	54.7	41.2	Domestic and insects.
7	45.6	66.1	26.8	Distant traffic, domestic & birds.	45.4	63.2	38.2	Domestic, insects and distant traffic.
8	36.3	62.5	25.7	Distant traffic, domestic & birds.	37.6	56.3	27.8	Insects and distant traffic.
9	36.2	64.3	22.4	Distant traffic, domestic & birds.	38.0	51.3	28.7	Insects and distant traffic.
10	34.9	65.1	22.0	Birds.	33.8	60.5	21.9	Distant insects.
11	33.4	63.8	20.5	Birds.	30.3	54.5	18.4	Distant insects.

Source: (Van der Merwe, 2019)

The arithmetic averages throughout the study area are as follows:

a) Villages – 35.6dBA during the day and 34.7dBA during the night; and
b) Vicinity of feeder roads – 45.6dBA during the day and 45.4dBA during the night.

Table 27: Sound pressure levels of construction machinery

Equipment	Reduction in the noise level some distance from the source - dBA								
Cumulative distance from source in meters	2m from the machinery and/or equipment	15m	30m	60m	120m	240m	480m	960m	1920m
Dump truck	91.0	62.5	56.5	50.4	44.4	38.4	32.4	26.4	20.3
Backhoe	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Drilling Equipment	100.0	71.5	65.5	59.4	53.4	47.4	41.4	35.4	29.3
Flatbed truck	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pickup truck	70.0	41.5	35.5	29.4	23.4	17.4	11.4	5.4	-0.7
Tractor trailer	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Crane	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pumps	70.0	41.5	35.5	29.4	23.4	17.4	11.4	5.4	-0.7
Welding Machine	72.0	43.5	37.5	31.4	25.4	19.4	13.4	7.4	1.3
Generator	90.0	61.5	55.5	49.4	43.4	37.4	31.4	25.4	19.3
Compressor	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pile driver	100.0	71.5	65.5	59.4	53.4	47.4	41.4	35.4	29.3
Jackhammer	90.0	61.5	55.5	49.4	43.4	37.4	31.4	25.4	19.3
Rock drills	100.0	71.5	65.5	59.4	53.4	47.4	41.4	35.4	29.3
Pneumatic tools	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Cumulative noise levels from the construction activities when all of such work within a radius of 30m	105.5	76.9	70.9	64.9	58.9	52.9	46.8	40.8	34.8

Source: (Van der Merwe, 2019)

The noise reduction calculated in Table 27 is for direct line of sight and medium ground conditions. Engineering control measures and topography can have an influence on how the noise level is perceived by the occupants of nearby noise sensitive areas. The cumulative noise level of the machinery and equipment will be 64.9dBA at 60m and 40.8dBA at 960m from the construction area if all the machinery operates in a radius of 30m at one time. This will seldom happen, and the cumulative noise level will therefore be lower.

15.4.2 Impact Assessment

Table 28: Noise impact assessment

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Construction Phase			
Site clearing	Clearing and stripping of topsoil and vegetation	Earthwork activities to be done during daytime working hours unless there is no heavy-duty machinery which may create a noise problem.	Low
	Construction of mine infrastructure	Building activities to be done during daytime working hours unless there is no heavy-duty machinery which may create a noise problem.	Low
Operational Phase			
Operation of processing plant			Medium

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Pit activities	Noise increase at the boundary of the mine footprint and at the abutting residential	a) All noise sources exceeding 85.0dBA to be identified and if practical to be acoustically screened off.	
Hauling of waste rock to the waste dump		b) Noise survey to be done on a quarterly basis and after one year to change to an annual basis if the prevailing ambient noise levels at the boundaries of the plant have not changed.	
Hauling of material to the plant			
Additional traffic		Speed limit of mining areas to be adhered to at all times.	Low
Operation of an emergency generator		Noise readings to be done in the vicinity of and along the emergency	Medium

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		boundaries to ensure that the prevailing ambient noise level is not exceeded.	
Decommissioning Phase			
Backfill of disturbed areas	Noise increase at the boundary of the mine footprint and at the abutting residential	Building activities to be done during daytime working hours unless there is no heavy-duty machinery which may create a noise problem.	Low
Planting of grass and vegetation at rehabilitated area		Building activities to be done during daytime working hours unless there is no heavy-duty machinery which may create a noise problem.	Low
Maintenance of disturbed area		Maintenance activities to be done during daytime working hours.	Low

15.5 *Aquatics*

15.5.1 Desktop Assessment

15.5.1.1 National Freshwater Ecological Priority Areas for the Sub-Quaternary Reaches

The identified watercourses have no freshwater priority areas designated to them (Driver *et al*., 2011). Their location within the National Freshwater Ecological Priority Areas (NFEPA) map is presented in Figure 48.

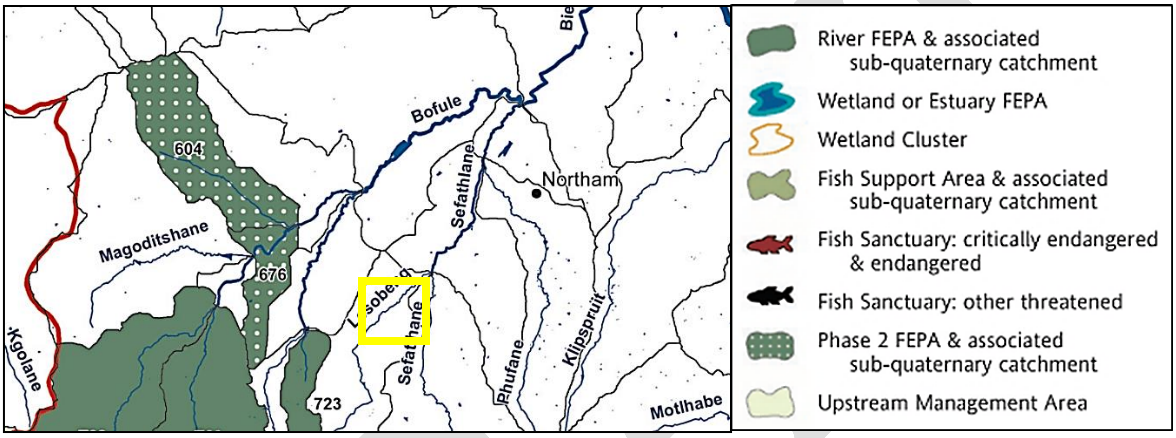

Figure 48: NFEPA associated with the project area. Yellow square indicates location of proposed project (Nel et al., 2011)

It is important to note that river FEPAs currently in an A or B ecological category, as both these are, may still require some rehabilitation effort, e.g. clearing of invasive alien plants and/or rehabilitation of river banks. In regard to the biodiversity, rehabilitation programmes should therefore focus on securing the ecological structure and functioning of FEPAs before initiating any rehabilitation programmes.

15.5.1.2 Status of Sub-Quaternary Reaches

Desktop information was obtained from DWS (2018). The A24E-00642 SQR (Sefathlane) and A24E00688 (Lesobeng) directly associated with the Matai Project area span 35.03 km and 25.04 km of the Sefathlane and Lesobeng Rivers, respectively. The desktop Present Ecological State (PES) of the Sefathlane river reach is a class C (moderately modified), Ecological Sensitivity (ES) and Ecological Importance (EI) are rated as high. The desktop Present Ecological State (PES) of the Lesobeng river reach is a class B (Largely natural), Ecological Sensitivity (ES) and Ecological Importance (EI) are rated as high. The results are presented in Table 29.

Anthropogenic impacts identified within the sub-quaternary catchment included road crossings (causeways), irrigation for rural villages, subsistence farming, over-grazing which results in erosion and sediment deposition.

Table 29: Summary of the status of the Sub-Quaternary Reaches

SQRS	A24E-00642 (Sefathlane)	A24E00688 (Lesobeng)
Present Ecological Status	Moderately Modified (Class C)	Largely Natural (Class B)
Ecological Importance	High	High
Ecological Sensitivity	High	High

15.5.2 Expected Fish Species

There were nine (9) fish species that were expected within the project area. There was one expected fish species of conservation concern. The expected fish species are presented in Table 30. It must be noted that the possible fish list indicates species that may be present within the area.

Table 30: The expected fish species within the Project area

Family	Scientific name	Common name	IUCN Status
Cichlidae	*Coptodon rendalli*	Redbreast Tilapia	Not evaluated
Cichlidae	*Oreochromis mossambicus*	Mozambique Tilapia	Near threatened
Cichlidae	*Pseudocrenilabrus philander*	Southern Mouth-Brooder	Least concern
Cichlidae	*Tilapia sparrmanii*	Banded Tilapia, Or Vlei Kurper	Least concern
Clariidae	*Clarias gariepinus*	African Sharptooth Catfish	Least concern
Cyprinidae	*Barbus paludinosus*	Straightfin Barb	Least concern
Cyprinidae	*Barbus trimaculatus*	Threespot Barb, Threespot Ghielemientjie or “Ghielie”	Least concern

Cyprinidae	*Labeo molybdinus*	*Laden Labeo*	Lest concern
Poeciliidae	*Gambusia affinis*	Western mosquitofish	Invasive

15.5.3 Field Assessment

A field assessment was conduct over two surveys in December 2018 and January 2019. The selected assessments points are presented in Figure 49.

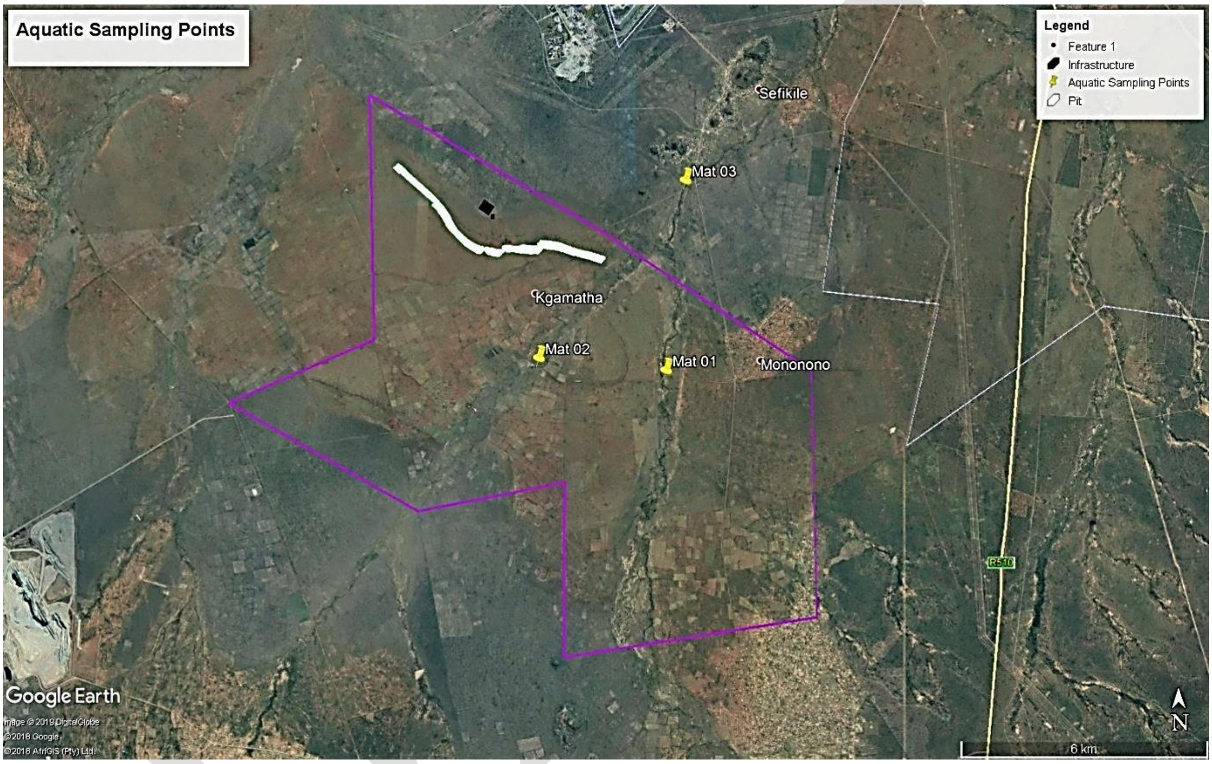

Figure 49: Aquatic Sampling points associated with the Matai Project area

Three (3) aquatic sampling points were selected for the assessment namely Mat 01, Mat 02 and Mat 03. Mat 01 was on the Sefathlane River, Mat 02 was on the Lesobeng River and Mat 03 was on the Sefathlane River after the confluence with the Lesobeng River. Images of the selected sample points are presented in Table 31.

Sampling points Mat 01 and Mat 03 were determined to be dry and could not be assessed. Sampling point Mat 02 was determined to hold a little water; however, could not be sampled as the watercourse presented wetland features and did not meet the minimum requirements for an aquatic survey.

Table 31: The identified and assessed aquatic sampling points

Aquatic Sampling Point	Upstream	Downstream
Mat 01 (Sefathlane River)		
Mat 02 (Lesobeng River)		
Mat 03 (Sefathlane River after confluence with Lesobeng River)		

15.5.4 Impact Assessment

Table 32: Aquatic impact assessment

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Construction Phase			
Site clearance for establishment of access roads, infrastructure and pit area	Sedimentation as a result of bare areas of soil	a) Sediment trapping berms Stormwater management plans b) Dry season construction	Low
Establishment or access roads and crossings structures	Disturbance of watercourse channels and sedimentation	a) Upgrade existing roads and causeways b) Dry season construction	Low
Vehicle movement and refuelling	Pollution of water resources as result of hydrocarbon spills	a) Service all vehicles and machinery Refuel in hard-park/bunded area Store	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		hydrocarbons safely in bunded area b) Vehicle maintenance and inspection daily c) Spill kits must always be available and ready on-site	
Operational Phase			
Operation of mine and access roads	Vehicular movement and sedimentation	a) Sediment trapping berms b) Stormwater management plans	Low
	Pollution of water resources as a result of mine waste	a) Implement Integrated Waste Water Management Plan b) Aquatic biomonitoring	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
	Pollution of water resources as result of hydrocarbon spills	a) Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area b) Vehicle maintenance and inspection daily c) Spill kits must always be available and ready on-site	Low
Decommissioning and Rehabilitation Phase			
Shaping of landscape	Sedimentation as a result of bare areas of soil	a) Sediment trapping berms b) Stormwater management plans c) Dry season working d) Aquatic biomonitoring	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Vehicular and machinery movement	Pollution of water resources as result of hydrocarbon spills	a) Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area b) Vehicle maintenance and inspection daily c) Spill kits must always be available and ready on-site	Low

15.6 *Soil, Land Use and Land Capability*

15.6.1 Soil chemical conditions

The purpose of establishing baseline chemical composition of soil on a site before development commences, is to determine whether there is any deterioration in soil fertility and what the nutrient status of the soil is associated with the natural vegetation. Should the chemical content of the soil be drastically different once rehabilitation commences, the chemical composition might have to be amended by the addition of fertilizers or organic matter. The analyses results obtained from the laboratory is attached as Appendix 2 of the Soil, Land Use and Land Capability Specialist Report.

15.6.2 pH

The pH of the soil is measured potentiometrically in a supernatant suspension of a 1:2.5 soil to liquid mixture. For this assessment potassium chloride (KCl) was used. The pH levels will be described using the scale of general descriptive terminology as was defined by the United States Department of Agriculture Natural Resources Conservation Service (NRCS).

Table 33: Descriptive terminology for pH ranges (NRCS, USDA)

Description/Denomination	pH range
Ultra-acidic	<3,5
Extremely acidic	3,5 – 4,4
Very strongly acidic	4,5 – 5,0
Strongly acidic	5,1 – 5,5
Moderately acidic	5,6 – 6,0
Slightly acidic	6,1 – 6,5
Neutral	6,6 – 7,3
Slightly alkaline	7,4 – 7,8
Moderately alkaline	7,9 – 8,4

Description/Denomination	pH range
Strongly alkaline	8,5 – 9,0
Very strongly alkaline	>9,0

The pH values of the samples range between 4,73 and 6,09 and are therefore very strongly acidic to slightly acidic. pH values below 5 result in high solubility of aluminium that results in aluminium toxicity symptoms such as stunted root growth and minimum lateral root development (Mengel and Kirkby, 2001). As only samples are below pH 5, the pH levels are not considered a hindrance to agricultural production.

15.6.3 Plant-available phosphorus (P)

Plant-available phosphorus is extracted with a Bray 1 solution for soils with a neutral to low pH value. The plant-available phosphorus levels are mostly high (the highest is 65,4 mg/kg at Mat01 [topsoil]) with only two points indicating low phosphorus levels (these points are representative of the Arcadia soil form). The high phosphorus levels in the soil indicate that the soil has previously been cultivated and that phosphorus fertilizer was added to the soil. Undisturbed in situ profiles in the warm, drier areas of the country such as the area of the proposed Mathai project, usually have much lower P levels.

15.6.4 Major cationic plant nutrients

The exchangeable complexed fraction of the major cationic plant nutrients (magnesium, calcium, potassium and sodium) were determined by percolation of the samples with ammonium acetate and measurement of bases in the percolate. The levels of all four cations are very high. The samples representing the Arcadia soil form showed extremely high levels of calcium and magnesium, high levels of potassium as well as rather high levels of sodium. Especially the Arcadia soil in close proximity to the river is very high in calcium as calcium nodules are also present in this area. The high magnesium and sodium levels can prove to be problematic for soil texture as deflocculation can occur.

The organic carbon content was measured with the Walkley-Black methodology. The organic carbon content is relatively high for the climatic conditions of the project area and can be attributed to the higher clay content of the soil forms there. The organic carbon content ranges between 1,44% and 3,42%.

15.6.5 Land capability

Land capability can be defined as "the extent to which land can meet the needs of one or more uses under defined conditions of management" (Schoeman, 2002). The land capability of an area is the combination of the inherent soil properties and the climatic conditions as well as other landscape properties such as slope and drainage patterns that may inhibit agricultural land use or result in the development of specific land functionality such as wetlands. Land capability affects the socio-economic aspects of human settlements and determine the livelihood possibilities of an area. Baseline land capabilities are also used as a benchmark for rehabilitation of land in the case of project decommissioning.

Following the land capability classification of the South African Chamber of Mines, the largest portion of the area assessed can be classified as having arable land capability. Although the vertic topsoil horizon of the Arcadia form is high in clay content, this soil form is successfully used in the larger region of the project area for the production of sunflowers and cotton. The area around the river as well as the two pockets of the shallow Glenrosa form, has grazing land capability. Especially the area around the river is not suitable for crop cultivation because of the excessively high cation content that can lead to erosion of the landscape should the in situ soil profiles be disturbed.

The larger prospecting right area within which the proposed project fall was also assessed using the newly launched land capability classification systems as released by DAFF (2017). This data set show that the prospecting right area is dominated by land with high and moderate high arable land capability (Figure **51**). This is in agreement with the findings of the soil survey and site assessment.

15.6.6 Agricultural potential

The largest portion of the area assessed has suitability for rain-fed agriculture. There are soil physical and chemical evidence that crop cultivation was previously practiced in this area. It is not evident why this has ceased and whether it is as a result of climatic constraints or as a result of a change in landownership. The site also has potential for irrigated agriculture although no irrigation infrastructure was observed during the site visit.

Livestock farming is also considered a viable option for the project site. The grazing capacity of a specified area for domestic herbivores is given either in large animal unit per hectare or in hectares per large animal unit. One large animal unit is regarded as a steer of 450kg whose weight increases by 500g per day on veld with a mean energy digestibility of 55%. The grazing capacity of the veld in the project site is 8 to 10 hectares per large animal unit or large stock unit (LSU) (Morgenthal et al., 2005).

15.6.7 Sensitivity analysis of the project site

Following the analysis of the baseline properties of the project site, it can be classified as having high, medium and low sensitivity to the proposed project from the perspective of soil, land capability and agricultural potential (**Error! Reference source not found.**). The area around the river has high sensitivity to disturbance but the current proposed surface footprint does not fall within this area. The largest parts of the areas to be disturbed has medium sensitivity to the proposed development as the soil has high arable potential although it is not currently cultivated. Areas which consist of the shallow Glenrosa soil form has low sensitivity to the proposed project.

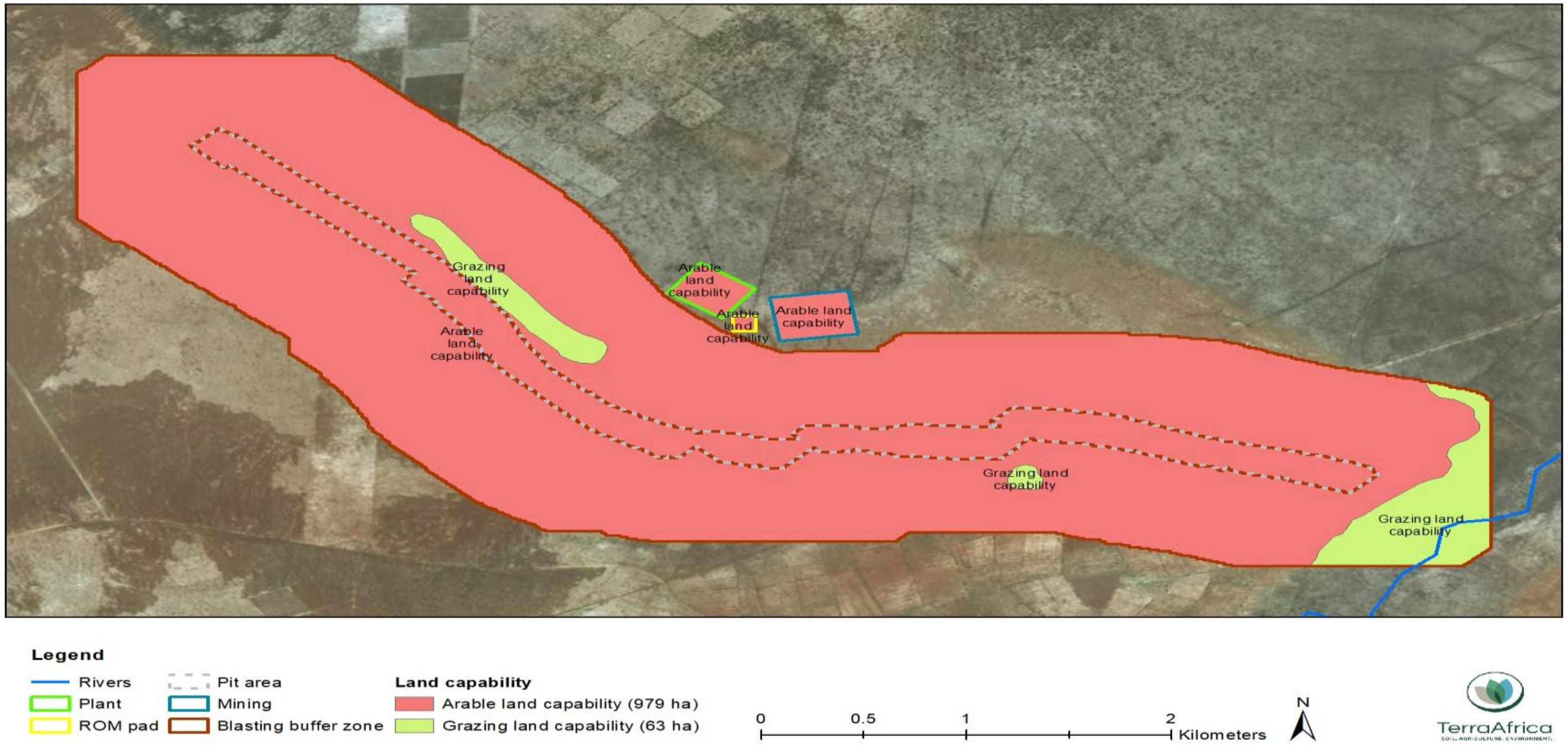

Figure 50: Land capability map of the areas of proposed infrastructure and impact of the Matai Mining Project

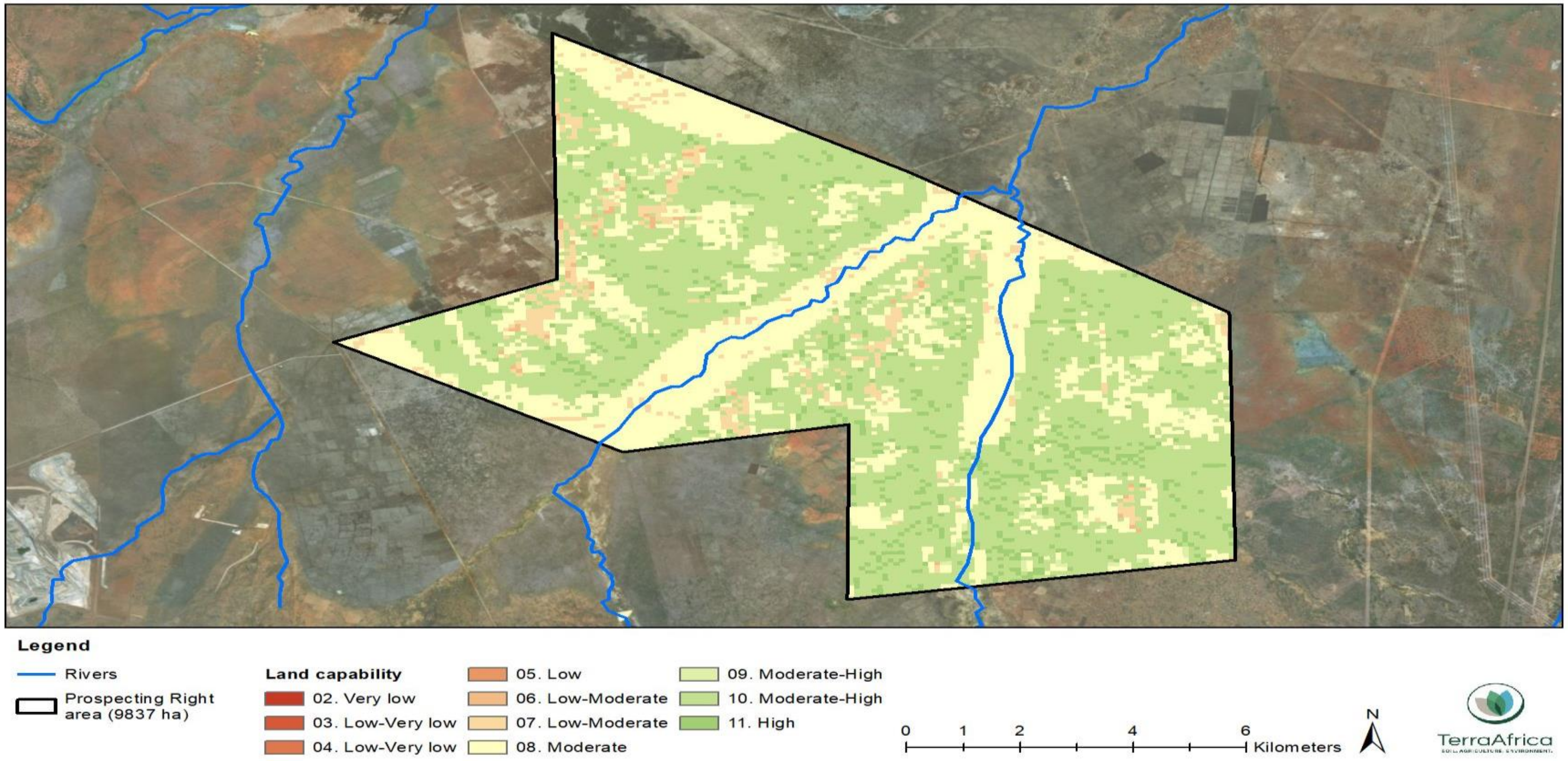

Figure 51: Land capability map of the Matai Mining (Pty) Ltd Prospecting Right area (data source: DAFF, 2017)

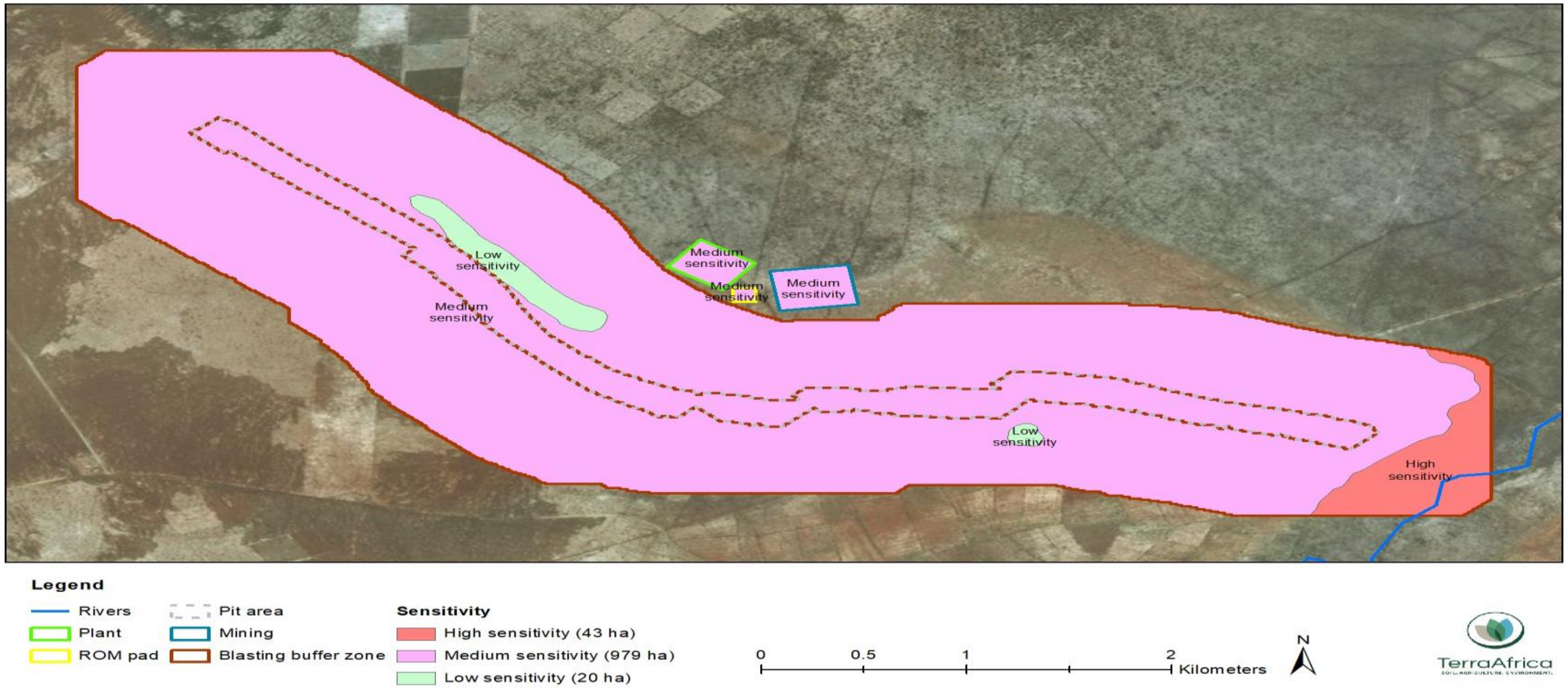

Figure 52: Sensitivity of the baseline environment to the proposed project layout

15.6.8 Impact Assessment

Table 34: Soil, land use and land capability impact assessment

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Construction Phase			
Transport of materials and labour	This will compact the soil of the existing roads and fuel and oil spills from vehicles may result in soil chemical pollution	**a) Minimise the footprint of the Matai Mining Project** The existing pre-construction mine layout and design is aiming to minimise the area to be occupied by mine infrastructure (workshops, administration, product stockpile, etc.) to as small as practically possible. All footprint areas should also be clearly defined and	Medium-Low
Earthworks	Clearing of vegetation from the surface, stripping topsoil (soil excavation) and stockpiling as well as drilling and blasting for the initial removal of overburden at the planned open cast pit as well as the construction of infrastructure like		Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
	the Primary Crushing Facility, water management systems, contractors camp. These activities are the most disruptive to natural soil horizon distribution and will impact on the current soil hydrological properties and functionality of soil. It will also change the current land use as well as land capability in areas where activities occur, and infrastructure is constructed	demarcated and edge effects beyond these areas clearly defined. This measure will significantly reduce areas to be compacted by heavy construction vehicles and regular activities during the operational phase **b) Management and supervision of construction teams** The activities of construction contractors or employees will be restricted to the planned areas. Instructions must be included in	
Handling and storage of building material	This will have the potential to result in soil pollution when not managed properly.		Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Vegetation clearance	Soil erosion is also anticipated due to vegetation clearance.	contracts that will restrict construction work and construction workers to the clearly defined limits of the construction site. In addition, compliance to these instructions must be monitored **c) Location of stockpiles** Locate all soil stockpiles in areas where they will not have to be relocated prior to replacement for final rehabilitation. Refrain from locating stockpiles as close as possible to the development for cost saving only to have them relocated later during the life of the operation.	Medium-low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		The ideal is to place all overburden materials removed during construction in their final closure location, or as close as practicable to it **d) Topsoil stripping** Wherever possible, stripping and replacing of soils should be done in a single action. This is both to reduce compaction and also to increase the viability of the seed bank contained in the stripped surface soil horizons.	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		Stripping should be conducted a suitable distance ahead of development of, for example the open pit, at all times to avoid loss and contamination. As a norm, soil stripping should be kept within 3-9 months of development, or between 50-100 metres ahead of the active operations. **e) Stockpiling of topsoil** To minimise compaction associated with stockpile creation, it is recommended that the height of stockpiles be restricted between of 4	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		– 5 meters maximum. For extra stability and erosion protection, the stockpiles may be benched. The clay content of the topsoil on the largest area of the Matai Mining project area is not sufficient for stockpiles to remain relatively stable without benching. The areas on the Arcadia soil form do have sufficient clay content **f) Prevention of stockpile contamination** Topsoil stockpiles can be contaminated by dumping waste materials next to or on the stockpiles,	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		contamination by dust from blasting and waste rock stockpiles and the dampening for dust control with contaminated water are all hazards faced by stockpiles. This should be avoided at all cost and if it occurs, should be cleaned up immediately **g) Terrain stability to minimise erosion potential** Management of the terrain for stability by using the following measures will reduce the risk of erosion significantly:	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		• Using appropriate methods of excavating that are in accordance with regulatory requirements and industrial best practices procedures; • Reducing slope gradients as far as possible along road cuts and disturbed areas to gradients at or below the angle of repose of those disturbed surfaces; and • Using drainage control measures and culverts to	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		manage the natural flow of surface runoff Management of the terrain for stability by using the following measures will reduce the risk of erosion significantly: • Using appropriate methods of excavating that are in accordance with regulatory requirements and industrial best practices procedures; • Reducing slope gradients as far as possible along road cuts and disturbed areas to gradients at or below the	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		angle of repose of those disturbed surfaces; and • Using drainage control measures and culverts to manage the natural flow of surface runoff **h) Management of access and services roads** Existing established roads should be used wherever possible. Where possible, roads that will carry heavy-duty traffic should be designed in areas previously disturbed rather than clearing new areas, where possible. The moisture content of access road surface layers must be	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		maintained through routine spraying or the use of an appropriate dust suppressant. Access roads should be designed with a camber to avoid ponding and to encourage drainage to side drains; where necessary, culverts will be installed to permit free drainage of existing water courses. The side drains on the roads can be protected with sediment traps and/or gabions to reduce the erosive velocity of water during storm events and where necessary geo-membrane lining can be used	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		i) Prevention of soil contamination During the construction phase, chemical soil pollution should be minimised as follows: • Losses of fuel and lubricants from the oil sumps and steering racks of vehicles and equipment should be contained by using a drip tray with plastic sheeting filled with absorbent material; • Using biodegradable hydraulic fluids, using lined sumps for collection of hydraulic fluids, recovering	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		contaminated soils and treating them off-site, and securely storing dried waste mud by burying it in a purpose-built containment area; • Avoiding waste disposal at the site wherever possible, by segregating, trucking out, and recycling waste; • Containing potentially contaminating fluids and other wastes; and • Cleaning up areas of spillage of potentially contaminating liquids and solids.	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Operational Phase			
Open pits and mine infrastructure	Open pits and surface infrastructure will both lead to surface impacts on soil resources. Surface infrastructure like buildings, haul roads, waste rock dumps and product stockpiles are by far the most disruptive to current land uses, land capability as well as agricultural potential of the soil. Soil underneath buildings and stockpiles are subject to compaction and sterilization of the topsoil	**Management of potential soil contamination during the operational phase** The following management measures will either prevent or significantly reduce the impact of soil chemical pollution on site during the operation phase: a) Stockpiles are managed so they do not become contaminated and then need additional handling or disposal;	
Spills of fuel and lubricants	Soil chemical pollution as a result of spills of fuel and lubricants by		

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
	vehicles and machinery as wells as the accumulation of domestic waste, is considered to be a moderate deterioration of the soil resource. This impact will be localized within the site boundary and have medium-high significance on the soil resource.	b) A low process or storage inventory must be held to reduce the potential volume of material that could be accidentally released or spilled; c) Processing areas should be contained, and systems designed to effectively manage and dispose of contained storm water, effluent and solids; d) Storage tanks of fuels, oils or other chemicals stored are above ground, preferably	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		with inspectable bottoms, or with bases designed to minimise corrosion. Above-ground (rather than in-ground) piping systems should be provided. Containment bunds should be sealed to prevent spills contaminating the soil and groundwater; e) Equipment, and vehicle maintenance and washdown areas, are contained and appropriate means provided	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		for treating and disposing of liquids and solids f) Air pollution control systems avoid release of fines to the ground (such as dust from dust collectors or slurry from scrubbing systems); g) Solids and slurries are disposed of in a manner consistent with the nature of the material and avoids contamination; and	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		h) Effluent and processing drainage systems avoid leakage to ground.	
Vehicle movement	Soil compaction will be a measurable deterioration that will occur as a result of the weight of the topsoil and overburden stockpiles stored on the soil surface as well as the movement of vehicles on the soil surfaces (including access and haul roads). This is a permanent impact that will be localized within the site boundary with medium-low consequence and significance in the mitigated scenario.	Same as above	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Vegetation clearance	During the operational phase, topsoil stockpiles as well as roads running down slopes will still be susceptible to erosion. Soil surfaces with infrastructure such as concrete slabs and buildings will not be exposed to erosion any longer. This is a permanent impact that will be localized within the site boundary with medium-high consequence and significance.	Same as above	
	Decommissioning and Rehabilitation		
Traffic movement	Transport of materials away from site. This will compact the soil of the existing roads and fuel and oil spills	**a) Management and supervision of decommissioning teams**	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
	from vehicles may result in soil chemical pollution	The activities of decommissioning contractors or employees will be restricted to the planned areas. Instructions must be included in contracts that will restrict decommissioning workers to the areas demarcated for decommissioning. In addition, compliance to these instructions must be monitored. **b) Infrastructure removal** All buildings, structures and foundations not part of the post-	
Earthworks	Earthworks will include redistribution of inert waste materials to fill the open pits as well as topsoil to add to the soil surface. These activities will not result in further impacts on land use and land capability but may increase soil compaction		
Handling and storage of materials	Other activities in this phase that will impact on soil are the handling and storage of materials and different kinds of waste generated as well as		

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
	accidental spills and leaks with decommissioning and rehabilitation activities. This will have the potential to result in soil pollution when not managed properly	closure land use plan must be demolished and removed from site	
Revegetation	With the decommissioning phase, soil surfaces are in the process of being replanted with indigenous vegetation and until vegetation cover has established successfully, all surfaces are still susceptible to potential soil erosion	**c) Site preparation** Once the site has been cleared of infrastructure and potential contamination, the slope must be re-graded (sloped) in order to approximate the pre-project aspect and contours. The previous infrastructure footprint area must be ripped a number of times in order to reduce soil compaction. The area must then be covered with topsoil material from the stockpiles	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		d) Seeding and re-vegetation Once the land has been prepared, seeding and re-vegetation will contribute to establishing a vegetative cover on disturbed soil as a means to control erosion and to restore disturbed areas to beneficial uses as quickly as possible. The vegetative cover reduces erosion potential, slows down runoff velocities, physically binds soil with roots and reduces water loss through evapotranspiration. Indigenous species will be used for the re-vegetation, the exact species will be	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		chosen based on research available and then experience as the further areas are re-vegetated **e) Prevention of soil contamination** During the decommissioning phase, chemical soil pollution should be minimised as follows: Losses of fuel and lubricants from the oil sumps of vehicles and equipment should be contained using a drip tray with plastic sheeting and filled with absorbent material;	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		○ Using biodegradable hydraulic fluids, using lined sumps for collection of hydraulic fluids and recovering contaminated soils and treating them off-site; ○ Avoiding waste disposal at the site wherever possible, by segregating, trucking out, and recycling waste; ○ Containing potentially contaminating fluids and other wastes; and	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		○ Cleaning up areas of spillage of potentially contaminating liquids and solids.	

15.7 *Groundwater Impacts*

15.7.1 Aquifers

The mining activities and associated infrastructures are located on a well-developed (up to 100 mbgl) mafic and ultra-mafic rocks (Gabbro, Norite, Melanorite, Plagioclase, Olivine, Magnetite), laterally bounded in the south east by the acid rocks of the Pilanesberg outcrop.

Three dominants hydro-stratigraphic units (Alluvial deposits; Shallow weathered aquifer system; and Shallow and Deeper Localized fracture aquifer system) are found in the catchments.

15.7.2 Alluvial aquifers

The alluvial deposits occur along the main surface water drainage. The water flowing down this river will recharge the shallow alluvial aquifers, which in turn will drain downwards to the weathered and fractured aquifers due to their inter-connectivity.

15.7.3 Shallow weathered aquifers

The top soil (overburden) forms the roof of the weathered/fractured igneous and sedimentary rocks. Current drilling information (boreholes drilling logs analysis) in the mining area, suggests an average thickness of 15 m and occurred up to 30 mbgl. To account for the transition to the competent rock, it is assumed that the shallow weathered aquifer extends to 50 mbgl.

The depths to static groundwater level are up to 0.57 m below ground level. Such measured water levels are a function of the product of the combined saturated aquifers (weathered and fractured) thickness, the hydraulic conductivity (transmissivity) and effective aquifer recharge. This aquifer is unconfined to semi-confined and is recharged by rainfall. Literature review suggests that rock materials of the shallow weathered aquifer are of low permeability (0.05 to 5 m/d). The regional groundwater gradient is predominantly toward the Diphiri River (A24E) in the east, and the Bofule River in the west (A24D).

15.7.3.1 Deeper fractured aquifer

A deeper fractured rock aquifer formed by competent rocks. Fracturing associated with tectonic movements may occurred at places during intrusions. The deeper fractured aquifer is expected to be unconfined to semi-confined, as available geological logs in the area did not show any impermeable layer between the two aquifer systems.

There is insufficient information available to confirm the exact thickness of the deeper aquifer fractured, but general information from existing literature suggests we limit the deeper fractured aquifer at 50 m below the bottom of the shallow weathered aquifer.

15.7.4 Groundwater Level

For the purpose of the study, water level measured during the hydrocensus are used. The water levels measured during the hydrocensus ranges between 14.31mbgl and 44.9 mbgl. A comparison of the water level elevation with topography shows a good correlation of 99.9% (Figure 53). This confirms that groundwater elevation mimics the topography.

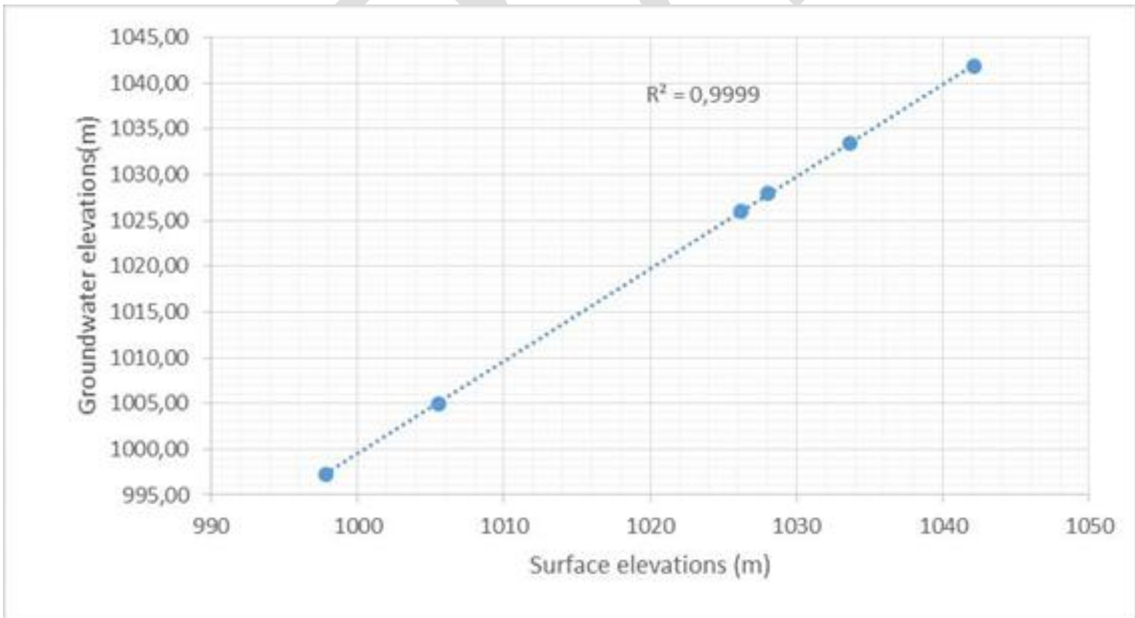

Figure 53: Correlation between surface and groundwater elevations

15.7.5 Recharge Estimation

The quantity of rainfall and intensity of rainfall (monthly rainfall) are the major drivers of aquifer recharge in the study area. Groundwater recharge is sustained by direct rainfall on the surface area. For the recharge estimation, the chloride method will be used.

According to Cook (2003), the Chloride Mass Balance is the most reliable technique for determine the recharge rates to fractured rock aquifers. The percentage rainfall, representing average annual recharge, can be derived from the ratio of the chloride concentration in rainfall relative to that of groundwater, (Bredenkamp et al, 1995). The CMB-method can be applied to the saturated zone to estimate a 'true' total recharge originating from both diffuse and preferential flow components through the unsaturated zone. The CMB-method in the saturated zone has been used in basement aquifers throughout southern Africa to estimate recharge (Xu and Beekman, 2003; Adams et al., 2004). This method entails determining the recharge over an entire drainage area by integrating the ratio of average chloride content in rainfall (wet and dry deposition) to that of groundwater over the whole area.

The Chloride Mass Balance can be represented by this equation:

$$Rt= \frac{P * Clp + D}{Clgw}$$

P= Precipitation (mm per time)

Rt= total recharge (mm per time

D=Dry deposition

Clp: Chloride concentration in precipitation

Clgw: Chloride Concentration in groundwater

Recharge estimate was obtained by using the chloride concentration in the rainwater and groundwater, together with annual rainfall. The average concentration of chloride (44 mg/L) in groundwater of the boreholes within the mine were used for the calculation.

$$RE\% = \frac{Clp}{Clgw} X100$$

Clp: Chloride concentration in precipitation

Clgw: Chloride Concentration in groundwater

The mean annual precipitation of the project area is 937 mm. The chloride rainfall concentration is assumed to be 0,5 mg/L for a semi-arid area. Based on the calculation, the recharge rate is 1,14% of MAP, with 6,82 Mm/year.

15.7.6 Groundwater Quality

Water quality data was presented by means of tables, a stiff diagram and a piper diagram. The Piper diagram was generated using the WISH software. A Piper diagram is utilised to characterise water types in a graphical manner and to distinguish between specific water types in an area.

The Piper diagram was quartered to simplify this process and can be grouped into a left, bottom, right and upper quarter. The position of the water sample on the plot is based on the ratio of the various constituents (measured in equivalence) and is not an indication of the absolute water quality or the suitability thereof for domestic consumption.

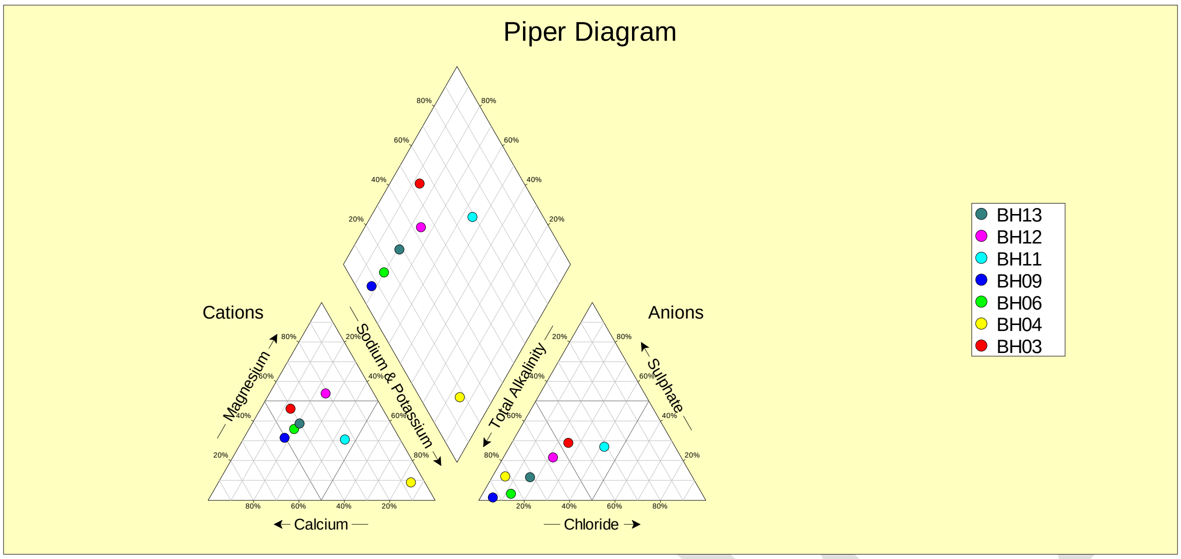

Figure 54: Piper Diagram

The following could be deduced from the piper diagram

Cations

a) BH13, BH06, BH03, BH11 and BH09 are no dominant type water

b) BH12 magnesium

c) BH04 sodium and potassium

Anions

a) BH13, BH06, BH09, BH12 and BH04 are Bicarbonate type

b) BH11 and BH03 No dominant type

c) BH13, BH06, BH09, BH12 and BH03 is magnesium bicarbonate type water

d) BH04 is sodium bicarbonate type water

e) BH11 is mixed type water

Stiff diagrams are used to understand the interactions of water samples with anthropogenic pollutants (McKenzie *et al*., 2001)

The samples can be classified as follows:

a) BH03: Mg-HCO_3
b) BH04: Na-HCO_3
c) BH06: CaMg-HCO3
d) BH09: CaMg-HCO3
e) BH11: Na-Cl
f) BH12: Mg-HCO_3
g) BH13: CaMg-HCO3

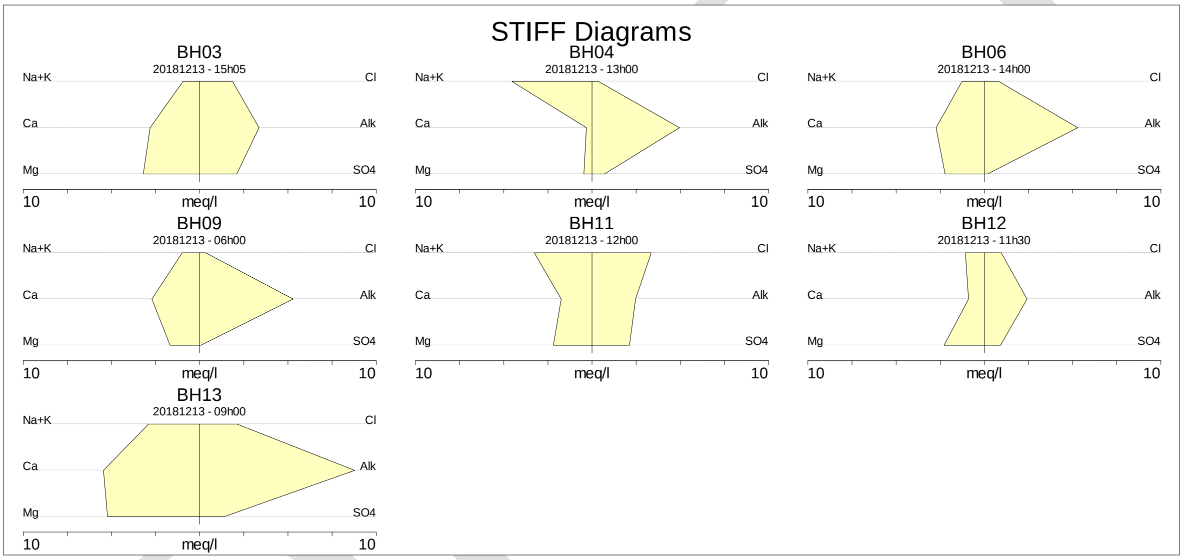

Figure 55: Stiff Diagram: Chemistry Results

15.7.7 Aquifer Domain and Boundaries

There is a good correlation between the groundwater level elevations and the surface topography. No evidence of subsurface no-flow boundaries has been clearly identified.

The Mine is projected on the water divided of 02 quaternary catchments (A24D, and A24E), and groundwater drainage is confirmed to follow main topography, it is logical therefore to include large areas of the surface water sub-catchments of the principal (perennial) surface drainage (The Phufane river, and the Bofule River), into the modelling domain. We consider that the groundwater system extents over the geometry of the surface water system within the catchments. The Phufane river (far east of the project area), the Bofule River (west of project area) and the water divided (North, and South of the project are) of the quaternary catchments boundary, form the limit of the groundwater systems to be modelled. The Diphiri river (east of the mining area), which feed into the Phufane river may also receive groundwater from the study area and is considered as internal model boundary. Most of the groundwater recharges occurring within the study area are expected to discharge into these water courses.

According to Vegter (1995) the regional recharge is 32 mm/a. Groundwater recharge (R) for the area was also calculated using the chloride method (Bredenkamp et al., 1995) and is expressed as a percentage of the Mean Annual Precipitation (MAP). This estimation suggests that local recharge to the shallow aquifer may reach 10.90% of the Mean Annual Precipitation:

This dynamic recharge from rainfall results in fresh and good groundwater quality in undisturbed areas. This aquifer is, however, more likely to be affected by contaminant sources situated on surface.

15.7.8 Potential Contamination Sites

Impacts of mining activities should be limited to the shallow aquifer(s) and surface water bodies in the near vicinity of the lease area. Such impacts are expected to be probably contaminations from plan's area, and waste dump, will be located north of the projected pits.

15.7.9 NUMERICAL MODEL

The numerical model solves both complex and simple problems and can be used to simulate various scenarios without undue effort. The basic steps involved in modelling can be summarised as:

a) Collecting and interpreting field data, to understand the natural system and to specify the investigated groundwater problem. The assignment of real field parameters makes the numerical model a site-specific groundwater model. The quality of the simulations depends largely on the quality of the input data.

b) Calibration & validation; which require to overcome the lack of input data. The calibration and validation also accommodate the simplification of the natural system in the model. The model input data are altered within ranges, until the simulated and observed values are fitted within an acceptable tolerance.
c) Modelling scenarios: Alternative scenarios for a given area may be assessed efficiently. When applying numerical models in a predictive sense, limits exist in model application. Predictions of a relative nature are often more useful than those of an absolute nature.

15.7.10 Numerical Software Code and Geometry Model

The base line model is built with Fe flow, which is developed since 1979 by the WASY Institute for Water Resources Planning and Systems Research Ltd (Germany), and is has been continuously improved. It is an interactive groundwater modelling system for three and two-dimensional, areal and cross-sectional, fluid density-coupled, thermohaline or uncoupled, variably saturated, transient or steady state flow, mass and heat transport in subsurface water resources with or without one or multiple free surfaces.

Finite elements divide the aquifer into a mesh of node points that form polygonal (triangular) cells, which can be adapted to different types of boundaries conditions. A finite element network was designed to provide a high resolution of the numerical solution, and to accommodate the model area. A grid consisting of 3 layers, 81315 elements, 50058 nodes, and 220603 faces, 189345 edges. The topographic elevations from SRTM DEM were used with available geological information to for the elevations of the slices. 3D-views of the modelling area are given in Figure 58 and Figure 59.

15.7.11 Mass Transport model

The most important processes that involved in the transport through a medium are Advection, and the Hydrodynamic dispersion (Mechanical dispersion and Molecular diffusion). Other phenomena (sorption, adsorption, deposition, ion exchange, etc...) may affect the concentrations distribution of a contaminant as it moves through a medium. The effective porosity is required to calculate the average linear velocity of groundwater flow, which in turn is needed to track water particles and to calculate contaminant concentrations in the groundwater.

Table 35: Details of model layers and simplified flow characteristics

Layer Number	Porosity	Longitudinal dispersivity	Transversal dispersivity
Layer 1	0,3	70	7
Layer 2	0,15	30	3
Layer 3	0,08	0,07	0,007

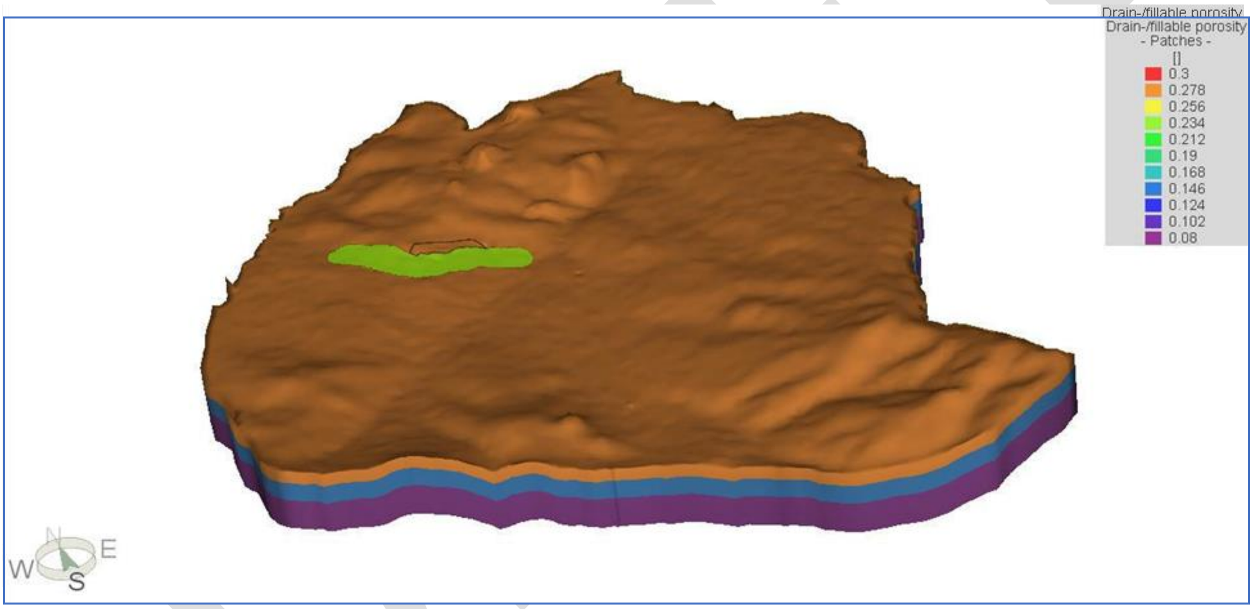

Figure 56: Model Input Porosity

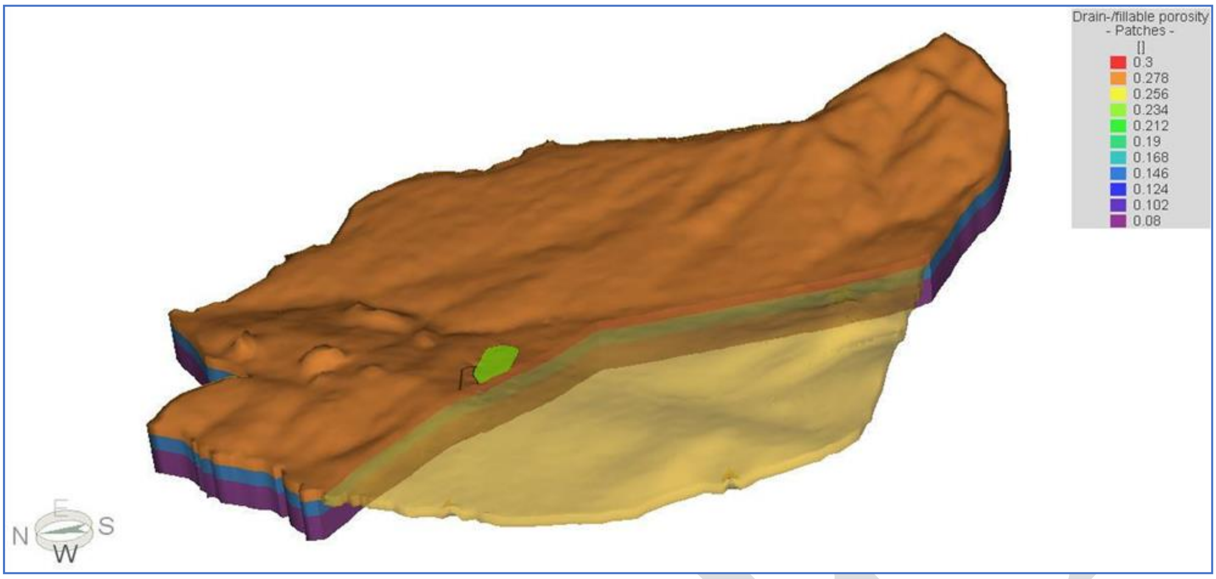

Figure 57: Model Input Porosity (Pane view)

The mass balance equation (Bear and Verruijt, 1992) (equation of hydrodynamic dispersion or the advection-dispersion equation) of a pollutant (contaminant) is expressed as:

$$\frac{nc}{t} = -q_{c,total} - f + n - P_c + R_c$$

where: nc = mass of pollutant per unit volume of porous medium; n = porosity of saturated zone; c = concentration of pollutant (mass of pollutant per unit volume of liquid (water)); △q = excess of inflow of a considered pollutant over outflow, per unit volume of porous medium, per unit time; f = quantity of pollutant leaving the water (through adsorption, ion exchange etc.); = mass of pollutant added to the water (or leaving it) as a result of chemical interactions among species inside the water, or by various decay phenomena; = rate at which the mass of a pollutant is added to the water per unit mass of fluid; ρ = density of pollutant; Pc = total quantity of pollutant withdrawn (pumped) per unit volume of porous medium per unit time; Rc = total quantity of pollutant added (artificial recharge) per unit volume of porous medium per unit time.

Contaminant migration is attributable only to advection and hydrodynamic dispersion. It is assumed that no decay or retardation of contaminants is taking place in the aquifer. The effect of retardation will be reduced due to the fractured flow characteristics of the hard rock formations. This assumption will provide a worst-case scenario in terms of travel distance of contaminants.

No mass transport was possible, because this is a base line numerical model and there is insufficient monitoring data.

By default, initial concentration of 0 mg/l is assigned to fresh water in the aquifer system. The contamination sources are represented by a higher initial concentration at the top aquifer. The mass flux (source term) of the contaminant (Sulphate) was assigned accordingly. Assuming a maximum contaminant concentration of 600 mg/l, and a minimum mitigation measure under pollution source, a mass flux of 52.2 x 10-3 g/m^2/day was used in the contamination area.

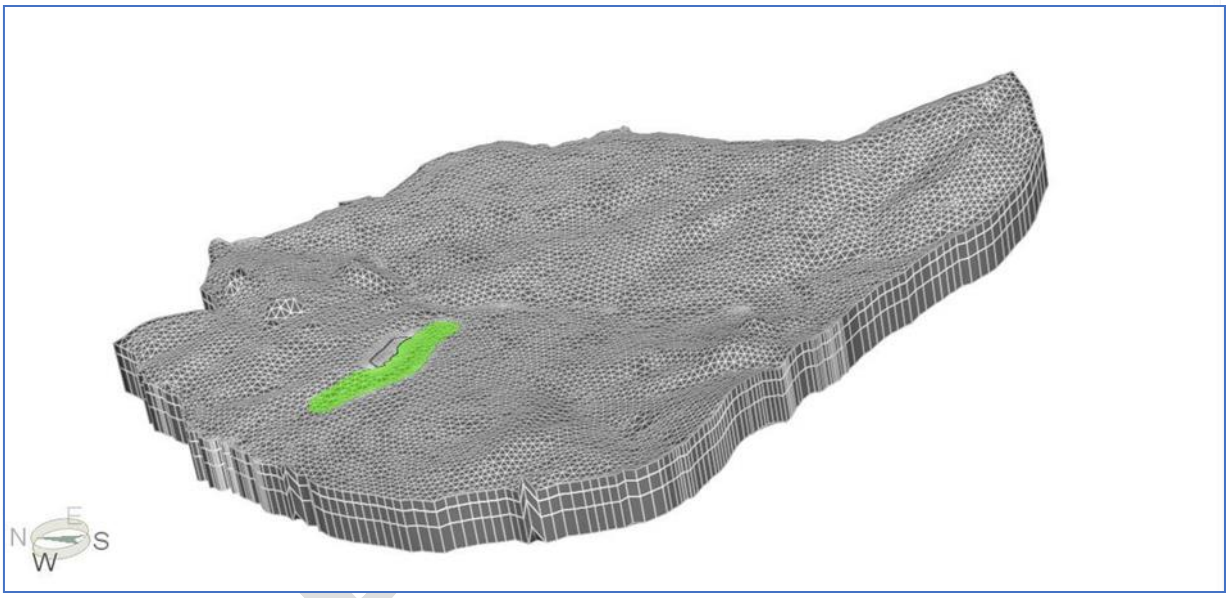

Figure 58: Baseline numerical model geometry

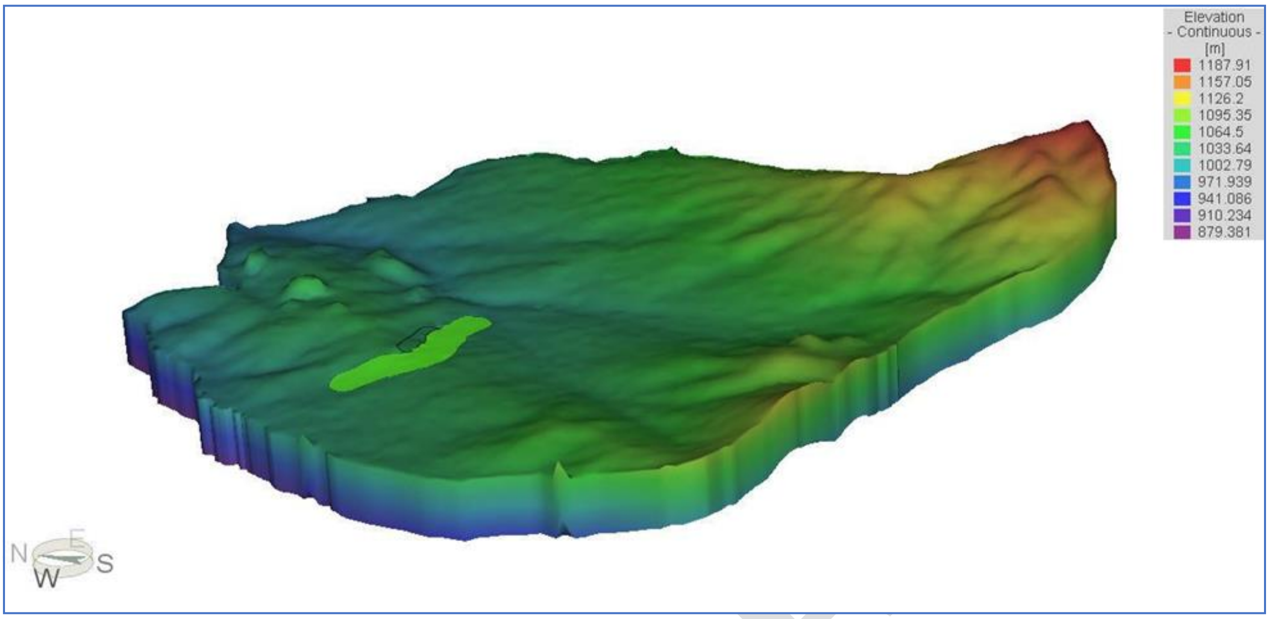

Figure 59: Baseline Numerical Model Elevations

15.7.12 Simulation of Predictive Scenarios

The simulation of scenarios of potential impacts of the proposed mining of the Matai mine project, to groundwater is conducted, with focus on the contamination migration scenarios (Pollution plume).

15.7.12.1 Seepage into Open Pit

Opencast mining will result in groundwater inflows into the pits, which needs to be dewatered. Subsequent to such dewatering, a cone of depression will be formed radially around the open pit, and the groundwater flow gradient will be toward the open pit. The shape and extent of the cone of depression is determined by many factors including:

a) The Transmissivity of the surrounding aquifer systems,
b) The presence of geological structures such as dykes and faults that could act, as preferred flow paths for groundwater,
c) Depth of mining below the static groundwater level,
d) The recharge rate, and

e) Rate of mining, and the size of the opencast pit.

No concurrent rehabilitation has been included in this scenario and therefore it be the 'worst-case' scenario.

The cone of depression will mostly extend in the western direction toward the Bofule River (Catchment A24D) and become deeper as pit floor is lowered. The expected inflow into the pit is 730 m^3/d when mining floor will reach 20 mbgl. It will increase to a maximum of 2800 m^3/d when mining floor reaches 60 mbgl, and it will stabilize to 1150 m^3/d when mining floor will reach 90 mbgl. The simulated cone of depressions for different depths of pit floor, are shown from Figure 60 to Figure 62.

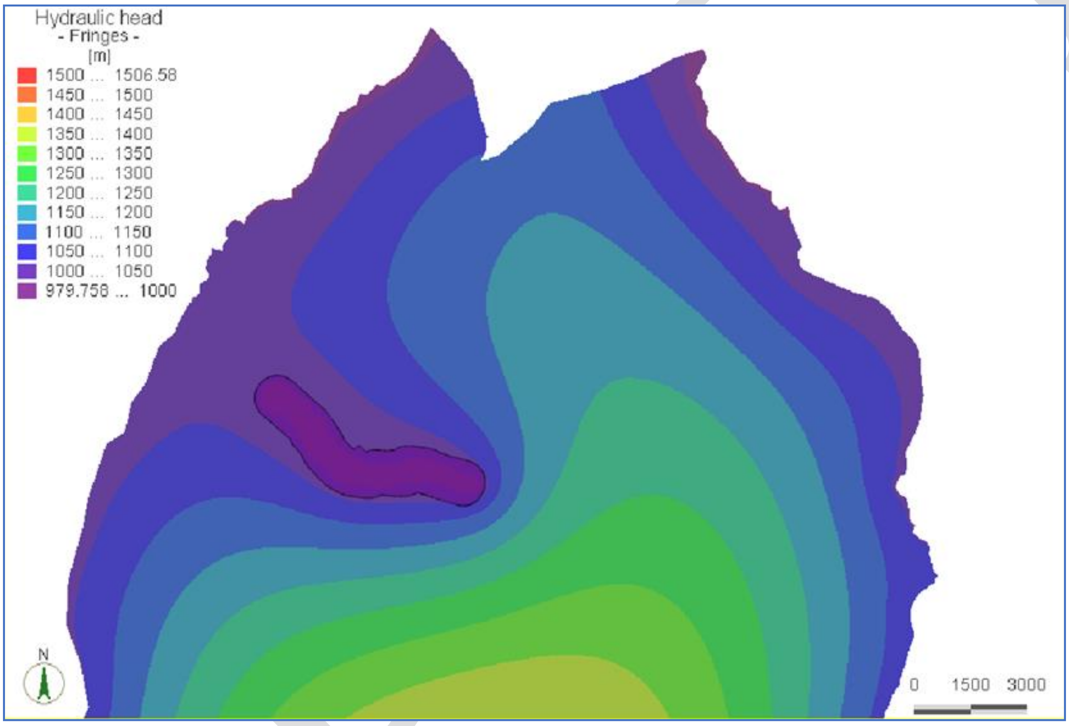

Figure 60: Cone of depression when open pit floor reaches 20 mbgl

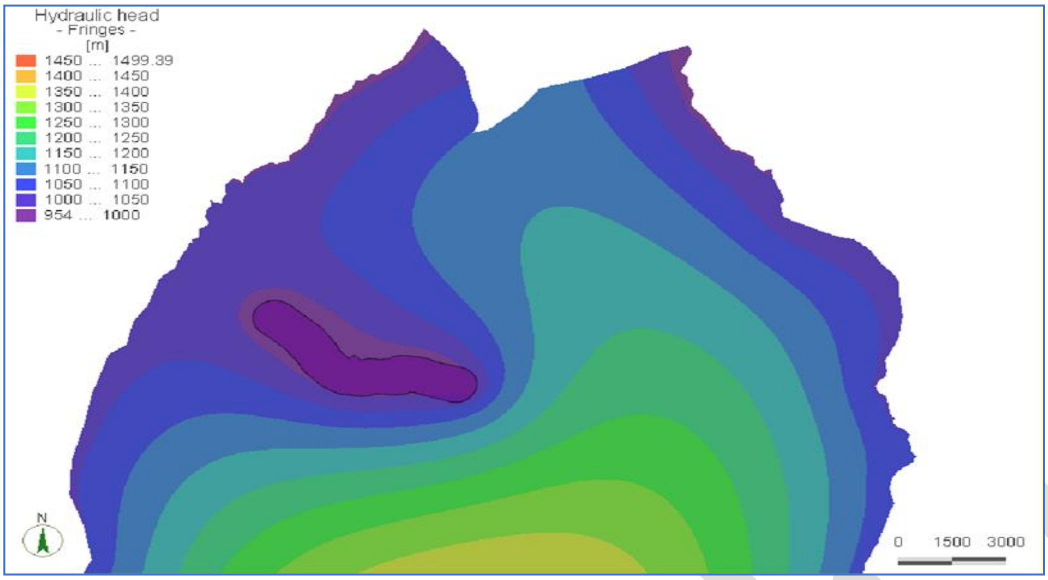

Figure 61: Cone of depression when open pit floor reaches 60 mbgl

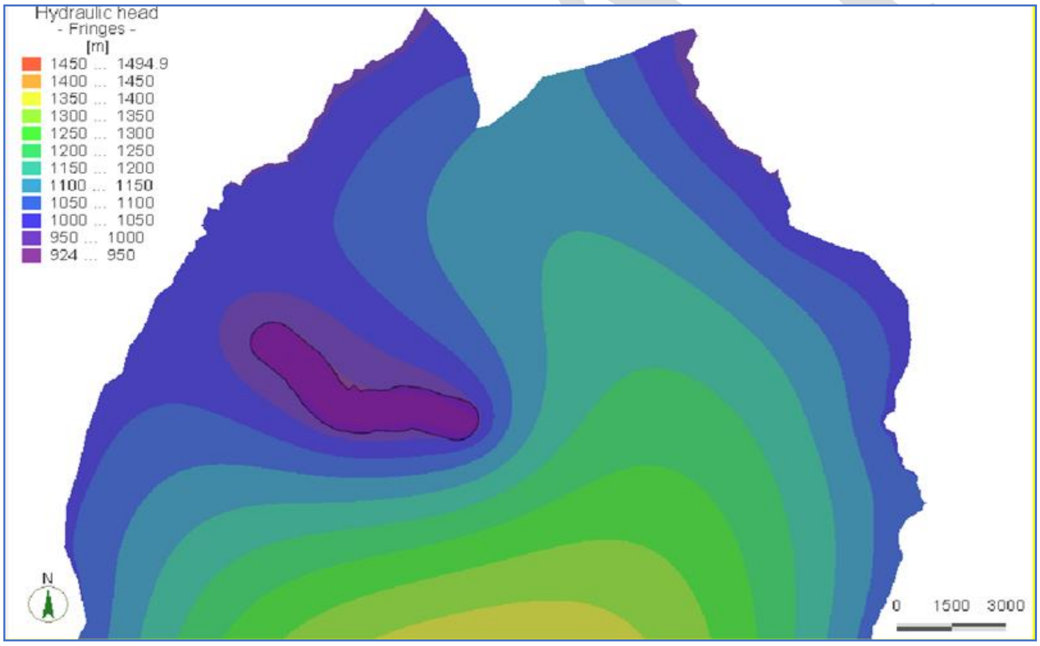

Figure 62: Cone of depression when open pit floor reaches 90 mbgl

15.7.12.2 Pollutions

As the potential pollution sources are located close to water divided, and open pit, groundwater flow during active mining will be toward the open pit, but also toward main natural surface drainage. The contamination plume that will emanate from the plant area is anticipated to move into western direction toward the mine pit (Figure 57 to Figure 70). But the contamination plume that will emanate from the waste dump area is anticipated to move into eastern direction toward the north-north-east down-gradient of the waste dump. The toe of the plume (with a concentration of less 1 mg/l) is estimated to extend 700 m away from waste dump, 20 years after contamination commences.

The open pit area will be kept dry for mine safety and polluted water should be pumped to dirty water dams.

Any pollution plumes emanating from mining activities (Waste dump, plant, dirty water dams, etc.) is expected to be restricted to the mine property. Neighbouring boreholes will not be affected during active mining

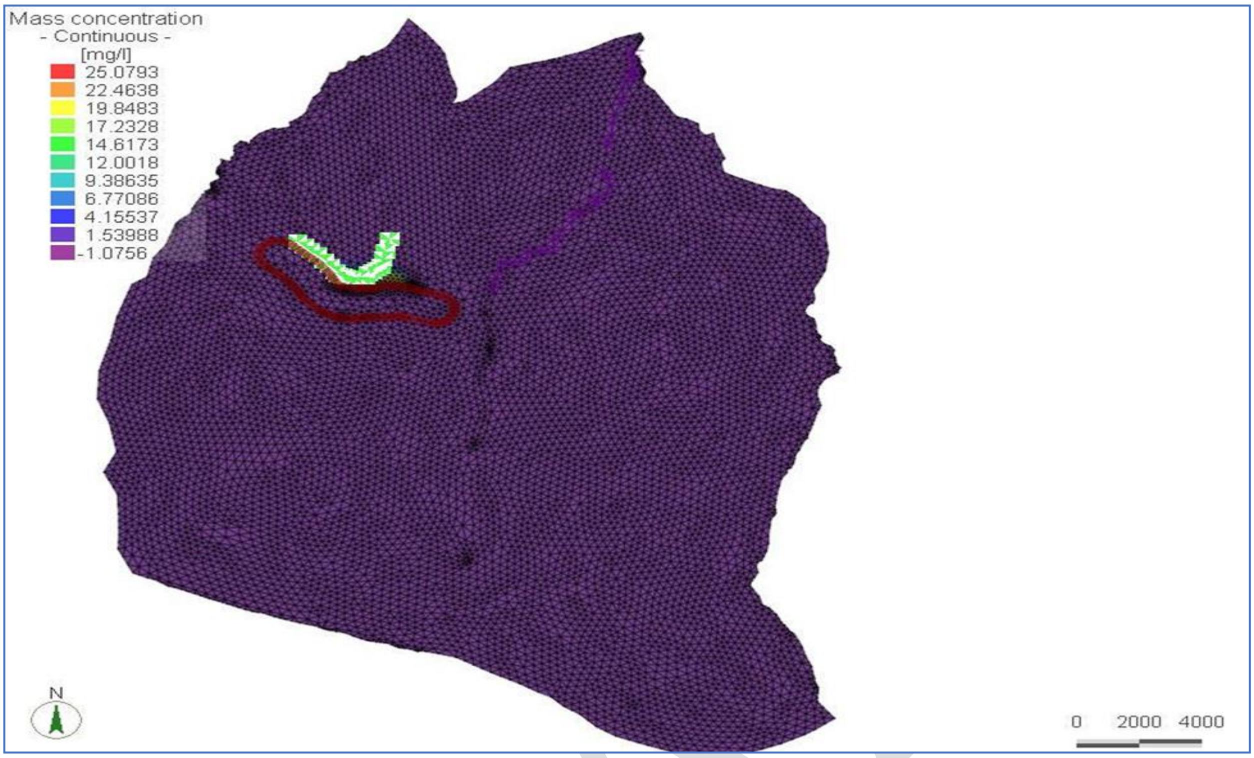

Figure 63: Contamination plume after _ global 3D view

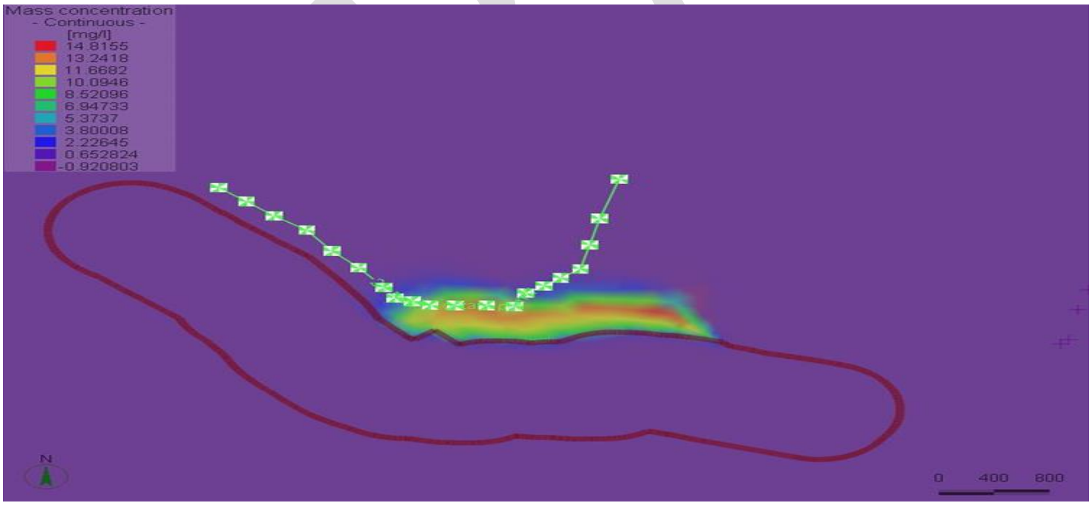

Figure 64:Contamination plume after 5 years _ zoom

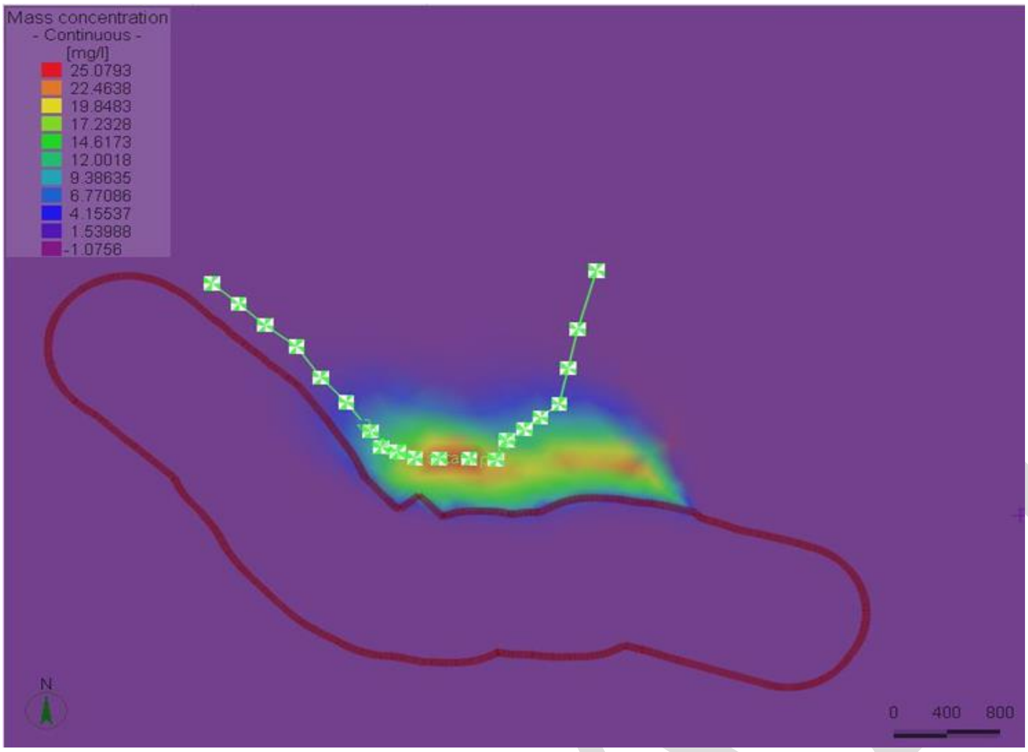

Figure 65: Contamination plume after 20 years _ zoom

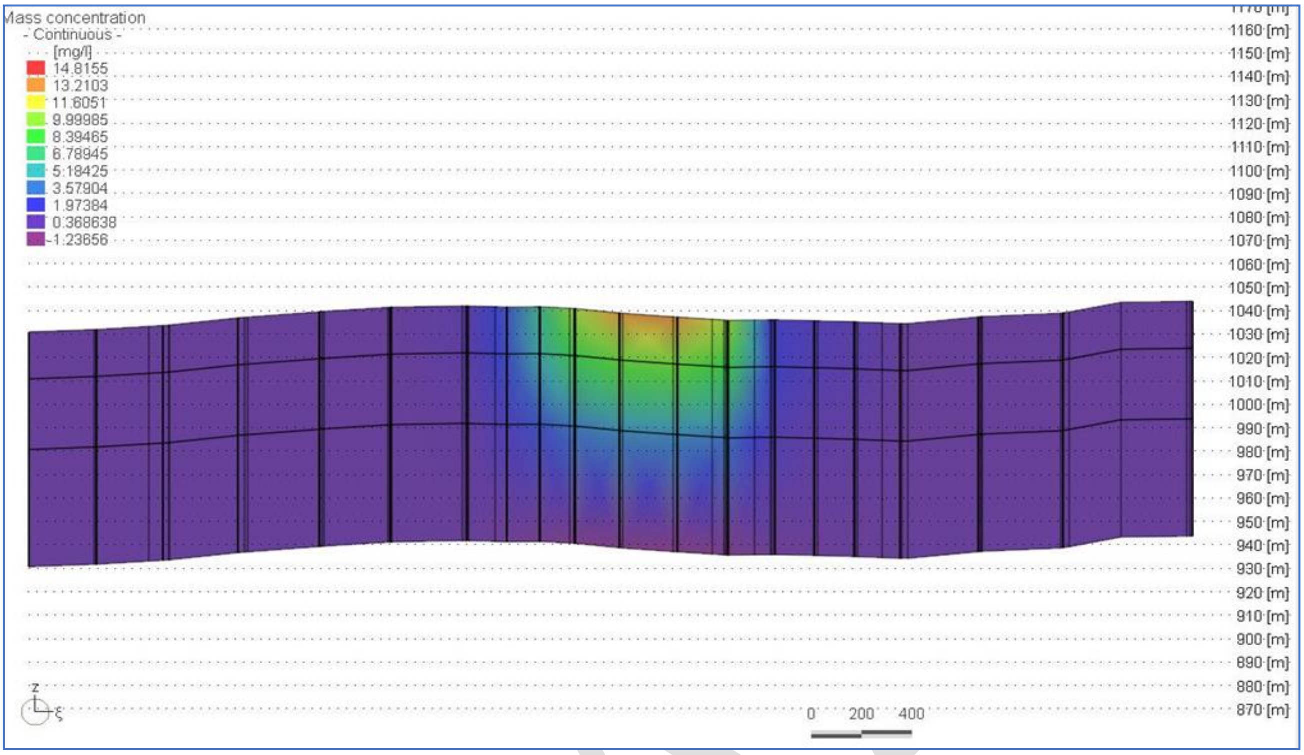

Figure 66:Contamination plume after 5 years _ Cross section view

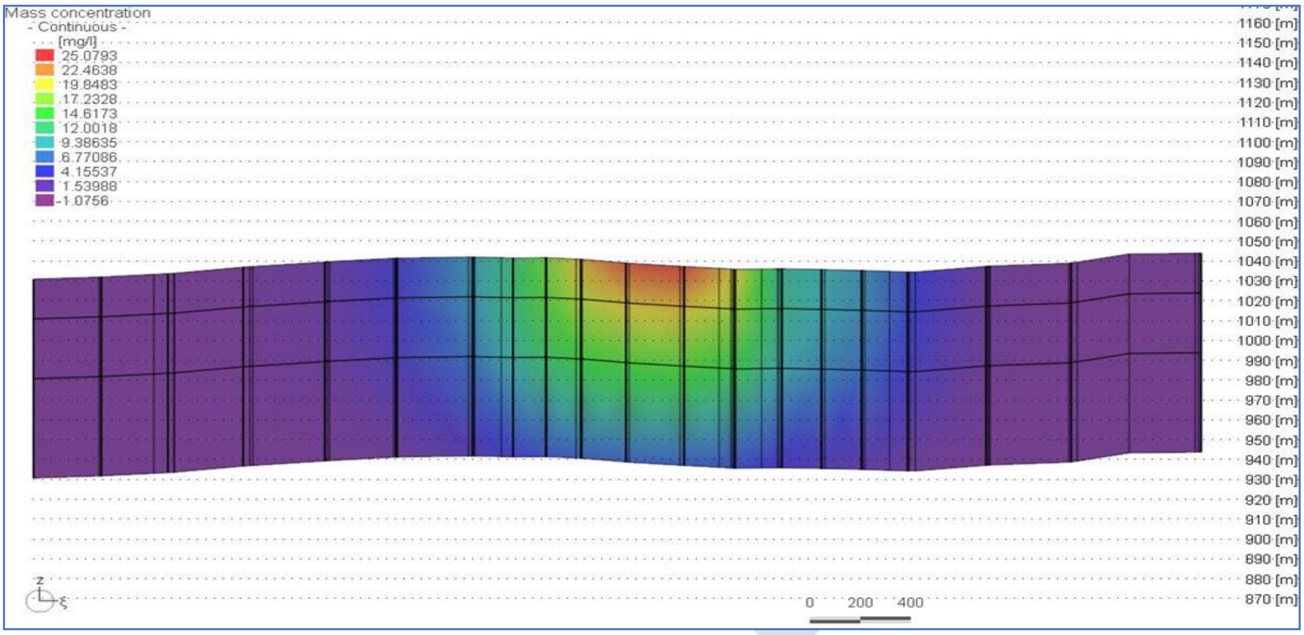

Figure 67: Contamination plume after 20 years _ Cross section view

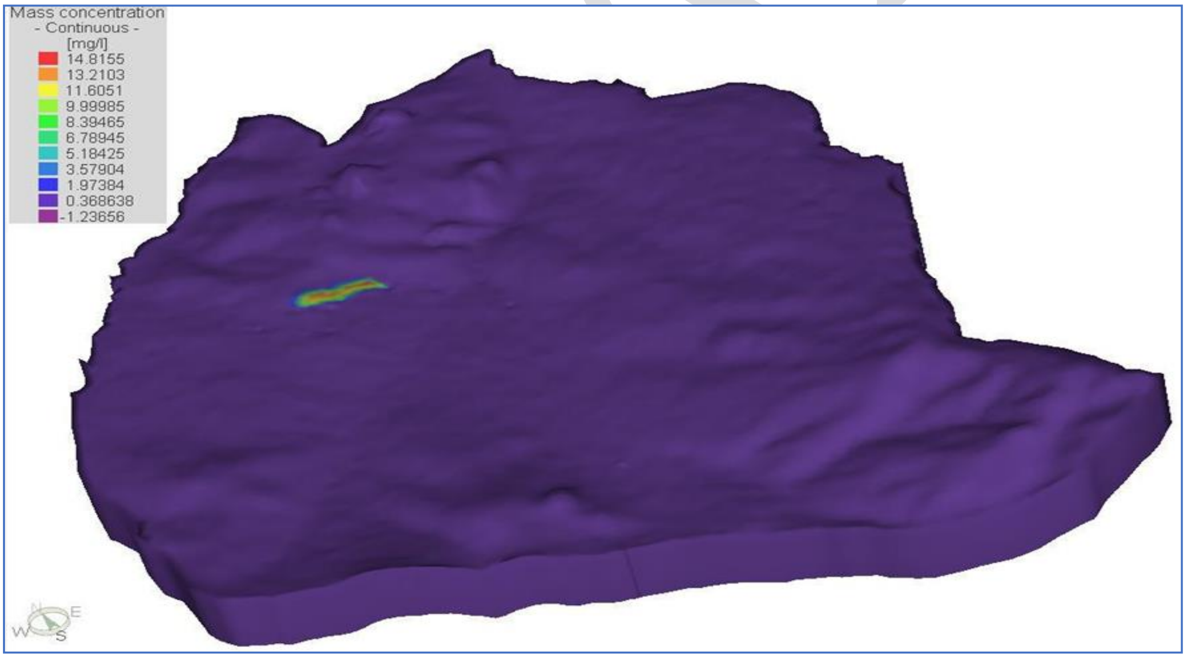

Figure 68: Contamination plume after 5 years _ global 3D view

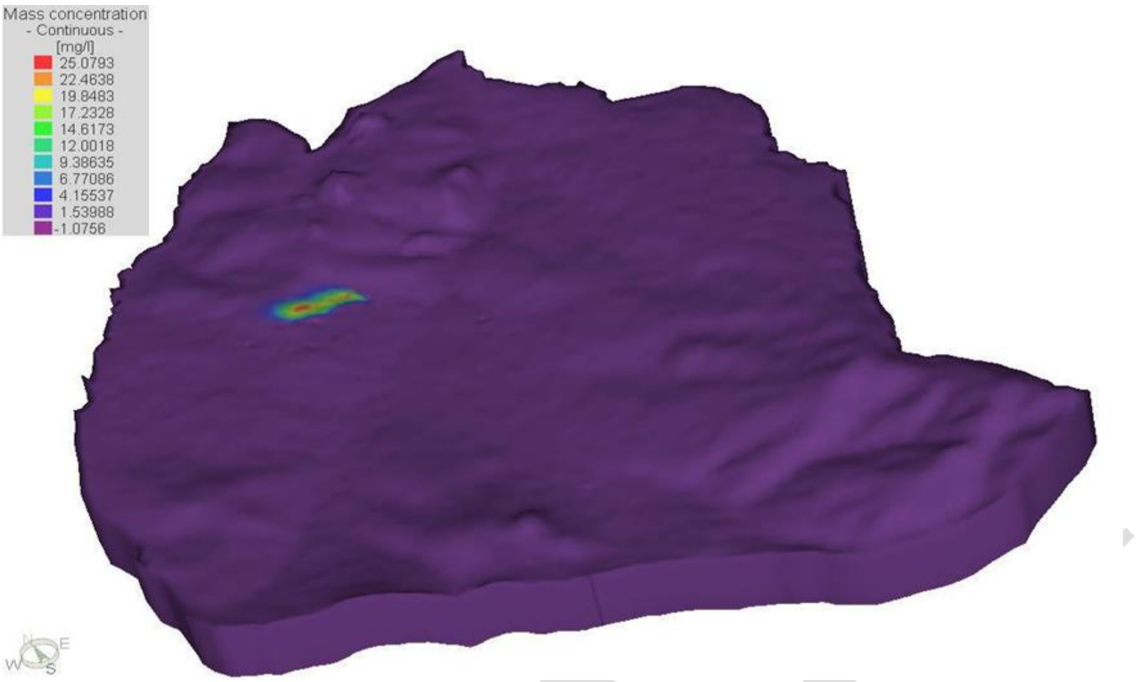

Figure 69:Contamination plume after 20 years _ global 3D view

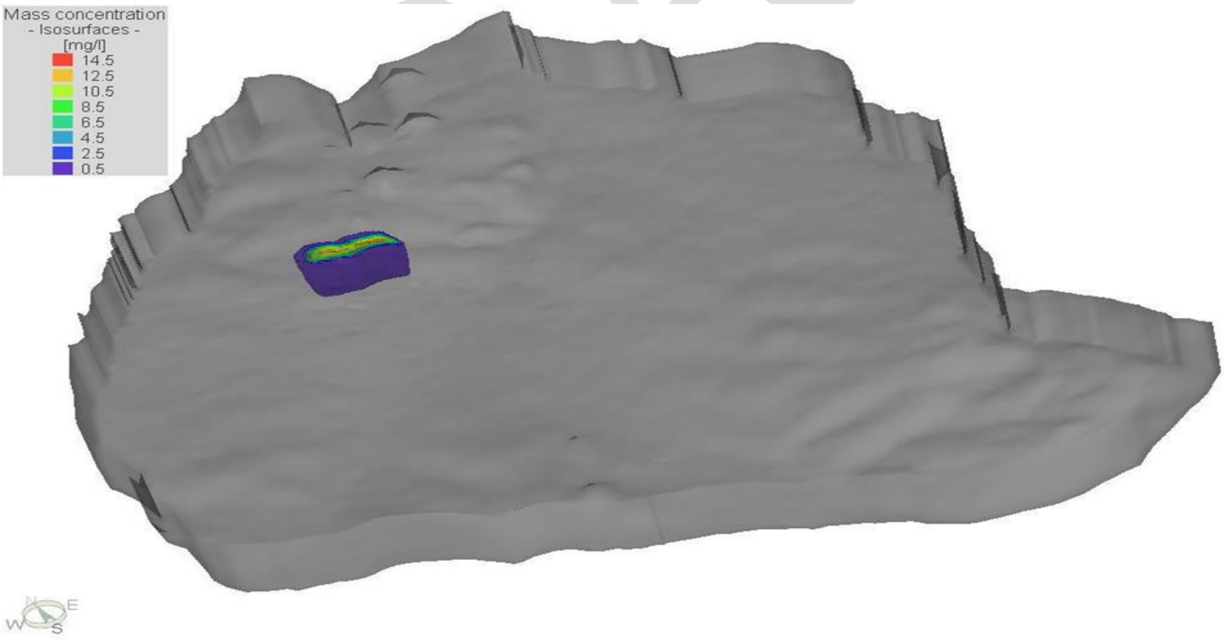

Figure 70:Contamination plume after 5 years _ global 3D view2

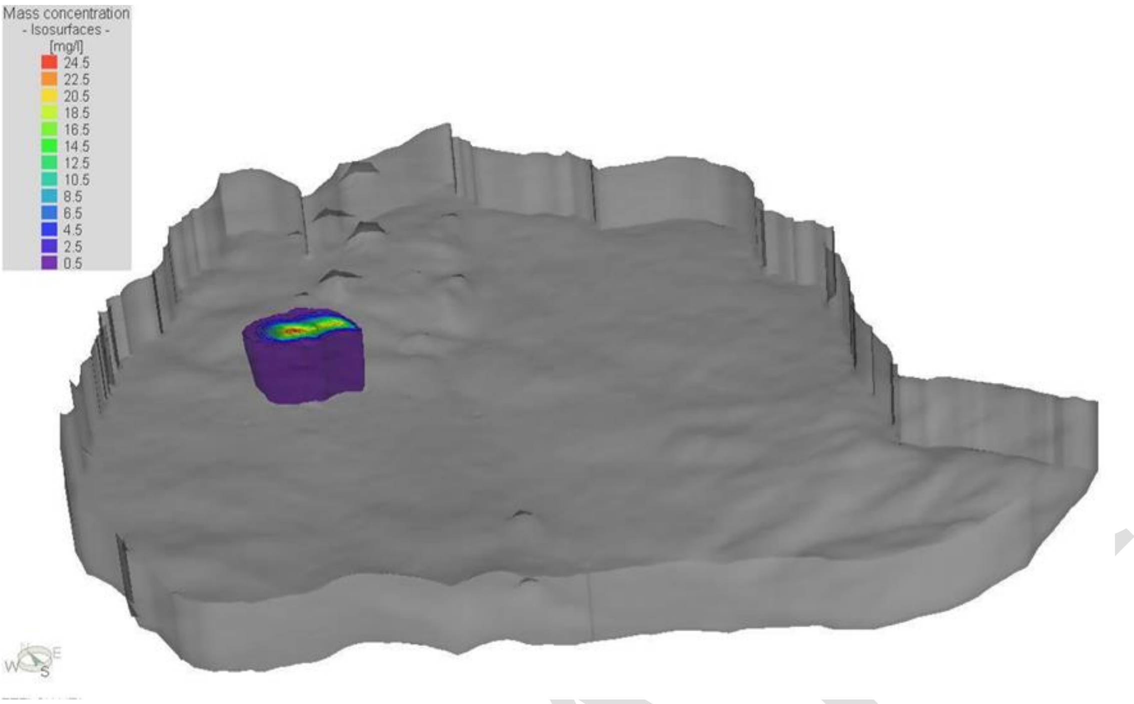

Figure 71: Contamination plume after 20 years _ global 3D view2

15.7.13 Impact Assessment

Table 36: Groundwater impact assessment

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Construction Phase			
Drilling	Groundwater contamination as a result of drilling of new monitoring boreholes to investigate possible preferred groundwater flow pathways and one or two areas outside preferred pathways, which will: a) Identify geological and hydrogeological control	Monthly monitoring of the boreholes with regard to water levels and water quality	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
	across the proposed mining right area; b) Provide facilities to undertake aquifer testing and water sample collection; and c) Serve as future monitoring points in an initial groundwater monitoring network.		
Storage of fuels and lubricants and movement of vehicles	Spills from improper storage of fuels and lubricants and also from leaking vehicles	a) Monthly monitoring of the boreholes with regard to	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		water levels and water quality b) Place drip trays under vehicles when parked. c) If in-field refuelling is done from a tanker, it should be done in a designated dirty area and a spill kit and clean-up team must be available on site; d) Spillages should be cleaned up immediately and contaminated soil must either be remediated in situ or disposed of at an	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		appropriately licensed landfill site; e) Hydrocarbon storage areas must be in a bunded area and comply with the relevant SANS standards	
Operational Phase			
Mine dewatering	Opencast mining of will result in groundwater inflows into the pits, which needs to be pumped out for mine safety. The expected inflow into the pit is 730 m^3/d when mining floor will reach 20 mbgl. It will stabilise to	a) Store the dewatered water in PCDs and ensure that the dams will have enough storage volume; b) If that is not possible, re-introduce treated water into the streams after ensuring that they	Medium-Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
	1150 m^3/d when mining floor will reach 90 mbgl	meet the required standards as per the WUL or river quality objectives; c) Supply equal volumes and better-quality water to affected user if proven that there is an impact on specific users; d) Monitoring of groundwater water levels and groundwater inflow rates; and e) Update numerical model annually	
Mine water run off	Any contamination that will seep from the WRDs is expected to move	a) Implement compacted clay or synthetic liner underneath the	Medium-Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
	eastern direction toward the north-north-east down-gradient of the waste dump. The toe of the plume estimated to extend 700 m away from waste dump, 20 years after contamination commences	WRDs to minimizes seepage following the waste classification result; b) Re-use water collected in the WRDs berms. Any excess should be treated to acceptable quality before it is discharged to the environment; c) Monthly and quarterly monitoring of the surface water and groundwater respectively	
		Decommissioning and Rehabilitation	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Decanting and groundwater contamination	After mine closure and ceasing of dewatering, pit is likely to decant. Once the mine starts to decant, it is not expected to stop naturally. Pollution from WRDs on groundwater quality will continue in perpetuity, even after mine closure. Seepage and decant is expected to have a serious impact and require management and rehabilitation measures to prevent irreplaceable impacts. If the pH is acidic, dissolved metals and sulphates will remain is solution	a) Identify decant areas and raise topography to increase time to decant; b) Plan open cast mining so that the perimeters follow the surface contours along the lowest side of the pit and not cut directly across streams; c) Monitoring groundwater levels, decant rates and qualities; d) Revegetated WRD as quickly as possible to minimize recharge rates;	Medium-Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		e) Divert all clean runoff away from, the pit through a series of berms; f) Re-evaluate impact of decant after end of life, once monitoring information is available; and g) Treat seepage and decanted water using passive or active means to meet the recommended standards.	

15.8*Surface Water*

Both quaternary catchments are bound to the south by the Pilanesberg, which comprises an area of elevated topography and hills. The watercourses in the area are all non-perennial with the headwaters emanating from the Pilanesberg. The watercourses have a relatively flat grade except for the watercourses originating at the catchment divide in the Pilanesberg mountain range, which are extremely steep through the mountainous area before flattening at the foot of the range. The tributaries of the Brakspruit within the catchment A24E which drain through the MRA area east of the infrastructure footprint include:

a) The Sefatlhane (also known as the Moruleng in upstream reaches) flows north from the Pilanesberg to a confluence with the Lesobeng.

b) The Lesobeng (also known as the Lesele in upstream reaches) flows north from the Pilanesberg to a confluence with the Sefathlane, approximately 0.5 km south of the project area;

On the west of the site within quaternary catchment A24D, is the Bofule river draining northwards. The potential runoff from the study area drains, either to the west into the Bofule (only the pit footprint) or to the east into the Lesobeng - Sefahlane river system.

Both the Bofule and Sefahlane river systems eventually end in the into the Bierspruit River after they converge at the outflow from the quaternary catchment A24E approximately 19km northeast and downstream off the Matai project boundary. The Bierspruit then flows onwards to a confluence with the Crocodile River approximately 45km north of the project area.

15.8.1 Water Quality

From the water quality results obtained, exceedances of the SANS 241 drinking water standards were determined, and these were for the parameters aluminium, iron and turbidity. High turbidity can be attributed to the rains that were reportedly received on the day of the sampling as the water was observed to be very muddy, this was also expected. The elevated iron and aluminium can be attributed to the general geology, however there were no other samples taken to validate this.

15.8.2 Impact Assessment

Table 37: Surface water impact assessment

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Construction			
Exposure of topsoil	Sedimentation of watercourses due to exposing and loosening of soil as a result of vegetation clearing for the construction of infrastructure and pollution of watercourses due to hydrocarbon and chemical spillages	a) Use wet suppression, chemical stabilization and wind speed reduction methods that should be used to control open dust sources at the construction sites b) Vegetation should only be removed where absolutely necessary; c) Hydrocarbons should be stored on hardpark bunded	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		facilities to ensure that all spillages are contained; and d) Clean and dirty surface water trenches/channels should be constructed to divert runoff separately to appropriate storage facilities	
Vegetation removal	Altered drainage paths and loss of catchment yield due to the removal of vegetation and construction of diversion berms.	Reuse dirty water as much as possible onsite instead of obtaining water from the catchment, or to treat dirty water to acceptable standards and then to discharge to the catchment.	Medium-Low
Operational Phase			

Activity	**Impact Description**	**Mitigation Measures**	**Significance Rating After Mitigation**
Mining activities	Pollution of surrounding watercourses as a result of activities during the operational phase (spills, overflows and contaminated runoff)	a) There are no mitigation measures for a loss of contained water to the catchment yield as long as the mine is there however, b) Reuse dirty water as much as possible onsite instead of obtaining water from the catchment, or to treat dirty water to acceptable standards and then to discharge to the catchment. - Sustainable mine water management needs to be implemented	Medium - Low
Decommissioning and Rehabilitation Phase			

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Mine decommissioning	Pollution of surrounding watercourses as a result of activities during the decommissioning phase	a) The perimeter stormwater management measures should remain in place and should only be removed once rehabilitation of other activities has been completed. This will capture most of the sediment produced from rehabilitation activities and any spills from removal of hydrocarbon and chemical storage; b) Credible contractors should be used for the cessation of the mining and decommissioning of all infrastructure.	Medium-Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Post-closure activities	Rehabilitation of the site post mining will result in a positive impact on surface water quantity when completed.	Rehabilitation will result in a positive improvement as surface water drainage patterns will be restored to a state similar to pre-mining which is likely to result in an improvement in catchment yield after land profiling and cover having been restored	Medium-Low

15.9 *Traffic Impact*

15.9.1 Mine Operations Traffic

15.9.1.1 Employee Traffic

It is estimated that once fully developed the mine will employee approximately 300 workers, most of them will be the surrounding areas. The mine will provide transportation through provision of buses to ferry the workers for the different shifts. Although the mine will operate in shifts in order to model the worst-case scenario Table 38 models all the employees arriving in the AM peak hour and departing in the PM peak hour.

Table 38: Employee trip generation

	Number	**Split**	**Vehicles**
Employees	194	Buses	3
	50	Walk/Cycle	-
	56	Cars	56
Expected total trips		Total number of expected vehicle cars	59 trips
Directional split 90:10 AM	IN OUT 53 6		
Directional split 10:90 PM	IN OUT 6 53		

Table 39: Haulage trips

Directional split			Number of trucks
Directional split 50:50 AM	IN 8 OUT 8	Total peak hour trips	16
Directional split 50:50 PM	IN 8 OUT 8	Total peak hour trips	16

The trip calculation in Table 38 and Table 39 above assumes that all these trips happen within the typical peak hour duration, so as to model the worst case scenarios however as clearly set out the mine will operate under 3 different shifts starting as early as 0500hrs which falls outside the typical peak hour.

15.9.2 Traffic Growth Rate

Although the study area is semi developed, it is assumed that even these traffic volumes will experience some growth over the next few years. An annual growth rate of 2.0 % was considered for the purpose of this application. This rate is fairly high but might be justifiable in the event of the area experiencing a boom as a result of the new mine. The growth rate was used to determine the expected future target year (2024) through traffic volumes from the base year (2019) volumes.

15.9.3 Trip Distribution

Assumptions about the expected trip distribution were based on the location of the site, the existing traffic volumes, traffic patterns and on-site observations. It is assumed, backed by the current observations that traffic would most likely distribute as below:

a) 5% North on Swartklip;
b) 10% South on Swartklip;
c) 35 % North on R510;
d) 50 % South on R510;

15.9.4 Impact Assessment

Table 40: Traffic impact assessment

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		Construction Phase	
Transportation of materials and labourers	Construction materials being transported to site will contribute to the addition of traffic on the road network	Road network able to support additional trucks.	Low
	Employees and labourers transported to/ from site	Road network able to support additional commuter trips	Low
	Dust will increase with increased traffic flow along gravel roads	Ensure that gravel roads are kept watered to prevent dust (other dust suppression measures may also be used).	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Operational Phase			
Transportation of staff	Haulage to/ from site; and mine staff to/from site	Road network able to support additional trucks.	Low
Dust from vehicle movement	Dust will increase with increased traffic flow along gravel roads	Ensure that gravel roads are kept watered to prevent dust (other dust suppression measures may also be used).	Low
Noise from vehicle movement	Noise levels affecting sensitive areas including residential areas	Speed limits to be kept low and define routes away from residential areas.	Medium-Low
Decommissioning and Rehabilitation Phase			
Removal of rubble and other materials from site	Added traffic on the road network	Road network able to support additional trucks.	Medium-Low

15.10 *Heritage Impact Assessment*

The Phase I Archaeological and Cultural Heritage Impact Assessment for the proposed mining right of Vanadium, Titanium and Iron Ore has identified no significant impacts to archaeological or grave resources that will need to be mitigated prior construction. The structure which was noted (see Figure 72) is less than 60 years and not protected by the National Heritage Resource Act.

Therefore, no archaeological or cultural heritage remains were documented during the study.

Figure 72: An overview of the structure noted on the area proposed for blasting.

15.10.1 Impact Assessment

Table 41: Heritage impact assessment

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Construction Phase			
Site clearance	Site Clearance for construction activities might reveal or expose archaeological artefacts.	a) If any heritage sites are identified, appropriate steps as per the Heritage Resources Act will be undertaken b) Education and training on heritage resources will be given to mine employees	Low
Operational Phase			
Excavations of box-cut	Opening of the box-cut might expose or reveal archaeological artefacts	c) If any heritage sites are identified, appropriate steps as	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		per the Heritage Resources Act will be undertaken d) Education and training on heritage resources will be given to mine employees	
		Decommissioning and Rehabilitation	
Ripping and shaping of compacted areas	Ripping and shaping all compacted areas to be free draining, followed by re-vegetation might expose human remains or archaeological artefacts	e) If any heritage sites are identified, appropriate steps as per the Heritage Resources Act will be undertaken f) Education and training on heritage resources will be given to mine employees	Low

15.11 *Socio-Economic Impacts*

The community in Mankwe has been encountering challenges which range from economic, environmental, social and spatial challenges. At a regional scale, like other with various lagging municipalities, North West is faced with developmental challenges coupled with socio-economic problems such as unemployment, job creation, education, HIV prevalence, basic service delivery, inequality, poverty, economic growth, sectorial dependency and economic distribution.

For the purpose of this Project, social impacts have been assessed in light of the current existing socio-economic challenges in the local area. It is expected that the proposed Matai Mining Project will result in social changes which may positively or negatively affect communities within the study area. In terms of the social changes that have been assessed, the following social impacts are have been identified:

a) Employment opportunities;
b) Change in movement patterns;
c) Loss of agricultural land and infrastructure;
d) Physical and Economic displacement;
e) Impact on the local tourism industry;
f) Increased pressure on Municipal infrastructure;
g) Increased social pathologies linked to the influx of workers and job seekers; and
h) Increased nuisance factors and changed sense of place;

In light of the abovementioned, the following social variables were considered to determine the likely impacts:

a) Demographic processes refer to the movement and structure of the local community;
b) Geographic characteristics- refer to the processes that affect the land uses of the local area;
c) Economic processes refers to the economic activities with the affected project area;
d) Socio-cultural wellbeing- refer to the processes that affect the local culture of an affected area, i.e. the way in which the local community live;
e) Institutional, legal, political and equity-refers to the processes that affect service delivery of the study area.

The findings of this SIA indicate the proposed Matai Mining Project has positive and negative potential impacts which range in significance. The construction and the operation of the proposed Matai MVT Mine's positive impacts are mainly due to creation of employment opportunities, boosting of the local economy due to increased disposal disposable income and contribution to the revenue for the Moses Kotane Local Municipality. Negative impacts may be experienced due to loss of agricultural land, physical and economic displacement, increased pressure on municipal infrastructure, increased social pathologies linked to influx of job workers and work seekers, increased nuisance factors and changed sense of place.

15.11.1 Impact Assessment

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Construction Impacts			
Construction activities	The residual impacts associated with the creation of employment and business opportunities and training during the construction phase is that the workers can improve their skills by gaining more experience.	a) Establish targets for the employment and training; b) Train workforce for longer term employment; c) Adopt recruitment strategies that ensure local people are given employment preference; d) Effective implementation of training and skills development initiatives;	Positive impact

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		e) The recruitment process has to be transparent and equitable; f) Maximise and monitor local recruitment; g) Consult local labour recruitment offices; h) Prevent nepotism/corruption in local recruitment structures; i) Promote employment of women and youth; j) Formulate a labour recruitment strategy that would minimise impact on other sectors (e.g. do not	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		recruit unskilled labour at wage levels above the wages paid in the agricultural sector); and k) Establish a liaison point with the adjacent farming community to monitor the impact on their local labour force	
	Multiplier impacts on the local economy	a) Development of a register of local SMMEs; b) Linkages with skills development/ Small, Medium and Micro Enterprises (SMME) development	Positive impact

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		institutions and other mining operations; c) SMME skills development as part of mine SLP/LED commitments d) Create synergies with other mining/electricity enterprises LED/CSR projects e) Preference should be given to capable subcontractors who based within the local municipal area; f) Align skills development to build capacity of SMMEs;	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		g) Monitoring of sub-contractors procurement; h) Development of a register of local SMME; and i) Local procurement targets should be formalised in Matai's procurement policy	
	a) Improved economic development; b) Increased capacity to develop and maintain livelihood strategies	a) Ensure that there is stakeholder buy-in; b) Aligning LED projects with those of other development role-players; c) Liaison with beneficiaries to ensure needs are met;	Positive impact

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		d) Collaboration with other developmental role players (e.g. local and district municipalities, neighbouring mines and NGOs) during implementation of envisaged projects, and where possible aligning envisaged development projects with existing ones; e) Expanding its skills development and capacity building programmes for non-employees f) Monitoring system to regulate Historically	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		Disadvantaged South African procurement g) Where feasible, training should be NQF Accredited; and h) A record of training courses completed per individual should be kept	
	Increase in injuries and possible loss of lives	a) Access control to all project elements, including fencing; b) Personal Protective Equipment for mine workers; c) Notification of blasting schedules; d) Blasting and storage of hazardous materials to	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		adhere to prescribed regulation; e) Measures suggested minimising the impact of flyrock on surrounding roads and structure; f) Measures suggested in the Health Impact Assessment to minimize traffic related accidents; g) Traffic calming measures to prevent speeding (e.g. speed humps); h) Road maintenance; i) Provide safe road crossing points and fencing of the	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		main road and the mine site; and j) Community education to sensitize community members to potential traffic and blasting safety risks	
	Altered sense of place and breakdown of existing social networks	a) Where possible ensure that access to fields and grazing areas are uninterrupted by providing alternative access routes and/or temporary access points during construction activities; b) Matai Mine should ensure that residents are kept informed on a day-to-day	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		basis of construction progress and of when access will be blocked; c) Measures to prevent deterioration of roads; d) suggested in Traffic Impact Assessment (e.g. drivers to report road deterioration to the NW Province Department of Transport); e) Regulation of traffic at intersections and access roads to the site; f) Road upgrading measures should be investigated and implemented in conjunction	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		with the relevant government department (e.g. repairing and rehabilitating the main roads and sealing the roadway to increase its capacity for Heavy Moving Vehicles); g) Inform communities of planned construction activities that would affect vehicle/pedestrian traffic; h) Ensure that access to key services are uninterrupted by providing alternative access routes in cases where construction activities	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		restricts or disrupt movement i) Construction of cattle crossings at suitable intervals should be incorporated into project design	
	a) Displaced farm workers; b) Loss of livelihoods	a) Suitable mitigation measures should be defined that protect the farm workers and ensure that they are adequately provided for and supported should they be moved or lose their employment. b) A Resettlement Action Plan and associated Livelihood	Medium-Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		Restoration Plan may be required. c) Implement surface lease agreements with all community members who have grazing or ploughing land, this will minimise the impact of economic displacement. d) Implement the Grievance Mechanism to ensure ongoing, proactive engagement and effective management of grievances	
	Strain on the existing infrastructure which is already inadequate	a) To limit, as far as reasonably possible, additional pressure	Medium-Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		on existing infrastructure and services; b) To work in partnership with government, industry, and relevant organisations to enhance the existing infrastructure and services; c) To liaise openly and frequently with affected stakeholders to ensure they have information about the proposed Matai Mining Project; and d) Liaison with district and local municipalities well in	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		e) advance to ensure needs are met f) Ensure that municipalities take into account expected population influx g) Promotion of mining methods to allow for surface development h) Influx management i) To make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders	
Operational Impacts			

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Operational activities	The impact may be reversible over time as workers and job-seekers leave the area, consequences such as HIV/AIDS and unwanted pregnancies will be permanent	a) Limit, as far as reasonably possible, social ills caused by influx of workers and job-seekers; b) Liaise openly and frequently with affected stakeholders to ensure they have information about the Project; c) Extensive HIV/AIDS awareness and general health campaign. It should be noted that Matai MVT Mine has no control over activities related to workers' behaviour, however It is recommended that HIV/AIDS campaigns are	Medium-Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		conducted within the affected area; d) Discourage influx of job-seekers by prioritising employment of unemployed members of local communities; e) Liaise with Moses Kotane Local Municipality, and Traditional Authority to ensure that expected population influx is taken into account in infrastructure development and spatial development planning;	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		f) Create synergies with local government IDP and other companies' SLP/CSR projects to promote infrastructure development; g) Clear identification of workers –prevention of loitering; h) Liaison with police or establish/ support community policing forum; i) Promote projects providing housing, especially low cost housing, to link with the proposed Matai MVT mine; j) Community education; and	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		k) Implement measures to address potential conflict between locals and non-locals	
	The increase in nuisance factors and associated changed sense of place will be negative, and direct as a result of Project activities, and indirect as a result of migrant job-seekers	a) Minimise all nuisance factors such as noise, air quality, traffic, and visual-Implement all mitigation measures as specified in the relevant specialist studies; b) Make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders;	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		c) Liaise openly and frequently with affected stakeholders to ensure they have information about activities that will generate nuisance factors	
	Strain on the existing infrastructure which is already inadequate.	a) To limit, as far as reasonably possible, additional pressure on existing infrastructure and services; b) To work in partnership with government, industry, and relevant organisations to enhance the existing infrastructure and services; c) To liaise openly and frequently with affected	Medium-Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		stakeholders to ensure they have information about the proposed Matai Mining Project; and d) To make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders	
	Loss of grazing land	a) Ensure that the project design and associated layout seeks to minimise the project footprint, thus minimising the loss of agricultural land; engage with each directly	Medium-Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		affected landowner with the intention to acquire only the required servitude area; b) Should Matai Mine acquire the full farm and the project footprint only affects a portion of the land, the surrounding usable land should be utilised for agricultural purposes – potentially as part of a lease agreement; c) Where damage is incurred, suitable compensation must be negotiated with the affected farmer; Prepare a	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		site Rehabilitation Plan that will be implemented as part of the decommissioning phase	
	Altered sense of place and breakdown of existing social networks	a) Where possible ensure that access to fields and grazing areas are uninterrupted by providing alternative access routes and/or temporary access points during construction activities; b) Matai should ensure that residents are kept informed on a day-to-day basis of construction progress and of when access will be blocked	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
Operational activities	a) Developed local economy; b) Increased capacity to develop and maintain livelihood strategies	Maximise benefits from local employment, skills and economic development	
	Increase in injuries and possible loss of lives	a) Access control to all project elements, including fencing; b) Personal Protective Equipment for mine workers; c) Notification of blasting schedules; d) Blasting and storage of hazardous materials to adhere to prescribed regulation;	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		e) Measures suggested minimising the impact of flyrock on surrounding roads and structure; f) Measures suggested in the Health Impact Assessment to minimize traffic related accidents; g) Traffic calming measures to prevent speeding (e.g. speed humps); h) Road maintenance; i) Provide safe road crossing points and fencing of the main road and the mine site; and	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		j) Community education to sensitize community members to potential traffic and blasting safety risks	
Decommissioning and Rehabilitation Phase			
Mine closure	The impact may be reversible over time as workers and job-seekers leave the area, consequences such crime and other social pathologies will be permanent	a) Effect retrenchments according to procedures stipulated in approved SLP; b) The Mine's SLP should provide strategies and measures that prevent job loss; c) Support economic diversification through development of alternative markets;	Medium

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		d) Develop a Mine Closure Plan; e) Proactively and effectively implement mine closure plan; f) Collaborate with adjacent mining companies to develop and implement sustainable community; g) Develop alternative and sustainable livelihoods; h) Alternatives to save jobs/avoid downscaling should be investigated beforehand; i) Proactively assess and manage the social and economic impacts on	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		individuals, regions and economies where retrenchment and/or closure of the mine are certain; and j) Partner with the relevant government departments, to jointly manage Closure process	

15.12 *Waste Management Impacts*

The construction, operational and closure/rehabilitation activities will give rise to waste materials which, if not properly managed, could cause pollution of air, soil, surface water and groundwater. Wastes other than mining residues are typically generated in small enough quantities to be stored in skips until they can be removed for recycling or disposal, and there will be no need to construct lined waste management facilities for such wastes.

15.12.1 Waste Assessment Methodology

Six of the collected samples were analysed in order to classify the WRD and TSF material in accordance with the NEM: WA Regulations (2013) and NEM: WA, 2014 (Act No, 26 of 2014, by comparison with total and leachable concentration thresholds,

Total Concentration values were determined by *aqua regia* digestion and analysis with ICP methods by Aquatico Laboratory in Gauteng Province.

Total Concentration Threshold limits are subdivided into three categories as follows:

a) TCT0 limits based on screening values for the protection of water resources, as contained in the Framework for the Management of Contaminated Land (DEA, March 2010);
b) TCT1 limits derived from land remediation values for commercial/industrial land (DEA, March 2010); and
c) TCT2 limits derived by multiplying the TCT1 values by a factor of 4, as used by the Environmental Protection Agency, Australian State of Victoria.

Leachable concentration was determined by following the Australian Standard Leaching Procedure for Wastes, Sediments and Contaminated Soils (AS 4439.3-1997), as specified in the NEM: WA Regulations (2013). The procedure recommends the use of reagent water for leaching of non-putrescible material that will be mono-filled. A leachate of 1:20 solids per reagent water was prepared and analysed by Aquatico Laboratory.

Leachable Concentration Threshold (LCT) limits are subdivided into four categories as follows:

a) LCT0 limits derived from human health effect values for drinking water, as published by the Department of Water and Sanitation (DWS) and South African National Standards (SANS);
b) LCT1 limits derived by multiplying LCT0 values by a Dilution Attenuation Factor (DAF) of 50, as proposed by the Australian State of Victoria;
c) LCT2 limits derived by multiplying LCT1 values by a factor of 2; and
d) LCT3 limits derived by multiplying the LCT2 values by a factor of 4.

Waste is classified by comparison of the total and leachable concentration of elements and chemical substances in the waste material to TCT and LCT limits as specified in the National Norms and Standards for Waste Classification and the National Norms and Standards for Disposal to Landfill as per Table 42.

Table 42: Waste Classification Criteria

Waste Type	Element or chemical substance concentration	Disposal
0	LC > LCT3 **OR** TC > TCT2	Not allowed
1	LCT2 < LC ≤ LCT3 **OR** TCT1 < TC ≤ TCT2	Class A or Hh:HH landfill
2	LCT1 < LC ≤ LCT2 **AND** TC ≤ TCT1	Class B or GLB+ landfill
3	LCT0 < LC ≤ LCT1 **AND** TC ≤ TCT1	Class C or GLB- landfill
4	LC ≤ LCT0 **AND** TC ≤ TCT0 for metal ions and inorganic anions **AND** all chemical substances are below the total concentration limits provided for organics and pesticides listed	Class D or GLB- landfill

15.12.2 Results

Based on the results from the analysis, none of the samples were measured to be above LCT0. Based on the LCT results only, the residue is classified as type 4

Based on the results from the analysis of the total concentration of the samples:

d) TCT0 threshold values for barium and nickel is exceeded in MDD004-KIM-02;
e) TCT0 threshold value for cobalt is exceeded in MDD004-KIM-01 and MDD004-KIM-02,
f) TCT0 threshold values for copper is exceeded in all samples;
g) TCT0 threshold values for manganese is exceeded in MDD004-KIM-01 and
h) TCT0 threshold values for vanadium is exceed in MDD004-KIM-03 and MDD004-KIM-04.

Based on the TC results only, the residue is classified as type 3. Based on R 635, waste with all elements or chemical substances leachable concentration levels for metal ions and inorganic anions below or equal to the LCT0 limits are Type 3 waste. This will apply irrespective of the total concentration of elements or chemical substances in the waste, provided that the inherent physical and chemical character of the waste is stable and will not change over time. For the study, a Class C landfill will be needed for disposal of the material based on the TC and LC results.

15.12.3 Risk Based Approach Model

The Department of Environmental Affairs (DEA) has published the following notification:

a) No 1440: Proposed Amendments to The Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits, 2015

The main aim of the amendments is to allow for the pollution control barrier system required for residue stockpiles and residue deposits to be determined on a case by case basis, based on a risk analysis approach.

The leach test results show that no chemicals of concern leached out. Based on the risk-based approach model, the current mitigation (separation of dirty and clean water, containing of all runoff from storage facilities and installation of stockpile berms), Kimopax proposes that the residue stockpiles be classed as Type 4 waste that needs to be deposited on Class D disposal area.

Kimopax advises that monitoring boreholes be established near the waste rock dumps. The Class D liner setup is depicted in figure below. According to GNR 636: "Type 4 waste may only be disposed of at a Class D landfill designed in accordance with section 3(1) and (2) of these Norms and Standards, or, subject to section 3(4) of these Norms and Standards, may be disposed of at a landfill site designed in accordance with the requirements for a G:L:B+ landfill as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998

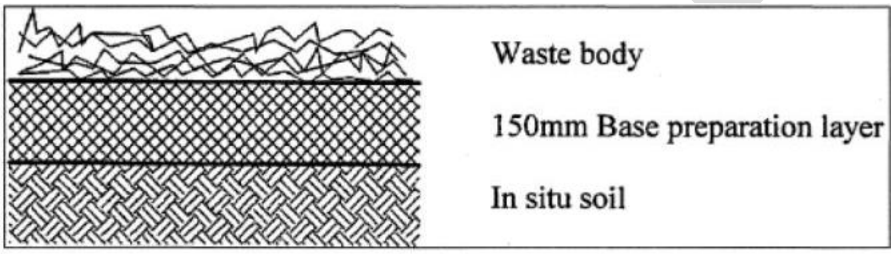

Figure 73:Class D landfill (GNR 636)

Table 43: LCT Classification

Elements & Chemical Substances in Waste	LCT0	LCT1	LCT2	LCT3	MDD004-KIM-01	MDD004-KIM-02	MDD004-KIM-03	MDD004-KIM-04
mg/l								
As, Arsenic	0.01	0.5	1	4	<0,010	<0,010	<0,010	<0,010
B, Boron	0.5	25	50	200	<0,500	<0,500	<0,500	<0,500
Ba, Barium	0.7	35	70	280	<0,700	<0,700	<0,700	<0,700
Cd, Cadmium	0.003	0.15	0.3	1.2	<0,003	<0,003	<0,003	<0,003
Co, Cobalt	0.5	25	50	200	<0,400	<0,400	<0,400	<0,400
Cr Total, Chromium	0.05	2.5	5	20	<0,100	<0,100	<0,100	<0,100
Cr (VI), Chromium (VI)	0.05	2.5	5	20	<0,020	<0,020	<0,020	<0,020
Cu, Copper	2.0	100	200	800	<1,00	<1,00	<1,00	<1,00
Hg, Mercury	0.006	0.3	0.6	2.4	<0,006	<0,006	<0,006	<0,006
Mn, Manganese	0.5	25	50	200	<0,500	<0,500	<0,500	<0,500
Mo, Molybdenum	0.07	3.5	7	28	<0,070	<0,070	<0,070	<0,070
Ni, Nickel	0.07	3.5	7	28	<0,070	<0,070	<0,070	<0,070
Pb, Lead	0.01	0.5	1	4	<0,010	<0,010	<0,010	<0,010
Sb, Antimony	0.2	10	20	8	<0,020	<0,20	<0,20	<0,020
Se, Selenium	0.01	0.5	1	4	<0,010	<0,010	<0,010	<0,010
V, Vanadium	0.2	10	20	80	<0,200	<0,200	<0,200	<0,200
Zn, Zinc	5.0	250	500	2000	<2,00	<2,00	<2,00	<2,00
TDS	1000	12500	25000	100000	<100	<100	<100	<100
Chloride	300	1500	30000	120000	<50,0	<50,0	<50,0	<50,0

Elements & Chemical Substances in Waste	LCT0	LCT1	LCT2	LCT3	MDD004-KIM-01	MDD004-KIM-02	MDD004-KIM-03	MDD004-KIM-04
mg/l								
Sulphate	250	12500	25000	100000	<50,0	<50,0	<50,0	<50,0
NO_3 as N, Nitrate-N	11	550	1100	4400	<10,0	<10,0	<10,0	<10,0
F, Fluoride	1.5	75	150	600	<1,00	1,06	<1,00	<1,00
CN-(total), Cyanide Total	0.07	3.5	7	28	<0,05	<0,05	<0,05	<0,05

Table 44: TCT Classification

Elements & Chemical Substances in Waste	TCT0	TCT1	TCT2	MDD004-KIM-01	MDD004-KIM-02	MDD004-KIM-03	MDD004-KIM-04
mg/kg							
As, Arsenic	5,8	500	2000	<5,80	<5,80	<5,80	<5,80
B, Boron	150	15000	60000	<150	<150	<150	<150
Ba, Barium	62,5	6250	25000	<62,5	**124**	<62,5	<62,5
Cd, Cadmium	7,5	260	1040	<7,50	<7,50	<7,50	<7,50
Co, Cobalt	50	5000	20000	**110**	**77,6**	<50,0	<50,0
Cr Total, Chromium Total	46000	800000	N/A	<1000	<1000	<1000	<1000
Cr (VI), Chromium (VI)	6,5	500	2000	<5,00	<5,00	<5,00	<5,00
Cu, Copper	16	19500	78000	**68,1**	**156**	**81,4**	**47,8**

Elements & Chemical Substances in Waste	TCT0	TCT1	TCT2	MDD004-KIM-01	MDD004-KIM-02	MDD004-KIM-03	MDD004-KIM-04
mg/kg							
Hg, Mercury	0,93	160	640	<0,900	<0,900	<0,900	<0,900
Mn, Manganese	1000	25000	100000	**2200**	<1000	<1000	<1000
Mo, Molybdenum	40	1000	4000	<10,0	<10,0	<10,0	<10,0
Ni, Nickel	91	10600	42400	<50,0	**539**	76,5	51
Pb, Lead	20	1900	7600	<20,0	<20,0	<20,0	<20,0
Sb, Antimony	10	75	300	<10,0	<10,0	<10,0	<10,0
Se, Selenium	10	50	200	<10,0	<10,0	<10,0	<10,0
V, Vanadium	150	2680	10720	<100	140	**302**	**172**
Zn, Zinc	240	160000	640000	<220	<220	<220	<220

15.12.4 Impact Assessment

Table 45: Waste management impacts

Activity	**Impact Description**	**Mitigation Measures**	**Significance Rating After Mitigation**
		Construction Phase	
Construction activities	Typical wastes produced during construction activities include unused concrete mix, oils, lubricants, paints, solvents, packaging materials, general domestic waste and offcuts of building materials such as steel, wood, glass and tiles. If stored or discarded on open ground, hydrocarbons will cause soil contamination and possibly groundwater pollution	a) Sort the wastes and store in separate skips or other containers for hydrocarbons, recyclable materials and non-recyclable materials. Recyclable materials should be sorted into wood, steel, glass, plastic, paper and used oil, and stored in separate containers; b) Have recyclable wastes removed by responsible recyclers; and	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		c) Have non-recyclable wastes removed by reputable contractors for disposal at appropriately licensed landfill	
		Operational Phase	
Mining activities	In terms of the National Environmental Management Amendment Act 2014, mining residues are classified as wastes and must be managed as prescribed by the National Environmental Management: Waste Act of 2008 and its Regulations GN R.632 and R.633	a) Manage waste in accordance with Regulations GN R.634 – 636, i.e. provide PCD with HDPE liner, WRDs and b) TSF with Class D liners and heap leach pads with at least class B liners; c) Undertake regular inspection and maintenance of waste management facilities;	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		d) Monitor groundwater and surface water quality down-gradient of waste management facilities; and e) Take such corrective action as may be required.	
Decommissioning and Rehabilitation			
Mine closure	Wastes expected to result from the decommissioning and rehabilitation activities include scrap metals, building rubble, oils, lubricants, paints, solvents, contaminated soils, PCD dam silt and liners, tailings dam, waste rock dumps and potentially recyclable materials such as steel,	a) Identify areas of possible soil contamination, sample such areas, analyse and determine degree of soil contamination. Remove and dispose of soil with contamination levels exceeding then prevailing standards/guidelines;	Low

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
	wood, plastics, glass and tiles. If stored or discarded on open ground, hydrocarbons will cause soil contamination and possibly groundwater pollution, an impact rated as	b) Remove silt, synthetic liners and contaminated non-synthetic liner materials from PCD and dispose at appropriately licenced landfill. Liner materials and building rubble with contamination levels below prevailing standards/guidelines may be backfilled into the last portion of the opencast void; c) Sort the remaining wastes and store in separate skips or other containers for hydrocarbons, recyclable materials and non-recyclable materials. Recyclable materials should be sorted into	

Activity	Impact Description	Mitigation Measures	Significance Rating After Mitigation
		wood, steel, glass, plastic, paper and used oil, and stored in separate containers; d) Have recyclable wastes removed by responsible recyclers; and e) Have non-recyclable wastes removed by reputable contractors for disposal at appropriately licensed landfills	

16 SUMMARY OF ENVIRONMENTAL IMPACTS

16.1 *Summary Construction Impacts*

Summary of construction impacts indicated in Table 46

Table 46: Summary of construction impacts

Potential Environmental Impact	**Environmental Significance Before Mitigation**						**Environmental Significance After Mitigation**					
	E	**D**	**I**	**P**	**TOTAL**	**RISK**	**E**	**D**	**I**	**P**	**TOTAL**	**RISK**
Construction Phase												
Air Quality Site clearance, civil works and vehicle movement will cause dispersion of PM10 and PM2.5 particulates and emissions from vehicles	1	3	3	3	21	Medium-High	1	2	1	1	4	Low
Ecology	1	1	1	2	6	Low-Medium	1	1	1	1	3	Low

Potential Environmental Impact	**Environmental Significance Before Mitigation**						**Environmental Significance After Mitigation**					
	E	**D**	**I**	**P**	**TOTAL**	**RISK**	**E**	**D**	**I**	**P**	**TOTAL**	**RISK**
Removal of flora and stripping of topsoil and also the disturbance of faunal habitat												
Noise Impact will be limited by distance, existing noise levels and relatively short construction period	1	1	1	2	6	Low-Medium	1	1	1	1	3	Low
Aquatics Sedimentation as a result bare area of soil and pollution of water courses resulting from hydrocarbon spills	1	1	1	2	6	Low-Medium	1	1	1	1	3	Low
Soil, land use and land capability	1	1	2	3	12	Low-Medium	1	1	1	2	6	Low-Medium

Potential Environmental Impact	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	E	**D**	**I**	**P**	**TOTAL**	**RISK**	**E**	**D**	**I**	**P**	**TOTAL**	**RISK**
Soil compaction resulting from vehicle movement and soil contamination resulting from accidental spills												
Groundwater Contamination from accidental spills and improper storage of fuels and lubricants	1	3	2	3	18	Medium-High	1	3	1	2	12	Medium
Surface water Sedimentation of watercourses and altered drainage paths and loss of catchment yield.	1	3	2	3	18	Medium-High	1	3	1	2	12	Medium
Heritage	1	1	1	2	6	Low-Medium	1	1	1	1	3	Low

Potential Environmental Impact	**Environmental Significance** **Before Mitigation**						**Environmental Significance** **After Mitigation**					
	E	**D**	**I**	**P**	**TOTAL**	**RISK**	**E**	**D**	**I**	**P**	**TOTAL**	**RISK**
Impacts will occur only if fossils are unearthed during earthmoving operations												
Traffic Impact Increased traffic flow along gravel roads giving rise to dust production	1	1	1	2	6	Low-Medium	1	1	1	1	3	Low
Socio-economic Employment creation	1	1	1	2	6	Low-Medium	1	1	1	1	3	Low
Waste management Poor waste management could cause soil	1	1	1	2	6	Low-Medium	1	1	1	1	3	Low

Potential Environmental Impact	Environmental Significance Before Mitigation					Environmental Significance After Mitigation					
	E	D	I	P	TOTAL	RISK	E	D	I	P	TOTAL	RISK
contamination by hydrocarbons, chemicals, cement												

16.2 *Summary of Operational Impacts*

Potential impacts resulting for the operational phase are indicated in Table 47

Table 47: Summary of operational impacts

Potential Environmental Impact	**Environmental Significance Before Mitigation**						**Environmental Significance After Mitigation**					
	E	**D**	**I**	**P**	**TOTAL**	**RISK**	**E**	**D**	**I**	**P**	**TOTAL**	**RISK**
Operational Phase												
Air Quality Particulate mobilisation from stockpiles, crushers, TSF, and vehicular movement	1	3	1	3	12	Low-Medium	1	3	1	2	6	Low-Medium
Ecology Displacement of faunal, habitat fragmentation	1	3	3	3	21	Medium-High	1	3	1	1	5	Low
Noise	1	3	2	3	18	Medium-High	1	3	1	2	12	Medium

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Potential Environmental Impact	**Environmental Significance** **Before Mitigation**						**Environmental Significance** **After Mitigation**					
	E	**D**	**I**	**P**	**TOTAL**	**RISK**	**E**	**D**	**I**	**P**	**TOTAL**	**RISK**
Noise unlikely to cause exceedances of guideline levels, but some receptors will experience intrusive noise												
Aquatics Sedimentation as a result bare area of soil and pollution of water courses resulting from hydrocarbon spills	1	3	2	3	18	Medium-High	1	3	1	1	5	Low
Soil, land use and land capability Loss of current land uses and agricultural productivity and soil compaction from vehicle movements	1	3	3	3	21	Medium-High	1	3	1	1	5	Low
Groundwater	1	3	2	3	18	Medium-High	1	3	1	1	5	Low

Potential Environmental Impact	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	E	**D**	**I**	**P**	**TOTAL**	**RISK**	**E**	**D**	**I**	**P**	**TOTAL**	**RISK**
Groundwater inflow into the pit and reduction of groundwater levels due to dewatering of pits												
Surface water Pollution of surrounding watercourses due to spills, overflows and contaminated run-off	3	3	3	2	18	Medium-High	1	3	1	1	5	Low
Heritage Excavations may expose archaeological artefacts	1	3	2	3	18	Medium-High	1	3	1	1	5	Low
Traffic Impact	1	3	1	3	15	Low-Medium	1	3	1	1	5	Low

Potential Environmental Impact	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	E	D	I	P	TOTAL	RISK	E	D	I	P	TOTAL	RISK
Increase in traffic on the road networks												
Socio-economic Strain on basic services and loss of livelihoods for relocated farmers. Possible increase in HIV/AIDS and unwanted pregnancies.	3	3	3	3	27	High	1	3	1	2	10	Low-Medium
Waste management Mining residues have low potential for mobilisation of contaminants	2	3	3	3	24	Medium-High	1	3	1	1	5	Low

16.3 *Summary of Decommissioning and Rehabilitation Phase*

Impacts emanating from decommissioning and rehabilitation phase are indicated in Table 48.

Table 48: Summary of decommissioning and rehabilitation impacts

Potential Environmental Impact	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	E	D	I	P	TOTAL	RISK	E	D	I	P	TOTAL	RISK
Decommissioning and Rehabilitation Phase												
Air Quality Considerations and impacts similar to construction phase, possibly greater due to larger area and eddy	2	3	1	3	18	Medium-High	1	3	1	1	5	Low
Ecology Habitat stabilisation and reconstruction	1	3	3	3	21	Medium-High	1	3	1	1	5	Low
Noise	3	3	3	3	27	High	3	3	1	1	7	Low-Medium

Potential Environmental Impact	Environmental Significance Before Mitigation					Environmental Significance After Mitigation					
	E	**D**	**I**	**P**	**TOTAL**	**RISK**	**E**	**D**	**I**	**P**	**TOTAL**	**RISK**
Noise unlikely to cause exceedances of guideline levels, but some receptors will experience intrusive noise												
Aquatics Sedimentation as a result bare area of soil and pollution of water courses resulting from hydrocarbon spills	3	3	3	3	27	High	3	3	1	1	7	Low-Medium
Soil, land use and land capability Soil impacts on TSF and WRD footprints will be permanent. Elsewhere, mixing of topsoil with subsoil	3	3	3	3	27	High	3	3	1	1	7	Low-Medium

Potential Environmental Impact	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	E	D	I	P	TOTAL	RISK	E	D	I	P	TOTAL	RISK
during rehabilitation would have an adverse impact												
Groundwater Decanting and groundwater contamination	2	3	3	3	24	Medium-High	1	3	1	1	5	Low
Surface water Increase in surface water quantity	2	3	2	3	21	Medium-High	1	3	1	1	5	Low
Heritage The closure and rehabilitation activities cannot possibly affect any items of archaeological or cultural significance unless	0	0	0	0	0	None	0	0	0	0	0	None

Potential Environmental Impact	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	E	D	I	P	TOTAL	RISK	E	D	I	P	TOTAL	RISK
earthmoving takes place on areas of the site where no such activities were undertaken during the construction and operational phases. If any												
Traffic Impact Significantly less traffic than operational phase, but will have some effect on road safety, wear & tear, driver frustration.	2	3	3	3	24	Medium-High	1	3	1	1	5	Low
Socio-economic	2	3	3	3	24	Medium-High	1	3	1	1	5	Low

Potential Environmental Impact	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	E	**D**	**I**	**P**	**TOTAL**	**RISK**	**E**	**D**	**I**	**P**	**TOTAL**	**RISK**
Loss of jobs and local spend can be softened by skills training and support for entrepreneurs and proper rehabilitation of disturbed footprint.												
Waste management Mobilisation of particulates and other contaminants from mining residue deposits	2	3	3	3	24	Medium-High	1	3	1	1	5	Low

17 ENVIRONMENTAL IMPACT STATEMENT

17.1 *SUMMARY OF THE KEY FINDINGS OF THE ENVIRONMENTAL IMPACT ASSESSMENT;*

The impact assessment in Section 12 & 13 above discusses impacts in terms of specialist findings; and provides an overall impact assessment. Although some impacts of high significance have been identified, no fatal flaws have been identified for the project.

The surface infrastructure area has been placed and avoids all highly sensitive habitat such as wetlands, rivers and ridges. The flora associated with this area is transformed due to agriculture and thus the loss of biodiversity is not significant in this area. Impact to the agriculturally important soils is a significant impact, thus correct soil stripping, handling and management is important.

The infrastructure area has been designed to minimise the overall footprint as far as possible. Clean and dirty water areas have been mapped and a storm water management plan has been compiled in accordance with GN704. Ensuring properly designed storage areas (coal, waste, chemicals and mine residue) and practicing good housekeeping practices at all times by ensuring all materials are properly stored within designated areas, will further reduce the potential risk for contamination by surface water runoff. Although not further detailed here, other impacts of moderate or lower significance must be managed in accordance with the EMP.

17.2 *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.)

Refer to Figure 28

17.3 *Summary Of The Positive And Negative Implications And Risks Of The Proposed Activity And Identified Alternatives;*

Refer to Table 15: Positive and Negative impact of the proposed activity

18 Proposed Impact Management Objectives and The Impact Management Outcomes for Inclusion in The EMPr;

The EMP will address the environmental impacts during the Construction, Operational, Decommissioning and Post-Closure Phases of the Project. Due regard must be given to environmental protection during the entire Project; many environmental recommendations are made to achieve environmental protection. The impact management objectives and outcomes of the proposed project are as follows:

a) Reduce mine decant at the rehabilitated pits
b) To reuse contaminated water from mining site and prevent discharge of contaminated onto natural environment
c) To continually monitor ground water levels and water quality to ensure that adverse impacts are managed.
d) Re-shape rehabilitated slopes to ensure free draining
e) Monitor dust dispersion as per the Dust Regulations

18.1 *Final Proposed Alternatives.*

Please refer to Section 5, where the alternatives to the project are motivated and Figure 28

18.2 *Aspects for Inclusion as Conditions of Authorisation.*

The authorisation should include the following conditions:

a) Compliance with the approved EMPr
b) Undertaking of environmental performance assessment reporting once in every two (2) years.
c) Revising quantum financial provision on an annual basis
d) External auditing of the EMPr by an independent environmental auditor

18.3 *Description of Any Assumptions, Uncertainties And Gaps In Knowledge.*

All specialist studies are conducted to certain levels of confidence, and in all instances known and accepted methodologies have been used and confidence levels are generally high. This means that in most cases the situation described in the pre-mining environment is accurate at high certainty levels, but there exists a low probability that some issues have not been identified during the studies. Such situations cannot be avoided simply due to the nature of field work. All specialist studies are conducted to certain levels of confidence, and in all instances known and accepted methodologies have been used and confidence levels are generally high. This means that in most cases the situation described in the pre-mining environment is accurate at high certainty levels, but there exists a low probability that some issues have not been identified during the studies. Such situations cannot be avoided simply due to the nature of field work and have therefore not been further discussed below.

18.4 *Reasoned Opinion As To Whether The Proposed Activity Should Or Should Not Be Authorised*

The sections above provide a compact summary of pertinent findings, all of which can be mitigated by varying degrees depending on the type of mitigation measure applied. The EIA/EMPr is a comprehensive document with information provided through the specialist studies, none of which identified fatal flaws. Upon review of all specialist input, the project should go ahead with the recommended mitigation measures contained herein. It is therefore Kimopax's reasoned opinion that the activity be authorised on condition that the EMP is fully adhered to, annually audited and amended where necessary based on audit findings.

18.4.1.1.1 Rehabilitation requirements

Rehabilitation of the project will aim to:

a) Ensure that the final elevation around the site is free draining.
b) Ensure that soil replaced in the same sequence to ensure soil characteristics are retained as far as possible.
c) Ensure a self-sustaining post-mining land capability similar to pre-mining of grazing and limited low-intensity arable lands.
d) Ensure that the rehabilitated areas are cleared of all contaminating substances and that runoff from the area is returned to the natural catchment.
e) Ensure that vegetation growth and cover on the rehabilitated area is sustainable and local indigenous species are establishing on site and that succession and colonisation from surrounding areas is taking place on rehabilitated areas.
f) Ensure that alien invasive growth is eradicated until the closure certificate is granted.

18.4.2 Period for Which The Environmental Authorisation Is Required.

The Environmental Authorisation will be required for a period of 30 years.

18.4.3 Undertaking

It is confirmed 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 EIA Report and the EMPr.

18.5 *Financial Provision*

As per NEMA financial provision regulations, itemised costs must be provided within the financial provision. As the DMR's closure cost assessment provides itemised costs, this process was used to determine the quantum for financial provision. Financial Provision will be made by way of a guarantee acceptable to the DMR, as per the Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations

19 DEVIATIONS FROM THE APPROVED SCOPING REPORT AND PLAN OF STUDY.

19.1 *Deviations From The Methodology Used In Determining The Significance Of Potential Environmental Impacts And Risks.*

No deviations will be made

19.2 *Motivation For The Deviation.*

Not applicable as no deviation was made

20 OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

20.1 *Socio-Economic Impacts*

The directly affected people will be residents of the cattle post and the other five (5) villages namely:

a) Manamakgotheng
b) Legogolwe
c) Mononono
d) Sefikile
e) Lesobeng

Impacts and mitigation measures are detailed in the Socio-Economic Specialist report

20.2 *Impact On Any National Estate Referred To In Section 3(2) Of The National Heritage Resources Act.*

Despite that no archaeological objects were observed during the survey, and that the area is disturbed due to entertainment activities, the client is reminded that unavailability of archaeological material does not mean absentee, archaeological material might be hidden underground. It is thus the responsibility of the developer to notify contractors and workers about archaeological material (e.g., pottery, stone tools, remnants of stone-walling, graves, etc) and fossils that may be located underground. Furthermore, the client is reminded to take precautions during construction.

20.3 *Other Matters Required In Terms Of Sections 24(4)(a) and (b) of the Act.*

Section 24(4) (b) (i) of the Act specifies the need for investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity.

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

21 DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME.

21.1 *Introduction*

An Environmental Management Plan (EMP) is a document used to prescribe management mechanisms/methods for the prevention of undue or reasonably avoidable adverse environmental impacts and for the enhancement of the positive environmental benefits of a development. An EMP can be based on the National Environmental Management Act (Act No. 107 of 1998, (NEMA)(as amended), and also bestows a 'Duty of Care' on those who cause, have caused or may in future cause pollution or degradation of the environment, as per of Section 28(1) of NEMA

21.2 *Objectives of the EMP*

The EMP has been compiled to provide recommendations and guidelines for environmental monitoring throughout the construction and operational phase of the proposed project. This is done to ensure that all relevant factors are considered, and to ensure for environmentally responsible development.More specific objectives for this EMP include:

a) Provide an outline of the legal requirements;
b) Ensuring compliance with regulatory authority stipulations and guidelines which may be local, provincial, national and/or international;
c) The mitigation management of construction associated impacts such as water quality impairment, flow modification, loss of riparian habitat and loss of aquatic ecosystem services;
d) To assign roles and responsibilities to parties involved regarding the implementation of this EMPr;
e) To describe a monitoring / stakeholder engagement programme which will enable a review of the success of the EMPr;

f) To outline mitigation measures and environmental specifications which are required to be implemented for all phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the proposed project;
g) Identifying construction activities that might have detrimental impacts on the environment;
h) To identify measures that could optimize beneficial impacts;
i) To establish a method of monitoring and auditing environmental management practices during all phases of project
j) Detail specific actions deemed necessary to assist in mitigating the environmental impact of the project;
k) Propose mechanisms for monitoring compliance with the EMPr and reporting thereon;

21.3 *Details of the EAP*

The details of the EAP have been provided in Section 2, Item 2.1 in Part A of this report.

21.4 *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 (7.1.1) herein as required).

Refer to Section 3.3 of Part A.

21.5 *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 any areas that should be avoided, including buffers).

Refer to Figure 28

21.6 *Description Of Impact Management Objectives Including Management Statements*

The objectives of impact mitigation and management are to:

a) Primarily pre-empt impacts and prevent the realisation of these impacts - PREVENTION.

b) To ensure activities that are expected to impact on the environment are undertaken and controlled in such a way so as to minimise their impacts – MODIFY and/or CONTROL.

c) To ensure a system is in place for treating and/or rectifying any significant impacts that will occur due to the proposed activity – REMEDY.

d) Implement an adequate monitoring programme to:

- Ensure that mitigation and management measure are effective.
- Allow quick detection of potential impacts, which in turn will allow for quick response to issue/impacts.
- Reduce duration of any potential negative impacts.

Environmental management outcomes and related management statements are:

a) Protect the biophysical environment as far as possible.

- Minimise impacts to the biophysical environment.
- Ensure relevant legislation are applied on site including but not limited to alien invasive management and protection of ecologically sensitive species and environments.
- Permits for any activities related to protected species on site will be sought prior to these species being affected. Preservation and 'offset' approaches will be applied to these species as far as possible.

b) Protect the water resources in the area.

- Ensure clean and dirty water separation systems are established on site from the onset and are in line with GN704 principals.
- Use water responsibly and recycle water as much as possible.
- Ensure relevant legislation regarding the National Water Act are applied on site.
- Ensure IWUL is obtained prior to activities commencing on site.
- Annually update the IWWMP with updated data recorded from site.

c) Ensure atmospheric pollution is to a minimum:

- Manage dust generation.
- Revegetate all bare soil.

d) Mine responsibly and ensure operation is compliant with legislative requirements.

- Ensure an adequate rehabilitation model is compiled before decommissioning.
- Ensure soil utilisation guide is applied on site and maintain soil berms and stockpiles at all times from the onset of activities.
- Conduct annual EMP audits and complete the necessary amendment process where this is deemed necessary.

e) Ensure socially responsible mining:

- Ensure the targets and objectives set out in the SLP are followed and adhered to.
- Provide a safe environment for people to work in:
  - ✓ Ensure safety policies are established on site in line with national policy.
  - ✓ Ensure adequate PPE for staff, contractors and visitors to the site.
  - ✓ Ensure health and environmental policies are established and in line with national policies.

f) Protect historical and cultural aspects:

- Ensure all archaeological and cultural artefacts/sites are preserved in situ until such time that authorisation to remove these is obtained.
- Ensure South African Heritage Resources Act principals are applied with regard to all the archaeological and cultural artefacts/sites
- Ensure any relocation of culturally sensitive sites is done according to SAHRA principals, in a socially sensitive manner and with open and transparent communication with relevant I&APs.

g) Maintain open and transparent dialogue with I&APs:

- Conduct regular feedback meetings with I&APs (at least biannually).
- Maintain a complaints register on site and respond to comments in a timely manner.
- Ensure communications and any necessary agreements are made between any sensitive I&APs identified through any stage of the project.

21.7 *Determination of Closure Objectives.*

The overall closure objective is to restore the area disturbed by the project activities to condition that is safe for humans and animals and suitable for farming and cattle grazing, and to ensure that off-site environmental quality is not adversely affected by physical effects and chemical contamination arising from the past mining and ore processing activities. This will be done by:

a) Leaving the haul roads to provide safe and easy access to water accumulating in the pits and to discourage more dangerous access across the waste rock berms (enviro bunds) surrounding the rest of the pit perimeters;
b) Conducting dedicated soil surveys over the operational footprint area and removing identified pockets of contaminated soil;
c) Cleaning up of sources of possible soil contamination still present on the site to protect the downstream receiving environment;

d) Shaping the tailings storage facility (TSF) to a whaleback form on the upper surface and side slopes no steeper than 1 in 5;
e) Ripping compacted areas and shaping all project-affected areas to be free draining and so that runoff from the rehabilitated project area is routed to the natural drainage lines;
f) Spreading stockpiled subsoil and topsoil consecutively on areas from which it had been stripped, on the upper surface and slopes of the TSF and sparingly onto the waste rock dumps;
g) Testing the topsoil and ameliorating/fertilising it appropriately;
h) Vegetating the site with locally indigenous species of grass, forbs, shrubs and trees
i) Monitoring groundwater quality and surface runoff for at least 5 years after closure, longer if warranted by the results. Target water quality objectives must be based on pre-closure groundwater and surface runoff quality from the Smarty mine and infrastructure site; and
j) Providing the required measures to limit at source the generation of contaminants which could adversely affect local groundwater quality.

21.8 *Closure Objectives*

Closure objectives must be met with regards to:

a) Topography

- To ensure that the final elevation will result in the continuation of the pre-mining surface drainage pattern.

b) Soil, Land Capability and Land Use

- To ensure that soil types are replaced in correct sequence, subsoil followed by topsoil, and at appropriate depths.
- To ensure post-mining land capability is at least similar to pre-mining which is grazing and some arable lands.
- To ensure that the land capability is self-sustaining.
- To ensure that pre-mining land uses can continue.

c) Surface Water

- To ensure that no dirty water from the site enters the surrounding surface water systems.
- To maintain flow in downstream rivers to prevent deterioration of ecological status.

d) Groundwater

- To ensure that possible plumes originating from the mining areas do not impact significantly on the surface water features or surrounding user's boreholes.
- To ensure that groundwater users that are impacted have alternative sustainable water sources of the similar quality and quantity.

e) Flora and Fauna

- To ensure that vegetation growth and cover on the rehabilitated areas is sustainable.
- To ensure that alien invasive growth is eradicated until the closure certificate is granted.
- To encourage surrounding animals to return into the rehabilitated areas to maintain the surrounding biodiversity.

f) Aquatic Ecosystems

- To ensure that aquatic ecosystems are maintained as close as possible to that of the pre-mining environment.

g) Wetlands

- To minimise the disturbance on wetlands.
- To ensure that the adjacent wetland conditions are similar to that of the pre-mining Present Ecological State.

21.9 *The Process For Managing Any Environmental Damage, Pollution, Pumping And Treatment Of Extraneous Water Or Ecological Degradation As A Result Of Undertaking A Listed Activity.*

Surface Water

a) Clean and dirty water separation and dirty water containment features must be established on site, in line with GN704 requirements and engineered designs, prior to any other activity taking place on site:

- The dirty water catchment must be demarcated and managed as small as possible.
- Upslope soil berms will be constructed as close to the activity area as possible to divert clean water runoff around the site into natural drainage lines.
- Where diverted storm water flow enters a wetland or drainage line, flow dissipaters and / or silt traps must be installed if high flow, erosion and / or sedimentation is observed.
- Internal trenches will be excavated to drain dirty water from the active footprint to lined containment dams. Excavated soils will be placed upslope of the trenches to prevent contamination of the soil with dirty water runoff.
- All storm water diversion features will be designed to divert a 1:50 year 24hr storm event.
- All dirty water runoff will be collected in these trenches which will divert the runoff to the PCD.
- Silt traps will be established upslope of PCD to reduce the need for silt clearing in dirty water dams.
- PCD and high-load trenches will be lined with an appropriate liner.
- All trenches and PCDs will be designed to contain a 1:50 year 24hr storm event.

b) Pipelines and pumps required on site will be adequately sized and backups will be available on site to ensure continuation of water transfer activities in event of breakdowns.

- Pipelines should be laid within the dirty water footprint area.
- Pipelines should have a series of shut-off valves which can prevent flow of contaminated water should leaks occur.
- Inspect, maintain and repair all pipelines and pumps throughout the life of mine.

21.10 *Potential risk of Acid Mine Drainage.*

The acid generation potential of the hard rock and stockpile materials were estimated by using ABA on the samples collected from waste representing the WRD. The NAG test provides a direct assessment of the potential for a material to produce acid after a period of exposure (to a strong oxidant) and weathering. The test can be used to refine the results of the ABA predictions. In the Net-acid Generating (NAG) test hydrogen peroxide (H_2O_2) is used to oxidize sulphide minerals in order to predict the acid generation potential of the sample.

For the material to be classified in terms of their acid-mine drainage (AMD) potential, the ABA results could be screened in terms of its NNP, %S and NP:AP ratio.

Research and experience across the world have shown that there is a range from – 20 to 20 kg/t $CaCO_3$ where the system or sample can either become acidic or remain neutral. Some authorities state that any sample with a negative NNP value (NNP < -20) is potentially acid-generating, and any sample with positive NNP value (NNP > 20) might not generate acid since there will be enough alkalinity to buffer any acid that could be generated.

The analysed samples show a positive NNP value indicating the potential to neutralise the acid or predict a positive net drainage water quality from a rock sample. All the samples representing the stockpile material have a positive NNP, and this illustrate the buffering capacity of the material.

Based on the NAG pH, none of the sample have high risk to generate acid (see Table 49)

Table 49: NAGpH Classification

Sample number	NAGpH	NAG pH Rating	Verdict
MDD004-KIM-01	5,24	>5,5	Non-acid generating
MDD004-KIM-02	6,84	>5,5	Non-acid generating
MDD004-KIM-03	4,02	Between 3,5 and 5,5	Low risk acid generating
MDD004-KIM-04	4,07	Between 3,5 and 5,5	Low risk acid generating

21.11 *Volumes And Rate Of Water Use Required For The Mining*

The average monthly water balance indicates that a total of 124 050 cubic metres will be required as presented in the Surface Water Specialist report.

21.12 *Has A Water Use Licence Has Been Applied For?*

A water use license application (IWULA) and associated Integrated Water and Waste Management Plan (IWWMP) is in the process of being completed and will be submitted to the DWS. To date a pre-application meeting and a site visit has been held with the DWS.

21.13 *Impacts to be mitigated in their respective phases*

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
Construction Phase						
Air Quality	Excavations All infrastructure areas, development footprints and associated activities		Dust emissions due to erosion of open storage stockpiles and exposed areas when the threshold wind speed is exceeded.	a) Wet suppression, applied sparingly, to ensure the absence of visible dust; b) Wet suppression is about 50% effective on unpaved roads, but chemical binders such as Dustex or Dust-ASide may also be used; c) Enforce low vehicle speeds on unpaved areas (< 40 km/h); d) Use of shade cloth where necessary, to reduce wind speeds and reduce travel distance of dust; e) Vegetate the berm and other surfaces that were laid bare as a result of construction with a locally indigenous grass species where practicable, as soon as possible; and f) Requiring contractors to maintain construction vehicles in good condition	Dust fallout will be monitored and managed as per GNR827 and compared to baseline limits (which already exceed NEM:AQA limits). Conditions stipulated in licenses/rights/permits.	Dust management plan must be in place at the start of the project and carried out through all phases of the LOM.
	Vehicle movement		Emissions from the resuspension of loose material on the road surface. Vehicle-entrained dust emissions from the unpaved haul roads within the proposed Matai Mining Project mining area potentially represent the most significant source of fugitive dust for the mine	Haul road mitigation measures include tarring or paving, wet suppression and chemical surface treatments. Regular, light watering of the road is needed for water spraying to be effective in reducing particulate emissions. Other surface treatments include the use of chemicals such as calcium chloride or magnesium chloride. These chemicals attract moisture – drawing moisture out		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
				of the air during periods of high humidity, and also reducing the evaporation rate of water during hot periods. Some products contain surfactants which act as wetting agents. These not only reduce the amount of water required for wetting the roads, but also have slight binding properties. Another approach to dust control involves the application of organic or synthetic compounds that physically bind the dust particles together. The disadvantage of paving/tarring, infrequent watering and chemical mitigation measures is their inability to prevent material spillage from being re-entrained		
Ecology	Site clearance for establishment or access roads, infrastructure and pit area		Clearing of vegetation	Avoid sensitive areas and implement buffer zones	Preservation of biodiversity in terms of NEM:BA	From day 1, through life of project until rehabilitation vegetation established
			Loss of plant SSC	Limit the footprint area to the pit and infrastructure Avoid areas of remaining indigenous vegetation		
			Displacement of fauna species	Avoid high biodiversity sensitivity areas (natural vegetation, watercourses & wetlands) and comply to prescribed buffer zones		
			Loss of faunal SSC	Avoid areas in which plant species of conservation concern may occur; If some areas cannot be avoided implement rescue of plant species of conservation concern		
Noise Impact	Site clearing		Clearing and stripping of topsoil and vegetation	Earthwork activities to be done during daytime working hours unless there is no heavy-duty machinery which may create a noise problem.	Environmental Conservation Act, Noise Regulations	From day 1, through life of project until rehabilitation vegetation established
			Construction of mine infrastructure	Building activities to be done during daytime working hours unless there is no heavy-duty machinery which may create a noise problem		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
Aquatics	Site clearance for establishment of access roads, infrastructure and pit area		Sedimentation as a result of bare areas of soil	a) Sediment trapping berms b) Stormwater management plans c) Dry season construction	GNR704 and Water Use License	From construction phase until rehabilitation
	Establishment or access roads and crossings structures		Disturbance of watercourse channels and sedimentation	a) Upgrade existing roads and causeways b) Dry season construction		
	Vehicle movement and refuelling		Pollution of water resources as result of hydrocarbon spills	a) Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area b) Vehicle maintenance and inspection daily c) Spill kits must always be available and ready on-site		
Soil, Land Use and Land Capability	Transport of materials and labour Earthworks		Transport of materials and labour with trucks and buses as well as other light vehicles using the existing access roads. This will compact the soil of the existing roads and fuel and oil spills from vehicles may result in soil chemical pollution Earthworks will include clearing of vegetation from the surface, stripping topsoil (soil excavation) and stockpiling as well as drilling and blasting for the initial removal of overburden at the planned open cast pit as well as the construction of infrastructure like the Primary Crushing Facility, water management systems, contractors camp and sewage treatment plants. These activities are the most disruptive to	**a) Minimise the footprint of the Matai Mining Project** The existing pre-construction mine layout and design is aiming to minimise the area to be occupied by mine infrastructure (workshops, administration, product stockpile, etc.) to as small as practically possible. All footprint areas should also be clearly defined and demarcated and edge effects beyond these areas clearly defined. This measure will significantly reduce areas to be compacted by heavy construction vehicles and regular activities during the operational phase **b) Management and supervision of construction teams** The activities of construction contractors or employees will be restricted to the planned areas.	NEMA, MPRDA & CARA regarding rehabilitation & erosion control. NEM:BA in terms of protection of biodiversity. Any conditions stipulated in licenses/rights/permits	Demarcate infrastructure area and fence off before any activity takes place and maintain these for life of mine. Rehabilitate areas completely as soon as activity in those areas ceases.

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			natural soil horizon distribution and will impact on the current soil hydrological properties and functionality of soil. It will also change the current land use as well as land capability in areas where activities occur and infrastructure is constructed	Instructions must be included in contracts that will restrict construction work and construction workers to the clearly defined limits of the construction site. In addition, compliance to these instructions must be monitored **c) Location of stockpiles**		
	Handling and storage of building material		This will have the potential to result in soil pollution when not managed properly.	Locate all soil stockpiles in areas where they will not have to be relocated prior to replacement for final rehabilitation. Refrain from locating stockpiles as close as possible to the development for cost saving only to have them relocated later during the life of the operation. The ideal is to place all overburden materials removed during construction in their final closure location, or as close as practicable to it		
	Vegetation clearance		Soil erosion is also anticipated due to vegetation clearance. The impacts of soil erosion are both direct and indirect. The direct impacts are the reduction in soil quality which results from the loss of the nutrient-rich upper layers of the soil and the reduced water-holding capacity of severely eroded soils. The off-site indirect impacts of soil erosion include the disruption of riparian ecosystems and sedimentation. Soil erosion is a permanent impact for once the resource has been lost from the landscape it cannot be recovered. Although there are off-site indirect impacts associated with this, the impact is mainly considered to be local.	**d) Topsoil stripping** Wherever possible, stripping and replacing of soils should be done in a single action. This is both to reduce compaction and also to increase the viability of the seed bank contained in the stripped surface soil horizons. Stripping should be conducted a suitable distance ahead of development of, for example the open pit, at all times to avoid loss and contamination. As a norm, soil stripping should be kept within 3-9 months of development, or between 50-100 metres ahead of the active operations.		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
				e) Stockpiling of topsoil To minimise compaction associated with stockpile creation, it is recommended that the height of stockpiles be restricted between of 4 – 5 meters maximum. For extra stability and erosion protection, the stockpiles may be benched. The clay content of the topsoil on the largest area of the Matai Mining project area is not sufficient for stockpiles to remain relatively stable without benching. The areas on the Arcadia soil form do have sufficient clay content **f) Prevention of stockpile contamination** Topsoil stockpiles can be contaminated by dumping waste materials next to or on the stockpiles, contamination by dust from blasting and waste rock stockpiles and the dampening for dust control with contaminated water are all hazards faced by stockpiles. This should be avoided at all cost and if it occurs, should be cleaned up immediately **g) Terrain stability to minimise erosion potential** Management of the terrain for stability by using the following measures will reduce the risk of erosion significantly: • Using appropriate methods of excavating that are in accordance with regulatory		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
				requirements and industrial best practices procedures; • Reducing slope gradients as far as possible along road cuts and disturbed areas to gradients at or below the angle of repose of those disturbed surfaces; and • Using drainage control measures and culverts to manage the natural flow of surface runoff Management of the terrain for stability by using the following measures will reduce the risk of erosion significantly: • Using appropriate methods of excavating that are in accordance with regulatory requirements and industrial best practices procedures; • Reducing slope gradients as far as possible along road cuts and disturbed areas to gradients at or below the angle of repose of those disturbed surfaces; and • Using drainage control measures and culverts to manage the natural flow of surface runoff **h) Management of access and services roads** Existing established roads should be used wherever possible. Where possible, roads that will carry heavy-duty traffic should be designed in areas previously disturbed rather than clearing new areas, where possible. The moisture content of access road surface layers must be maintained through routine spraying or the use of an appropriate dust suppressant. Access roads should be designed with a camber to avoid ponding and to encourage drainage to side drains; where necessary, culverts will be installed		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
				to permit free drainage of existing water courses. The side drains on the roads can be protected with sediment traps and/or gabions to reduce the erosive velocity of water during storm events and where necessary geo-membrane lining can be used **i) Prevention of soil contamination** During the construction phase, chemical soil pollution should be minimised as follows: • Losses of fuel and lubricants from the oil sumps and steering racks of vehicles and equipment should be contained by using a drip tray with plastic sheeting filled with absorbent material; • Using biodegradable hydraulic fluids, using lined sumps for collection of hydraulic fluids, recovering contaminated soils and treating them off-site, and securely storing dried waste mud by burying it in a purpose-built containment area; • Avoiding waste disposal at the site wherever possible, by segregating, trucking out, and recycling waste; • Containing potentially contaminating fluids and other wastes; and • Cleaning up areas of spillage of potentially contaminating liquids and solids.		
Groundwater	Drilling		Groundwater contamination as a result of drilling of new monitoring boreholes to investigate possible preferred groundwater flow pathways and one or two areas outside preferred pathways, which will: a) Identify geological and hydrogeological control	Monthly monitoring of the boreholes with regard to water levels and water quality	Dangerous goods stored and managed as per SANS 10228:2006 and MSDSs and MPRDA Regulations. MHSA will be complied with regarding signage and access control. Surface water and groundwater quality in neighbouring areas will be maintained within SANS	Hydrocarbons will only be stored on site once bunded areas are constructed. Storage and handling of hydrocarbons (including used hydrocarbons) will be managed in accordance with the EMP as soon as

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			across the proposed mining right area; b) Provide facilities to undertake aquifer testing and water sample collection; and c) Serve as future monitoring points in an initial groundwater monitoring network.		241:2011 standards for hydrocarbons.	hydrocarbons are brought to site for the life of mine.
	Storage of fuels and lubricants and movement of vehicles		Spills from improper storage of fuels and lubricants and also from leaking vehicles	a) Monthly monitoring of the boreholes with regard to water levels and water quality b) Place drip trays under vehicles when parked. c) If in-field refuelling is done from a tanker, it should be done in a designated dirty area and a spill kit and clean- up team must be available on site; d) Spillages should be cleaned up immediately and contaminated soil must either be remediated in situ or disposed of at an appropriately licensed landfill site; e) Hydrocarbon storage areas must be in a bunded area and comply with the relevant SANS standards	Same as above	Same as above
Surface Water	Exposure of topsoil		Sedimentation of watercourses due to exposing and loosening of soil as a result of vegetation clearing for the construction of infrastructure and	a) Use wet suppression, chemical stabilization and wind speed reduction methods that should be used to control	Dangerous goods stored and managed as per SANS 10228:2006 and MSDSs and MPRDA Regulations. MHSA will	Hydrocarbons will only be stored on site once bunded areas are constructed. Storage and handling of

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Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			pollution of watercourses due to hydrocarbon and chemical spillages	open dust sources at the construction sites b) Vegetation should only be removed where absolutely necessary; c) Hydrocarbons should be stored on hardpark bunded facilities to ensure that all spillages are contained; and d) Clean and dirty surface water trenches/channels should be constructed to divert runoff separately to appropriate storage facilities	be complied with regarding signage and access control. Surface water and groundwater quality in neighbouring areas will be maintained within SANS 241:2011 standards for hydrocarbons.	hydrocarbons (including used hydrocarbons) will be managed in accordance with the EMP as soon as hydrocarbons are brought to site for the life of mine.
	Vegetation removal		Altered drainage paths and loss of catchment yield due to the removal of vegetation and construction of diversion berms	Reuse dirty water as much as possible onsite instead of obtaining water from the catchment, or to treat dirty water to acceptable standards and then to discharge to the catchment.		
Traffic	Transportation of materials and labourers		Construction materials being transported to site will contribute to the addition of traffic on the road network	Road network able to support additional trucks.	Mine safety in terms of MHSA and relevant regulations	From day 1 until mine closure
			Employees and labourers transported to/ from site	Road network able to support additional commuter trips		
			Dust will increase with increased traffic flow along gravel roads	Ensure that gravel roads are kept watered to prevent dust (other dust suppression measures may also be used).		
Heritage	Site clearance		Site Clearance for construction activities might reveal or expose archaeological artefacts.	a) If any heritage sites are identified, appropriate steps as per the Heritage Resources Act will be undertaken a) Education and training on heritage resources will be given to mine employees	Heritage resources act	From construction until closure

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
Socio-Economic	Construction activities		The residual impacts associated with the creation of employment and business opportunities and training during the construction phase is that the workers can improve their skills by gaining more experience.	a) Establish targets for the employment and training; b) Train workforce for longer term employment; c) Adopt recruitment strategies that ensure local people are given employment preference; d) Effective implementation of training and skills development initiatives; e) The recruitment process has to be transparent and equitable; f) Maximise and monitor local recruitment; g) Consult local labour recruitment offices; h) Prevent nepotism/corruption in local recruitment structures; i) Promote employment of women and youth; j) Formulate a labour recruitment strategy that would minimise impact on other sectors (e.g. do not recruit unskilled labour at wage levels above the wages paid in the agricultural sector); and k) Establish a liaison point with the adjacent farming community to monitor the impact on their local labour force	SLP, Mine Charter and Good relations with communities	From construction until mine closure
			Multiplier impacts on the local economy	a) Development of a register of local SMMEs; b) Linkages with skills development/ Small, Medium and Micro Enterprises (SMME) development institutions and other mining operations; c) SMME skills development as part of mine SLP/LED commitments d) Create synergies with other mining/electricity enterprises LED/CSR projects e) Preference should be given to capable subcontractors who based within the local municipal area;		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
				f) Align skills development to build capacity of SMMEs; g) Monitoring of sub-contractors procurement; h) Development of a register of local SMME; and i) Local procurement targets should be formalised in Matai's procurement policy		
			a) Improved economic development; b) Increased capacity to develop and maintain livelihood strategies	a) Ensure that there is stakeholder buy-in; b) Aligning LED projects with those of other development role-players; c) Liaison with beneficiaries to ensure needs are met; d) Collaboration with other developmental role players (e.g. local and district municipalities, neighbouring mines and NGOs) during implementation of envisaged projects, and where possible aligning envisaged development projects with existing ones; e) Expanding its skills development and capacity building programmes for non-employees f) Monitoring system to regulate Historically Disadvantaged South African procurement g) Where feasible, training should be NQF Accredited; and h) A record of training courses completed per individual should be kept		
			Increase in injuries and possible loss of lives	a) Access control to all project elements, including fencing; b) Personal Protective Equipment for mine workers; c) Notification of blasting schedules; d) Blasting and storage of hazardous materials to adhere to prescribed regulation; e) Measures suggested minimising the impact of flyrock on surrounding roads and structure;		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
				f) Measures suggested in the Health Impact Assessment to minimize traffic related accidents; g) Traffic calming measures to prevent speeding (e.g. speed humps); h) Road maintenance; i) Provide safe road crossing points and fencing of the main road and the mine site; and j) Community education to sensitize community members to potential traffic and blasting safety risks		
			Altered sense of place and breakdown of existing social networks	a) Where possible ensure that access to fields and grazing areas are uninterrupted by providing alternative access routes and/or temporary access points during construction activities; b) Matai Mine should ensure that residents are kept informed on a day-to-day basis of construction progress and of when access will be blocked; c) Measures to prevent deterioration of roads; d) suggested in Traffic Impact Assessment (e.g. drivers to report road deterioration to the NW Province Department of Transport); e) Regulation of traffic at intersections and access roads to the site; f) Road upgrading measures should be investigated and implemented in conjunction with the relevant government department (e.g. repairing and rehabilitating the main roads and sealing the roadway to increase its capacity for Heavy Moving Vehicles); g) Inform communities of planned construction activities that would affect vehicle/pedestrian traffic; h) Ensure that access to key services are uninterrupted by providing alternative access routes in cases where construction activities restricts or disrupt movement i) Construction of cattle crossings at suitable intervals should be incorporated into project design		
			a) Displaced farm workers; b) Loss of livelihoods	a) Suitable mitigation measures should be defined that protect the farm workers		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
				and ensure that they are adequately provided for and supported should they be moved or lose their employment. b) A Resettlement Action Plan and associated Livelihood Restoration Plan may be required. c) Implement surface lease agreements with all community members who have grazing or ploughing land, this will minimise the impact of economic displacement. d) Implement the Grievance Mechanism to ensure ongoing, proactive engagement and effective management of grievances		
			Strain on the existing infrastructure which is already inadequate	a) To limit, as far as reasonably possible, additional pressure on existing infrastructure and services; b) To work in partnership with government, industry, and relevant organisations to enhance the existing infrastructure and services; c) To liaise openly and frequently with affected stakeholders to ensure they have information about the proposed Matai Mining Project; and d) Liaison with district and local municipalities well in e) advance to ensure needs are met f) Ensure that municipalities take into account expected population influx g) Promotion of mining methods to allow for surface development h) Influx management i) To make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders		
Waste Management	Construction activities		Typical wastes produced during construction activities include unused concrete mix, oils, lubricants, paints, solvents, packaging materials, general domestic waste and offcuts of building materials such as steel, wood, glass and tiles. If stored or discarded on open	a) Sort the wastes and store in separate skips or other containers for hydrocarbons, recyclable materials and non- recyclable materials. Recyclable materials should be sorted into wood, steel, glass, plastic, paper and used oil, and stored in separate containers;	Waste management standards and Regulations	From construction until closure

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			ground, hydrocarbons will cause soil contamination and possibly groundwater pollution	b) Have recyclable wastes removed by responsible recyclers; and c) Have non-recyclable wastes removed by reputable contractors for disposal at appropriately licensed landfill		
Operational Phase						
Air Quality	Drilling and blasting		Emissions from drilling are a relatively minor component of the overall emission from an open pit mine. The only available emission factor for drilling is a simple uncontrolled TSP emission factor of 0.59kg/hole for overburden (US EPA, 1995). Clearly, other variables such as the depth of the holes, diameter of the holes, and moisture content of the material being drilled would also be relevant and it might be supposed that an emission factor equation should take account of these variables. However, in the absence of other data (and given the relatively minor contribution of this source to overall emissions from mining operations), it is reasonable to accept the 0.59 kg/hole factor for TSP	a) Efficiency will be applied to reduce wastage and unnecessary fuel consumption; b) Carbon offsets will be considered if required; c) Concurrent best practice rehabilitation and vegetation monitoring will be applied to allow for the restoration of some the carbon sink functionality within the mining right area. d) Avoid blasting under windy conditions as far as practicable	Dust fallout will be monitored and managed as per GNR827 and compared to baseline limits (which already exceed NEM:AQA limits). Conditions stipulated in licenses/rights/permits.	Dust management plan must be in place at the start of the project and carried out through all phases of the LOM.
	Processing plant		The moisture content of the material processed can have a substantial effect on emissions	Surface wetness causes fine particles to agglomerate on, or to adhere to, the faces of larger chunks of ore, with a resulting dust suppression effect. However, as new fine particles are created by crushing and attrition, and as the moisture content is reduced by evaporation, this suppressive effect diminishes and may disappear		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
	Vehicle movement		Vehicle entrainment from unpaved roads	a) Enforcement of a 40 km/hour speed restriction on unpaved haul roads; b) Wet suppression on haul roads, with the addition of a chemical binder if necessary		
	Crushing and screening		Crushing and screening operations represent significant dust-generating sources if uncontrolled. The large percentage of fines in this dustfall material enhances the potential for it to become airborne. It was assumed that primary crushing (crushing to achieve particles of <300 mm) will take place in the pit to reduce the ore to a transportable size for the conveyor system.	Wet suppression will be used for both the secondary and tertiary crushing stages		
	Materials handling		Materials handling operations which are predicted to result in significant fugitive dust emissions from mining operations include the transfer of material by means of loading and offloading of trucks, loading and offloading conveyors, transfer from one conveyor to another and bulldozing. The quantity of dust which will be generated will depend on various non-climatic parameters such as the nature (moisture content and silt content) and volume of the material handled.	a) Reduced tipping and drop heights where practicable; b) Regular clean-up at loading areas and on paved surfaces to prevent entrainment by wind or vehicles; c) Use of shade cloth where necessary, to reduce wind speeds and reduce travel distance of dust; d) Covering of exposed areas with coarsely crushed rock or aggregate material where practicable; e) Maintaining all vehicles in good condition at all times; and f) Continuous dust and fine particulate monitoring should be implemented to monitor compliance with the NAAQS		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
Ecology			Alien plant establishment	Implementation of alien invasive plant management plan needs to be continued during operation to prevent the growth of invasive on cleared areas	Preservation of biodiversity in terms of NEM:BA	From day 1, through life of project until rehabilitation vegetation established
			Disturbance/Displacement of Faunal species	Minimise footprint area Work only in clearly demarcated areas		
			Disturbance of vegetation communities	Minimise footprint area Work only in clearly demarcated areas		
			Habitat fragmentation	Minimise footprint area Work only in clearly demarcated areas		
			Killing of faunal species	Minimise footprint area Work only in clearly demarcated areas		
Noise	Operation of processing plant Pit activities Hauling of waste rock to the waste dump Hauling of material to the plant		Noise increase at the boundary of the mine footprint and at the abutting residential	a) All noise sources exceeding 85.0dBA to be identified and if practical to be acoustically screened off. b) Noise survey to be done on a quarterly basis and after one year to change to an annual basis if the prevailing ambient noise levels at the boundaries of the plant have not changed.	Environmental Conservation Act, Noise Regulations	From day 1, through life of project until rehabilitation vegetation established
	Additional traffic			Speed limit of mining areas to be adhered to at all times		
	Operation of an emergency generator			Noise readings to be done in the vicinity of and along the emergency boundaries to ensure that the prevailing ambient noise level is not exceeded.		
Aquatics	Operation of mine and management of access roads		Vehicular movement and sedimentation	a) Sediment trapping berms b) Stormwater management plans	GNR704 and Water Use License	From construction phase until rehabilitation
			Pollution of water resources as a result of mine waste	a) Implement Integrated Waste Water Management Plan b) Aquatic biomonitoring		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			Pollution of water resources as result of hydrocarbon spills	d) Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area e) Vehicle maintenance and inspection daily f) Spill kits must always be available and ready on-site		
Soil, land use and land capability	Open pits and mine infrastructure		Open pits and surface infrastructure will both lead to surface impacts on soil resources. Surface infrastructure like buildings, haul roads, waste rock dumps and product stockpiles are by far the most disruptive to current land uses, land capability as well as agricultural potential of the soil. Soil underneath buildings and stockpiles are subject to compaction and sterilization of the topsoil	**Management of potential soil contamination during the operational phase** The following management measures will either prevent or significantly reduce the impact of soil chemical pollution on site during the operation phase: a) Stockpiles are managed so they do not become contaminated and then need additional handling or disposal; b) A low process or storage inventory must be held to reduce the potential volume of material that could be accidentally released or spilled; c) Processing areas should be contained and systems designed to effectively manage and dispose of contained storm water, effluent and solids; d) Storage tanks of fuels, oils or other chemicals stored are above ground, preferably with inspectable bottoms, or with bases designed to minimise corrosion. Above-ground (rather than in-ground) piping systems should be provided. Containment bunds should be	NEMA, MPRDA & CARA regarding rehabilitation & erosion control. NEM:BA in terms of protection of biodiversity. Any conditions stipulated in licenses/rights/permits	Demarcate infrastructure area and fence off before any activity takes place and maintain these for life of mine. Rehabilitate areas completely as soon as activity in those areas ceases.
	Spills of fuel and lubricants		Soil chemical pollution as a result of spills of fuel and lubricants by vehicles and machinery as wells as the accumulation of domestic waste, is considered to be a moderate deterioration of the soil resource. This impact will be localized within the site boundary and have medium-high significance on the soil resource. Vanadium and titanium are unlikely to cause toxic effects for soil microbes or plants due to dust from or soil stockpiles			
	Vehicle movement		Soil compaction will be a measurable deterioration that will occur as a result			

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			of the weight of the topsoil and overburden stockpiles stored on the soil surface as well as the movement of vehicles on the soil surfaces (including access and haul roads). This is a permanent impact that will be localized within the site boundary with medium-low consequence and significance in the mitigated scenario.	sealed to prevent spills contaminating the soil and groundwater; e) Equipment, and vehicle maintenance and washdown areas, are contained and appropriate means provided for treating and disposing of liquids and solids f) Air pollution control systems avoid release of fines to the ground (such as dust from dust collectors or slurry from scrubbing systems); g) Solids and slurries are disposed of in a manner consistent with the nature of the material and avoids contamination; and h) Effluent and processing drainage systems avoid leakage to ground.		
	Vegetation clearance		During the operational phase, topsoil stockpiles as well as roads running down slopes will still be susceptible to erosion. Soil surfaces with infrastructure such as concrete slabs and buildings will not be exposed to erosion any longer. This is a permanent impact that will be localized within the site boundary with medium-high consequence and significance. With proper mitigation measures and the embedded controls as recommended in the Soil Management Plan, it is anticipated that the significance of this impact will be reduced to low			
Groundwater	Mine dewatering		Opencast mining of will result in groundwater inflows into the pits, which needs to be pumped out for mine safety. The expected inflow into the pit is 730 m³/d when mining floor will reach 20 mbgl. It will stabilise to 1150 m³/d when mining floor will reach 90 mbgl	a) Store the dewatered water in PCDs and ensure that the dams will have enough storage volume; b) If that is not possible, re-introduce treated water into the streams after ensuring that they meet the required standards as per the WUL or river quality objectives;	Dangerous goods stored and managed as per SANS 10228:2006 and MSDSs and MPRDA Regulations. MHSA will be complied with regarding signage and access control. Surface water and groundwater quality in neighbouring areas will be maintained within SANS	Hydrocarbons will only be stored on site once bunded areas are constructed. Storage and handling of hydrocarbons (including used hydrocarbons) will be managed in accordance with the EMP as soon as

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
				c) Supply equal volumes and better-quality water to affected user if proven that there is an impact on specific users; d) Monitoring of groundwater water levels and groundwater inflow rates; and e) Update numerical model annually	241:2011 standards for hydrocarbons.	hydrocarbons are brought to site for the life of mine.
	Mine water runoff		Any contamination that will seep from the WRDs is expected to move eastern direction toward the north-north-east down-gradient of the waste dump. The toe of the plume estimated to extend 700 m away from waste dump, 20 years after contamination commences	a) Implement compacted clay or synthetic liner underneath the WRDs to minimizes seepage following the waste classification result; b) Re-use water collected in the WRDs berms. Any excess should be treated to acceptable quality before it is discharged to the environment; c) Monthly and quarterly monitoring of the surface water and groundwater respectively		
Surface water	Mining activities		Pollution of surrounding watercourses as a result of activities during the operational phase (spills, overflows and contaminated runoff)	a) There are no mitigation measures for a loss of contained water to the catchment yield as long as the mine is there however, b) Reuse dirty water as much as possible onsite instead of obtaining water from the catchment, or to treat dirty water to acceptable standards and then to discharge to the catchment. - Sustainable mine water management needs to be implemented	Dangerous goods stored and managed as per SANS 10228:2006 and MSDSs and MPRDA Regulations. MHSA will be complied with regarding signage and access control. Surface water and groundwater quality in neighbouring areas will be maintained within SANS 241:2011 standards for hydrocarbons.	Hydrocarbons will only be stored on site once bunded areas are constructed. Storage and handling of hydrocarbons (including used hydrocarbons) will be managed in accordance with the EMP as soon as hydrocarbons are brought to site for the life of mine.
Traffic	Transportation of staff		Haulage to/ from site; and mine staff to/from site	Road network able to support additional trucks.	Mine safety in terms of MHSA and relevant regulations	From day 1 until mine closure

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
	Dust from vehicle movement		Dust will increase with increased traffic flow along gravel roads	Ensure that gravel roads are kept watered to prevent dust (other dust suppression measures may also be used).		
	Noise from vehicle movement		Noise levels affecting sensitive areas including residential areas	Speed limits to be kept low and define routes away from residential areas.		
Heritage Impact Assessment	Opening of box-cut		Opening of the box-cut might expose or reveal archaeological artefacts	a) If any heritage sites are identified, appropriate steps as per the Heritage Resources Act will be undertaken b) Education and training on heritage resources will be given to mine employees	Heritage resources act	From construction until closure
Socio-Economic			The impact may be reversible over time as workers and job-seekers leave the area, consequences such as HIV/AIDS and unwanted pregnancies will be permanent	a) Limit, as far as reasonably possible, social ills caused by influx of workers and job-seekers; b) Liaise openly and frequently with affected stakeholders to ensure they have information about the Project; c) Extensive HIV/AIDS awareness and general health campaign. It should be noted that Matai Mine has no control over activities related to workers' behaviour, however It is recommended that HIV/AIDS campaigns are conducted within the affected area; d) Discourage influx of job-seekers by prioritising employment of unemployed members of local communities; e) Liaise with Moses Kotane Local Municipality, and Traditional Authority to ensure that expected population influx is taken into account in infrastructure development and spatial development planning; f) Create synergies with local government IDP and other companies' SLP/CSR projects to promote infrastructure development; g) Clear identification of workers – prevention of loitering; h) Liaison with police or establish/ support community policing forum;	SLP, Mine Charter and Good relations with communities	From construction until mine closure

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
				i) Promote projects providing housing, especially low cost housing, to link with the proposed Matai MVT mine; j) Community education; and k) Implement measures to address potential conflict between locals and non-locals		
			The increase in nuisance factors and associated changed sense of place will be negative, and direct as a result of Project activities, and indirect as a result of migrant job-seekers	a) Minimise all nuisance factors such as noise, air quality, traffic, and visual- Implement all mitigation measures as specified in the relevant specialist studies; b) Make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders; c) Liaise openly and frequently with affected stakeholders to ensure they have information about activities that will generate nuisance factors		
			Strain on the existing infrastructure which is already inadequate.	a) To limit, as far as reasonably possible, additional pressure on existing infrastructure and services; b) To work in partnership with government, industry, and relevant organisations to enhance the existing infrastructure and services; c) To liaise openly and frequently with affected stakeholders to ensure they have information about the proposed Matai Mining Project; and d) To make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders		
			Loss of grazing land	a) Ensure that the project design and associated layout seeks to minimise the project footprint, thus minimising the loss of agricultural land; engage with each directly affected landowner with the intention to acquire only the required servitude area; b) Should Matai MVT Mine acquire the full farm and the project footprint only affects a portion of the land, the		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
				surrounding usable land should be utilised for agricultural purposes – potentially as part of a lease agreement; c) Where damage is incurred, suitable compensation must be negotiated with the affected farmer; Prepare a site Rehabilitation Plan that will be implemented as part of the decommissioning phase		
			Altered sense of place and breakdown of existing social networks	a) Where possible ensure that access to fields and grazing areas are uninterrupted by providing alternative access routes and/or temporary access points during construction activities; b) Matai should ensure that residents are kept informed on a day-to-day basis of construction progress and of when access will be blocked		
			a) Developed local economy; b) Increased capacity to develop and maintain livelihood strategies	Maximise benefits from local employment, skills and economic development		
			Increase in injuries and possible loss of lives	a) Access control to all project elements, including fencing; b) Personal Protective Equipment for mine workers; c) Notification of blasting schedules; d) Blasting and storage of hazardous materials to adhere to prescribed regulation; e) Measures suggested minimising the impact of flyrock on surrounding roads and structure; f) Measures suggested in the Health Impact Assessment to minimize traffic related accidents; g) Traffic calming measures to prevent speeding (e.g. speed humps); h) Road maintenance; i) Provide safe road crossing points and fencing of the main road and the mine site; and j) Community education to sensitize community members to potential traffic and blasting safety risks		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
Waste management	Mining operations		In terms of the National Environmental Management Amendment Act 2014, mining residues are classified as wastes and must be managed as prescribed by the National Environmental Management: Waste Act of 2008 and its Regulations GN R.632 and R.633	a) Manage waste in accordance with Regulations GN R.634 – 636, i.e. provide PCD with HDPE liner, WRDs and b) TSF with Class D liners and heap leach pads with at least class B liners; c) Undertake regular inspection and maintenance of waste management facilities; d) Monitor groundwater and surface water quality down-gradient of waste management facilities; and e) Take such corrective action as may be required.	Waste management standards and Regulations	From construction until closure
Decommissioning and Rehabilitation Phase						
Air quality	Demolition of infrastructure and backfilling of pit		Particulate mobilisation can be caused by the demolition of buildings and handling of the rubble, backfilling of the storm water dam and "dirty" water collection channels and ripping and shaping of compacted areas	a) Wet suppression during landscaping and materials handling activities; b) Enforcement of low vehicle speeds on unpaved areas (< 40 km/h); c) Use of shade-cloth where necessary, to reduce wind speeds and reduce travel distance of dust; d) Vegetation of bare surfaces with a locally indigenous grass species as soon as possible; e) Continue dust fall monitoring until vegetation cover is well established; and f) Requiring contractors to maintain construction vehicles in good condition	Dust fallout will be monitored and managed as per GNR827 and compared to baseline limits (which already exceed NEM:AQA limits). Conditions stipulated in licenses/rights/permits.	Dust management plan must be in place at the start of the project and carried out through all phases of the LOM.

Environmental Aspect	**Activity**	**Size and scale**	**Potential Impacts**	**Mitigation Measures**	**Compliance with Standards**	**Time Period for Implementation**
Ecology	Shaping of landscape		Loss of species of conservation concern	All infrastructure that could have a negative impact on faunal species (powerlines etc) needs to be decommissioned and removed	Preservation of biodiversity in terms of NEM:BA	From day 1, through life of project until rehabilitation vegetation established
	Revegetation of landscape		Impact on the growth and health of both fauna and flora	Implement rehabilitation strategy and rehabilitation interventions		
	Monitoring of plant species establishment		Establishment of vegetation	Implement rehabilitation monitoring plan and remedy actions		
			Habitat reconstruction	Implement rehabilitation monitoring plan and remedy actions		
			Habitat stabilisation	Implement rehabilitation monitoring plan and remedy actions		
Noise	Backfill of disturbed areas		Noise increase at the boundary of the mine footprint and at the abutting residential	Building activities to be done during daytime working hours unless there is no heavy-duty machinery which may create a noise problem.	Environmental Conservation Act, Noise Regulations	From day 1, through life of project until rehabilitation vegetation established
	Planting of grass and vegetation at rehabilitated area			Building activities to be done during daytime working hours unless there is no heavy-duty machinery which may create a noise problem.		
	Maintenance of disturbed area			Maintenance activities to be done during daytime working hours.		
Aquatics	Shaping of landscapes		Sedimentation as a result of bare areas of soil	e) Sediment trapping berms f) Stormwater management plans g) Dry season working h) Aquatic biomonitoring	GNR704 and Water Use License	From construction phase until rehabilitation
	Vehicular and machinery movement		Pollution of water resources as result of hydrocarbon spills	a) Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area b) Vehicle maintenance and inspection daily c) Spill kits must always be available and ready on-site		
Soil, land use and land capability	Traffic movement		Transport of materials away from site. This will compact the soil of the existing		NEMA, MPRDA & CARA regarding rehabilitation &	Demarcate infrastructure area and fence off before

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			roads and fuel and oil spills from vehicles may result in soil chemical pollution	**a) Management and supervision of decommissioning teams** The activities of decommissioning contractors or employees will be restricted to the planned areas. Instructions must be included in contracts that will restrict decommissioning workers to the areas demarcated for decommissioning. In addition, compliance to these instructions must be monitored. **b) Infrastructure removal** All buildings, structures and foundations not part of the post-closure land use plan must be demolished and removed from site **c) Site preparation** Once the site has been cleared of infrastructure and potential contamination, the slope must be re-graded (sloped) in order to approximate the pre-project aspect and contours. The previous infrastructure footprint area must be ripped a number of times in order to reduce soil compaction. The area must then be covered with topsoil material from the stockpiles **d) Seeding and re-vegetation** Once the land has been prepared, seeding and re-vegetation will contribute to establishing a vegetative cover on disturbed soil as a means to control erosion and to restore disturbed areas to	erosion control. NEM:BA in terms of protection of biodiversity. Any conditions stipulated in licenses/rights/permits	any activity takes place and maintain these for life of mine. Rehabilitate areas completely as soon as activity in those areas ceases.
	Earthworks		Earthworks will include redistribution of inert waste materials to fill the open pits as well as topsoil to add to the soil surface. These activities will not result in further impacts on land use and land capability but may increase soil compaction			
	Handling and storage of materials		Other activities in this phase that will impact on soil are the handling and storage of materials and different kinds of waste generated as well as accidental spills and leaks with decommissioning and rehabilitation activities. This will have the potential to result in soil pollution when not managed properly			
	Revegetation		With the decommissioning phase, soil surfaces are in the process of being replanted with indigenous vegetation and until vegetation cover has established successfully, all surfaces are still susceptible to potential soil erosion			

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
				beneficial uses as quickly as possible. The vegetative cover reduces erosion potential, slows down runoff velocities, physically binds soil with roots and reduces water loss through evapotranspiration. Indigenous species will be used for the re-vegetation, the exact species will be chosen based on research available and then experience as the further areas are re-vegetated **e) Prevention of soil contamination** During the decommissioning phase, chemical soil pollution should be minimised as follows: Losses of fuel and lubricants from the oil sumps of vehicles and equipment should be contained using a drip tray with plastic sheeting and filled with absorbent material; ○ Using biodegradable hydraulic fluids, using lined sumps for collection of hydraulic fluids and recovering contaminated soils and treating them off-site; ○ Avoiding waste disposal at the site wherever possible, by segregating, trucking out, and recycling waste; ○ Containing potentially contaminating fluids and other wastes; and ○ Cleaning up areas of spillage of potentially contaminating liquids and solids.		
Groundwater	Decanting		After mine closure and ceasing of dewatering, pit is likely to decant. Once the mine starts to decant, it is not expected to stop naturally. Pollution	a) Identify decant areas and raise topography to increase time to decant; b) Plan open cast mining so that the perimeters follow the surface contours along the lowest	Dangerous goods stored and managed as per SANS 10228:2006 and MSDSs and MPRDA Regulations. MHSA will	Hydrocarbons will only be stored on site once bunded areas are constructed. Storage and handling of

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			from WRDs on groundwater quality will continue in perpetuity, even after mine closure. Seepage and decant is expected to have a serious impact and require management and rehabilitation measures to prevent irreplaceable impacts. If the pH is acidic, dissolved metals and sulphates will remain is solution	side of the pit and not cut directly across streams; c) Monitoring groundwater levels, decant rates and qualities; d) Revegetated WRD as quickly as possible to minimize recharge rates; e) Divert all clean runoff away from, the pit through a series of berms; f) Re-evaluate impact of decant after end of life, once monitoring information is available; and g) Treat seepage and decanted water using passive or active means to meet the recommended standards.	be complied with regarding signage and access control. Surface water and groundwater quality in neighbouring areas will be maintained within SANS 241:2011 standards for hydrocarbons.	hydrocarbons (including used hydrocarbons) will be managed in accordance with the EMP as soon as hydrocarbons are brought to site for the life of mine.
Surface water	Mine rehabilitation		Pollution of surrounding watercourses as a result of activities during the decommissioning phase	a) The perimeter stormwater management measures should remain in place and should only be removed once rehabilitation of other activities has been completed. This will capture most of the sediment produced from rehabilitation activities and any spills from removal of hydrocarbon and chemical storage; b) Credible contractors should be used for the cessation of the mining and decommissioning of all infrastructure.	Dangerous goods stored and managed as per SANS 10228:2006 and MSDSs and MPRDA Regulations. MHSA will be complied with regarding signage and access control. Surface water and groundwater quality in neighbouring areas will be maintained within SANS 241:2011 standards for hydrocarbons.	Hydrocarbons will only be stored on site once bunded areas are constructed. Storage and handling of hydrocarbons (including used hydrocarbons) will be managed in accordance with the EMP as soon as hydrocarbons are brought to site for the life of mine.
	Post closure		Rehabilitation of the site post mining will result in a positive impact on surface water quantity when completed.	Rehabilitation will result in a positive improvement as surface water drainage patterns will be restored to a state similar to pre-mining which is likely to result in an improvement in		

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
				catchment yield after land profiling and cover having been restored		
Traffic Impact	Removal of rubble and other materials from site		Added traffic on the road network	Road network able to support additional trucks.	Mine safety in terms of MHSA and relevant regulations	From day 1 until mine closure
Heritage	Ripping and shaping of compacted areas		Ripping and shaping all compacted areas to be free draining, followed by re-vegetation might expose human remains or archaeological artefacts	a) If any heritage sites are identified, appropriate steps as per the Heritage Resources Act will be undertaken b) Education and training on heritage resources will be given to mine employees	Heritage resources act	From construction until closure
Socio-Economic	Mine closure		The impact may be reversible over time as workers and job-seekers leave the area, consequences such crime and other social pathologies will be permanent	a) Effect retrenchments according to procedures stipulated in approved SLP; b) The Mine's SLP should provide strategies and measures that prevent job loss; c) Support economic diversification through development of alternative markets; d) Develop a Mine Closure Plan; e) Proactively and effectively implement mine closure plan; f) Collaborate with adjacent mining companies to develop and implement sustainable community; g) Develop alternative and sustainable livelihoods; h) Alternatives to save jobs/avoid downscaling should be investigated beforehand; i) Proactively assess and manage the social and economic impacts on individuals, regions and economies where retrenchment and/or closure of the mine are certain; and	SLP, Mine Charter and Good relations with communities	From construction until mine closure

Environmental Aspect	Activity	Size and scale	Potential Impacts	Mitigation Measures	Compliance with Standards	Time Period for Implementation
				j) Partner with the relevant government departments, to jointly manage Closure process		
Waste management	Mine closure		Wastes expected to result from the decommissioning and rehabilitation activities include scrap metals, building rubble, oils, lubricants, paints, solvents, contaminated soils, PCD dam silt and liners, tailings dam, waste rock dumps and potentially recyclable materials such as steel, wood, plastics, glass and tiles. If stored or discarded on open ground, hydrocarbons will cause soil contamination and possibly groundwater pollution, an impact rated as	a) Identify areas of possible soil contamination, sample such areas, analyse and determine degree of soil contamination. Remove and dispose of soil with contamination levels exceeding then prevailing standards/guidelines; b) Remove silt, synthetic liners and contaminated non-synthetic liner materials from PCD and dispose at appropriately licenced landfill. Liner materials and building rubble with contamination levels below prevailing standards/guidelines may be backfilled into the last portion of the opencast void; c) Sort the remaining wastes and store in separate skips or other containers for hydrocarbons, recyclable materials and non-recyclable materials. Recyclable materials should be sorted into wood, steel, glass, plastic, paper and used oil, and stored in separate containers; d) Have recyclable wastes removed by responsible recyclers; and e) Have non-recyclable wastes removed by reputable contractors for disposal at appropriately licensed landfills	Waste management standards and Regulations	From construction until closure

21.14 *Impact Management Outcomes*

They have been discussed in Section 18

21.15 *Impact Management Actions*

They have been discussed in detail in Section 15

21.16 *Summary of Environmental Impact Management and Monitoring Actions*

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
			Construction Phase			
Air Quality	Excavations All infrastructure areas, development footprints and associated activities	Remain within the Air Quality Regulations and Dust Regulations standards	Dust emissions due to erosion of open storage stockpiles and exposed areas when the threshold wind speed is exceeded.	a) Wet suppression, applied sparingly, to ensure the absence of visible dust; b) Wet suppression is about 50% effective on unpaved roads, but chemical binders such as Dustex or Dust-ASide may also be used; c) Enforce low vehicle speeds on unpaved areas (< 40 km/h); d) Use of shade cloth where necessary, to reduce wind speeds and reduce travel distance of dust; e) Vegetate the berm and other surfaces that were laid bare as a result of construction with a locally indigenous grass species where practicable, as soon as possible; and f) Requiring contractors to maintain construction vehicles in good condition	ECO Occupational hygienist	Monthly
	Vehicle movement	Same as above	Emissions from the resuspension of loose material on the road surface. Vehicle-entrained dust emissions from the unpaved haul roads within the proposed Matai Mining Project mining area potentially represent the most significant source of fugitive dust for the mine	Haul road mitigation measures include tarring or paving, wet suppression and chemical surface treatments. Regular, light watering of the road is needed for water spraying to be effective in reducing particulate emissions. Other surface treatments include the use of chemicals such as calcium chloride or magnesium chloride. These chemicals attract moisture – drawing moisture out of the air during periods of high humidity, and also reducing the evaporation rate of water during hot periods. Some products contain surfactants which act as wetting agents. These not only reduce the amount of water required for wetting the roads, but also have slight binding properties. Another approach to dust control involves the application of		

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
				organic or synthetic compounds that physically bind the dust particles together. The disadvantage of paving/tarring, infrequent watering and chemical mitigation measures is their inability to prevent material spillage from being re-entrained		
Ecology	Site clearance for establishment or access roads, infrastructure and pit area		Clearing of vegetation	Avoid sensitive areas and implement buffer zones	ECO	Monthly
			Loss of plant SSC	Limit the footprint area to the pit and infrastructure Avoid areas of remaining indigenous vegetation		
			Displacement of fauna species	Avoid high biodiversity sensitivity areas (natural vegetation, watercourses & wetlands) and comply to prescribed buffer zones		
			Loss of faunal SSC	Avoid areas in which plant species of conservation concern may occur; If some areas cannot be avoided implement rescue of plant species of conservation concern		
Noise Impact	Site clearing	To prevent indiscreet noise levels to surrounding environment	Clearing and stripping of topsoil and vegetation	Earthwork activities to be done during daytime working hours unless there is no heavy-duty machinery which may create a noise problem.	ECO Occupational hygienist	Monthly
			Construction of mine infrastructure	Building activities to be done during daytime working hours unless there is no heavy-duty machinery which may create a noise problem		
Aquatics	Site clearance for establishment of access roads, infrastructure and pit area	To minimise impacts on aquatics	Sedimentation as a result of bare areas of soil	a) Sediment trapping berms Stormwater management plans b) Dry season construction	ECO	Monthly
	Establishment or access roads and crossings structures		Disturbance of watercourse channels and sedimentation	a) Upgrade existing roads and causeways c) Dry season construction		
	Vehicle movement and refuelling	Same as above	Pollution of water resources as result of hydrocarbon spills	a) Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area b) Vehicle maintenance and inspection daily		

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
				c) Spill kits must always be available and ready on-site		
Soil, Land Use and Land Capability	Transport of materials and labour Earthworks	To preserve quality of topsoil until it is needed for closure	Transport of materials and labour with trucks and buses as well as other light vehicles using the existing access roads. This will compact the soil of the existing roads and fuel and oil spills from vehicles may result in soil chemical pollution Earthworks will include clearing of vegetation from the surface, stripping topsoil (soil excavation) and stockpiling as well as drilling and blasting for the initial removal of overburden at the planned open cast pit as well as the construction of infrastructure like the Primary Crushing Facility, water management systems, contractors camp and sewage treatment plants. These activities are the most disruptive to natural soil horizon distribution and will impact on the current soil hydrological properties and functionality of soil. It will also change the current land use as well as land capability in areas where activities occur and infrastructure is constructed	**a) Minimise the footprint of the Matai Mining Project** The existing pre-construction mine layout and design is aiming to minimise the area to be occupied by mine infrastructure (workshops, administration, product stockpile, etc.) to as small as practically possible. All footprint areas should also be clearly defined and demarcated and edge effects beyond these areas clearly defined. This measure will significantly reduce areas to be compacted by heavy construction vehicles and regular activities during the operational phase **b) Management and supervision of construction teams** The activities of construction contractors or employees will be restricted to the planned areas. Instructions must be included in contracts that will restrict construction work and construction workers to the clearly defined limits of the construction site. In addition, compliance to these instructions must be monitored **c) Location of stockpiles** Locate all soil stockpiles in areas where they will not have to be relocated prior to replacement for final rehabilitation. Refrain from locating stockpiles as close as possible to the development for cost saving only to have them relocated later during the life of the operation. The ideal is to place all overburden	ECO	Monthly
	Handling and storage of building material		This will have the potential to result in soil pollution when not managed properly.		ECO	Monthly
	Vegetation clearance		Soil erosion is also anticipated due to vegetation clearance. The impacts of soil erosion are both direct and indirect. The direct impacts are the reduction in soil		ECO	Monthly

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
			quality which results from the loss of the nutrient-rich upper layers of the soil and the reduced water-holding capacity of severely eroded soils. The off-site indirect impacts of soil erosion include the disruption of riparian ecosystems and sedimentation. Soil erosion is a permanent impact for once the resource has been lost from the landscape it cannot be recovered. Although there are off-site indirect impacts associated with this, the impact is mainly considered to be local.	materials removed during construction in their final closure location, or as close as practicable to it **d) Topsoil stripping** Wherever possible, stripping and replacing of soils should be done in a single action. This is both to reduce compaction and also to increase the viability of the seed bank contained in the stripped surface soil horizons. Stripping should be conducted a suitable distance ahead of development of, for example the open pit, at all times to avoid loss and contamination. As a norm, soil stripping should be kept within 3-9 months of development, or between 50-100 metres ahead of the active operations. **e) Stockpiling of topsoil** To minimise compaction associated with stockpile creation, it is recommended that the height of stockpiles be restricted between of 4 – 5 meters maximum. For extra stability and erosion protection, the stockpiles may be benched. The clay content of the topsoil on the largest area of the Matai Mining project area is not sufficient for stockpiles to remain relatively stable without benching. The areas on the Arcadia soil form do have sufficient clay content **f) Prevention of stockpile contamination** Topsoil stockpiles can be contaminated by dumping waste materials next to or on the stockpiles, contamination by dust from blasting and waste rock stockpiles and the dampening for dust control with		

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
				contaminated water are all hazards faced by stockpiles. This should be avoided at all cost and if it occurs, should be cleaned up immediately **g) Terrain stability to minimise erosion potential** Management of the terrain for stability by using the following measures will reduce the risk of erosion significantly: • Using appropriate methods of excavating that are in accordance with regulatory requirements and industrial best practices procedures; • Reducing slope gradients as far as possible along road cuts and disturbed areas to gradients at or below the angle of repose of those disturbed surfaces; and • Using drainage control measures and culverts to manage the natural flow of surface runoff Management of the terrain for stability by using the following measures will reduce the risk of erosion significantly: • Using appropriate methods of excavating that are in accordance with regulatory requirements and industrial best practices procedures; • Reducing slope gradients as far as possible along road cuts and disturbed areas to gradients at or below the angle of repose of those disturbed surfaces; and • Using drainage control measures and culverts to manage the natural flow of surface runoff **h) Management of access and services roads**		

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
				Existing established roads should be used wherever possible. Where possible, roads that will carry heavy-duty traffic should be designed in areas previously disturbed rather than clearing new areas, where possible. The moisture content of access road surface layers must be maintained through routine spraying or the use of an appropriate dust suppressant. Access roads should be designed with a camber to avoid ponding and to encourage drainage to side drains; where necessary, culverts will be installed to permit free drainage of existing water courses. The side drains on the roads can be protected with sediment traps and/or gabions to reduce the erosive velocity of water during storm events and where necessary geo-membrane lining can be used **i) Prevention of soil contamination** During the construction phase, chemical soil pollution should be minimised as follows: • Losses of fuel and lubricants from the oil sumps and steering racks of vehicles and equipment should be contained by using a drip tray with plastic sheeting filled with absorbent material; • Using biodegradable hydraulic fluids, using lined sumps for collection of hydraulic fluids, recovering contaminated soils and treating them off-site, and securely storing dried waste mud by burying it in a purpose-built containment area; • Avoiding waste disposal at the site wherever possible, by segregating, trucking out, and recycling waste; • Containing potentially contaminating fluids and other wastes; and • Cleaning up areas of spillage of potentially contaminating liquids and solids.		
Groundwater	Drilling	To prevent deterioration in ground water quality	Groundwater contamination as a result of drilling of new monitoring boreholes to investigate possible preferred groundwater flow pathways and one or	Monthly monitoring of the boreholes with regard to water levels and water quality	ECO	Monthly

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
			two areas outside preferred pathways, which will: a) Identify geological and hydrogeological control across the proposed mining right area; b) Provide facilities to undertake aquifer testing and water sample collection; and c) Serve as future monitoring points in an initial groundwater monitoring network.			
	Storage of fuels and lubricants and movement of vehicles	Same as above	Spills from improper storage of fuels and lubricants and also from leaking vehicles	a) Monthly monitoring of the boreholes with regard to water levels and water quality b) Place drip trays under vehicles when parked. c) If in-field refuelling is done from a tanker, it should be done in a designated dirty area and a spill kit and clean- up team must be available on site; d) Spillages should be cleaned up immediately and contaminated soil must either be remediated in situ or disposed of at an appropriately licensed landfill site; e) Hydrocarbon storage areas must be in a bunded area and comply with the relevant SANS standards	ECO	Monthly
Surface Water	Exposure of topsoil	To prevent pollution of surface waterbodies	Sedimentation of watercourses due to exposing and loosening of soil as a result of vegetation clearing for the construction of infrastructure and pollution of watercourses due to hydrocarbon and chemical spillages	a) Use wet suppression, chemical stabilization and wind speed reduction methods that should be used to control open dust sources at the construction sites b) Vegetation should only be removed where absolutely necessary;	ECO	Monthly

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
				c) Hydrocarbons should be stored on hardpark bunded facilities to ensure that all spillages are contained; and d) Clean and dirty surface water trenches/channels should be constructed to divert runoff separately to appropriate storage facilities		
	Vegetation removal	Same as above	Altered drainage paths and loss of catchment yield due to the removal of vegetation and construction of diversion berms	Reuse dirty water as much as possible onsite instead of obtaining water from the catchment, or to treat dirty water to acceptable standards and then to discharge to the catchment.		
Traffic	Transportation of materials and labourers	Minimise congestion in access roads and intersections	Construction materials being transported to site will contribute to the addition of traffic on the road network	Road network able to support additional trucks.	ECO	Monthly
			Employees and labourers transported to/ from site	Road network able to support additional commuter trips		
			Dust will increase with increased traffic flow along gravel roads	Ensure that gravel roads are kept watered to prevent dust (other dust suppression measures may also be used).		
Heritage	Site clearance	To prevent destruction of artefacts should they be unearthed.	Site Clearance for construction activities might reveal or expose archaeological artefacts.	a) If any heritage sites are identified, appropriate steps as per the Heritage Resources Act will be undertaken b) Education and training on heritage resources will be given to mine employees	ECO	Monthly
Socio-Economic	Construction activities	To create employment opportunities for the local communities	The residual impacts associated with the creation of employment and business opportunities and training during the construction phase is that the workers can improve their skills by gaining more experience.	a) Establish targets for the employment and training; b) Train workforce for longer term employment; c) Adopt recruitment strategies that ensure local people are given employment preference; d) Effective implementation of training and skills development initiatives;	ECO	Monthly

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
				e) The recruitment process has to be transparent and equitable; f) Maximise and monitor local recruitment; g) Consult local labour recruitment offices; h) Prevent nepotism/corruption in local recruitment structures; i) Promote employment of women and youth; j) Formulate a labour recruitment strategy that would minimise impact on other sectors (e.g. do not recruit unskilled labour at wage levels above the wages paid in the agricultural sector); and k) Establish a liaison point with the adjacent farming community to monitor the impact on their local labour force		
			Multiplier impacts on the local economy	a) Development of a register of local SMMEs; b) Linkages with skills development/ Small, Medium and Micro Enterprises (SMME) development institutions and other mining operations; c) SMME skills development as part of mine SLP/LED commitments d) Create synergies with other mining/electricity enterprises LED/CSR projects e) Preference should be given to capable subcontractors who based within the local municipal area; f) Align skills development to build capacity of SMMEs; g) Monitoring of sub-contractors procurement; h) Development of a register of local SMME; and i) Local procurement targets should be formalised in Matai's procurement policy		
			a) Improved economic development;	a) Ensure that there is stakeholder buy-in; b) Aligning LED projects with those of other development role-players;		

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
			b) Increased capacity to develop and maintain livelihood strategies	c) Liaison with beneficiaries to ensure needs are met; d) Collaboration with other developmental role players (e.g. local and district municipalities, neighbouring mines and NGOs) during implementation of envisaged projects, and where possible aligning envisaged development projects with existing ones; e) Expanding its skills development and capacity building programmes for non-employees f) Monitoring system to regulate Historically Disadvantaged South African procurement g) Where feasible, training should be NQF Accredited; and h) A record of training courses completed per individual should be kept		
			Increase in injuries and possible loss of lives	a) Access control to all project elements, including fencing; b) Personal Protective Equipment for mine workers; c) Notification of blasting schedules; d) Blasting and storage of hazardous materials to adhere to prescribed regulation; e) Measures suggested minimising the impact of flyrock on surrounding roads and structure; f) Measures suggested in the Health Impact Assessment to minimize traffic related accidents; g) Traffic calming measures to prevent speeding (e.g. speed humps); h) Road maintenance; i) Provide safe road crossing points and fencing of the main road and the mine site; and j) Community education to sensitize community members to potential traffic and blasting safety risks		
			Altered sense of place and breakdown of existing social networks	a) Where possible ensure that access to fields and grazing areas are uninterrupted by providing alternative access routes and/or temporary access points during construction activities; b) Matai Mine should ensure that residents are kept informed on a day-to-day basis of construction progress and of when access will be blocked; c) Measures to prevent deterioration of roads;		

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
				d) suggested in Traffic Impact Assessment (e.g. drivers to report road deterioration to the NW Province Department of Transport); e) Regulation of traffic at intersections and access roads to the site; f) Road upgrading measures should be investigated and implemented in conjunction with the relevant government department (e.g. repairing and rehabilitating the main roads and sealing the roadway to increase its capacity for Heavy Moving Vehicles); g) Inform communities of planned construction activities that would affect vehicle/pedestrian traffic; h) Ensure that access to key services are uninterrupted by providing alternative access routes in cases where construction activities restricts or disrupt movement i) Construction of cattle crossings at suitable intervals should be incorporated into project design		
			c) Displaced farm workers; d) Loss of livelihoods	a) Suitable mitigation measures should be defined that protect the farm workers and ensure that they are adequately provided for and supported should they be moved or lose their employment. b) A Resettlement Action Plan and associated Livelihood Restoration Plan may be required. c) Implement surface lease agreements with all community members who have grazing or ploughing land, this will minimise the impact of economic displacement. d) Implement the Grievance Mechanism to ensure ongoing, proactive engagement and effective management of grievances		
			Strain on the existing infrastructure which is already inadequate	a) To limit, as far as reasonably possible, additional pressure on existing infrastructure and services; b) To work in partnership with government, industry, and relevant organisations to enhance the existing infrastructure and services; c) To liaise openly and frequently with affected stakeholders to ensure they have information about the proposed Matai Mining Project; and d) Liaison with district and local municipalities well in e) advance to ensure needs are met		

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
				f) Ensure that municipalities take into account expected population influx g) Promotion of mining methods to allow for surface development h) Influx management i) To make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders		
Waste Management	Construction activities	To practise the 3Rs (Recycle, Reuse and Reduce)	Typical wastes produced during construction activities include unused concrete mix, oils, lubricants, paints, solvents, packaging materials, general domestic waste and offcuts of building materials such as steel, wood, glass and tiles. If stored or discarded on open ground, hydrocarbons will cause soil contamination and possibly groundwater pollution	a) Sort the wastes and store in separate skips or other containers for hydrocarbons, recyclable materials and non- recyclable materials. Recyclable materials should be sorted into wood, steel, glass, plastic, paper and used oil, and stored in separate containers; b) Have recyclable wastes removed by responsible recyclers; and c) Have non-recyclable wastes removed by reputable contractors for disposal at appropriately licensed landfill	ECO	Monthly
Operational Phase						
Air Quality	Drilling and blasting	Monitor emissions concentrations in line with Air Quality Standards and Dust Regulations	Emissions from drilling are a relatively minor component of the overall emission from an open pit mine. The only available emission factor for drilling is a simple uncontrolled TSP emission factor of 0.59kg/hole for overburden (US EPA, 1995). Clearly, other variables such as the depth of the holes, diameter of the holes, and moisture content of the material being drilled would also be relevant and it might be supposed that an emission factor equation should take account of these variables. However, in the absence of other data (and given the relatively minor contribution of this source to overall emissions from mining	a) Efficiency will be applied to reduce wastage and unnecessary fuel consumption; b) Carbon offsets will be considered if required; c) Concurrent best practice rehabilitation and vegetation monitoring will be applied to allow for the restoration of some the carbon sink functionality within the mining right area. d) Avoid blasting under windy conditions as far as practicable	ECO Occupational hygienist	Monthly

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
			operations), it is reasonable to accept the 0.59 kg/hole factor for TSP			
	Processing plant		The moisture content of the material processed can have a substantial effect on emissions	Surface wetness causes fine particles to agglomerate on, or to adhere to, the faces of larger chunks of ore, with a resulting dust suppression effect. However, as new fine particles are created by crushing and attrition, and as the moisture content is reduced by evaporation, this suppressive effect diminishes and may disappear		
	Vehicle movement		Vehicle entrainment from unpaved roads	a) Enforcement of a 40 km/hour speed restriction on unpaved haul roads; b) Wet suppression on haul roads, with the addition of a chemical binder if necessary		
	Crushing and screening		Crushing and screening operations represent significant dust-generating sources if uncontrolled. The large percentage of fines in this dustfall material enhances the potential for it to become airborne. It was assumed that primary crushing (crushing to achieve particles of <300 mm) will take place in the pit to reduce the ore to a transportable size for the conveyor system.	Wet suppression will be used for both the secondary and tertiary crushing stages		
	Materials handling		Materials handling operations which are predicted to result in significant fugitive dust emissions from mining operations include the transfer of material by means of loading and offloading of trucks, loading and offloading conveyors, transfer from one conveyor to another and bulldozing. The quantity of dust which will be generated will depend on various non-climatic parameters such as	a) Reduced tipping and drop heights where practicable; b) Regular clean-up at loading areas and on paved surfaces to prevent entrainment by wind or vehicles; c) Use of shade cloth where necessary, to reduce wind speeds and reduce travel distance of dust;		

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
			the nature (moisture content and silt content) and volume of the material handled.	d) Covering of exposed areas with coarsely crushed rock or aggregate material where practicable; e) Maintaining all vehicles in good condition at all times; and f) Continuous dust and fine particulate monitoring should be implemented to monitor compliance with the NAAQS		
Ecology	Operation of mine and management of access roads	Confine vegetation clearance and faunal disturbance to mine boundary	Alien plant establishment	Implementation of alien invasive plant management plan needs to be continued during operation to prevent the growth of invasive on cleared areas	ECO	Monthly
			Disturbance/Displacement of Faunal species	Minimise footprint area Work only in clearly demarcated areas		
			Disturbance of vegetation communities	Minimise footprint area Work only in clearly demarcated areas		
			Habitat fragmentation	Minimise footprint area Work only in clearly demarcated areas		
			Killing of faunal species	Minimise footprint area Work only in clearly demarcated areas		
Noise	Operation of processing plant	To minimise intrusive noise levels at al sensitive receptors	Noise increase at the boundary of the mine footprint and at the abutting residential	a) All noise sources exceeding 85.0dBA to be identified and if practical to be acoustically screened off. b) Noise survey to be done on a quarterly basis and after one year to change to an annual basis if the prevailing ambient noise levels at the boundaries of the plant have not changed.	ECO Occupational hygienist	Monthly
	Pit activities					
	Hauling of waste rock to the waste dump					
	Hauling of material to the plant					
	Additional traffic			Speed limit of mining areas to be adhered to at all times		
	Operation of an emergency generator			Noise readings to be done in the vicinity of and along the emergency boundaries to ensure that the prevailing ambient noise level is not exceeded.		
Aquatics			Vehicular movement and sedimentation	a) Sediment trapping berms	ECO	Monthly

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
	Operation of mine and management of access roads	Prevent contamination of water bodies		b) Stormwater management plans		
			Pollution of water resources as a result of mine waste	a) Implement Integrated Waste Water Management Plan b) Aquatic biomonitoring		
			Pollution of water resources as result of hydrocarbon spills	a) Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area b) Vehicle maintenance and inspection daily c) Spill kits must always be available and ready on-site		
Soil, land use and land capability	Open pits and mine infrastructure	To protect soil from contamination; and To preserve as much of the fertility of the topsoil as possible;	Open pits and surface infrastructure will both lead to surface impacts on soil resources. Surface infrastructure like buildings, haul roads, waste rock dumps and product stockpiles are by far the most disruptive to current land uses, land capability as well as agricultural potential of the soil. Soil underneath buildings and stockpiles are subject to compaction and sterilization of the topsoil	**Management of potential soil contamination during the operational phase** The following management measures will either prevent or significantly reduce the impact of soil chemical pollution on site during the operation phase: a) Stockpiles are managed so they do not become contaminated and then need additional handling or disposal; b) A low process or storage inventory must be held to reduce the potential volume of material that could be accidentally released or spilled; c) Processing areas should be contained and systems designed to effectively manage and dispose of contained storm water, effluent and solids; d) Storage tanks of fuels, oils or other chemicals stored are above ground, preferably with inspectable bottoms, or with bases designed to minimise corrosion.	ECO	Monthly
	Spills of fuel and lubricants		Soil chemical pollution as a result of spills of fuel and lubricants by vehicles and machinery as wells as the accumulation of domestic waste, is considered to be a moderate deterioration of the soil resource. This impact will be localised within the site boundary and have medium-high significance on the soil resource. Vanadium and titanium are unlikely to cause toxic effects for soil microbes or plants due to dust from or soil stockpiles			

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
	Vehicle movement		Soil compaction will be a measurable deterioration that will occur as a result of the weight of the topsoil and overburden stockpiles stored on the soil surface as well as the movement of vehicles on the soil surfaces (including access and haul roads). This is a permanent impact that will be localised within the site boundary with medium-low consequence and significance in the mitigated scenario.	Above-ground (rather than in-ground) piping systems should be provided. Containment bunds should be sealed to prevent spills contaminating the soil and groundwater; e) Equipment, and vehicle maintenance and washdown areas, are contained and appropriate means provided for treating and disposing of liquids and solids f) Air pollution control systems avoid release of fines to the ground (such as dust from dust collectors or slurry from scrubbing systems); g) Solids and slurries are disposed of in a manner consistent with the nature of the material and avoids contamination; and h) Effluent and processing drainage systems avoid leakage to ground.		
	Vegetation clearance		During the operational phase, topsoil stockpiles as well as roads running down slopes will still be susceptible to erosion. Soil surfaces with infrastructure such as concrete slabs and buildings will not be exposed to erosion any longer. This is a permanent impact that will be localized within the site boundary with medium-high consequence and significance. With proper mitigation measures and the embedded controls as recommended in the Soil Management Plan, it is anticipated that the significance of this impact will be reduced to low			
Groundwater	Mine dewatering	Prevent groundwater contamination and reduction of groundwater levels	Opencast mining of will result in groundwater inflows into the pits, which needs to be pumped out for mine safety. The expected inflow into the pit is 730 m^3/d when mining floor will reach 20 mbgl. It will stabilise to 1150 m^3/d when mining floor will reach 90 mbgl	a) Store the dewatered water in PCDs and ensure that the dams will have enough storage volume; b) If that is not possible, re-introduce treated water into the streams after ensuring that they meet the required standards as per the WUL or river quality objectives; c) Supply equal volumes and better-quality water to affected user if proven that there is an impact on specific users;	ECO	Monthly

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
				d) Monitoring of groundwater water levels and groundwater inflow rates; and e) Update numerical model annually		
	Mine water runoff		Any contamination that will seep from the WRDs is expected to move eastern direction toward the north-north-east down-gradient of the waste dump. The toe of the plume estimated to extend 700 m away from waste dump, 20 years after contamination commences	a) Implement compacted clay or synthetic liner underneath the WRDs to minimizes seepage following the waste classification result; b) Re-use water collected in the WRDs berms. Any excess should be treated to acceptable quality before it is discharged to the environment; c) Monthly and quarterly monitoring of the surface water and groundwater respectively		
Surface water	Mining activities	Prevent contamination of surface water bodies	Pollution of surrounding watercourses as a result of activities during the operational phase (spills, overflows and contaminated runoff)	a) There are no mitigation measures for a loss of contained water to the catchment yield as long as the mine is there however, b) Reuse dirty water as much as possible onsite instead of obtaining water from the catchment, or to treat dirty water to acceptable standards and then to discharge to the catchment. - Sustainable mine water management needs to be implemented	ECO	Monthly
Traffic	Transportation of staff	Ensure worker safety and compliant with road safety signages	Haulage to/ from site; and mine staff to/from site	Road network able to support additional trucks.	ECO	Monthly
	Dust from vehicle movement		Dust will increase with increased traffic flow along gravel roads	Ensure that gravel roads are kept watered to prevent dust (other dust suppression measures may also be used).		
	Noise from vehicle movement		Noise levels affecting sensitive areas including residential areas	Speed limits to be kept low and define routes away from residential areas.		
Heritage Impact Assessment	Opening of box-cut	Report any suspicion of unmarked graves or artefacts to SAHRA and Provincial Heritage Resource Agency	Opening of the box-cut might expose or reveal archaeological artefacts	a) If any heritage sites are identified, appropriate steps as per the Heritage Resources Act will be undertaken	ECO	Monthly

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
				b) Education and training on heritage resources will be given to mine employees		
Socio-Economic		To implement the conditions of the SLP	The impact may be reversible over time as workers and job-seekers leave the area, consequences such as HIV/AIDS and unwanted pregnancies will be permanent	a) Limit, as far as reasonably possible, social ills caused by influx of workers and job-seekers; b) Liaise openly and frequently with affected stakeholders to ensure they have information about the Project; c) Extensive HIV/AIDS awareness and general health campaign. It should be noted that Matai Mine has no control over activities related to workers' behaviour, however It is recommended that HIV/AIDS campaigns are conducted within the affected area; d) Discourage influx of job-seekers by prioritising employment of unemployed members of local communities; e) Liaise with Moses Kotane Local Municipality, and Traditional Authority to ensure that expected population influx is taken into account in infrastructure development and spatial development planning; f) Create synergies with local government IDP and other companies' SLP/CSR projects to promote infrastructure development; g) Clear identification of workers –prevention of loitering; h) Liaison with police or establish/ support community policing forum; i) Promote projects providing housing, especially low cost housing, to link with the proposed Matai MVT mine; j) Community education; and k) Implement measures to address potential conflict between locals and non-locals	ECO	Monthly
			The increase in nuisance factors and associated changed sense of place will be negative, and direct as a result of Project activities, and indirect as a result of migrant job-seekers	a) Minimise all nuisance factors such as noise, air quality, traffic, and visual-Implement all mitigation measures as specified in the relevant specialist studies; b) Make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders; c) Liaise openly and frequently with affected stakeholders to ensure they have		

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
				information about activities that will generate nuisance factors		
			Strain on the existing infrastructure which is already inadequate.	a) To limit, as far as reasonably possible, additional pressure on existing infrastructure and services; b) To work in partnership with government, industry, and relevant organisations to enhance the existing infrastructure and services; c) To liaise openly and frequently with affected stakeholders to ensure they have information about the proposed Matai Mining Project; and d) To make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders		
			Loss of grazing land	a) Ensure that the project design and associated layout seeks to minimise the project footprint, thus minimising the loss of agricultural land; engage with each directly affected landowner with the intention to acquire only the required servitude area; b) Should Matai MVT Mine acquire the full farm and the project footprint only affects a portion of the land, the surrounding usable land should be utilised for agricultural purposes – potentially as part of a lease agreement; c) Where damage is incurred, suitable compensation must be negotiated with the affected farmer; Prepare a site Rehabilitation Plan that will be implemented as part of the decommissioning phase		
			Altered sense of place and breakdown of existing social networks	a) Where possible ensure that access to fields and grazing areas are uninterrupted by providing alternative access routes and/or temporary access points during construction activities; b) Matai should ensure that residents are kept informed on a day-to-day basis of construction progress and of when access will be blocked		
			a) Developed local economy; b) Increased capacity to develop and maintain livelihood strategies	Maximise benefits from local employment, skills and economic development		

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
			Increase in injuries and possible loss of lives	a) Access control to all project elements, including fencing; b) Personal Protective Equipment for mine workers; c) Notification of blasting schedules; d) Blasting and storage of hazardous materials to adhere to prescribed regulation; e) Measures suggested minimising the impact of flyrock on surrounding roads and structure; f) Measures suggested in the Health Impact Assessment to minimize traffic related accidents; g) Traffic calming measures to prevent speeding (e.g. speed humps); h) Road maintenance; i) Provide safe road crossing points and fencing of the main road and the mine site; and j) Community education to sensitize community members to potential traffic and blasting safety risks		
Waste management	Mining operations	To prevent contamination of soil and water resources by acid, salts or metals and to practises 3Rs of waste management	In terms of the National Environmental Management Amendment Act 2014, mining residues are classified as wastes and must be managed as prescribed by the National Environmental Management: Waste Act of 2008 and its Regulations GN R.632 and R.633	a) Manage waste in accordance with Regulations GN R.634 – 636, i.e. provide PCD with HDPE liner, WRDs and b) TSF with Class D liners and heap leach pads with at least class B liners; c) Undertake regular inspection and maintenance of waste management facilities; d) Monitor groundwater and surface water quality down-gradient of waste management facilities; and e) Take such corrective action as may be required.	ECO	Weekly
Decommissioning and Rehabilitation Phase						
Air quality	Demolition of infrastructure and backfilling of pit	To remain within national standards at site perimeter and at sensitive receptors	Particulate mobilisation can be caused by the demolition of buildings and handling of the rubble, backfilling of the storm water dam and "dirty" water collection	a) Wet suppression during landscaping and materials handling activities; b) Enforcement of low vehicle speeds on unpaved areas (< 40 km/h);	ECO	Weekly

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
			channels and ripping and shaping of compacted areas	c) Use of shade-cloth where necessary, to reduce wind speeds and reduce travel distance of dust; d) Vegetation of bare surfaces with a locally indigenous grass species as soon as possible; e) Continue dust fall monitoring until vegetation cover is well established; and f) Requiring contractors to maintain construction vehicles in good condition		
Ecology	Shaping of landscape	To establish a self-sustaining diversity of local indigenous vegetation	Loss of species of conservation concern	All infrastructure that could have a negative impact on faunal species (powerlines etc) needs to be decommissioned and removed	ECO	Monthly
	Revegetation of landscape		Impact on the growth and health of both fauna and flora	Implement rehabilitation strategy and rehabilitation interventions		
	Monitoring of plant species establishment		Establishment of vegetation	Implement rehabilitation monitoring plan and remedy actions		
			Habitat reconstruction	Implement rehabilitation monitoring plan and remedy actions		
			Habitat stabilisation	Implement rehabilitation monitoring plan and remedy actions		
Noise	Backfill of disturbed areas	To avoid intrusive noise levels at sensitive receptors	Noise increase at the boundary of the mine footprint and at the abutting residential	Building activities to be done during daytime working hours unless there is no heavy-duty machinery which may create a noise problem.	ECO Occupational Hygienist	Monthly
	Planting of grass and vegetation at rehabilitated area			Building activities to be done during daytime working hours unless there is no heavy-duty machinery which may create a noise problem.		
	Maintenance of disturbed area			Maintenance activities to be done during daytime working hours.		
Aquatics	Shaping of landscapes	Prevent contamination of water bodies	Sedimentation as a result of bare areas of soil	a) Sediment trapping berms b) Stormwater management plans c) Dry season working d) Aquatic biomonitoring	ECO	Monthly

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
	Vehicular and machinery movement		Pollution of water resources as result of hydrocarbon spills	a) Service all vehicles and machinery Refuel in hard-park/bunded area Store hydrocarbons safely in bunded area b) Vehicle maintenance and inspection daily c) Spill kits must always be available and ready on-site		
Soil, land use and land capability	Traffic movement	Restore land to its pre-mining state	Transport of materials away from site. This will compact the soil of the existing roads and fuel and oil spills from vehicles may result in soil chemical pollution	**a) Management and supervision of decommissioning teams** The activities of decommissioning contractors or employees will be restricted to the planned areas. Instructions must be included in contracts that will restrict decommissioning workers to the areas demarcated for decommissioning. In addition, compliance to these instructions must be monitored. **b) Infrastructure removal** All buildings, structures and foundations not part of the post-closure land use plan must be demolished and removed from site **c) Site preparation** Once the site has been cleared of infrastructure and potential contamination, the slope must be re-graded (sloped) in order to approximate the pre-project aspect and contours. The previous infrastructure footprint area must be ripped a number of times in order to reduce soil compaction. The area must then be covered with topsoil material from the stockpiles **d) Seeding and re-vegetation**	ECO	Monthly
	Earthworks		Earthworks will include redistribution of inert waste materials to fill the open pits as well as topsoil to add to the soil surface. These activities will not result in further impacts on land use and land capability but may increase soil compaction			
	Handling and storage of materials		Other activities in this phase that will impact on soil are the handling and storage of materials and different kinds of waste generated as well as accidental spills and leaks with decommissioning and rehabilitation activities. This will have the potential to result in soil pollution when not managed properly			
	Revegetation		With the decommissioning phase, soil surfaces are in the process of being replanted with indigenous vegetation and until vegetation cover has established successfully, all surfaces are still susceptible to potential soil erosion			

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
				Once the land has been prepared, seeding and re-vegetation will contribute to establishing a vegetative cover on disturbed soil as a means to control erosion and to restore disturbed areas to beneficial uses as quickly as possible. The vegetative cover reduces erosion potential, slows down runoff velocities, physically binds soil with roots and reduces water loss through evapotranspiration. Indigenous species will be used for the re-vegetation, the exact species will be chosen based on research available and then experience as the further areas are re-vegetated **e) Prevention of soil contamination** During the decommissioning phase, chemical soil pollution should be minimised as follows: Losses of fuel and lubricants from the oil sumps of vehicles and equipment should be contained using a drip tray with plastic sheeting and filled with absorbent material; o Using biodegradable hydraulic fluids, using lined sumps for collection of hydraulic fluids and recovering contaminated soils and treating them off-site; o Avoiding waste disposal at the site wherever possible, by segregating, trucking out, and recycling waste; o Containing potentially contaminating fluids and other wastes; and o Cleaning up areas of spillage of potentially contaminating liquids and solids.		
Groundwater	Decanting	Prevent contamination of water bodies	After mine closure and ceasing of dewatering, pit is likely to decant. Once the mine starts to decant, it is not expected to stop naturally. Pollution from	a) Identify decant areas and raise topography to increase time to decant; b) Plan open cast mining so that the perimeters follow the surface contours along the lowest	ECO	Monthly

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
			WRDs on groundwater quality will continue in perpetuity, even after mine closure. Seepage and decant is expected to have a serious impact and require management and rehabilitation measures to prevent irreplaceable impacts. If the pH is acidic, dissolved metals and sulphates will remain is solution	side of the pit and not cut directly across streams; c) Monitoring groundwater levels, decant rates and qualities; d) Revegetated WRD as quickly as possible to minimize recharge rates; e) Divert all clean runoff away from, the pit through a series of berms; f) Re-evaluate impact of decant after end of life, once monitoring information is available; and g) Treat seepage and decanted water using passive or active means to meet the recommended standards.		
Surface water	Mine rehabilitation	Prevent contamination of water bodies	Pollution of surrounding watercourses as a result of activities during the decommissioning phase	a) The perimeter stormwater management measures should remain in place and should only be removed once rehabilitation of other activities has been completed. This will capture most of the sediment produced from rehabilitation activities and any spills from removal of hydrocarbon and chemical storage; b) Credible contractors should be used for the cessation of the mining and decommissioning of all infrastructure.	ECO	Monthly
	Post closure		Rehabilitation of the site post mining will result in a positive impact on surface water quantity when completed.	Rehabilitation will result in a positive improvement as surface water drainage patterns will be restored to a state similar to pre-mining which is likely to result in an improvement in catchment yield after land profiling and cover having been restored		
Traffic Impact	Removal of rubble and other materials from site	To avoid adding to frustration of other road users or compromising road safety	Added traffic on the road network	Road network able to support additional trucks.	ECO	Monthly

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
Heritage	Ripping and shaping of compacted areas	Report any suspicion of unmarked graves or artefacts to SAHRA and Provincial Heritage Resource Agency	Ripping and shaping all compacted areas to be free draining, followed by re-vegetation might expose human remains or archaeological artefacts	a) If any heritage sites are identified, appropriate steps as per the Heritage Resources Act will be undertaken b) Education and training on heritage resources will be given to mine employees	ECO	Monthly
Socio-Economic	Mine closure	To implement the conditions of the SLP	The impact may be reversible over time as workers and job-seekers leave the area, consequences such crime and other social pathologies will be permanent	a) Effect retrenchments according to procedures stipulated in approved SLP; b) The Mine's SLP should provide strategies and measures that prevent job loss; c) Support economic diversification through development of alternative markets; d) Develop a Mine Closure Plan; e) Proactively and effectively implement mine closure plan; f) Collaborate with adjacent mining companies to develop and implement sustainable community; g) Develop alternative and sustainable livelihoods; h) Alternatives to save jobs/avoid downscaling should be investigated beforehand; i) Proactively assess and manage the social and economic impacts on individuals, regions and economies where retrenchment and/or closure of the mine are certain; and j) Partner with the relevant government departments, to jointly manage Closure process	ECO	Monthly
Waste management	Mine closure	To prevent contamination of soil and water resources by acid, salts or metals and to practises 3Rs of waste management	Wastes expected to result from the decommissioning and rehabilitation activities include scrap metals, building rubble, oils, lubricants, paints, solvents,	a) Identify areas of possible soil contamination, sample such areas, analyse and determine degree of soil contamination. Remove and dispose of soil	ECO	Weekly

Environmental Aspect	Activity	Objective	Potential Impacts	Mitigation Measures	Responsible Person	Monitoring Frequency
			contaminated soils, PCD dam silt and liners, tailings dam, waste rock dumps and potentially recyclable materials such as steel, wood, plastics, glass and tiles. If stored or discarded on open ground, hydrocarbons will cause soil contamination and possibly groundwater pollution, an impact rated as	with contamination levels exceeding then prevailing standards/guidelines; b) Remove silt, synthetic liners and contaminated non-synthetic liner materials from PCD and dispose at appropriately licenced landfill. Liner materials and building rubble with contamination levels below prevailing standards/guidelines may be backfilled into the last portion of the opencast void; c) Sort the remaining wastes and store in separate skips or other containers for hydrocarbons, recyclable materials and non-recyclable materials. Recyclable materials should be sorted into wood, steel, glass, plastic, paper and used oil, and stored in separate containers; d) Have recyclable wastes removed by responsible recyclers; and e) Have non-recyclable wastes removed by reputable contractors for disposal at appropriately licensed landfills		

22 FINANCIAL PROVISION

22.1 *Closure Objectives.*

Closure objectives identified in this report include:

a) Topography
   - To ensure that the final elevation will result in the continuation of the pre-mining surface drainage pattern, albeit that topographical changes on site, such as the mine residue facility, will be altered permanently.

b) Soil, Land Capability and Land Use
   - To ensure that soil types are replaced in correct sequence, subsoil followed by topsoil, and at appropriate depths.
   - To ensure post-mining land capability is at least similar to pre-mining which is grazing and some arable lands.
   - To ensure that the land capability is self-sustaining.
   - To ensure that pre-mining land uses can continue.

c) Surface Water
   - To ensure that no dirty water from the site enters the surrounding surface water systems.
   - To maintain flow in downstream rivers to prevent deterioration of downstream ecological status.

d) Groundwater
   - To ensure that possible plumes originating from the mining areas do not impact significantly on the surface water features or surrounding users' boreholes.
   - To ensure that groundwater users that are impacted have alternative sustainable water sources of the similar quality and quantity.

e) Flora and Fauna

- To ensure that vegetation growth and cover on the rehabilitated areas is sustainable.
- To ensure that alien invasive growth is eradicated until the closure certificate is granted.
- To encourage surrounding animals to return into the rehabilitated areas to maintain the surrounding biodiversity.

f) Aquatic Ecosystems

- To ensure that aquatic ecosystems are maintained as close as possible to that of the pre-mining environment.

g) Wetlands

- To minimise the disturbance on wetlands.
- To ensure that the adjacent wetland conditions are similar to that of the pre-mining Present Ecological State.

22.2 *Confirm Specifically That The Environmental Objectives In Relation To Closure Have Been Consulted With Landowner And Interested And Affected Parties.*

Closure objectives will be presented in the draft EIA/EMP phase meeting. All registered I&APs and landowners will be invited to attend. Furthermore, the draft EIA/EMPr will be made available to I&APs and landowners for a 30-day review period.

22.3 *Calculate And State The Quantum Of The Financial Provision Required To Manage And Rehabilitate The Environment In Accordance With The Applicable Guideline.*

As per NEMA financial provision regulations, itemised costs must be provided within the financial provision. The financial provision was assessed using the DMR's rules based assessment.

Table 50: Quantum Calculation

CALCULATION OF THE QUANTUM							
Applicant:	**Matai Mining (Pty) Ltd**				**Ref No.:**		
Evaluators:	**Kimopax (Pty) Ltd**				**Date:**	**Aug-18**	
No.	**Description**	**Unit**	**A** Quantity	**B** Master Rate	**C** Multiplication factor	**D** Weighting factor 1	**E=A*B*C*D** Amount (Rands)
1	Dismantling of processing plant and related structures (including overland conveyors and powerlines)	m3	600	14,05	1	1	8430
2 (A)	Demolition of steel buildings and structures	m2	5000	195,76	1	1	978800
2(B)	Demolition of reinforced concrete buildings and structures	m2	2000	288,49	1	1	576980
3	Rehabilitation of access roads	m2	1000	35,03	1	1	35030
4 (A)	Demolition and rehabilitation of electrified railway lines	m	0	340,01	1	1	0
4 (A)	Demolition and rehabilitation of non-electrified railway lines	m	0	185,46	1	1	0
5	Demolition of housing and/or administration facilities	m2	1000	391,53	1	1	391530
6	Opencast rehabilitation including final voids and ramps	ha	10	205242,16	1	1	2052421,6
7	Sealing of shafts edits and inclines	m3	0	105,09	1	1	0
8 (A)	Rehabilitation of overburden and spoils	ha	70	136828,1	1	1	9577967
8 (B)	Rehabilitation of processing waste deposits and evaporation ponds (non-polluting potential)	ha	0,5	170416,93	1	1	85208,465
8 (C)	Rehabilitation of processing waste deposits and evaporation ponds (polluting potential)	ha	0	494971,55	1	1	0
9	Rehabilitation of subsided areas	ha	0	114572,93	1	1	0
10	General surface rehabilitation	ha	70	108390,94	1	1	7587365,8
11	River diversions	ha	0	108390,94	1	1	0
12	Fencing	m	0	123,64	1	1	0
13	Water management	ha	1	41213,28	1	1	41213,28
14	2 to 3 years of maintenance and aftercare	ha	70	14424,65	1	1	1009725,5
15 (A)	Specialist study	Sum				1	0

15 (B)	Specialist study	Sum	1	80000	1	1	80000
					Sub Total 1		22424671,65
1	Preliminary and General		2690960,597		**weighting factor 2** 1,05		2825508,627
2	Contingencies		2242467,165				2242467,165
					Subtotal 2		27492647,44
					VAT (15%)		4123897,12
					Grand Total		**R 31 616 544,55**

22.4 *Confirm That The Financial Provision Will Be Provided As Determined.*

Financial Provision, to the amount of R31,616,544.55 be made by way of a guarantee acceptable to the DMR, as per the Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations.

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

23.1 *Monitoring of Impact Management Actions*

Refer to Section 21.16

23.2 *Monitoring and reporting frequency*

Refer to Section 21.16**Error! Reference source not found.**

23.3 *Responsible persons*

Refer to Section 21.16

23.4 *Time period for implementing impact management actions*

Refer to Section 21.15

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23.5 *Indicate The Frequency Of The Submission Of The Performance Assessment Report.*

The Environmental Performance Report will be submitted to the DMR after every 2 years

24 ENVIRONMENTAL AWARENESS PLAN

24.1 *Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work.*

24.1.1 Training Needs

A training needs analysis is to be performed through all levels of the organization including those within the administration, plant and mining worker sectors. Each of the categories / levels of the organization have different responsibilities and roles, accordingly, different knowledge requirements are applicable. A training needs analysis is to be performed through all levels of the organization including those within the administration, plant and mining worker sectors. Each of the categories / levels of the organization have different responsibilities and roles, accordingly, different knowledge requirements are applicable.

24.1.2 General Awareness Training

The Human Resources Development (HRD) Manager, together with the SHE 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 Matai personnel and contractors with regard to the environmental requirements and a review of the emergency procedures and corrective actions; and

A Training Practitioner or the Environmental Officer (EO) 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.

24.2 Manner In Which Risks Will Be Dealt With In Order To Avoid Pollution Or The Degradation Of The Environment.

Training will address the specific measures and actions as listed in the EIA and EMP. In this way each staff member will be provided the knowledge required for their job to firstly prevent impact and secondly identify if an impact is likely to occur and then to report the possibility of risk or impact immediately so as to ensure immediate response.

The following is a list of the most likely potential environmental emergencies, followed by basic summary of procedures (mine will develop detailed SOPs, which will incorporate detailed requirements under the MPRDA Regulations, for emergency events:

a) Fires
b) Chemical/hydrocarbon spill or leak
c) Explosions

In the case of environmental emergencies, the remedial measures and actions as listed in the Emergency Response Plan should be followed, in addition the relevant authorities should be contacted

24.2.1 Fire

Veld fires and fires resulting from other sources must be handled with extreme caution. Fire extinguishers should be placed around the mine at accessible locations and needs to be frequently inspected and maintained in working condition. The following procedures apply in the event of a fire:

a) An alarm should be activated to alert all employees and contractors.
b) Identify the type of fire and the appropriate extinguishing material. For example, water for a grass fire, and mono ammonium phosphate-based fire extinguisher for chemical and electrical fires.
c) In the event of a small fire the fire extinguishers placed around the mine should be used to contain and extinguish the fire.
d) In the event of a large fire, the fire department will be notified.
e) All staff will receive training in response to a fire emergency on site, including evacuation procedures.

f) A Fire Association should be set up with the mine and surrounding land owners to facilitate communication during fire events and assist in fighting fires, where necessary. If such an association exists, then the mine will join such an association.
g) If possible, all surrounding drains, such as storm water drains need to be covered and or protected to prevent any contaminated water from entering the drains.
h) In case of a chemical or petroleum fire, run-off from the area should be contained as far as possible using the most appropriate measures e.g. spill absorbent cushions, sand or a physical barrier.
i) Contaminated run-off must be diverted into an oil sump or cleaned up.

24.2.2 Hydrocarbon/Chemical Spill

Hydrocarbons such as diesel, petrol, and oil which are used as fuel for mine machinery will be kept on site; therefore, there is the possibility that spillage may occur. As this is a coal mine there is also the possibility of a coal spillage occurring. Further, any chemicals contained on site, such as those associated with explosives may also be detrimental to the environment if spills occur. In the event of a spillage, procedures must be put into place to ensure that there are minimal impacts to the surrounding environment. The following procedure applies to a hydrocarbon/chemical spill:

a) The incident must be reported to the Environmental coordinator immediately.
b) The Environmental Coordinator will assess the situation from the information provided and set up an investigation team. Included in this team could be the Mine Manager, Chief Safety Officer, the employee who reported the incident and any individual responsible for the incident.
c) When investigating the incident, priority must be given to safety.
d) Once the situation has been assessed, the Environmental Coordinator must report back to the Mine Manager.
e) The Mine Manager and the investigation team must make a decision on what measures can be taken to limit the damage caused by the incident, and if possible any remediation measures that can be taken.
f) In the event of a small spillage, the soil should be treated in situ, using Hazmat clean up kits and bioremediation.

g) Every precaution should be taken to prevent the spill from entering the surface water environment.
h) In the event of a large spillage, adequate emergency equipment for spill containment or collection, such as additional supplies of booms and absorbent materials, will be made available and if required, a specialised clean-up crew will be called in to decontaminate the area. The soil should be removed and treated at a special soil rehabilitation facility.
i) Reasonable measures must be taken to stop the spread of spills and secure the area to limit access.
j) Dispatch necessary services.

24.2.3 Explosion

Other than explosion incidents related to mining, explosions can occur in the workshop areas when working with gas cylinders and chemicals. These could result in large numbers of employees being injured and requiring medical assistance. The procedure to be followed is:

a) Safe evacuation routes should be devised in the event of an uncontrolled explosion and all staff trained on relevant evacuation routes and assembly points.
b) Once safe to do so first responders may provide first aid to injured parties.
c) All relevant emergency response units must be notified, and hospitals informed of incoming patients.

DMR to be notified of the incident.

25 IMPLEMENTATION PLAN

It is recommended that the EMP be implemented and monitored through regular audits conducted by an independent environmental practitioner. It is suggested that the audits be conducted annually, starting from the commencement of the mining operations up to rehabilitation phase. The audit reports must be submitted to the competent authority.

25.1 *Responsibility for Matai*

Matai remains ultimately accountable for the site and remains liable for any environmental damage caused by activities undertaken on the site. It is from this point of view that Matai sets out a range of requirements in terms of the management of the environmental aspects for the site, to which Contractors must adhere as a prerequisite to their appointment.

It is the responsibility of Matai to ensure that the principles of integrated environmental management, in terms of the requirements of Chapter 5 of NEMA, are implemented and maintained on the site and that environmentally sustainable practices are undertaken on the site. Matai has to ensure that an approved EMPr and the conditions of the Environmental Authorisation (EA) be supplied to the Contractor for the activities undertaken on the site and also monitor the Contractor's compliance to the requirements set out in the EMPr and EA and take disciplinary action for non-compliance.

26 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) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed; ☐

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