NOZALA COAL (PTY) LTD

PROPOSED GRUISFONTEIN PROJECT

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT
SEPTEMBER 2019

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mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED GRUISFONTEIN PROJECT

FOR LISTED ACTIVITIES ASSOCIATED WITH A MINING RIGHT APPLICATION

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: Nozala Coal (Pty) Ltd

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FILE REFERENCE NUMBER SAMRAD: LP30/5/1/2/2/10170MR

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 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 (EAP) 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.

OBJECTIVES 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, biophysical, biological, social, economic, heritage and cultural aspects of the environment;
(d) determine the -
    a. nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
    b. degree to which these impacts -
        i. can be reversed;
        ii. may cause irreplaceable loss of resources; and
        iii. 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.

In terms of the NEMA 2014 EIA Regulations contained in GN R982 of 04 December 2014 (as amended in 2017) the Environmental Impact Assessment Report (EIAR) must comply with Appendix 3 of the NEMA 2014 EIA Regulations.

Legal Requirement		**Relevant Section in EIAR**
(1)	An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include-	
(a)	Details of- (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae;	Section 1.2.2 Appendix 2
(b)	the location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including (i) the 21-digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in terms(i) and (ii) and is not available the coordinated of the boundary of the property or properties;	Section 1.3 Section 1.4
(c)	a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or if it is- (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; (ii) on the land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Figure 4 Appendix 19
(d)	a description of the scope of the proposed activity, including- (i) all listed and specified activities triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development;	Section 2
(e)	a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	Section 3
(f)	a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context to the preferred location development footprint within the approved site as contemplated in the accepted scoping report;	Section 4
(g)	a motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;	Section 5.1 Section 5.6
(h)	a full description of the process followed to reach the proposed development footprint within the approval site as contemplated in the accepted scoping report including; (i) details of the development footprint alternatives considered; (ii) details of the public participation process undertaken in terms of regulation 41 of the regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reason for including them; (iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (v) the impacts and risks identified including the nature, significance; including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed;	 Section 5 Section 8 Appendix 1 Section 8.2 Table 58 Section 6 Section 7.2 Table 42

Legal Requirement		Relevant Section in EIAR
	(bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks; (vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (viii) the possible mitigation measures that could be applied and level of residual risk; (ix) if no alternative development (locations) footprints for the activity were investigated, the motivation for not considering such; and (x) a concluding statement indicating the location of the preferred alternative development (location) footprint within the approved site as contemplated in the accepted scoping report;	Section 7.1 Section 7.2 Table 42 Section 7.3 Section 5.1 Section 5.1 Section 5.6
(i)	a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred (location) development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including— (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	Section 7.3 Table 43
(j)	an assessment of each identified potentially significant impact and risk, including— (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated;	Section 7.4
(k)	where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	Section 7.5
(l)	an environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment: (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred (site) development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Section 7.3 Table 43
(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed (impact management objectives, and the) impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	Section 9.1 Section 9.2

Legal Requirement		Relevant Section in EIAR
(n)	the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Section 5.7
(o)	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Section 9.2
(p)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 7.6
(q)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	TBC
(r)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	N/A
(s)	an undertaking under oath or affirmation by the EAP in relation to- (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	Section 10.6
(t)	where applicable, details of any financial provision or the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	Section 10.4
(u)	an indication of any deviation from the approved scoping report, including the plan of study, including– (i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation;	N/A
(v)	any specific information that may be required by the competent authority; and	Section 10
(w)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	Section 10

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GLOSSARY OF TERMS

Term / Abbreviation	Meaning
AIP	Alien and Invasive Plant
ARD	Acid Rock Drainage
AQA	National Environmental Management: Air Quality Act 39 of 2004, as amended
BID	Background Information Document
Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate
CA	Competent Authority
CARA	Conservation of Agricultural Resources Act 43 of 1983
CBA	Critical Biodiversity Area
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CRR	Comments and Response Report
DAFF	Department of Agriculture, Forestry and Fisheries
dBA	Decibels
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DM	District Municipality
DMR	Department of Mineral Resources
DRDLR	Limpopo Department of Rural Development and Land Reform
DRT	Department of Roads and Transport
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
EDD	Expanded Durov Diagram
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMPr	Environmental Management Programme
ESA	Ecological Support Area
GDP	Gross Domestic Product
GPS	Global Positioning system
HIA	Heritage Impact Assessment

Term / Abbreviation	Meaning
IAPs	Interested and Affected Parties
IBA	Important Bird and Biodiversity Area
IDPs	Integrated Development Plans
IUCN	International Union for Conservation of Nature and Natural Resources
IWUL	Integrated Water Use Licence
IWWMP	Integrated Water and Waste Management Plan
LCC	Land Claims Commissioner
LDP	Limpopo Development Plan
LED	Local Economic Development
LEDET	Limpopo Department of Economic Development, Environment and Tourism
LEMA	Limpopo Environmental Management Act 7 of 2003
LIHRA	Limpopo Heritage Resources Agency
LM	Local Municipality
LOM	Life of Mine
LSU	Large Stock Unit
Mamsl	Meters above mean sea level
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Run-off
mbs	Meters below surface
MCWAP	Mokolo and Crocodile (West) Water Augmentation Project
MPRDA	Mineral and Petroleum Resources Development Act 28 of 2002, as amended
MRA	Mining Right Application
MSA	Middle Stone Age
Mtpa	Million Tonnes Per Annum
MWP	Mining Work Programme
NBA	National Biodiversity Assessment, 2011
NDP	National Development Plan, 2030
NEMA	National Environmental Management Act 107 of 1998, as amended
NEMBA	National Environmental Management: Biodiversity Act 10 of 2004, as amended
NEMWA	National Environmental Management: Waste Act 59 of 2008, as amended
NFA	National Forest Act 84 of 1998
NFEPA	National Freshwater Ecosystem Priority Areas

Term / Abbreviation	Meaning
NGO	Non-Governmental Organisation
NHRA	National Heritage Resources Act 25 of 1999
NPAES	National Protected Areas Expansion Strategy, 2010
NPV	Net Present Value
NWA	National Water Act 36 of 2008, as amended
NWCS	National Wetland Classification System
PCD	Pollution Control Dam
PFD	Process Flow Diagram
PM	Particulate Matter
PRECIS	Pretoria Computer Information Systems
QDS	Quarter Degree Square
RDL	Red Data List
RE	Risk estimation
RoM	Run of Mine
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANS	South African National Standards
S&EIR	Scoping and Environmental Impact Reporting
SDF	Spatial Development Framework
SEIA	Socio-Economic Impact Assessment
SIA	Social Impact Assessment
SCC	Species of Conservation Concern
SLP	Social and Labour Plan
SMME	Small, Medium and Micro Enterprise Businesses
SPLUMA	Spatial Planning and Land Use Management Act 16 of 2013
TDS	Total Dissolved Solids
TOPS	Threatened or Protected Species
TWQR	Target Water Quality Range
VIA	Visual Impact Assessment
WHO	World Health Organisation
WML	Waste Management Licence

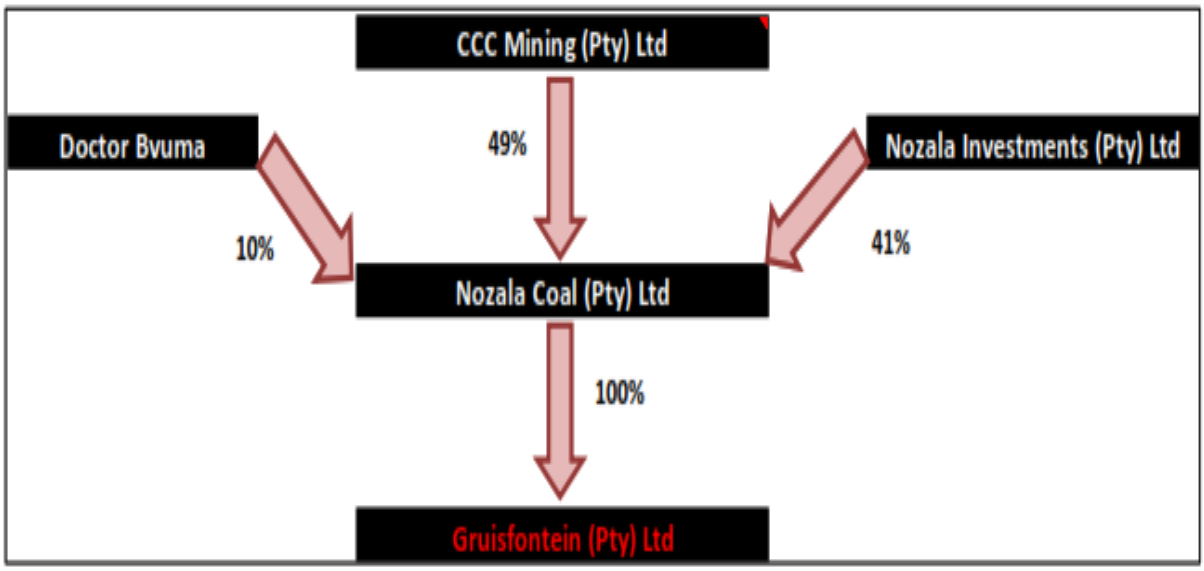
1 INTRODUCTION

1.1 BACKGROUND

Nozala Coal (Pty) Limited (Nozala Coal) holds a coal prospecting right (PR) over the farm Gruisfontein 230 LQ in the Waterberg Coalfield.

The PR was granted for the exploration of bituminous coal and was renewed in January 2017 for a further three years, expiring in January 2020. An application for a Mining Right was submitted to the Department of Mineral Resources (DMR) in terms of section 22 of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002) on 25 April 2019 and duly accepted by the DMR on 28 May 2019.

The project is referred to as the **Gruisfontein Project**. The illustration below shows the shareholding structure of Nozala Coal.



Shareholding In Nozala Coal (Pty) Ltd

RSV Enco Consulting (Pty) Ltd (RSV Enco) completed a Concept Study in 2018 to determine the most suitable exploitation of the resource. Subsequent to the Concept Study, RSV Enco was appointed to project manage the application for the mining right on behalf of Nozala Coal and to ensure that all legal requirements are in place for the said applications. RSV Enco in turn appointed Jacana Environmentals cc (Jacana) to apply for Environmental Authorisation (EA) in terms of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998), as amended, and for the Waste Management Licence (WML) in terms of the National Environmental Management: Waste Act (NEMWA), 2008 (Act 59 of 2008), as amended.

The Integrated Water Use Licence (IWUL) in terms of the National Water Act (NWA), 1998 (Act 36 of 1998), as amended, will only be applied for once the EA and WML are granted.

The development of the project will take approximately 4 years during which period licences will be secured, agreements for offtake and services will be entered into, feasibility studies completed, and construction commenced.

The below diagram indicates that operations will only commence during Stage 4, estimated to be around 2023, mainly due to licencing and construction of infrastructure for the mine.

The project is divided into different stages:

STAGE 1 LICENCING	STAGE 2 WATER USES AND FEASIBILITY	STAGE 3 CONSTRUCTION	STAGE 4 RAMP-UP OPERATIONS	STAGE 5 FULL PRODUCTION	STAGE 6 DOWNSCALING & CLOSURE
2019 – 2020 (12 mnths)	2020 (12 mnths)	2021 – 2022 (18 mnths)	2023 (12 mnths)	2024 (16 years)	2037 (3 years)
Mining Right Application Environmental Authorisation Waste Management Licence	Water Use Licence Feasibility Study	Commence Construction	Commence Operations	Operations in Full Production	Rehabilitation Downscaling Portable Skilling Closure
		Construction employees 250 - 300	Start-up employees 300 - 350	Full Production employees 500	

The integrated application for EA and the WML was submitted to the DMR on 25 April 2019, the Competent Authority (CA) for mining and related activities. The application was acknowledged by the DMR on 6 May 2019.

The Final Scoping Report (FSR), following a 30-day commenting period by registered Interested and Affected Parties (IAPs) and commenting authorities on the draft Scoping Report (DSR), was submitted to the CA on 10 June 2019. The FSR and Plan of Study was accepted on 18 July 2019.

This document serves as the **Draft Environmental Impact Assessment Report** (EIAR) which is, together with the Draft Environmental Management Programme (EMPr), available for comment by registered Interested and Affected Parties (IAPs) and commenting authorities for a period of 30 days, from 17 September to 19 October 2019.

1.2 APPLICANT AND SPECIALIST DETAILS

1.2.1 Applicant

Project applicant	Nozala Coal (Pty) Ltd
Responsible person	Doctor Makhawukani Bvuma
Physical address	First Floor, Building A, 3021 William Nichol Drive, Bryanston
Postal Address	PO Box 68413, Bryanston, Johannesburg, 2021
Telephone	011 463 5588
Facsimile	011 463 7590
E-mail	doctor@jarmaran.com

1.2.2 Environmental Assessment Practitioner

Independent EAP	Jacana Environmentals cc
Responsible person	Marietjie Eksteen
Physical address	7 Landdros Mare Street, Polokwane
Postal address	PO Box 31675, Superbia, 0759
Telephone	015 291 4015
Facsimile	086 668 4015
E-mail	marietjie@jacanacc.co.za
Professional Affiliation	Pr.Sci.Nat. at SA Council for Natural Science Professions (SACNASP) Reg No 400090/02 Member of the Land Rehabilitation Society of Southern Africa (LaRRSA): Membership ID 30835
Curriculum Vitae	Refer to Appendix 2

Marietjie Eksteen is the Managing Director of the consulting firm Jacana Environmentals cc, an environmental consulting firm based in Polokwane. She is an environmental scientist with 28 years' experience, her main fields of expertise being water quality management, mine water management, environmental legal compliance and project management. Ms Eksteen is a registered Professional Environmental Scientist (Pr.Sci.Nat.) at the South African Council for Natural Scientific Professions – Registration No. 400090/02.

Since establishing Jacana Environmentals in 2006, she has been involved in a variety of mine-related environmental projects serving clients such as Coal of Africa Limited, BHP Billiton Energy Coal SA, Xstrata Coal SA and Optimum Coal. Prior to 2006 she was employed by Pulles Howard & De Lange Inc as an environmental consultant for 2 years. Before consulting, Ms Eksteen was employed by BHP Billiton as a mine environmental manager at their operations in Mpumalanga, as well as the Department of Water Affairs where she was appointed as a water quality specialist for the mining industry. Her career started off as a geophysicist at Genmin in 1990. Ms Eksteen obtained a Masters' degree in Exploration Geophysics (MSc) from the University of Pretoria in 1993.

1.2.3 Specialist Team

The specialist team that has been appointed to assist Jacana Environmentals with the EIA is:

Soils, land use and capability	Rossouw Associates
Terrestrial Ecology	Scientific Terrestrial Services cc
Avifauna	Feathers Environmental Services
Groundwater	Groundwater Complete
Air Quality	EBS Advisory (Pty) Ltd
Ambient Noise, Blasting & Vibration	Enviro-Acoustic Research cc
Heritage	R&R Cultural Resource Consultants
Palaeontology	Chris Jones
Visual	Field and Form Landscape Science
Traffic	AvzconS Civil Engineering Consultant
Socio-Economic	Diphororo Development (Pty) Ltd

The team members, with their qualifications and professional registrations and affiliations is presented in Table 1.

Table 1: Qualification and professional registrations and affiliations of EIA specialists

Aspect	Firm	Specialists	Qualification	Professional registrations and affiliations
Soils, land use & land capability	Rossouw Associates	PS Rossouw	MSc Agric (Soil Science)	Pr.Sci.Nat. – SACNASP Reg. No. 400194/12. Member of Soil Science Society of South Africa (SSSSA). Member of South African Soil Surveyors Organisation (SASSO). Member of South African Wetland Society (SAWS).
Terrestrial impact assessment	Scientific Terrestrial Services	Stephen van Staden	BSc (Hons) Zoology MSc Environmental Management	Pr.Sci.Nat. - SACNASP Reg. No. 400134/05. Registered by the SA RHP as an accredited aquatic biomonitoring specialist. Member of the Gauteng Wetland Forum and SA Soil Surveyors Association (SASSO). Cert. Tools for Wetland Assessment.
		Christopher Hooton	National Diploma: Nature Conservation B Tech Nature Conservation	Extensive experience in large mammal and carnivore research and management across south Africa and especially the Phinda Game reserve. Ecologist with focus on zoology.
		Christien Steyn	MSc Plant Science BSc (Hons) Plant Science BSc Environmental Science	Member of the South African Association of Botanists (SAAB).
Avifaunal impact assessment	Feathers Environmental Services	Megan Diamond	BSc Environmental Management	Cert.Sci.Nat. - SACNASP Reg. No. 300022/14. Member of the IUCN Stork, Ibis and Spoonbill Specialist Group and the Eskom-EWT Strategic Partnership Ludwig's Bustard Working Group.
Groundwater impact assessment	Groundwater Complete	Gerhard Steenekamp	MSc Geohydrology / Hydrology	Pr.Sci.Nat. - SACNASP Reg. No. 400385/04.
		Wiekus du Plessis	MSc Geohydrology	Pr.Sci.Nat. - SACNASP Reg. No. 400148/15.
		Paul Naude	BSc (Hons) MSc (Mol. Phylogenetics)	Pr.Sci.Nat. - SACNASP Reg. No. 400130/10.
Air quality impact assessment	EBS Advisory (Pty) Ltd	Stuart Thompson	BSc (Hons) Applied Environmental Science	Society South African Geographers. South African Geophysical Association, M07/007. National Association for Clean Air. Air Pollution Information Network - Africa, life-time Membership. Astronomical Society for SA, Committee Member, THO003.
		Raylene Watson	PhD (Toxicology)	Pr.Sci.Nat. - SACNASP Reg. No. 400126/07. National Association for Clean Air. Air Pollution Information Network - Africa, life-time Membership.
Noise impact assessment Blasting & Vibration	Enviro-Acoustic Research	Morné de Jager	B. Ing (Chem)	-

Aspect	Firm	Specialists	Qualification	Professional registrations and affiliations
Heritage and cultural impact assessment	R&R Cultural Resources	Frans Roodt Principal Investigator	BA Hons MA Archaeology Post Grad Dip. in Museology	Association of Southern African Professional Archaeologists (ASAPA) Member No. 120.
Palaeontology impact assessment	-	Chris Jones	BSc (Hons) Geology National Diploma in Nature Conservation	Pr.Sci.Nat. - SACNASP Fellow of the Geological Society of South Africa. Fellow of the Linnean Society of London. Lecturer in Dept of Geology and Mining, University of Limpopo.
Visual Impact Assessment	Field and Form Landscape Science	Michelle Pretorius	BSc Landscape Architecture BSc Botany BSc (Hons) Plant Science MSc Environmental Ecology (in progress)	Pr.Sci.Nat. - SACNASP Reg. No. 400003/15. Professional Landscape Architectural Technologist - SACLAP Reg. No. 20253 Botanical Society of South Africa (BotSoc). Member of the Grassland Society of southern Africa (GSSA). Member of the Land Rehabilitation Society of Southern Africa (LaRRSA).
Traffic Impact Assessment	Avzcons (Pty) Ltd	Awie van Zyl	BSc Eng. Civil	ECSA Reg. No: 920506
Socio-Economic Impact Assessment	Diphororo Development	Lizinda Dickson	BA (Geography) BA (Hons) Environmental Management M Inst Agrar Environment and Society	International Association for Impact Assessment (IAIA).
		Carien Joubert	PhD Social and Behavioural Sciences	-
		Werner Neethling	CIMA: Chartered Management Accountant CGMA: Chartered Global Management Accountant JSE qualifications completed SAIFM: Introduction to financial markets SAIFM: The regulation and ethics of the SA financial markets SAIFM: The equity market 1996	Registered person in Equity

1.3 PROJECT LOCATION

The Gruisfontein Project is located in Ward 3 of the Lephalale Local Municipality within the Waterberg District Municipality of Limpopo Province. The proposed development lies within the Waterberg Coalfield.

The main settlement in the area is the Lephalale town that consist of Ellisras and Onverwacht, with a large settlement to the north-west called Marapong, approximately 40 km south-east from the Gruisfontein MRA area. The closest town to the proposed development is Steenbokpan, approximately 13 km to the south, with a relatively small settlement (± 400 households) called Lesedi located on the farms Steenbokpan and Vangpan.

The Matimba and Medupi Power Stations (Eskom) is situated strategically close to the proposed development, approximately 28 km south-east of the proposed Gruisfontein Project.

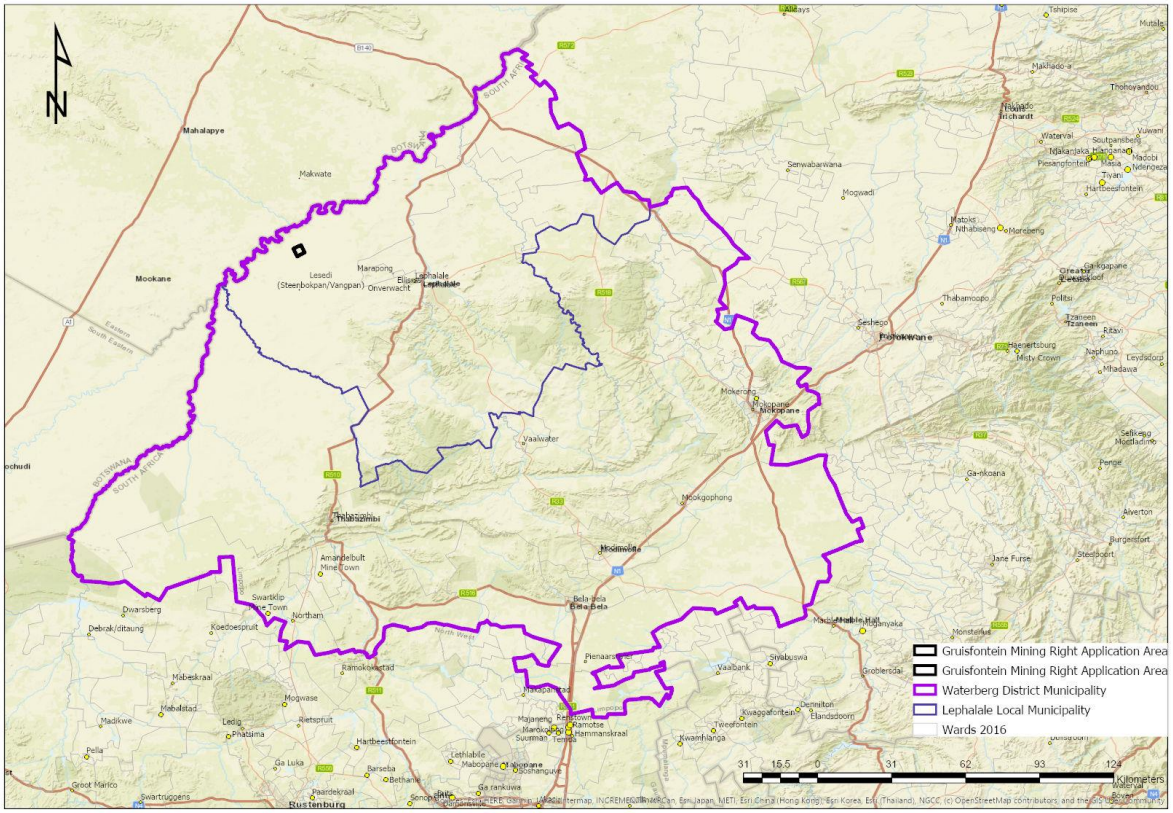


Figure 1: Project Locality and Institutional Map

1.4 DESCRIPTION OF PROPERTY

The farm Gruisfontein 230 LQ is privately owned farm used for cattle and game ranching. The areal extent of the property is in the order of 1 136.1 ha and the current surface owner is Prostart Traders 136 (Pty) Ltd (Directors Mr PJ Nel and HW Schönfeldt).

FARM NAME	GRUISFONTEIN 230 LQ
Application area (ha)	1 136.0655 (whole farm)
Magisterial district	Waterberg District
Registered owner	Prostart Traders 136 (Pty) Ltd
Title Deed number	T57802/2003 PTA
21-digit SG Code	T0LQ00000000023000000

Neighbouring landowners include private landowners (DH Steenkamp, GA Steenkamp, ME Swanepoel and SC Beukes) and commercial or mining companies (Kanivest 3067, Sasol Mafutha Mining, Anglo Operations, Eyesizwe Coal). Refer to Landownership Map (Figure 2) below.

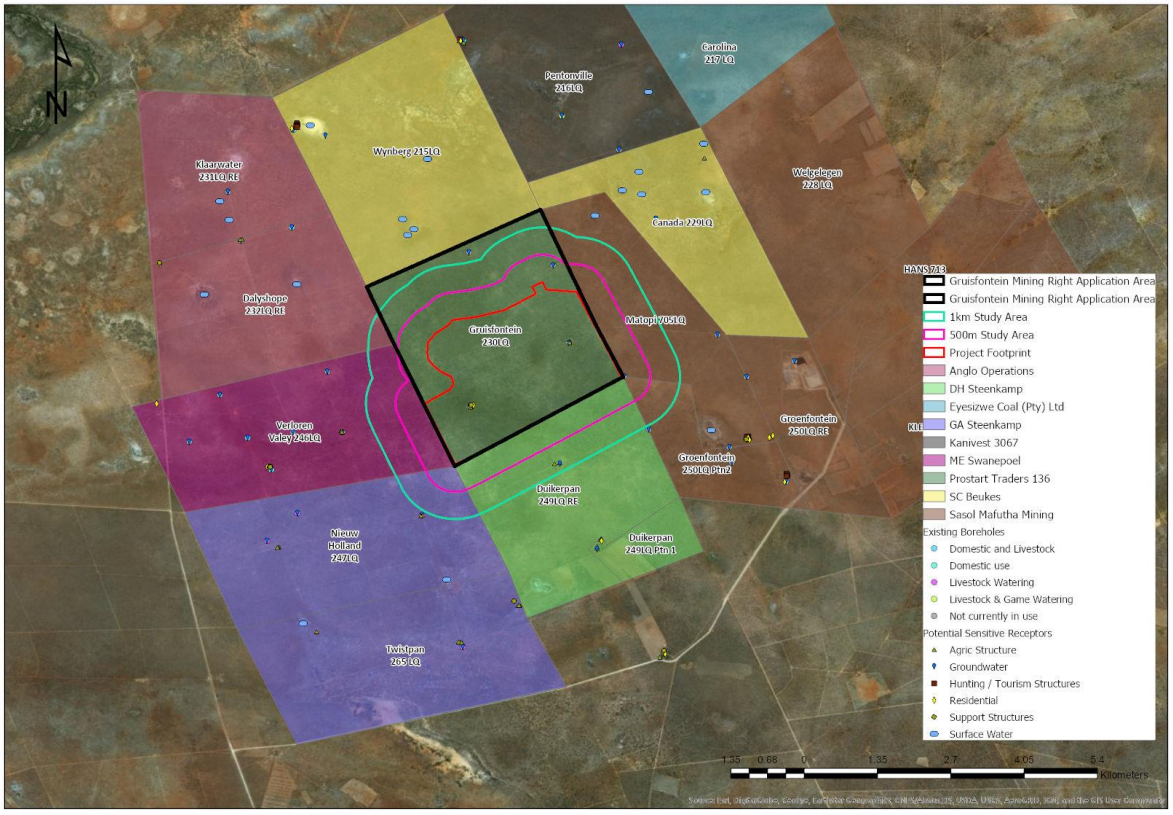


Figure 2: Landownership Map

A number of other mineral rights (prospecting and mining rights) are held by various companies in the region of the proposed Gruisfontein Project, as indicated in Figure 3.

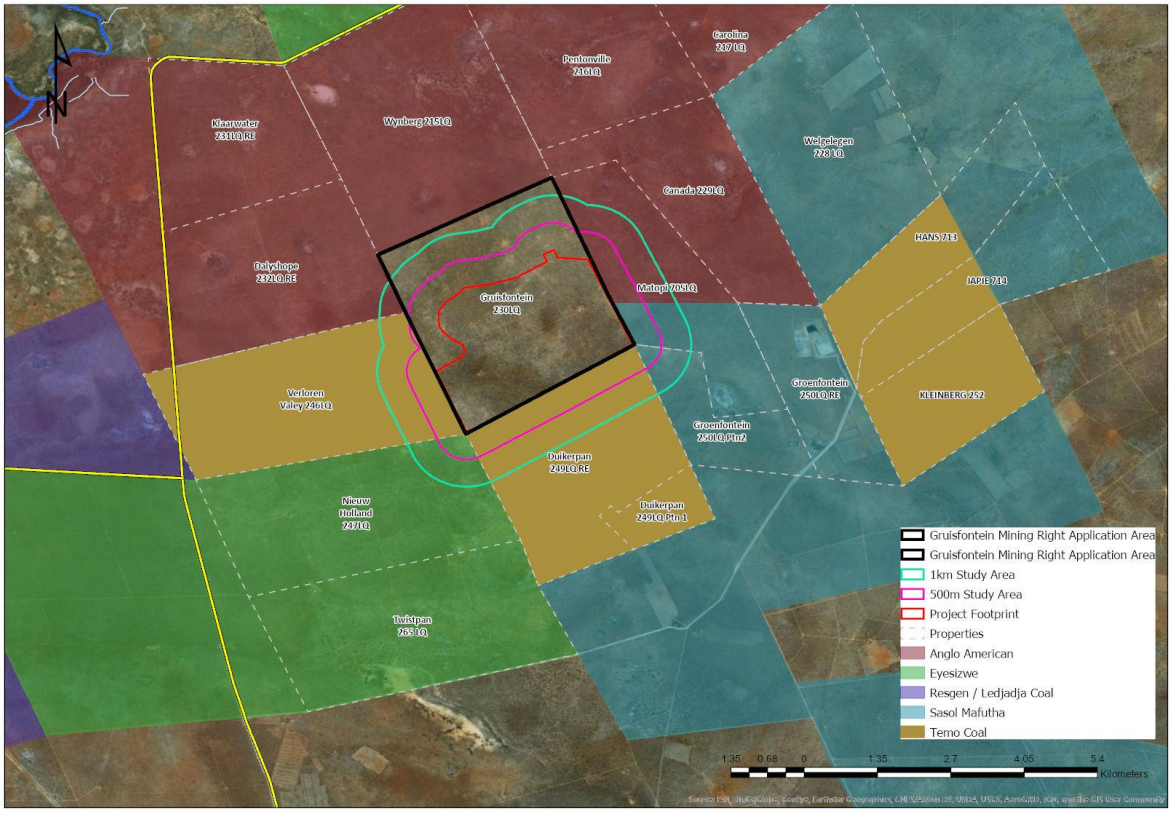


Figure 3: Mineral Rights Map

No traditional authority is present in this area and none was identified in close proximity of the proposed development.

The office of the Limpopo Regional Land Claims Commission confirmed that there are no land claims on the farm Gruisfontein 230 LQ – letter dated 4 July 2019 (Appendix 1-10).

2 PROJECT SCOPE AND ACTIVITIES

The Gruisfontein Project will be an opencast coal mine with processing plant, ancillary infrastructure and temporary and permanent dumps and stockpiles. The project has a life-of-mine (LOM) of approximately 16 years and will be mined via open pit truck and shovel operations. Gruisfontein Project is designed to accommodate a run-of-mine (RoM) production of 6 million tonnes per annum (Mtpa), and at a practical product yield of approximately 50%, resulting in 3 Mtpa of Eskom product.

The footprint of the infrastructure and mining areas (disturbed areas) is in the order of 830 ha (70% of the farm extent). The infrastructure will be placed to the south of the open pit and include a processing plant, temporary discard dump (3 years), long-term discard dump, overburden and topsoil stockpiles and water management and other supporting infrastructure. Product will be transported via road to either Medupi or Matimba Power stations or both, with an option of an export product transported via rail to the market.

The Gruisfontein resource is in close proximity to existing roads and proposed rail infrastructure linking South African Freight Rail to the Botswana rail network.

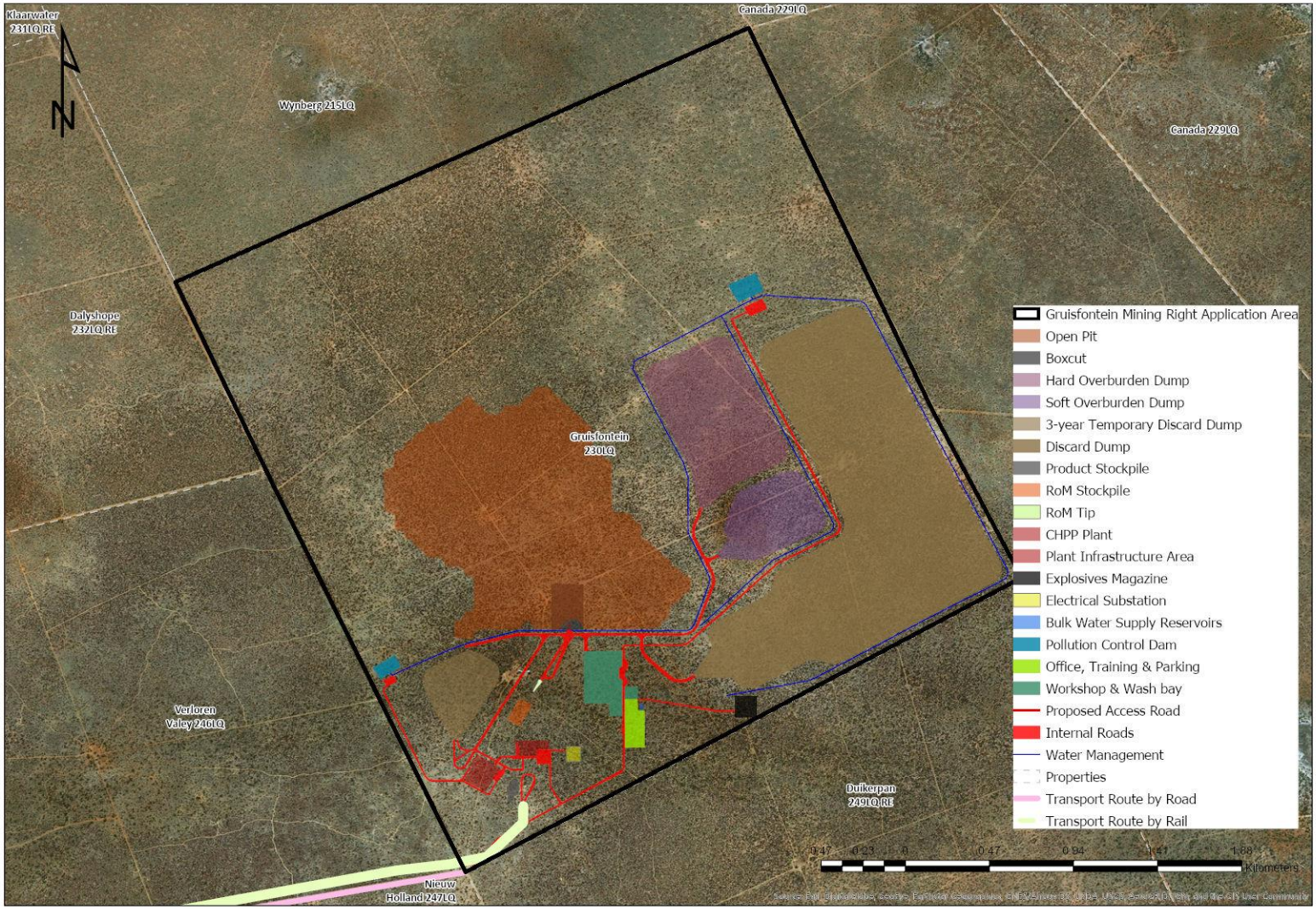


Figure 4: Gruisfontein Project Layout

2.1 LISTED ACTIVITIES

The proposed Gruisfontein Project trigger several listed activities as contemplated in the 2014 EIA regulations (as amended in 2017), as well as a waste management activity as contemplated in NEMWA: GN No. R. 921 of 2013, for which Environmental Authorisation is required.

Table 2: Listed and waste management activities associated with the Gruisfontein Project

ACTIVITY	LISTED ACTIVITY / WASTE MANAGEMENT ACTIVITY
Open Pit Mining & Processing	GNR983 – A24: *The development of a road with a reserve wider than 13.5 meters or where no reserve exists where the road is wider than 8 metres.*
	GNR984 – A15: *The clearance of an area of 20 hectares or more of indigenous vegetation.*
	GN984 – A17: *Any activity including the operation of that activity which requires a mining right as contemplated in terms of S22 of the MPRDA, including (a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or (b) the primary processing of a mineral resource including winning, reduction, extraction, classifying, concentrating, crushing, screening or washing.*
CHPP and related infrastructure (including water management infrastructure)	GN983 – A9: *The development of infrastructure exceeding 1000 m in length for the bulk transportation of water or storm water – (i) with an internal diameter of 0.36 metres or more; or (ii) with a peak throughput of 120 litres per second or more.*
	GNR983 – A10: *The development and related operation of infrastructure exceeding 1000 m in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge of slimes – (i) with an internal diameter of 0.36 metres or more; or (ii) with a peak throughput of 120 litres per second or more*
	GNR983 – A13: *The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 cubic metres or more.*
	GNR983 – A24: *The development of a road with a reserve wider than 13.5 meters or where no reserve exists where the road is wider than 8 metres.*
	GNR984 – A6: *The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent*.
	GNR984 – A15: *The clearance of an area of 20 hectares or more of indigenous vegetation.*
	GNR984 – A16: *The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 meters or higher or where the high-water mark of the dam covers an area of 10 hectares or more.*
	GNR984 – A17: *Any activity including the operation of that activity which requires a mining right as contemplated in terms of S22 of the MPRDA, including (a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or (b) the primary processing of a mineral resource including winning, reduction, extraction, classifying, concentrating, crushing, screening or washing.*
Overburden and discard dumps	GNR983 – A24: *The development of a road with a reserve wider than 13.5 meters or where no reserve exists where the road is wider than 8 metres.*
	GNR984 – A15: *The clearance of an area of 20 hectares or more of indigenous vegetation.*
	GN No. 921 – Category B11: *The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the MPRDA.*
Access / haul roads	GN983 – A12: T*he development of dams and infrastructure or structure with a physical footprint of 100 square metres or more, where such development occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse.*

ACTIVITY	LISTED ACTIVITY / WASTE MANAGEMENT ACTIVITY
	GNR983 – A19: *The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic meters from a watercourse*.
	GNR983 – A24: *The development of a road with a reserve wider than 13.5 meters or where no reserve exists where the road is wider than 8 metres.*
Bulk hydrocarbon facilities	GN984 – A4: *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 more than 500 cubic metres.*
Bulk Energy	GN983 – A11: *The construction of facilities or infrastructure for the transmission and distribution of electricity - (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.*

GNR 984 (Listing Notice 2) triggers a scoping and environmental impact reporting (S&EIR) process contemplated in regulation 21 to regulation 24 of the 2014 EIA Regulations for Environmental Authorisation. Similarly, a Category B waste management activity triggers a S&EIR process. Application for both authorisations are done in parallel in terms of the One Environmental System – refer to Section 3.2 for more detail on the S&EIR process.

2.2 GEOLOGY

Geological information provided in this report was interpreted from the 1:250 000 scale geological map around the project area (Figure 5) and descriptions were obtained from the Mining Work Programme, 2019 (MWP).

2.2.1 Regional geological setting

The Gruisfontein Project area falls within the Waterberg Coalfield which comprises of the Lower Carboniferous sediments of the Vryheid and overlying Grootegeluk Formations in the Karoo Supergroup. The Waterberg Coalfield reportedly accounts for over 45% of South Africa's un-mined coal resources. It is considered a strategic coalfield in light of South Africa's (and Southern Africa's) current energy crisis, with Eskom as well as mining and exploration companies presently investing heavily in this coal field.

The major coal bearing horizons of the Ecca Group of the Karoo Supergroup in the Waterberg are:

- The Volksrust (Grootegeluk) Formation, which consists of 55 m of intercalated mudstones and coal; and
- The Vryheid (Goedgedacht) Formation, which incorporates four major discrete seams of approximately 1.5 m, 3 m, 9 m and 4 m in thickness, respectively.

Coal measures occur over a stratigraphic interval of between 90 m – 110 m thick, characterized by 11 discrete coal zones, with the upper zones (Zone 6 – Zone 11) comprising of the highest commercial value including semi-soft coking coals. The upper zones are overlain by the barren Eendragtpan Formation of the Beaufort Group. The lower Zones are underlain by the barren Wellington Formation of the Ecca Group.

A simplified local stratigraphic column of the Waterberg Coalfield is indicated in Figure 6, which shows the idealised sub-surface stratigraphic units present from the bottom up.

Several prominent geological structures (i.e. faults and dykes) are indicated in Figure 5. The faults have displacements of up to a few hundred meters and these displacements are directly responsible for the economical accessibility of the major coal reserves in some areas while it is too deep in other areas to be economically mineable. The major faults in the larger Waterberg Coalfield generally trend north-east by south-west. Some faults occur in other directions as well, causing upliftment of down-shifting of the geological succession.

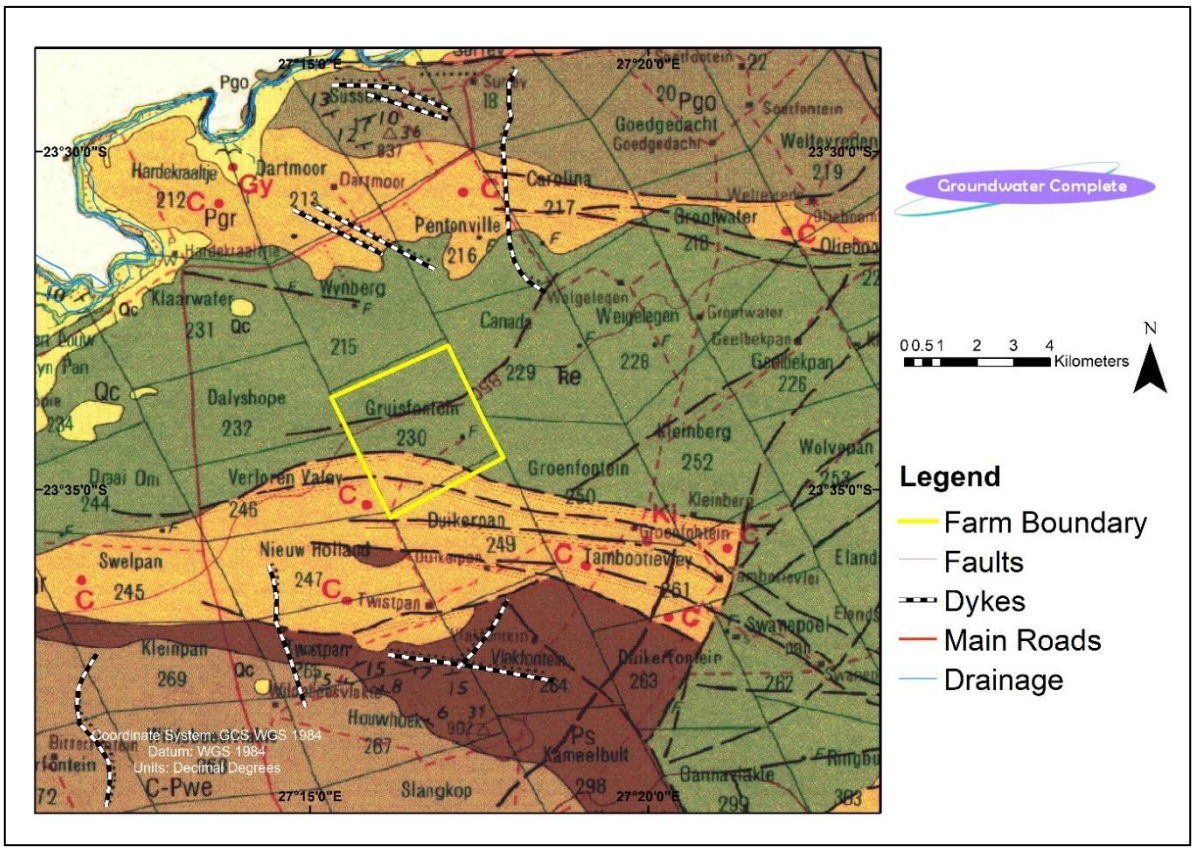


Figure 5: Regional geology around Gruisfontein

***Key**:*

CODE	***FORMATION***		***CODE***	***FORMATION***
Qc	*Quaternary (recent) alluvium*		***Tre***	*Eendrachtpan (Beaufort Group)*
Pgr	*Grootegeluk Fm (Ecca Group)*		***C-Pwe***	*Wellington Fm (Lower Ecca Group)*
Ps	*Swartland Fm (Ecca Group)*			

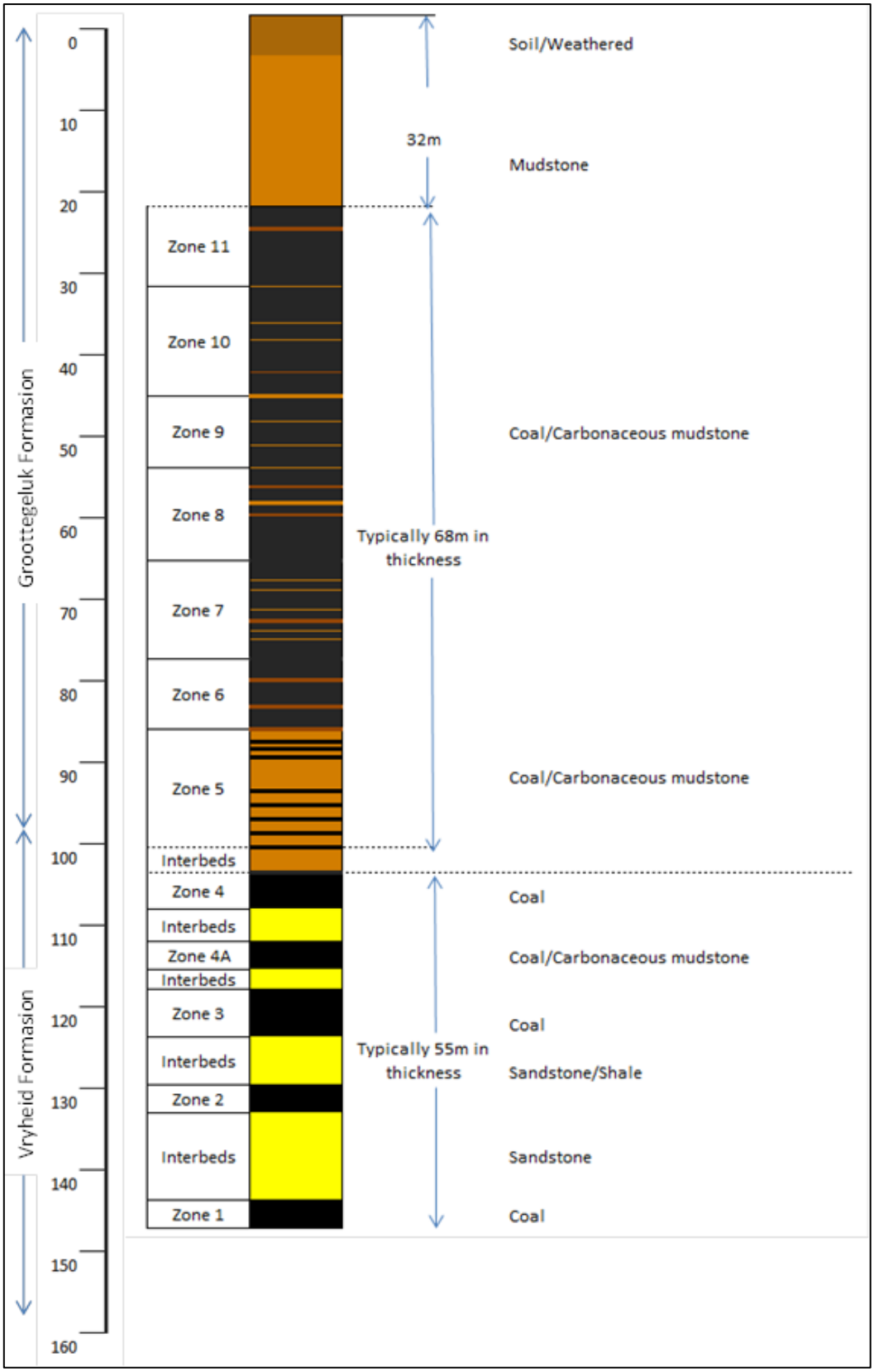


Figure 6: General stratigraphic column in the Waterberg Coalfield

2.2.2 Local Geology

Some 21 boreholes were drilled on Gruisfontein for geological exploration and resource estimation. The geological information from these boreholes was used to assist in formulation of the conceptual model for the area (MWP, 2019).

At Gruisfontein, all seams/coal zones are covered by some 30 m to 100 m of non-coal bearing superficial deposits ("overburden") with no coal outcrops. The project area has an uplifted block in the south-west where weathering has removed Zone 9 to Zone 11 whilst the rest of the area contains all 11 zones.

There are no pre-Karoo basement outcrops in the project area. All 11 Waterberg coal zones occur on the property, numbered from bottom to top as Zone 1 to Zone 11. None of the boreholes intersected dolerite intrusive but seam displacements are caused by localised and regional faults. The faults on Gruisfontein itself generally trend east-west with displacements mostly sub-vertical.

The project area has an uplifted block in the south-west where weathering has removed Zones 9 to 11 while the rest of the area contains all 11 zones. For modelling purposes, the project area was split into two blocks with one block containing Zones 1 to 11 and the other block only Zones 1 to 8. A plan showing the areas where the Zones are present over the farm is depicted in Figure 7**.**

A pilot geophysical test survey was conducted on Gruisfontein to determine if the faults and dykes in the area are picked up by the magnetic methods. Three traverses were conducted, and the positions are indicated in Figure 8. The interpreted faults are indicated in the figure as red dotted lines. The resulting magnetic response were however low, and it was concluded that the magnetic method was not useful in mapping or delineating the geological structures. The reason is probably the thick sandy soil and mudstone cover over most of the hard rock geology where faulting has occurred.

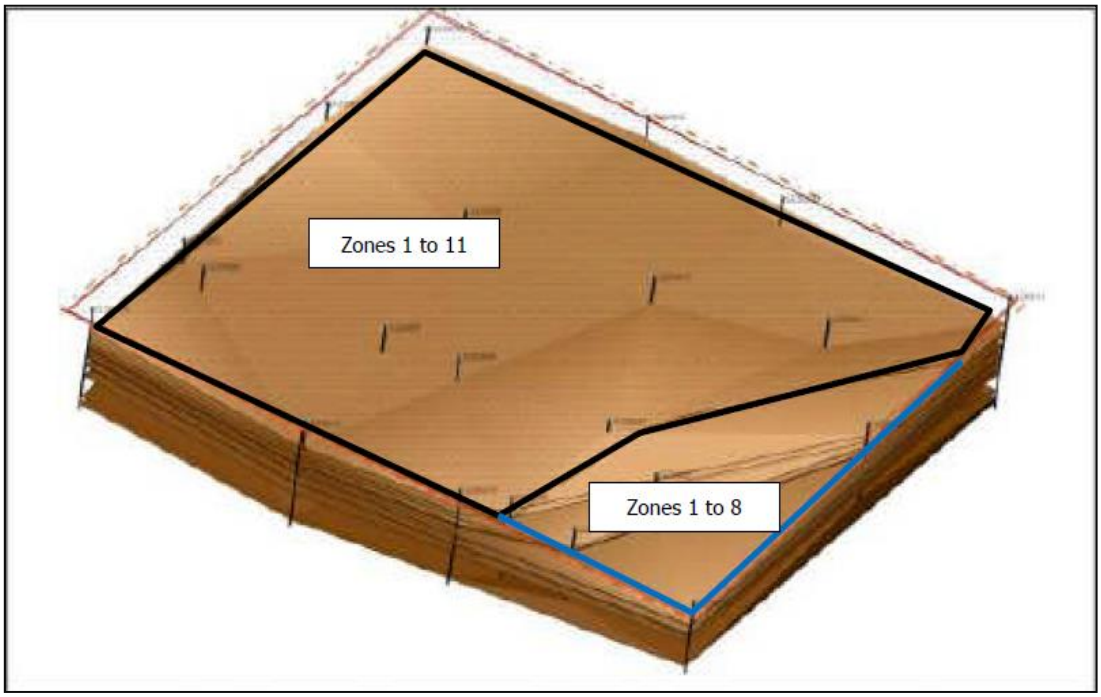


Figure 7: Resource Block Outline, Zone Distribution

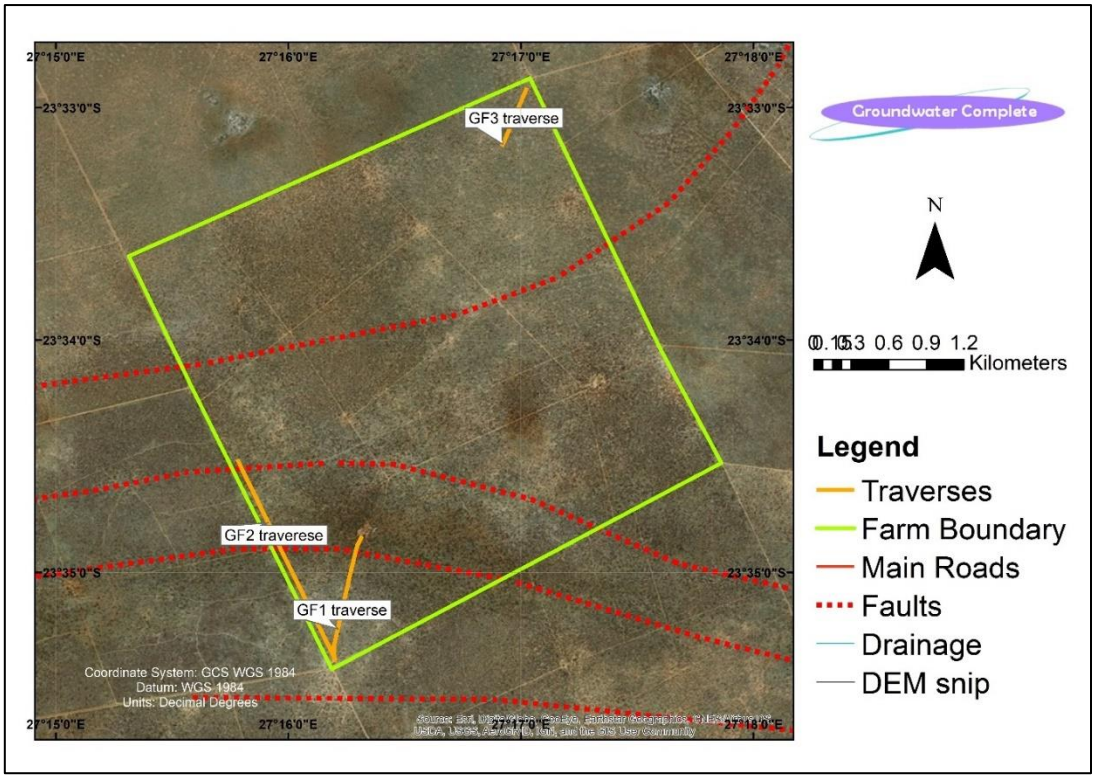


Figure 8: Positions of geophysical lines and identified geological anomalies

2.2.3 Resource Particulars

2.2.3.1 Type of mineral

The target product is a domestic thermal coal for Eskom with a quality specification of 19 - 20 MJ/kg (air dry basis).

2.2.3.2 Summary of product consumers

The project is estimated to produce approximately 6 Mtpa of RoM coal over a total mine life of approximately 16 years.

The quality to be produced will be suitable for local and regional markets. The coal can be marketed to the international market as a low-grade export product. Most of the coal will be used to supply the local thermal market.

2.2.4 Marketing Strategy

The marketing strategy is to supply the nearby Medupi power station and cover the shortfall that Grootgeluk mine will supply once Medupi is in full production.

The opportunity also exists to supply thermal coal into the Witbank region or to export as a low-grade coal which is feasible at current export prices.

2.3 OPEN PIT MINING

The Gruisfontein resource will be mined using the opencast strip-mining method which is preferred because the initial box cut lies generally close to the surface with a low strip ratio. This mining system is considered standard for these types of barcode coals, is well understood in southern Africa, and is suitable for large near-surface coal deposits found in the Waterberg coal basin.

The selected mining system has been identified as standard truck and shovel with blasting below rockhead. The mining operation will follow the sequence outlined below:

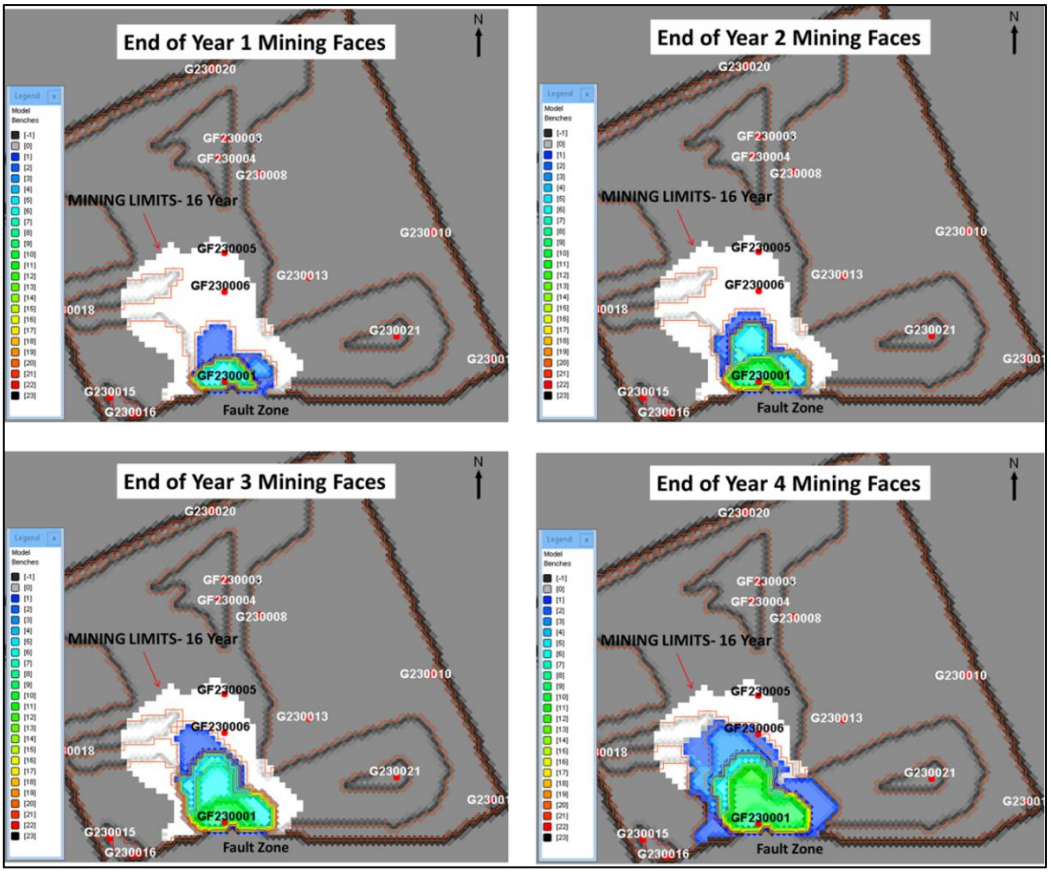
- Initial scrubbing to clear the land.
- Topsoil will be stripped from the waste, discard dumps and initial box cut and stockpiled appropriately for use at a later stage for reclamation and rehabilitation.
- Appropriate ditching will be applied around the perimeter of the excavations and soil removal areas.
- Overburden from the initial box cut will be removed by a combination of hydraulic digging, ripping and drill and blast as required. The combined method of extraction will be dependent on the rock mass and strength properties which have in turn been determined by geotechnical domain classification. The overburden will initially be hauled to an above-ground waste dump and later returned to the mined-out void. Once the waste dump has reached maximum capacity and there is sufficient mined-out volume the waste will be hauled to an adjacent mined-out void. Whenever possible preference will be given to backfilling due to the cost and time implications of hauling to a dump site.
- Once the overburden has been stripped to expose the coal mining horizons, they will be liberated by digging, ripping or drill and blast and loaded onto haul trucks using excavators. The haul trucks will then transport the RoM coal to the RoM pad at the coal handling and preparation plant (CHPP) for washing / beneficiation.
- The CHPP waste will be removed by haul truck and either taken to the dedicated discard dump or placed in compartments constructed from soft and hard overburden to prevent spontaneous combustion.

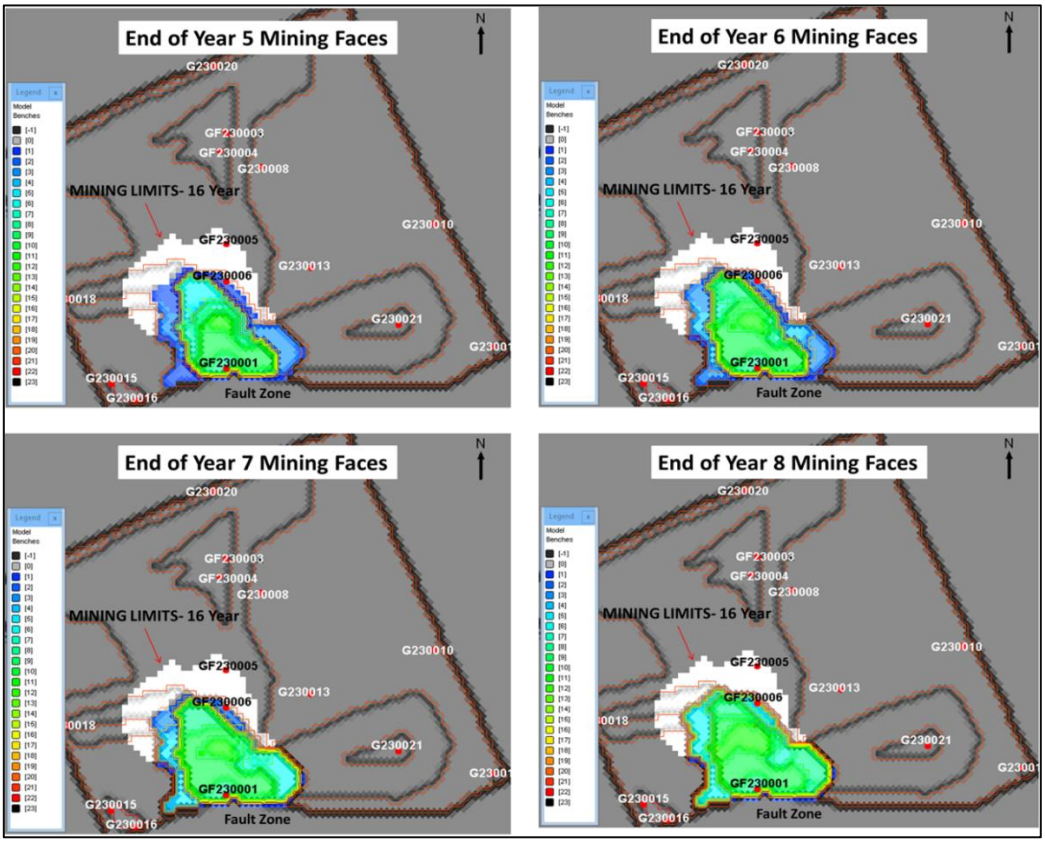
2.3.1 Mining Model and Schedule

Figure 9 shows how the resources are planned to be depleted over the LOM.

2.3.2 Production Profile

Gruisfontein Project is designed to accommodate a RoM production of 6 Mtpa, and at a practical product yield of approximately 50%, resulting in a 3 Mtpa Eskom product. The production profile is indicated in Figure 10.


End of Year 1 Mining Faces
End of Year 2 Mining Faces
End of Year 3 Mining Faces
End of Year 4 Mining Faces
MINING LIMITS- 16 Year
G230020
GF230003
GF230004
G230008
G230010
GF230005
GF230006
G230013
G230021
GF230001
G230015
G230016
Fault Zone
N


End of Year 5 Mining Faces
End of Year 6 Mining Faces
End of Year 7 Mining Faces
End of Year 8 Mining Faces
MINING LIMITS- 16 Year
G230020
GF230003
GF230004
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GF230005
GF230006
G230013
G230021
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G230015
G230016
Fault Zone
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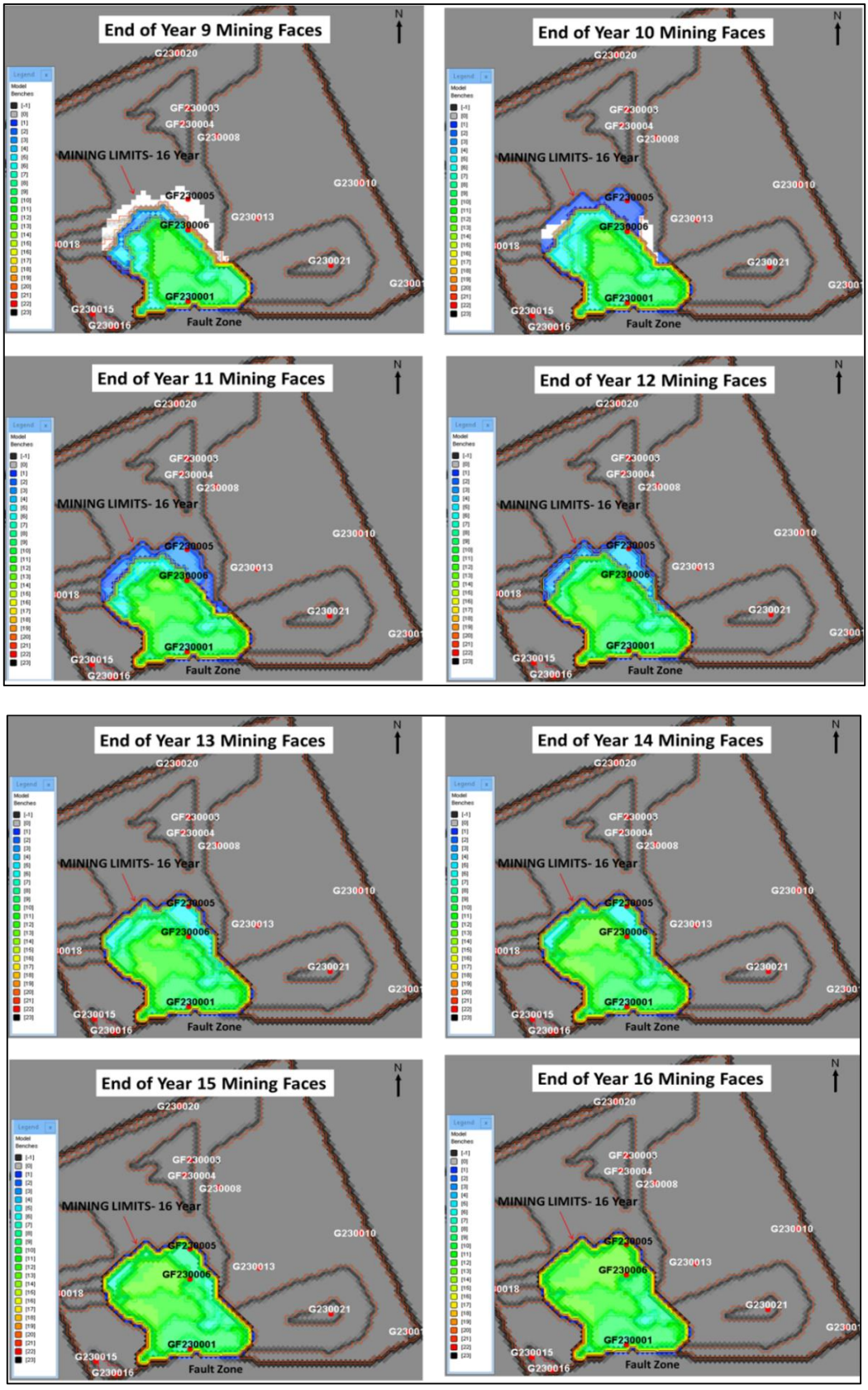

Figure 9: Mineable resource area

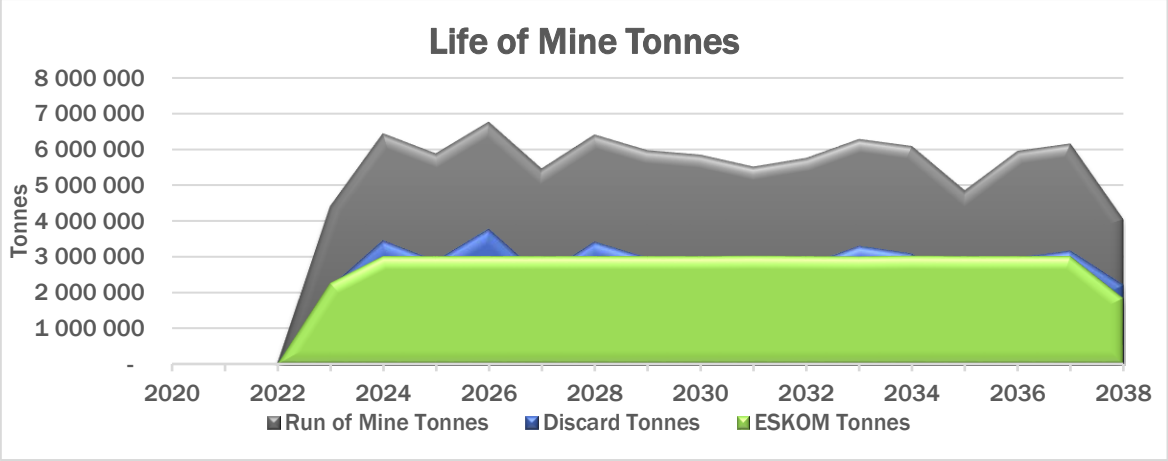

Figure 10: Production profile for the Gruisfontein Project

2.3.3 Rehabilitation and Closure Planning

At this stage it is envisaged that backfilling will only start after decommissioning of the mine. During the next study phase an optimised mine plan will be developed to create enough space for in-pit backfilling as soon as practically possible. This will be addressed in the Rehabilitation, Decommissioning and Closure Plan that will be developed in line with the requirements of Government Notice No. R.1147 (GN R.1147): "*Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations*" promulgated in November 2015. Financial provision will be updated on an annual basis in line with the requirements of GN R.1147.

Refer to Section 3.1 of the EMPr that deals with the closure management objectives for the Gruisfontein Project.

2.4 DESCRIPTION OF THE PROCESSING PLANT

The project requires the establishment of a new CHPP to process the extracted RoM from the opencast mine. The CHPP has been specified to supply coal of Calorific Value (CV) 19.0 - 20.0 MJ/kg (air dried) as the primary product. The CHPP will incorporate raw coal handling, beneficiation, fines bypass, water clarification product and discard handling facilities. The plant will be a single stage CHPP that will produce a product destined for the thermal domestic market.

Mining benches will be mined simultaneously and stockpiled on a raw coal stockpile. A stacker and reclaimer operation will be utilised to ensure adequate blending prior to feed to the CHPP and will act as buffer capacity between mine and CHPP.

The plant feed is equipped with a single deck scalping screen, 15 mm sizing. Dense medium cyclones are utilised for the 50 x 15mm and 1 x 0.15mm is beneficiated using spirals. It is expected that fines carry over from the scalping screen will occur, and for this reason a fines circuit has been allowed for. The 0.15 x 0 mm is dewatered in the thickener and filter plant, the filter product reports to the discard belt, and the 15 x 0 mm raw coal by-passes the plant and will report to product.

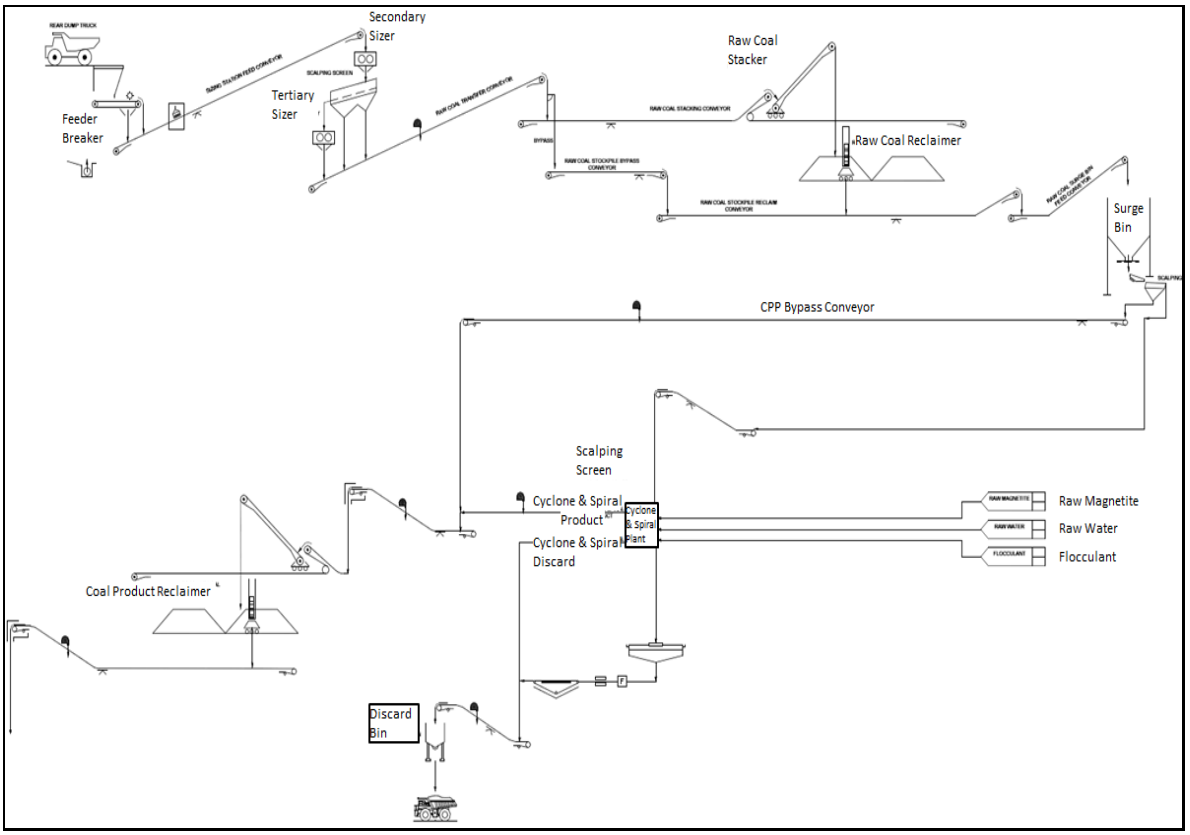

Figure 11: Process Flow Diagram of the Processing plant

A general description of the plant arrangement is provided below.

2.4.1 Screening Plant

Raw coal, nominal 50 x 0 mm, from the raw coal stockyard will be fed into one 200t capacity raw coal distribution bin that will feed the raw coal scalping screen. Feed to the scalping screen is extracted by means of vibrating feeders that control the feed rate.

2.4.2 Cyclone Plant

The coal preparation plant will consist of one module. The minus 50 mm raw coal discharging from the plant feed conveyor will be mixed with water prior to feeding onto a de-slime fixed sieve. Slurry consisting of dense medium and coal will be pumped into one high-capacity dense medium cyclone located on the top floor of the plant.

2.4.3 Magnetite Recovery

A portion of the medium from the correct medium head box will provide the bleed of medium via the correct medium bleed splitter box to the dilute medium tank. Concentrated magnetite from the magnetic separators will gravitate to the correct medium tank. Effluent from the magnetic separators will gravitate to the plant feed chute feeding the de-sliming screen.

2.4.4 Fines Circuit

The de-sliming screen underflow is pumped to a set of classifying cyclones. The classifying cyclones classify the feed at nominal 0.15 mm. Cyclone underflow gravitates to spiral banks for fines beneficiation.

2.4.5 Thickener and Filter Press Circuit

Overflow from the classifying cyclones gravitates to the thickener and combines with the discards dewatering screens underflow. Flocculent will be added in the thickener launder and feed-well to aid with settling of the material. The clarified water overflow from the thickener gravitates to a surge tank. The clarified water tank will be equipped with a level indicator. The level indicator will control the raw water make-up.

2.4.6 Flocculent Addition

A fully automated flocculent mixing / dosing system will be provided to serve the tailings thickener. The system will be designed to accept a powdered flocculent supply which will be manually charged into the flocculent bin regularly to ensure availability at all times.

2.4.7 Raw, Return and Potable Water System

For the return water system decanted water returning from the PCDs will be re-used as process water to minimise the volume of raw water needed to sustain the CHPP. Water from the dam will be pumped

to the clarified water tank. A potable water tank will be supplied complete with pump and reticulation pipelines to the flocculent make up plant.

2.5 INFRASTRUCTURE LAYOUT

The proposed infrastructure to be developed includes:

- Process plant and associated stockpile and load-out facilities;
- Buildings and structures (viz. offices, workshops, changes houses, stores, etc.);
- Roads (haul, service and access);
- Bulk services such as fuel, water, sewage and power;
- Water and power distribution facilities;
- Water management infrastructure, including clean and dirty water drains, pollution control dams, etc.; and
- Discard and carbonaceous material facilities.

The infrastructure components and layout are presented in Figure 4.

2.5.1 Access Roads

Access to the site will be gained via the Provincial Road D1675 from Lephalale towards Steenbokpan. From Steenbokpan, access to site will be via Provincial Road D175, a gravel secondary provincial road. This road will be upgraded to handle the additional traffic associated with the proposed mining project, as required. From the D175 the mine will be accessed via an existing service road running along the southern border of Verloren Valey 246 LQ. Similarly, this road will be upgraded to carry the additional traffic load. Formal access will be constructed to the pit and the infrastructure as the development progresses.

2.5.2 Traffic and Product Transport

The expected future daily trips that will be generated by the planned mining activities (construction and operational phases) are summarised below:

2.5.2.1 Construction

It is estimated that the construction activities at the mine site will on average generate no more than about 230 vehicle trips (two-way) daily. The main percentage of the trips will be concentrated in the morning and evening peak periods.

2.5.2.2 Employees / business trips

The following two-way trips are envisaged during the operational phase:

- Work Trips – Cars 52 trips per day
- Work Trips – Busses 28 trips per day
- Business Trips / Deliveries 40 trips per day

2.5.2.3 Product transport

Product will be transported from Monday through to Sunday during daylight hours.

Product for the domestic market will be transported along a haul road from the product stockpiles to the south-eastern corner of Gruisfontein. From there is will be transported along an existing service road situated on the southern border of Verloren Valey 246 LQ, turning south on the secondary (gravel) Provincial Road D175 to Steenbokpan, and finally along the paved Provincial Road D1675 from Steenbokpan to Medupi Power station.

The mine will require thirty-six (36) 50-tonne side tipping trucks to transport 10,000 tonnes per day calculated at 5.5 x truck loads per vehicle per day.

Alternatively, the product can be transported to the Temo Railloop Rapid Load-Out Facility planned approximately 400m south of the CHPP on farm Duikerpan 249 LQ (still to be confirmed and agreed).

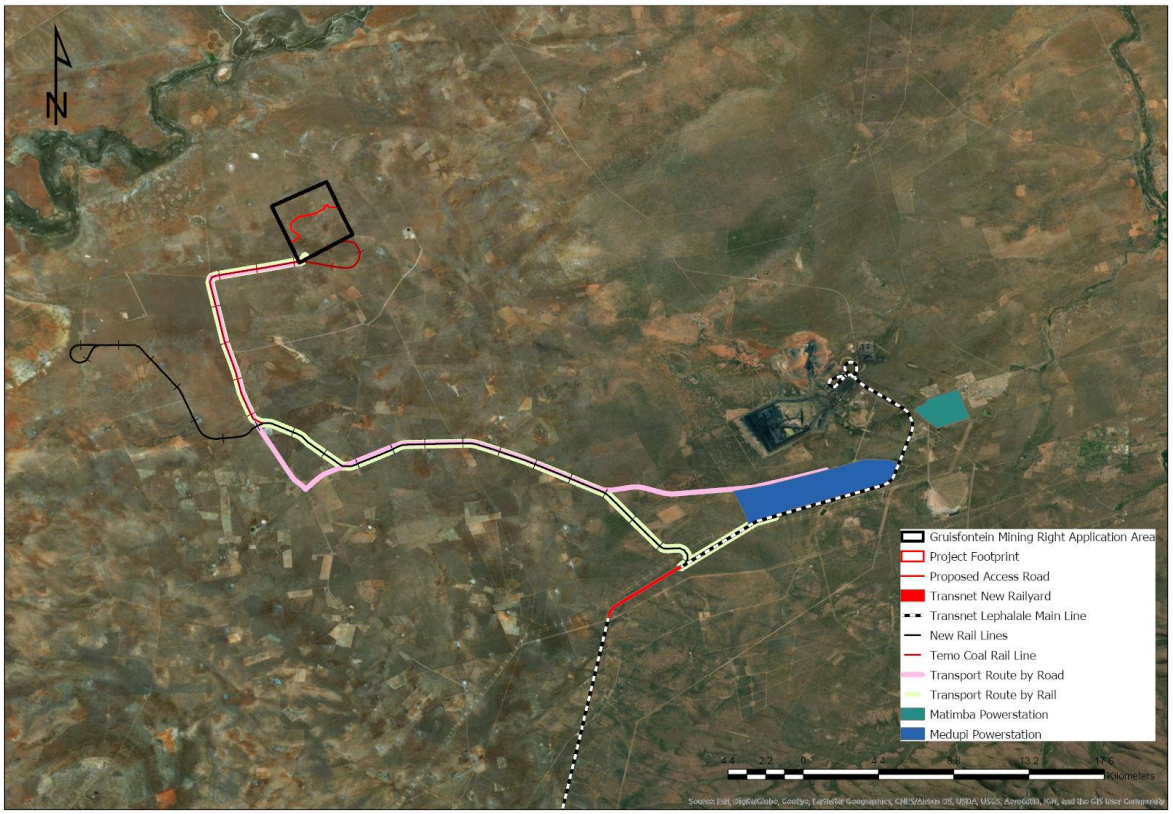

Figure 12: Product transport options

2.5.3 Waste Management

2.5.3.1 Mining Waste

Discard, soft overburden, hard overburden and carbonaceous material will be stockpiled separately although the commencement of the construction of the long-term discard/carbonaceous dumps will take place in terms of the construction of the paddocks using hard and soft overburden. Topsoil and soft overburden that will not be used to construct the carbonaceous dumps will be used for the construction of water diversion berms. This material will be used at the end of LOM for final layer works after backfilling of the open pit.

During the first three years of operation the plant discard will be placed on a temporary discard dump that will be constructed to the west of the CHPP. A filter press at the plant has been provided in order to conserve water. This eliminates the need of a co-disposal system.

From YR4 onwards all the waste material from the open pit, including the plant discard will be stockpiled on the long-term dump. Topsoil will be stockpiled separately. The long-term discard dump will be compartmentalised with soft overburden to eliminate the risk of spontaneous combustion. This methodology was developed by Grootegeluk Colliery to deal with the prevention of spontaneous combustion particularly the carbonaceous material and discard. A typical cross-section of the dump and its paddocks are shown in Figure 13.

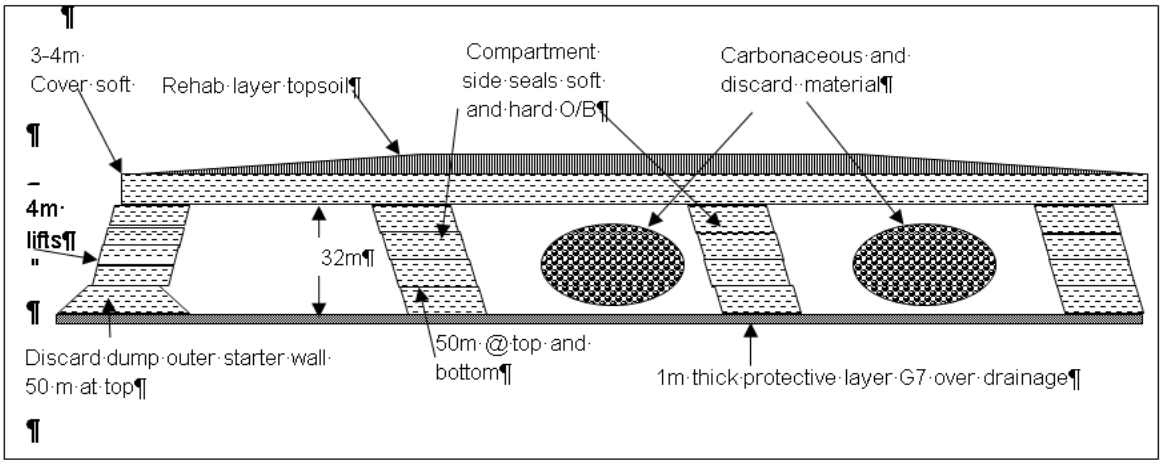

Figure 13: Carbonaceous dump cross-section

Once sufficient room has been established in the open pit, in-pit stockpiling of carbonaceous material and discard will take place. For the purpose of the impact assessment it will assumed that all material over the 16 LoM will be stockpiled on surface and that backfilling will only start after year 16.

During the next study phase an optimised mine plan will be developed to create sufficient space for in-pit back filling as soon as practically possible. The size of the current dumps should therefore reduce substantially in size.

The envisaged extent of the stockpiles and dumps at Gruisfontein is provided in Table 3.

Table 3: Extent of stockpiles and dumps at Gruisfontein Project

	Number	Height (m)	Extent (m^2)
Temporary discard	1	5	124,150
Long-term discard	1	90	1,487,197
Soft overburden	Included in long-term discard dump, 30% used for berm	5	161,968
Hard overburden	included as cladding for long-term discard dump	15	384,615
RoM stockpile	1	15	855,600
Product stockpiles	4	12	386,400

The Mine Residue Design and Lining Specification Report is attached as Appendix 18 (Deltabec, 2019).

2.5.3.2 Non-mining waste

2.5.3.2.1 General and hazardous waste

Upon approval of the project, a dedicated, approved (registered) waste contractor will be appointed by the mine to manage the non-mining waste generation and safe disposal thereof. The following waste types will be generated during the project:

- Domestic waste
- Hazardous waste, including used oil/diesel/greases
- Fluorescent tubes
- Glass and plastics
- Chemicals
- Medical waste
- Scrap metal
- Building rubble (construction & demolition activities)
- Used tyres

The different waste streams will be segregated and disposed of in appropriate designated receptacles. All waste will be disposed off-site at approved landfill sites. No landfill site will be established on the Gruisfontein Project site.

2.5.3.2.2 Sewage handling and treatment

Two sewerage treatment plants will be established within the project area. The treatment works will be an activated sludge treatment plant. Sewerage from various ablution facilities located in the mine area will be channelled to the treatment plants. Each ablution facility will contain water closets, urinals, wash hand basins and showers (for the change house). The sewage (brown and grey) water will be collected from the ablution facilities and will gravitate to the connection manholes via the internal and external sewer network at the building. The sewage will gravitate to a sewer pump station from where it will be pumped to a sewer treatment works. The treated effluent from the sewer treatment works will be pumped to a PCD for reuse in the CHPP.

2.5.4 Bulk Supply

2.5.4.1 Water requirements

The daily bulk water requirements for the Gruisfontein Project is as follow:

- Plant water demand – 747 942 m³/annum
- Office water demand – 104 875 m³/annum
- Dust suppression – 482 130 m³/annum.

The available water sources, as calculated with the available information, can be summarised as follow (Deltabec, 2019 – Appendix 17):

- Average annual rainfall – 4 644 m^3/annum.
- Recyclable plant water – It is estimated at this stage that 45% of the water used within the plant will be recycled for reuse and can, therefore, be seen as another source of water. This will amount to 568 631 m^3/annum.
- On-site STP – 182 625 m^3/annum (estimated at a sewage treatment rate of 0.5 Mℓ/day).

2.5.4.1.1 Water treatment and storage reservoirs

On-mine water treatment and storage facilities will be established to facilitate daily demands. Potable, raw water and service water will be stored in separate storage reservoirs. Refer to the Water-Balance Report for Gruisfontein Project (Deltabec, 2019 – Appendix 17) that describes the various dams envisaged together with the capacities and designs.

2.5.4.1.2 Stormwater management

The Stormwater Management Plan (SWMP) for the Gruisfontein Project is attached as Appendix 16 (Deltabec, 2019).

2.5.4.2 Power requirements

The proposed Gruisfontein Coal Mine has an estimated forecast maximum demand of between 3 and 4 MVA, excluding the provision of the power factor correction. This estimated power requirement will be firmed up in the next study phase.

An Eskom sub-station, Theunispan, is in proximity to the town of Steenbokpan and it is assumed that Gruisfontein will be able to source power from this substation. It is assumed that Eskom will provide a 22 kV overhead line from the sub-station to the mine and a 22 kV / 0.55 kV /10 MVA sub-station located on the mine.

2.5.4.3 Hydrocarbon requirements

A total of 607 m^3 of hydrocarbon storage facilities will be required for the operational phase, as indicated in Table 4.

Table 4: Hydrocarbon requirements for the Gruisfontein Project

Quantity	Volume	Location
6	82 000 litres	Bulk storage for diesel at the workshop area facility
4	23 000 litres	Bulk storage facilities for new oils and lubricants at the workshop area
1	23 000 litres	Bulk storage facilities for used oils at the workshop area

2.6 ORGANIZATIONAL STRUCTURE OF THE MINE

It is envisaged that the Gruisfontein Project will employ 500 people at full production, as indicated in Table 5. The nature of the operations requires employees that are all skilled to operate in a safe and effective manner. Due to the nature of the operations a Mine Manager as well as a Government Certificated Engineer will be appointed.

Table 5: Employment numbers

Phase	Designation	No
Construction	Permanent employees	10 (owners' team)
	Contractors	250-300
Operational	Permanent employees	53
	Contractors	447

The organisational structure is provided in Figure 14.

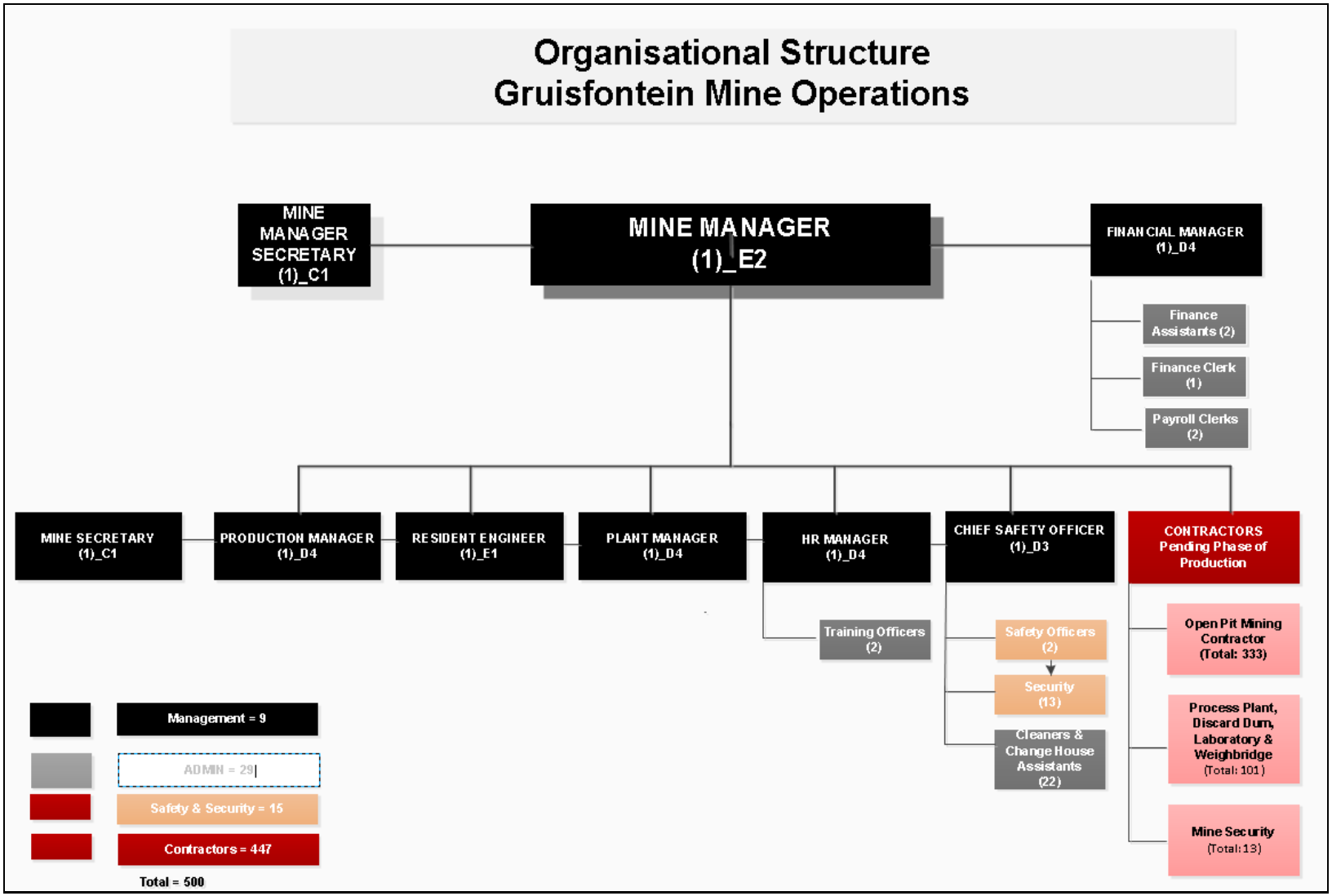

Figure 14: Organisational Structure for the Gruisfontein Project

3 POLICY AND LEGISLATIVE CONTEXT

3.1 APPLICABLE LEGISLATION, POLICIES AND STRATEGIES

The legal frameworks within which the mining development and associated infrastructure aspects operate is complex and include many acts, associated regulations, standards, principle, guidelines, conventions and treaties on an international, national, provincial and local level. The main legal frameworks that require compliance in terms of Environmental Authorisation are:

- Act No. 28 of 2002: Mineral and Petroleum Resources Development Act (MPRDA), as amended
- Act No. 107 of 1998: National Environmental Management Act (NEMA), as amended
- Act No. 36 of 1998: National Water Act (NWA), as amended
- Act No. 25 of 2014: National Environmental Management Laws Amendment Act (NEMLAA)

Other legislative frameworks applicable to the Gruisfontein Project include (list not exhaustive):

- Act No. 108 of 1996: The Constitution of South Africa
- Act No. 25 of 1999: National Heritage Resources Act (NHRA)
- Act No. 10 of 2004: NEMA: Biodiversity Act (NEMBA)
- Act No. 43 of 1983: Conservation of Agricultural Resources Act (CARA)
- Act No. 84 of 1998: National Forests Act (NFA)
- Act No. 39 of 2004: National Environmental Management: Air Quality Act (AQA)
- Act No. 57 of 2003: National Environmental Management: Protected Areas Act
- Act No. 59 of 2008: National Environmental Management: Waste Act (NEMWA)
- Act No. 26 of 2014: National Environmental Management Act: Waste Amendment Act
- Act No. 101 of 1998: National Veld and Forest Fire Act
- Act No. 15 of 1973: Hazardous Substances Act
- GN No. 704 of 4 June 1999: Regulation on use of water for mining and related activities aimed at the protection of water resources
- GN No. R. 982-986 of 4 December 2014: NEMA: EIA Regulations, as amended in 2017
- GN No. 634 of 23 August 2013: NEMWA: Waste Classification and Management Regulations
- GN No. R. 921 of 2013: NEMWA: Waste Management Activities, as amended by GN No. R.332 of 2 May 2014 and GN No. R.633 of 24 July 2015
- GN No. R.248 of 31 March 2010: AQA: Atmospheric Emissions Activities, as amended in 2013
- GN No. R.152 of 2007: NEMBA: Threatened or Protected Species (TOPS) Regulations
- GN No. R.1147 of 20 November 2015: Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations
- Act No. 7 of 2003: Limpopo Environmental Management Act (LEMA)
- Act No. 29 of 1996: Mine Health and Safety Act
- Act No. 125 of 1991: Physical Planning Act
- Act No. 16 of 2013: Spatial Planning and Land Use Management Act (SPLUMA)
- Act No. 16 of 2014: Special Economic Zones Act
- Act No. 117 of 1998: Municipal Structures Act
- Act No. 32 of 2000: Municipal Systems Act
- Act No. 67 of 1995: Development Facilitation Act

- Act No. 2 of 2000: Promotion of Access to Information Act
- Act No. 3 of 2000: Promotion of Administrative Justice
- Act No. 75 of 1997: Basic Conditions of Employment Act
- Act No. 66 of 1995: The Labour Relations Act
- Act No. 4 of 2000: Promotion of Equality and Prevention of Unfair Discrimination Act
- Act No. 85 of 1993: Occupational Health and Safety Act
- Act No. 53 of 2003: Broad Based Black Economic Empowerment Act
- Act No. 9 of 1972: National Road Safety Act
- Act No. 93 of 1996: National Road Traffic Act
- Act No. 19 of 1998: Prevention of Illegal Eviction from and Unlawful Occupation of Land Act
- Act No. 3 of 1996: Restitution of Land Rights Act
- Act No. 112 of 1991: Amendment of the Upgrading of Land Tenure Rights Act

Strategies, guidelines and other documents of importance to this project (list not exhaustive) are:

- National Protected Areas Expansion Strategy, 2010 (NPAES)
- National List of Threatened Terrestrial Ecosystems for South Africa, 2011
- National Biodiversity Assessment, 2011 (NBA)
- Mining and Biodiversity Guideline: Mainstreaming Biodiversity into the Mining Sector, 2013
- Implementation Manual for Freshwater Ecosystem Priority Areas, 2011
- Important Bird Areas, BirdLife South Africa
- Limpopo Conservation Plan Version 2, 2013 (Limpopo C-Plan)
- Good Practice Guidance for Mining and Biodiversity: International Council on Mining and Metals
- Convention on Biological Diversity (1995)
- Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora
- International Union for Conservation of Nature (IUCN)
- Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or the Bonn Convention)
- Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA)
- World Summit for Sustainable Development (2002)
- National Climate Change Adaption Strategy, 2017
- Limpopo Development Plan (LDP), 2015-2019
- Waterberg District and Lephalale Local Municipal Spatial Development Framework
- Waterberg District and Lephalale Local Municipal Integrated Development Plan

3.2 ENVIRONMENTAL AUTHORISATION PROCESS

Government's "One Environmental Management System" commenced on 8 December 2014 when the new EIA Regulations (Government Notice Nos R.982 to R.985 of 2014) came into effect. These regulations have streamlined the licensing processes for Environmental Authorisation, such that the licensing processes for the different regulatory regimes are served by a single EIA process.

A fully integrated process will thus be followed for the Environmental Authorisation (EA) and Waste Management Licence (WML) applications, in line with the One Environmental Management System timeframes as stipulated in the 2014 EIA Regulations (as amended in 2017). The proposed Gruisfontein Project triggers a Scoping and Environmental Impact Reporting (S&EIR) process, which entails the following key tasks:

- Application: Submission of application form to the relevant Competent Authority, in this case the Limpopo Department of Mineral Resources (DMR) for the EA and WML.
- Scoping Phase: Compilation of a draft Scoping Report (DSR) and providing it for comment to all registered Interested and Affected Parties (IAPs). The DSR will identify the key issues and alternatives to be assessed and recommend the approach to be followed during the EIA Phase to follow. Comments received from IAPs are incorporated in the DSR and the Final Scoping Report (FSR) is submitted to the Competent Authority, whereupon they accept or refuse it.
- EIA Phase: Upon Authority acceptance of the FSR, the EIA Phase can commence. This includes the preparation of the Environmental Impact Assessment Report (EIAR), which provides detailed assessments of the significance of biophysical and social impacts, as well as the Environmental Management Programme (EMPr). The draft EIAR and EMPr are again provided to registered IAPs for comment and comments are responded to in the Final EIAR and EMPr, which is submitted to the Competent Authority for decision-making.
- Authority review and decision-making: The Competent Authority reviews the information and recommendations provided in the Final EIAR and EMPr and is required to issue a decision to authorise (or refuse to authorise) the project within 107 days of submission of the documents.

The total time frame for the non-substantive S&EIR process is legislated to take no more than 300 calendar days (excluding public holidays and the December break). This implies a process where all issues could be satisfactorily resolved, and no substantive changes need to be made or new and unexpected information need to be added to the environmental reports. These timeframes imply, in practice, that the specialist work must commence before an application is submitted to the Competent Authority.

In parallel to the EIA process, a comprehensive Public Participation process must be conducted. This offers stakeholders the opportunity to learn about the project, to raise issues that they are concerned about, and to make suggestions for enhanced project benefits.

The following diagram indicate the S&EIR process and the steps to follow.

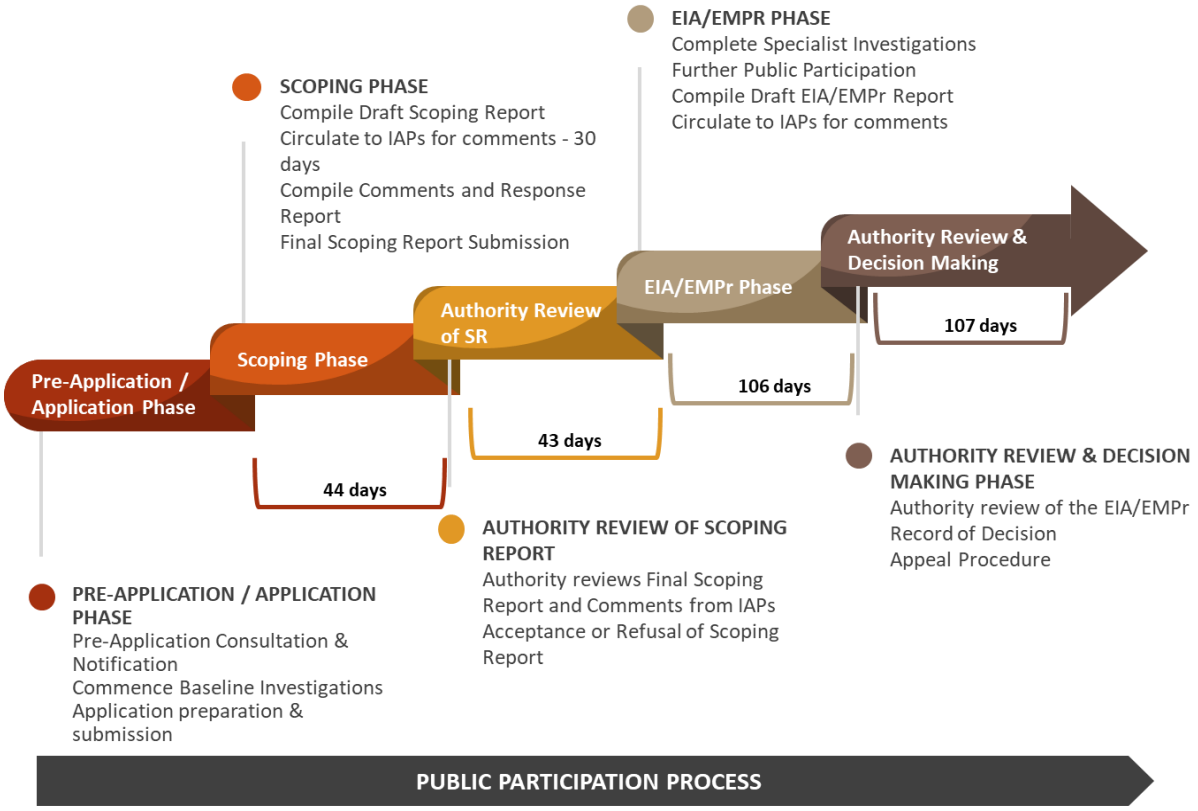

Figure 15: S&EIR process and timeframes

3.3 LICENSING REQUIREMENTS

The following preliminary licencing requirements have been identified:

Legislation	Requirement	Status
MPRDA **Nozala Coal (Pty) Ltd to apply for a mining right**	Submission of Mining Right Application (MRA) to Limpopo DMR	MRA submitted on 25 April 2019, acceptance received 28 May 2019.
NEMA, EIA Regulations (2014) **A number of listed activities are applicable, the majority triggering the threshold limit for a S&EIR required in terms of GN984**	Application for Environmental Authorisation (EA) to Limpopo DMR	EA application submitted on 25 April 2019 together with the MRA and acknowledged on 6 May 2019. Final Scoping Report was accepted on 18 July 2019. Draft EIAR and EMPr available for comment.
NEMWA, Waste Regulations (2013) **Mine residue is classified as a waste management activity**	Application for WML to Limpopo DMR	As above, parallel application.
NWA, S21 **A Water Use Licence will be required for a number of water uses**	IWULA and IWWMP for submission to DWS (Limpopo-Northwest Proto CMA)	The application for the IWULA in terms of the NWA will be submitted to the relevant authorities on granting of the Environmental Authorisation and the applicant has conducted further feasibility studies and detail designs in respect of its development.
Forest Act **Permits required for the destruction and/or relocation of protected tree species**	Permit application to DAFF	To follow once mining right is granted, prior to construction activities.
NEM:BA, TOPS regulations **Permits required for the destruction and/or relocation of protected species**	Permit application to LEDET	To follow once mining right is granted, prior to construction activities.
NHRA **Permits for Phase 1B and Phase 2 studies in respect of possible archaeological and palaeontological sites**	Permit application to SAHRA, if applicable	To follow once mining right is granted and construction activities commence for any subterranean chance finds.
SPLUMA **Rezoning of property**	Application to municipality for required rezoning	To follow once mining right is granted.

4 NEED AND DESIRABILITY OF THE PROJECT

4.1 SPECIALIST MARKET ANALYSIS

Thermal coal remains strategically critical to the South African economy with 248 Mtpa of production being used to generate over 90% of the country's electricity requirements. South Africa is the world's 5th largest coal exporter at 77 Mtpa. The coal sector is also a major employer and contributes ~3% to GDP and ~6% to export revenues, being the third largest export contributor after gold and iron ore. The availability and access of coal in the Waterberg region is becoming increasingly important as the country's historical coal centre in the Witbank becomes depleted. Resources in the coalfield are currently estimated to be ~46% of the country's overall reserves (MWP, 2019).

Despite the environmental issues raised by burning coal, most major energy forecasters agree that coal will remain a critical component of the global energy mix for many years, particularly in regions where cleaner energy options are not as immediately viable. According to the U.S. Energy Information Administration fossil fuels are expected to supply nearly 80% of world energy through to 2040. Global demand for coal is expected to rise to 9 Bt by 2019, growing by an average of 2.1% per year. Similarly, the International Energy Agency predicts electricity will remain the fastest-growing final form of energy worldwide and that by 2040, 56% of power will still be derived from fossil fuels, with coal accounting for 31% of the mix (MWP, 2019).

South Africa's need for power remains strong and as traditional coal producing centres reserves diminish a new coal source will soon be required. The South African domestic market principally comprises the acquisition by Eskom of ~130 Mtpa of thermal coal to fire its fleet of power stations. In addition, ~20 Mtpa of thermal coal is burned by various internal industries including, sugar, paper, healthcare. In South Africa, thermal coal is currently responsible for >90% of the countries' power generation, with coal-fired power expected to remain the base load power feed to the national energy grid well into 2030 and beyond (MWP, 2019).

As the Witbank / Mpumalanga reserve bases deplete and coal becomes incrementally more expensive to mine, Eskom continues to seek to diversify its coal supply options by procuring material quantities of coal from the Waterberg region where virgin coal mining costs are lower than in Witbank, despite the typically lower product yields (MWP, 2019).

4.2 NATIONAL AND REGIONAL DEVELOPMENT POLICIES

4.2.1 National Development Plan, 2030

The National Development Plan (NDP, 2030) aims to ensure that all South Africans attain a decent standard of living through the elimination of poverty and reduction of inequality by 2030. The NDP Executive Summary notes 10 critical actions on the road to success for South Africa. They are:

1. A social compact to reduce poverty and inequality and raise employment and investment.
2. A strategy to address poverty and its impacts by broadening access to employment, strengthening the social wage, improving public transport and raising rural incomes.

3. Steps by the state to professionalise the public service, strengthen accountability, improve coordination and prosecute corruption.
4. Boost private investment in labour-intensive areas, competitiveness and exports, with adjustments to lower the risk of hiring younger workers.
5. An education accountability chain, with lines of responsibility from state to classroom.
6. Phase in national health insurance, with a focus on upgrading public health facilities, producing more health professionals and reducing the relative cost of private health care.
7. Public infrastructure investment at 10 percent of Gross Domestic Product (GDP), financed through tariffs, public-private partnerships, taxes and loans and focused on transport, energy and water.
8. Interventions to ensure environmental sustainability and resilience to future shocks.
9. New spatial norms and standards – densifying cities, improving transport, locating jobs where people live, upgrading informal settlements and fixing housing market gaps.
10. Reduce crime by strengthening criminal justice and improving community environments.

Nozala Coal is committed to the above actions in the form of:

- Job creation;
- Human resource development;
- Human and community development;
- Environmental sustainability;
- Governance and policy; and
- Spatial equity.

4.2.2 New Growth Path (2010)

South Africa has embarked on a new economic growth path in a bid to create 5 million jobs and reduce unemployment from 25% to 15% over ten (10) years. The plan aims to address unemployment, inequality and poverty by unlocking employment opportunities in South Africa's private sector and identifies five priority areas (green energy, agriculture, mining, manufacturing and tourism) as part of the programme to create jobs.

4.2.3 National Spatial Development Perspective (2006)

The National Spatial Development Perspective (NSDP, 2006) provides a framework for a focused intervention by the State in equitable and sustainable development. It represents a key instrument in the State's drive towards ensuring greater economic growth, buoyant and sustained job creation and the eradication of poverty. It provides:

- a set of principles and mechanisms for guiding infrastructure investment and development decisions;
- a description of the spatial manifestations of the main social, economic and environmental trends that should form the basis for a shared understanding of the national space economy; and
- an interpretation of the spatial realities and the implications for government intervention.

4.2.4 National Infrastructure Plan 2012

SA Government adopted a National Infrastructure Plan (NIP) in 2012. With the plan it aims to transform SA's economic landscape while simultaneously creating significant numbers of new jobs and strengthen the delivery of basic services. The plan also supports the integration of African economies. The NIP seeks to promote:

- re-industrialisation through manufacturing of inputs, components and machinery;
- skills development aimed at critical categories;
- greening the economy; and o empowerment.

The NIP comprises 18 identified Strategic Integrated Projects (SIPs) which integrate multiple infrastructure plans into a coherent package. SIP 1 refers to "Unlocking the northern mineral belt with Waterberg as the catalyst".

- Unlock mineral resources;
- Rail, water pipelines, energy generation and transmission infrastructure;
- Thousands of direct jobs across the areas unlocked;
- Urban development in Waterberg - first major post-apartheid new urban centre will be a "green" development project;
- Rail capacity to Mpumalanga and Richards Bay;
- Shift from road to rail in Mpumalanga; and
- Logistics corridor to connect Mpumalanga and Gauteng.

The Gruisfontein Mining Project can play a role to one such goal, unlocking the northern mineral belt of the Waterberg as a catalyst. The Gruisfontein Project is thus of strategic importance and in line with the development goals of the NIP.

4.2.5 Limpopo Provincial Development Plan

The Limpopo Provincial government developed a five-year developmental plan for the period 2015-2019. The Limpopo Development Plan (LDP) serves as the medium-term strategic plan of the current provincial administration. Although the plan is being reviewed, it is still relevant to the economic development of the province and as such all planning in the province must be based on it. The plan is aligned to the NDP and its main goals include the reduction of poverty, unemployment and inequality through sustainable development and transformation as a means of growing the provincial economy. The vision of the LDP is to fulfil the potential for prosperity in a socially cohesive, sustainable and peaceful manner. The vision will be achieved through participatory leadership aimed at promoting excellence and an entrepreneurial spirit, improved service delivery, facilitation of decent job-creation and systematic poverty reduction The LDP emphasizes enhancing economic thrusts of the province, which include g mining, manufacturing, agriculture and tourism. The objectives of the LDP are to:

- Create decent employment through inclusive economic growth and sustainable livelihoods;
- Improve the quality of life of citizens Prioritize social protection and social investment;
- Promote vibrant and equitable sustainable urban and rural communities;
- Raise the effectiveness and efficiency of developmental public service; and

- Ensure sustainable development.

The main approach of the LDP in growing the local economy and creating jobs include focus in:

- Cluster value-chain development strategies, including the Special Economixc Zones (SEZs);
- The Green Economy Strategy;
- Information and Communication Technology Development;
- SMME and Co-operative Development, including the informal sector; and
- Biodiversity Development.

Economic planning in Lephalale will respond to the above focus areas.

4.2.6 Waterberg Spatial Development Framework

The Waterberg Spatial Development Framework (SDF) strongly emphasises the links between developments in the constituting municipalities. The development and implementation of the SDF is built around the powers and functions of the Waterberg District Municipality and the local municipalities within its area of jurisdictions.

The following areas and issues have been identified as critical to development in all the municipalities:

- Institutional support regarding:
    - Capacity for fulfilling the local municipalities land use control and spatial planning mandates.
    - Communication between municipalities regarding land use and spatial planning related matters affecting all municipalities.
    - Data needs and data management, which includes GIS capacity.
- The development of implementation plans to support development of the core components of the SDF.
- Developing a common approach to key development areas, namely:
    - Meeting the needs and demands for land and supporting infrastructure from mining companies.
    - The development of ecotourism facilities, which includes, eco-resorts, estates, various types protected areas and ancillary infrastructure in support of tourism in the area.
    - Service delivery and the provision of social infrastructure in the non-urban area.
- The development of the Waterberg biosphere in order to allow it to fulfil its potential as an ecological area of national and international importance.

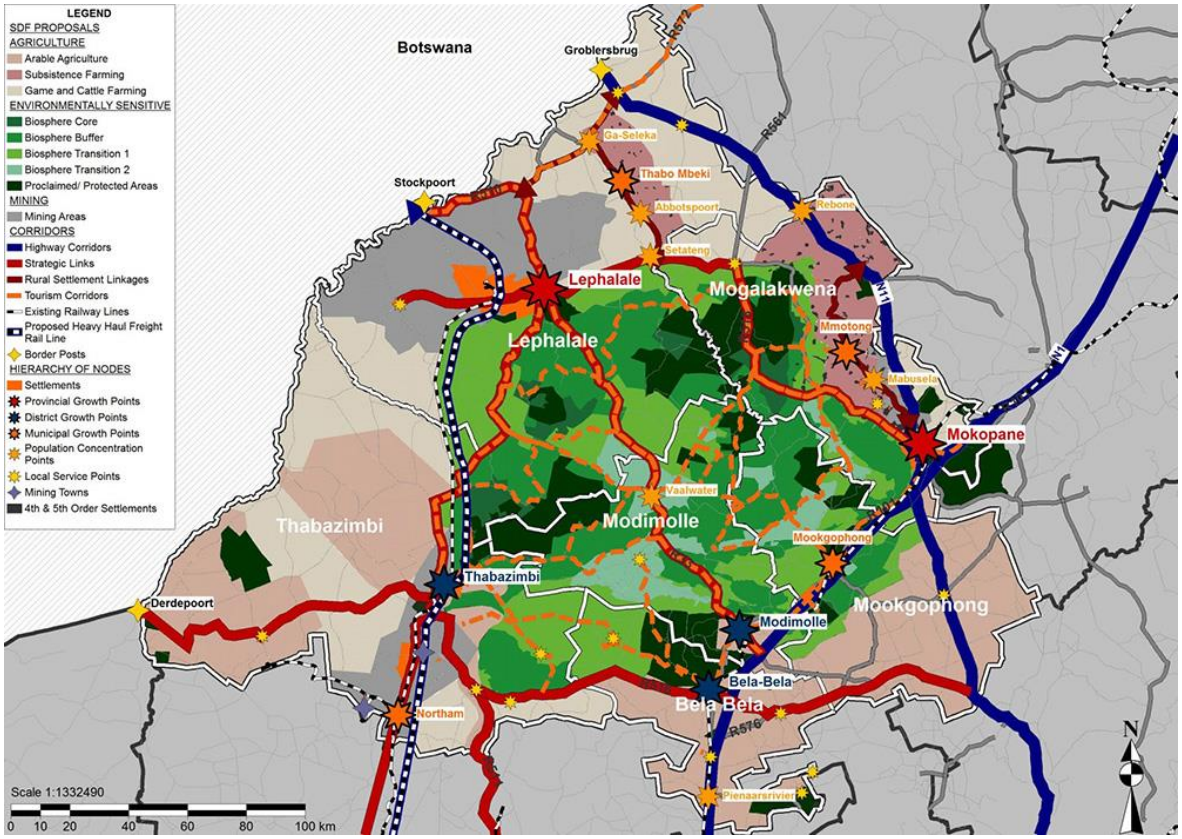

Figure 16: Waterberg SDF

4.2.7 Lephalale Spatial Development Framework

The Lephalele SDF is a core component of Lephalale Local Municipality's economic, sectoral, spatial, social, institutional, environmental vision, a tool to achieve the desired spatial form of the Municipality. The Lephalale SDF echoes the Waterberg District EMF in its land use planning objectives. Based on the Lephalale SDF the project site is outside any of the Environmental Management Zones but within their areas earmarked for future mining development.

4.2.8 Lephalale Local Municipal Integrated Development Plan

The Integrated Development Plan (IDP) is a process through which the municipalities prepare strategic development plans for a five-year period. An IDP is one of the key instruments for local government to cope with its new developmental role and seeks to arrive at decisions on issues such as municipal budgets, land management, promotion of local economic development and institutional transformation in a consultative system and strategic manner.

The IDP recognises the future development of further mining in the Steenbokpan region.

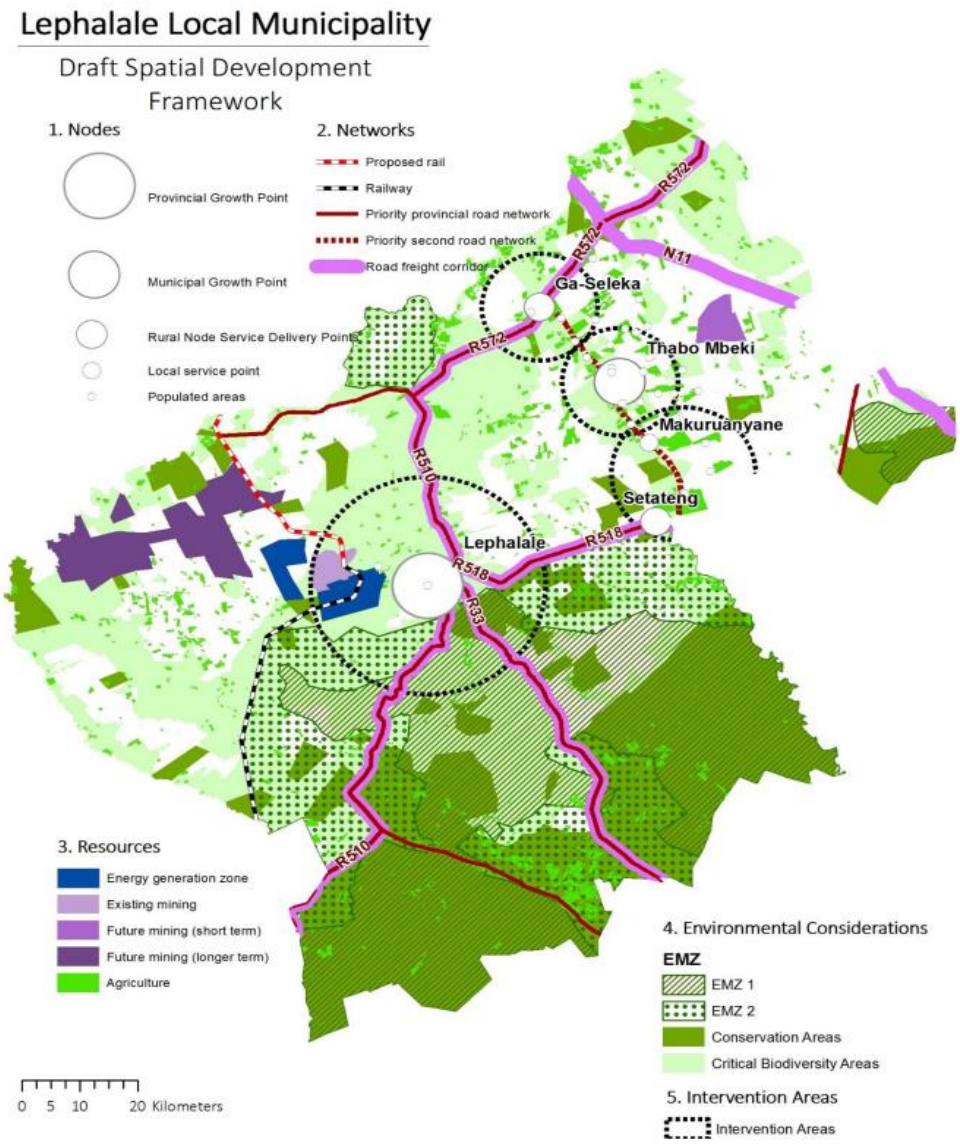

Figure 17: Lephalale SDF

4.2.9 Summary of the Regional Policies

The table below is an interpretation of the relevance and impact of the Regional Policies on the Gruisfontein Mine Project (Diphororo, 2019):

Table 6: Regional Policy/Plan Summary

POLICY	FOCUS AREA	RELEVANCE TO THE GRUISFONTEIN PROJECT
National & Limpopo	Focus on economic development. Unlock mineral potential Create jobs	Aligned with National and Provincial Plans
Waterberg DM & Lephalale LM	Leverage future mining development for infrastructure development and economic growth	Aligned with District and Municipal Plans

4.3 ECONOMIC BENEFITS

The proposed project will contribute towards the local, regional and national economies through the following:

- increased foreign investment and income;
- direct impacts arising from wages, taxes and profits. This includes money spent to pay for salaries, supplies, raw materials, and operating expenses;
- indirect impacts from the initial and operational spending which will create additional activity within the local and regional economy, as local businesses will be benefiting directly from the proposed development and will subsequently increase spending at other local businesses (indirect effect) as well as hiring additional staff members; and
- induced impacts as a result of increased personal income or spending power. Businesses will be experiencing increased revenue from the direct and indirect effects and will subsequently increase payroll expenditures (by hiring more employees, increasing payroll hours, raising salaries, etc.). Households will in turn, increase spending at local businesses. The induced effect is therefore a measure of this increase in household-to-business activity.

Table 7: Economic Value - Gruisfontein Economic contribution

Indicator	**Gruisfontein Project**
Assessment period	16 years
Capital investment	R 782 938 955 (NPV over 16 years[1])
Land value (current terms)	Liability of R 158.4 million before rehabilitation
Annual employment value including subcontractors and service providers	R 5.234 billion (NPV over 16 Years)
Revenue	R 25.988 billion (NPV over 16 years)

4.3.1 Direct employment

The labour cost for this project was obtained from the budgeted costs included within the Mine Works Programme. It is anticipated that the project will potentially create 500 new job opportunities over the life of the mine. The employment creation over the life of mine has a Net Present value of R 5.23 billion, of which R 1.57 billion is with low income households.

The construction period will create additional short-term employment opportunities of between 250 to 300. Due to its temporary nature these values were not taken into consideration.

[1] Upfront and sustainable capital expenditure

4.3.2 Economic Impact

4.3.2.1 Capital investment

The capital investment incorporates initial and on-going capital expenditure. The initial capital expenditure is stated as R 895.8 million within the 18-month construction period.

As part of ongoing capital expenditure, the applicant made provision for major overhauls, replacement of equipment and infrastructure, with an additional R 101.2 million for sustainable capital expenditure over the LOM.

The total capital investment for the proposed project equates to R 1 billion in real monetary terms. The figures equate to R 782.94 million in net present value terms using a discount rate of 10%. This capital investment will have a positive impact on direct, indirect and induced effects on the local, regional and national economy.

4.3.2.2 Expected Revenue

The revenue numbers included in the MWP was utilised in this study. The expected revenue was determined based on modelled RoM. A price is then calculated based on the estimated product quality, in the case of price the calorific value of total product and a price of R 610/ton.

Revenue numbers were provided for a period of 10 years. As the active operational life of the proposed project is 16 years, an annual average inflow of revenue was assumed for an additional 6 years. This equates to an NPV revenue of R 25.99 billion over a period of 16 years. No downturn of production was however considered in this calculation.

4.3.3 Contribution towards ESKOM

In addition, the proposed project has a potential impact on Eskom's economic footprint. Eskom have two coal fired power generations stations in the area. The Power stations are within 40km from the project, and with Transnet's infrastructure programme, there will also be access to the rail infrastructure. Eskom's older power stations consume on average coal with a calorific value of 24.4 MJ/kg to a minimum of 21.5 MJ/kg, the newer power stations like Medupi can accept lower quality coal (caloric values as low as 18.5 MJ/kg, 18.5% volatiles and an ash content less than 36%). Based on Gruisfontein's processing strategy, this present the mine with an opportunity to provide Eskom with high-or low-grade coal. Both power stations are currently contracted with the Grootegeluk Mine to supply 14.6 million tons of coal a year. Access to the rail system also provides an opportunity to transport the coal to the Mpumalanga power stations.

4.3.4 Contribution towards socio-economic development

In addition to the direct and indirect economic impacts discussed above, the mine through its corporate social investments and social and labour plan, contributes towards the local economic development in the area. The operation of the proposed mine has following positive socio-economic benefits to its employees and surrounding communities:

- development of skills through its skills development plan;
- learnership programs to provide learners with an occupational qualification; and
- investment in infrastructure development through local economic development and integrated development programmes.

The MWP indicated the following investments toward the Social and Labour Plan (SLP) for the first five years:

- Human resource development (HRD): R 16.87 million;
- Local economic development (LED): R 14.55 million; and
- Management of downscaling and retrenchments: R 19.2 million.

This equates to a total of R 31.42 million for the first five years. This commitment will be revaluated towards the end of the five-year period of the current SLP. The socio-economic investment over the life of mine has a Net Present Value of R 83.8 million.

4.3.5 Other economic benefits

In addition to the quantifiable economic benefits that will result from this development, there are also several benefits that are not measurable in the same way, but that should be considered. These benefits could include:

- ***Technology***: Technology used on the mine will work towards improving knowledge on available technologies and skills in using such technology. This may enable local communities to run their own successful businesses in the future.
- ***Skills development***: Local community members who may not have any marketable skills other than a basic education will be able to acquire skills through employment on the mine. In addition to technical skills, there will be numerous roles imparting valuable management and leadership skills as well.
- ***Asset base***: The capital expenditure outlaid into the land in the area will result in an asset base upon which future development can occur. In addition to this, the asset base adds value to the municipality itself and provides a starting point for future developments.
- ***Local procurement and SMME opportunities***: Local communities will be enabled and provided with opportunities to participate in contracts and other new businesses that would become available during the construction and operational phases.

4.4 JOB CREATION

Employment during the operational phase has the potential of being over a long period (operational phase will span 16 years), which can have a major, long term (as opposed to short-term construction opportunities), positive impact for successful job applicants and their dependents. The operational workforce requirement for the mine is approximately 500 employees.

With mining being an established industry in the region, it is expected that a sufficient number of the unemployed will have appropriate skills to qualify them for at least semi-skilled positions at the mine.

During the construction process potential candidates can also be identified to receive skills training, bursaries or internships preparing them for specific roles during operations.

This means that local communities can potentially take maximum advantage of employment opportunities to be created by the proposed mine, and that Gruisfontein will likely be able to meet its local recruitment target. It should be noted that some positions will require scarce skills, which will not necessarily be readily available in local labour sending areas, therefore a certain percentage of the mine's workforce will be recruited from elsewhere in Gauteng and Limpopo. Those who succeed in gaining employment on the Project would benefit substantially in terms of wages, training/skills development and income security. Local employment in the project supply chain could further increase the benefits of the Project. However, the challenge will be to ensure that contractors comply with recruitment policies and relevant legislative requirements.

The project will contribute R240 million in wages and salaries per annum at current prices for the 16-year LOM period. The operational phase of the proposed project could give rise to some indirect employment opportunities. These could include jobs in the informal sector and in the formal sector (for instance, by sourcing goods and service from enterprises elsewhere in the secondary area where possible or increasing the demand for commuter transport services).

4.5 WORKFORCE DEVELOPMENT

As part of the SLP, Nozala Coal plans to implement a comprehensive workforce development plan through adult basic education and training, core business training, artisan training, learnerships, bursaries and internships programmes. These will be supported by career-path planning and mentorship.

4.6 COMMUNITY DEVELOPMENT

Nozala Coal is committed to optimize opportunities in the local communities through the implementation of the SLP. To further support local communities, Nozala Coal is proposing a LED project and support small business development.

Nozala Coal proposes the implementation of the following projects over the first 5 years of mining:

- Waste Transfer Station & Recycling Depot
- Community Water Supply (Lesedi / Steenbokpan)
- Enterprise Development Programme
- Housing and Living Conditions Programme

The proposed projects and the SLP budget must however still be approved by the DMR and SLP implementation will only commence once a decision has been made by the DMR on the granting of the Mining Right.

Furthermore, Nozala Coal is committed to support business initiatives through the provision of opportunities, assistance and support to SMME's and new HDSA business ventures.

5 DEVELOPMENT ALTERNATIVES CONSIDERED

5.1 SITE LOCATION

No site location alternatives have been considered as mining can only be undertaken in areas where economically mineable resources occur. This area was established through extensive prospecting and geological modelling.

5.2 LAND USE ACTIVITY ALTERNATIVES

The obvious alternative land use on the properties affected is the current mix of livestock and game farming, other alternatives include livestock farming only on those affected properties, or game and hunting activities only on those affected properties. Table 8 indicates the economic values of the current land use that would be impacted if mining is selected as the preferred land use, it further indicates alternative land uses for the same affected area if livestock farming only is practiced or if game farming only is practiced. The table indicates economic value and employment for the various options.

Table 8: Land use Alternatives

Category	Current Land-use (No Go Option)	Option 1: Livestock farming Only	Option 2: Game farming Only	Option 3: Mine Development
Total estimated revenue generation per annum	R 1 228 831	R 1 818 760	R 730 141	R 2.015 billion
Net-Present Value over LOM at current values	R 9 614 017	R 6 381 179	R 5 712 407	R 25.99 billion
Total direct employment generation	8	5	7	500
Total estimated wages per annum	R 203 450	R 190 140	R 119 154	R 240 million
Total wages to low income households per annum	R 162 760	R 152 112	R 95 324	R 72 million
Net-Present Value of wages over life of mine at current values	R 1 591 732	R 907 436	R 932 229	R 5.235 billion

It is clear from the above that, from a socio-economic perspective, the mining development is the more viable option in the short-term.

At decommissioning, it is assumed that all infrastructure will be removed, and the area rehabilitated during the decommission and closure phases of the mine in line with the EMPr closure objectives to optimise post mining land use. Once the infrastructure has been removed and the area rehabilitated, the land will be restored to grazing land.

For the purposes of assessing the potential economic impacts of post-mining activities it was firstly assumed that agricultural activities neighbouring the MRA area may be able to resume to the same level as before mining. Secondly, two scenarios were assumed for the MRA area. The first scenario assumed that the entire area could be utilised for livestock farming only. The second scenario assumed

that the area can be utilised for game farming only. As the potential duration and sustainability of these activities is uncertain, only annual values for employment and revenue in present value terms were determined. These values are presented in Table 9 below:

Table 9: Post-Mining Land Use Economic Impact (Annual Value)

Area	Livestock farming only		Game farming only	
	Revenue per annum	**Employment value per annum**	**Revenue per annum**	**Employment value per annum**
MRA area	R 975 000	R 114 084 (3 employees)	R 383 307	R 76 056 (2 employees)
Surrounding impacted (indirectly) area	R 843 760	R 76 056 (2 employees)	R 346 833	R 93 802 (5 employees)

With proper rehabilitation, it is therefore assumed that the project area will have a very similar economic profile post-closure.

5.3 TECHNOLOGY ALTERNATIVES

5.3.1 Mining Methodology

Mining method selection is one of the most critical activities of mining engineering. The factors that have a major impact on the mining method selection include:

- Physical and mechanical characteristics of the deposit such as ground conditions of the coal seam zone, nature of overlying strata and parting between seams, type and strength of roof and floor rocks, seam thickness, general shape, orientation of coal seam, plunge, depth of coal below the surface, quality and strength of coal, etc. The basic components that define the ground conditions are rock material shear strength, natural fractures and discontinuities, orientation, length, spacing and location of major geologic structures, in situ stress, hydrologic conditions, etc.;
- Economic factors such as capital cost, operating cost, mineable coal tons, coal quality and coal value;
- Technical factors such as mine recovery, flexibility of methods, machinery and mining rate; and
- Productivity factors such as annual productivity, equipment, efficiency and environmental considerations.

The selected mining method for this project is an open pit truck and shovel operation. This mining method has been employed extensively in numerous similar deposits globally and in South Africa and in particular in the Waterberg Coalfield. The selection of this mining method is based on the following four key criteria:

- Production targets - required coal and waste tonnes to be excavated;
- Geometry of the coal deposit;
- Anticipated in-pit mining conditions; and
- Flexibility of mining multiple benches within the defined open pit operation.

Underground mining is not considered feasible due to the thick laminated coal horizons prevalent in the Waterberg Coalfield which are conducive to open pit mining operations. These types of operations lead to optimal resource extraction which results in lower operating costs.

5.3.2 Mine Residue Disposal

The following environmental considerations were included in the discard management design for Gruisfontein, despite the higher cost associated therewith:

- A filter press at the plant has been provided in order to conserve water. This eliminates the need for a co-disposal system.
- The discard dump will be compartmentalised with soft and hard blasted overburden to eliminate the risk of spontaneous combustion.

5.3.3 Processing Strategy

The basic processing strategies that can be applied range from no beneficiation to complete beneficiation. They are listed as follows:

- Stage 1 – Crush and Screen – the RoM material is passed through various levels of crusher and then directed straight to product. No material is removed, only sized;
- Stage 2 – De-stoning – the RoM material is passed through a primary crusher. It is then passed through a portion, or portions, of equipment that both reduces the size further and removes (some) contamination;
- Stage 3 – Partial beneficiation – the RoM material is crushed and then screened. The split of material over and under the screen determines what percentage will be fed to a beneficiation process. The lower size limit for this depends on the technology employed;
- Stage 4 – Fines beneficiation –applicable to the -1 mm +0.2 mm size fraction. The technologies commonly used are either spirals or reflux classifiers; and
- Stage 5 – Ultra fines beneficiation – applicable to the -0.2 mm +0 mm size fraction. The technologies commonly used are flotation cells.

For now, a conservative approach has been taken in this study by assuming that all RoM will be beneficiated. However, previous experience on projects in the Waterberg Coalfield has resulted in a partial by-pass of RoM feed and this option will be further assessed after large borehole fractional analysis has taken place during the feasibility stage.

The overall benefits that will be gained through a partial wash is:

- Reduced coal processing plant capital costs;
- Reduced RoM production resulting in a smaller mining fleet;
- Reduced processing water usage; and
- Reduced surface moisture resulting in a higher coal price.

5.4 DESIGN OR LAYOUT ALTERNATIVES

5.4.1 Surface Infrastructure Location

The assessment of the geological information indicated that coal resources cover the entire farm with a fault traversing the southern portion resulting in a down-throw to the south. A decision was made to locate the infrastructure on this area where the coal seams are relatively deep and the cost of mining relatively expensive compared to the remaining resource area. The delineation of the open pit undertaken during the study resulted in the ramp to access the pit being located north of the fault and the layout of the infrastructure was determined taking cognisance of the following parameters:

- Layout in the south-western corner of the farm to minimise the sterilisation of potentially economic coal resources;
- Minimising the distance from the open pit ramp through to the product stockpiles; and
- Considering the prevailing wind direction to minimise the environmental impact on the supporting infrastructure.

The location of the infrastructure, based on these parameters, is also conducive to the topography of the farm, which slopes gently to the north, in terms of dirty water handling systems.

According to the Limpopo Conservation Plan V.2 (C-Plan, 2013), a Critical Biodiversity Area (CBA) 1 is situated immediately to the north of the farm Gruisfontein – refer to Figure 18. A few private nature reserves are also located adjacent and to the north-east of the farm Gruisfontein – refer to Figure 19. By placing the mine infrastructure in the southern portion of the development footprint, a portion of natural vegetation will be left intact adjacent to the CBA 1 and the private nature reserves that could buffer against edge effects.

The terrestrial specialist study indicated that most of the proposed surface infrastructure falls within the Sweet Bushveld B habitat unit, which is of moderately high sensitivity and recommended that as far possible and feasible, the location of the infrastructure areas should be reconsidered. However, considering the factors above in terms of the engineering and operational aspects and the location of the conservation areas, the existing surface infrastructure location as indicated in the Scoping Report is still supported.

5.4.2 Transport

The current financial viability of the Gruisfontein Project is based on supplying Eskom steam coal product to either the Matimba or Medupi Power Stations. Product will be transported via road to either Medupi or Matimba Power stations or both, along the secondary (gravel) Provincial Road D175 and the paved Provincial Road D1675.

Alternatively, the product can be transported to the Temo Railloop Rapid Load-Out Facility planned approximately 400m south of the CHPP on farm Duikerpan 249 LQ (still to be confirmed and agreed).

Refer to Figure 12 for the product transport options.

5.5 NO-GO OPTION

The main consequence of the No-Go Option is the loss of opportunity to develop a viable mineral resource with an estimated LOM of 16 years which has the potential for increased economic benefits on local, provincial and national level in terms of employment and the contribution to the GDP.

Other socio-economic benefits that will be lost include the skills development opportunities, Local Economic Development projects (SLP) and Local procurement and SMME opportunities.

In the "no-go" scenario, the current land use activities will remain in force and agricultural activities will continue to contribute towards the local, regional and national economies as outlined.

In addition, the proposed project has a potential impact on Eskom's economic footprint. The potential impact of the project not going ahead, may not significantly impact on Eskom as coal could be sourced from other suppliers. Sourcing coal from another source may have an impact on operational expenses and ultimately the consumer, which would include the entire South Africa.

5.6 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

No alternatives site locations have been considered as mining can only be undertaken in areas where economically mineable resources occur. This area was established through extensive prospecting and geological modelling. Infrastructure to support the Gruisfontein Project has been laid out and engineered to best suit the topography and mining pit layout.

The mining and infrastructure layouts were optimised to minimise the area of disturbance, whilst allowing for the economical and optimal extraction of the mineral resource. The proposed footprint of the infrastructure and mining areas (disturbed areas) is in the order of 830 ha (70% of the farm extent) and is situated on the southern portion of the farm Gruisfontein. The placement allows for a portion of natural vegetation between the proposed activity and the conservation areas situated just to the north and north-east of the farm, which could buffer against edge effects on the sensitive area.

The only real alternative to the mine is the No-Go Option. The main consequence of the No-Go Option is the loss of opportunity to develop a viable mineral resource with an estimated LOM of 16 years which has the potential for increased economic benefits on local, provincial and national level in terms of employment and the contribution to the GDP, as well as further economic opportunities downstream of the mine. Other socio-economic benefits that will be lost include Skills development opportunities, LED projects (SLP) and Local procurement and SMME opportunities. Refer to Section 5.2 (Table 8) for the land use alternatives that were investigated and the associated economic value and employment opportunities.

5.7 MOTIVATION FOR PREFERRED DEVELOPMENT ALTERNATIVES

Table 10: Motivation for preferred development alternatives

Aspect	Preferred Development Alternative	Motivation
Land use activity	Mining	Currently the economic activities within the MRA area are limited and the mine will be a definite economic improvement. Although the proposed mine could potentially impact negatively on the current land use activities in the surrounding area, the net result is a positive improvement in benefits for the area. The positive economic contribution to the Limpopo and National economies is an additional positive factor.
Mining methodology	Opencast mining	Underground mining is not considered feasible due to the thick laminated coal horizons prevalent in the Waterberg Coalfield which are conducive to open pit mining operations.
Mine residue disposal	Filter press for slurry	A filter press at the plant will conserve water and eliminates the need for a co-disposal system, which has the potential for significant groundwater contamination if not managed.
	Compartmentalised discard dump	By compartmentalising the discard with soft and hard blasted overburden, the risk of spontaneous combustion will be eliminated.
Surface infrastructure location	South-western corner of the farm	By placing the mine infrastructure in the southern portion of the development footprint, a portion of natural vegetation will be left intact adjacent to the CBA 1 and the private nature reserves that could buffer against edge effects.
Transport	Combination of road and rail transport	Although rail is the best option in respect of social considerations, this option still needs to be confirmed and agreed with Temo Coal.

The preferred mining and layout infrastructure footprint are indicated in Figure 4. A large-scale plan is attached as Appendix 19.

6 ENVIRONMENTAL AND SOCIAL CONTEXT (BASELINE)

The specialist reports have addressed the baseline environment in detail and are attached as appendices. The following section is a summary of the specialist baseline work and relevant important environmental attributes associated with the mining site.

6.1 CONSERVATION CHARACTERISTICS

Table 11 contains data accessed as part of the desktop assessment for the study area, as well as the Quarter Degree Squares (QDSs) in which the study area is located. It is important to note, that although all data sources used provide useful and often verifiable high-quality data, the various databases do not always provide an entirely accurate indication of the study area's actual biodiversity characteristics.

The proposed mining development area is not located within any protected areas, or threatened ecosystems, nor is the study area considered important for meeting biodiversity targets in Limpopo seeing that it falls outside of any Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs).

According to the Limpopo C-Plan, the study area falls within an area that is natural and intact, i.e. no management objectives, land management recommendations or land use guidelines are prescribed for such areas within the Limpopo C-Plan. However, a CBA 1 area is situated immediately to the north of the farm Gruisfontein – refer to Figure 18. A few private nature reserves are also located adjacent and to the north-east of the farm Gruisfontein – refer to Figure 19.

By placing the mine infrastructure in the southern portion of the development footprint, a portion of natural vegetation will be left intact adjacent to the CBA 1 and the private nature reserves that could buffer against edge effects.

There is further no Important Bird and Biodiversity Areas (IBA) located within 10 km of the study area. The closest IBA to the proposed development area is the Waterberg System (SA007), with its northern boundary located approximately 40 km to the south-east of the proposed Gruisfontein Project site.

Table 11: Summary of the terrestrial conservation characteristics for QDS 2327CA & 2327CB (STS, 2019)

{CBA = Critical Biodiversity Area, ESA = Ecological Support Area, IBA = Important Bird and Biodiversity Area, MAP = Mean Annual Precipitation, MAT = Mean Annual Temperature, MFD = Mean Frost Days, MAPE = Mean Annual Potential for Evaporation, MASMS = Mean Annual Soil Moisture Stress, NBA = National Biodiversity Assessment, NPAES = National Protected Areas Expansion Strategy, SACAD = South African Conservation Areas Database, SAPAD = South African Protected Areas Database}

DETAILS OF THE STUDY AREA IN TERMS OF MUCINA & RUTHERFORD (2012)	
Biome	The study area is situated within the **Savanna Biome.**
Bioregion	The study area is located within the **Central Bushveld Bioregion.**
Vegetation type	The study area is situated within the **Limpopo Sweet Bushveld.**
CONSERVATION DETAILS PERTAINING TO THE STUDY AREA (VARIOUS DATABASES)	
NBA (2011)	The study area falls within an area that is currently **poorly protected**. Ecosystem types are categorised as "not protected", "poorly protected", "moderately protected" and "well protected" based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act, 2003 (Act 57 of 2003), and compared with the biodiversity target for that ecosystem type. Poorly protected areas are areas where < 50% of the biodiversity target protection level is met within protected areas as per the Protected Areas Act.
National Ecosystem Threat Status (2011)	According to the National Threatened Ecosystems (2011) database, the study area falls within an area that is of **least concern**.
IBA (2015)	There is no IBA located within 10 km of the study area.
NPAES (2009); SACAD (2018); SAPAD (2018)	SAPAD (2018) indicates four Private Nature Reserves (PNR) within 10 km of the study area. The Jacobs PNR is located ± 0.56 km to the north of the study area with the Emaria PNR ± 3.1 km northeast, the Jancornel PNR ± 4 km north and the Jee Lee PNR ± 9.2 km northeast of the study area. No other conservation or protected areas are located within 10 km of the study area according to the various databases assessed.
LIMPOPO CONSERVATION PLAN VERSION 2 (C-PLAN, 2013)	
According to the Limpopo C-Plan, the study area does not fall within any Protected Areas, CBAs or ESAs. However, the northern boundary of the study area borders a CBA 1 with additional small, isolated areas surrounding the study area considered to be ESAs 1. CBA 1 areas are considered to be irreplaceable areas that are required to meet biodiversity pattern and/or ecological processes targets. No alternative sites are otherwise available to meet such targets. An ESA 1 include natural, near natural and degraded areas supporting CBA's by maintaining ecological processes.	
Other Natural Areas	The entire study area falls within an area considered to be **natural**. These are natural and intact areas but are not required to meet targets, nor have they been identified as CBA or ESA.
Faunal ecology	According to the Limpopo C-Plan, the study area falls within a location that provides special habitat for cheetah populations.

DESCRIPTION OF THE VEGETATION TYPE(S) RELEVANT TO THE STUDY AREA ACCORDING TO MUCINA & RUTHERFORD (2012)					
Vegetation Type	**Limpopo Sweet Bushveld (SVcb 19)**				
Climate	Summer rainfall with very dry winters including the shoulder months of May and September. **Remark**: Though limited by low rainfall, this is a good area for game and cattle farming due to the high grazing capacity of sweet veld.				
	MAP* (mm)	**MAT* (°C)**	**MFD* (Days)**	**MAPE* (mm)**	**MASMS* (%)**
	421	20.2	9	2422	82
Altitude (m)	700–1 000 m.				
Distribution	Limpopo Province: Extends from the lower reaches of the Crocodile and Marico Rivers around Makoppa and Derdepoort, respectively, down the Limpopo River Valley including Lephalale and into the tropics past Tom Burke to the Usutu border post and Taaiboschgroet area in the north. The unit also occurs on the Botswana side of the border.				
Conservation	**Least threatened**. Target 19%. Less than 1% statutorily conserved and limited to reserves straddling the south-eastern limits of the unit, for example, the D'Nyala Nature Reserve. Very little conserved in other reserves. About 5% transformed, mainly by cultivation. Erosion is low to high.				
Geology & Soils	The northern half of the area is dominated by gneisses, metasediments and metavolcanics of the Malala Drift Group, Beit Bridge Complex (Swazian Erathem), basalts of the Letaba Formation (Lebombo Group of the Karoo Supergroup) are also found in the northeast. Sandstone, siltstone and mudstone of the Clarens Formation (Karoo Supergroup), as well as of the Matlabas Subgroup (Mokolian Waterberg Group) are found to the south and west. Soils with calcrete and surface limestone layers, brownish sandy (Clovelly soil form) clayey-loamy soils (Hutton soil form) on the plains and low-lying areas, with shallow, gravelly, sandy soils on the slightly undulating areas, localised areas of black clayey soils (Valsrivier or Arcadia soil forms) and Kalahari sand. Land types mainly Ae, Ah and Fc.				
Vegetation & landscape features	Plains, sometimes undulating or irregular, traversed by several tributaries of the Limpopo River. Short open woodland; in disturbed areas thickets of *Senegalia erubescens, S. mellifera* and *Dichrostachys cinerea* are almost impenetrable.				
MINING AND BIODIVERSITY GUIDELINES (2013)					
The Mining and Biodiversity Guidelines (2013) have not identified any areas of significance within the study area. There is, however, several small areas surrounding the study area that is of High Biodiversity Importance. An area considered to be of Highest Biodiversity Importance is located approximately 1.1 km north-west of the study area.					

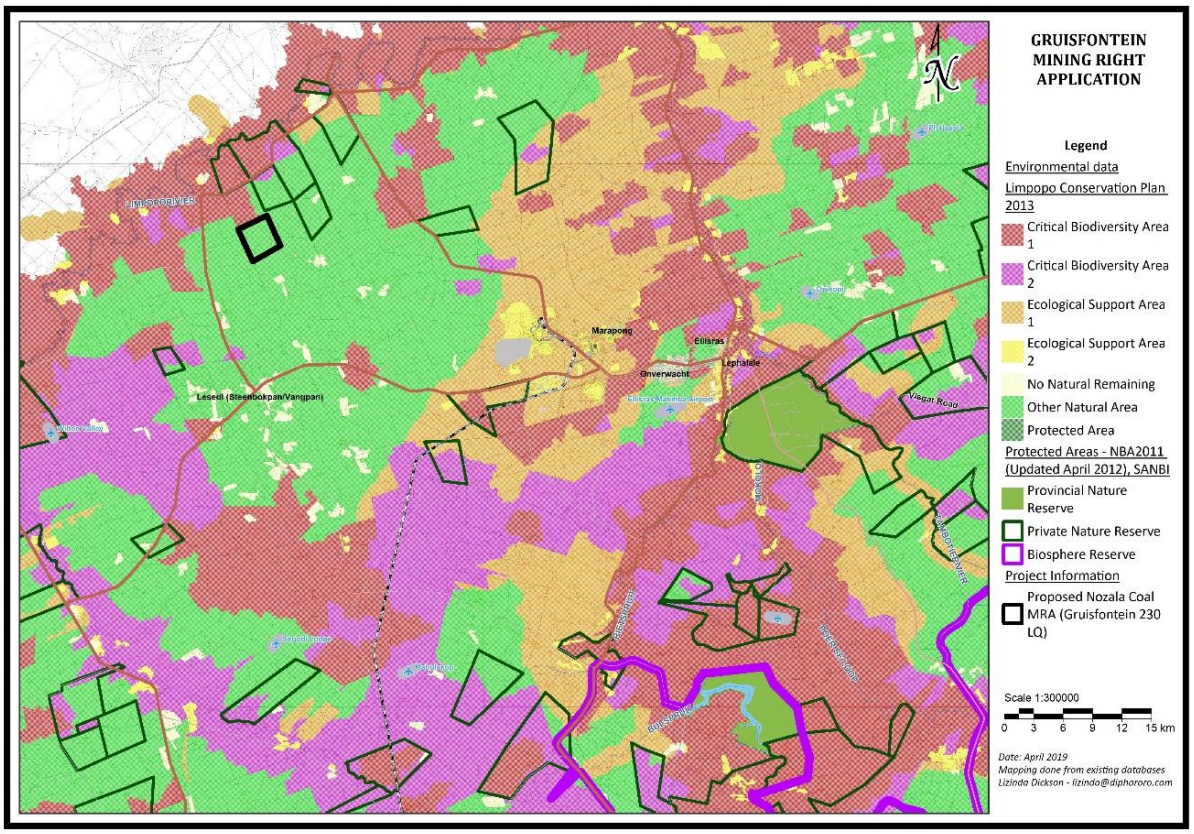

Figure 18: Limpopo C-Plan and protected and conservation areas in relation to the project area

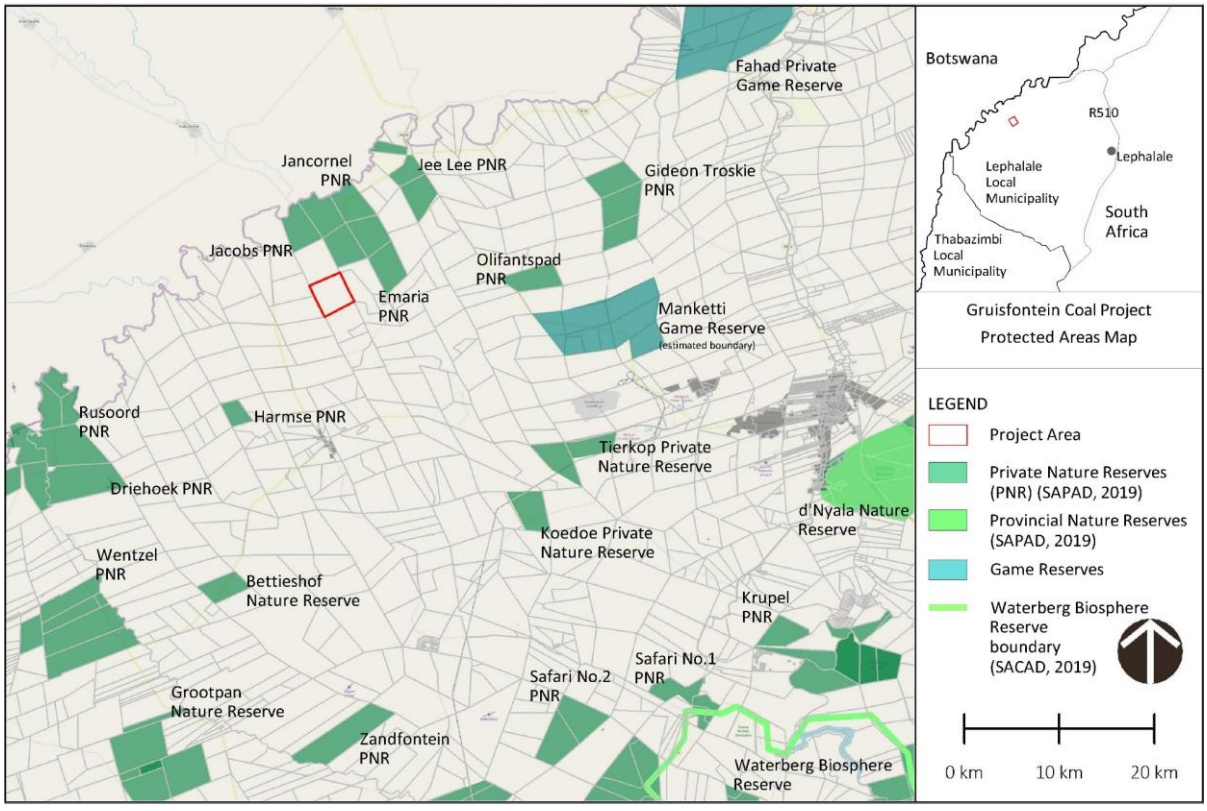

Figure 19: Protected Areas as indicated by the SAPAD database (2019) in relation to the project area

6.2 BIOPHYSICAL ENVIRONMENT

6.2.1 Topography and Landscape Character

The surface topography around Gruisfontein can be described as relatively flat with a very slight and gentle slope (0.4%) towards the north. Surface elevations vary between approximately 870 meters above mean sea level (mamsl) in the south and ± 840 mamsl in the north.

No significant distinguishing topographical features such as rivers or watercourses, or prominent hills, rocky outcrops or ridges are present within the Gruisfontein Project area. The proposed project area is however located within a water catchment area that drains into the Limpopo River to the north.

The landscape character, from a visual and aesthetical point of view, is defined by vegetation and topography and the way the landscape has been altered by human activity, through cultural factors such as land use or settlement patterns. The landscape character type associated with the Gruisfontein Project's receiving environment is relatively uniform and can broadly be defined as rural, level, open bushveld interspersed with unpaved access roads, in contrast to, for example, areas further to the south-east while has a more industrial and transformed character due to the presence of existing mining activity and adjacent power stations.

The general landscape character of the region and project area is illustrated in Figure 20. The vegetation cover is largely undisturbed and can be considered one of the most attractive features in the area.

Sense of Place relates to uniqueness, distinctiveness or strong identity and is sometimes referred to as *genius loci* meaning 'spirit of the place'. Sense of Place is created by the land use, character and quality of a landscape, as well as by the tangible and intangible value assigned thereto. The landscape character type, defined as rural, level, open bushveld, is relatively common within the larger region and has little visual variety, but the natural and pastoral character of the area exhibits an identifiable and positive sense of place. This is mainly due to the presence of distinctive bushveld vegetation, the vast skies, the relatively proximity of the Limpopo River, and the overall relaxed and tranquil rural atmosphere.

Considering the number of prospecting and planned mining developments in the region and its location within an environmental zone designed in terms of the Waterberg District Environmental Management Framework (EMF, 2017) as a mining focus area, it is highly likely that the current sense of place and landscape character will change to that of a more industrial and developed sense of place in the near future.

Figure 20: Landscape character of the project area and surrounds

The visual characteristics of the project area and surrounds are summarised in Table 12.

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Table 12: Visual characteristics of project area and surrounds

Landscape character	Rural, level, open bushveld interspersed regularly with unpaved access roads.
Sense of Place	The receiving landscape exhibits an identifiable and positive sense of place, which can be defined as natural and rural bushveld. The sense of place is mainly attributed to the presence of distinctive bushveld vegetation, the vast skies, the relative proximity of the Limpopo River, and the overall relaxed and tranquil atmosphere.
Landscape Value	Moderate: • The landscape is considered to have moderate importance and rarity in terms of recreational value, scenic beauty, tranquility or wildness, cultural associations or other conservation interests. • The landscape has limited potential for substitution (once it is lost it is unlikely to be regained).
Landscape Condition and Quality	Moderate: • Although the receiving landscape is relatively uniform, no distinct landscape features, such as prominent hills or watercourses are present within the project area. • The vegetation and scenic resources are largely intact although a few distracting or contrasting landscape elements, such as signage, access roads and bare road reserves, powerlines, gates and fences are present. • The landscape is cohesive and in an overall good condition, but relatively well-represented in the region. • Landscape elements, such as the existing bushveld vegetation contribute towards the overall positive character of the area.
Landscape Sensitivity	Medium: • The landscape has some capacity to accept well-planned and designed change and development.
Visual Absorption Capacity (VAC)	Moderate: • Existing vegetation is the primary contributor to screening of infrastructure, with screening from man-made structure and topography being limited. • Overall visual variety and topographical diversity in the area is low and the homogeneous landscape and vegetation pattern will contribute to the increased visual intrusion of infrastructure that contrasts with the receiving environment.
Visual Intrusion	High: • The proposed project and change in land use are likely to result in a noticeable change or are discordant with the surroundings.

6.2.2 Soils and Land Capability

6.2.2.1 Soils

Figure 21 illustrates the dominant soil forms for the area. The different soil polygons indicated on the map show the soils that dominate the area. The boundary lines between soil forms indicated on the map should be seen as a gradient of transition as opposed to an abrupt change.

The following soil forms were identified:

- The Hutton soil form (Hu) comprises an orthic A-horizon overlying a red apedal B-horizon. The red apedal B-horizon has macroscopically weakly developed structure or is altogether without structure and reflects weathering under well drained, oxidised conditions. The clay fraction is dominated by non-swelling 1:1 clay minerals and the red colour of the soil is ascribed to iron oxide coatings on individual soil particles that are dominated by hematite. These soils are predominantly deeper than 150 cm.
- The Ermelo soil form (Er) comprises an orthic A-horizon overlying a yellow brown apedal B-horizon. The latter horizon shows the same characteristics as the red apedal B-horizon with the exception that it displays a yellow colouration owing to the Fe mineral fraction containing less than 15 % hematite (Fe_2O_3). The yellow colouration is ascribed to goethite (FeOOH).

Both soil forms are sandy in nature (the Hutton soils display a somewhat higher silt content), deeper than 150 cm at all augering sites (approximately 724 holes were augered), exhibit good internal and external drainage (high saturated hydraulic conductivity), uniform colouration, no occurrence of rocks or layers impeding root development, no occurrence of free carbonates (*in situ* testing with a 10 % HCl solution was conducted) and no signs of regular water logging at any depth in the profile.

Table 13 summarises the hectares comprised by each soil form. None of the soils encountered on site showed hydromorphic characteristics within the top 50 cm of the soil profile.

Table 13: A summary of the hectares which each soil form comprises

Soil form	Hectares
Ermelo	739
Hutton	91
Total	830

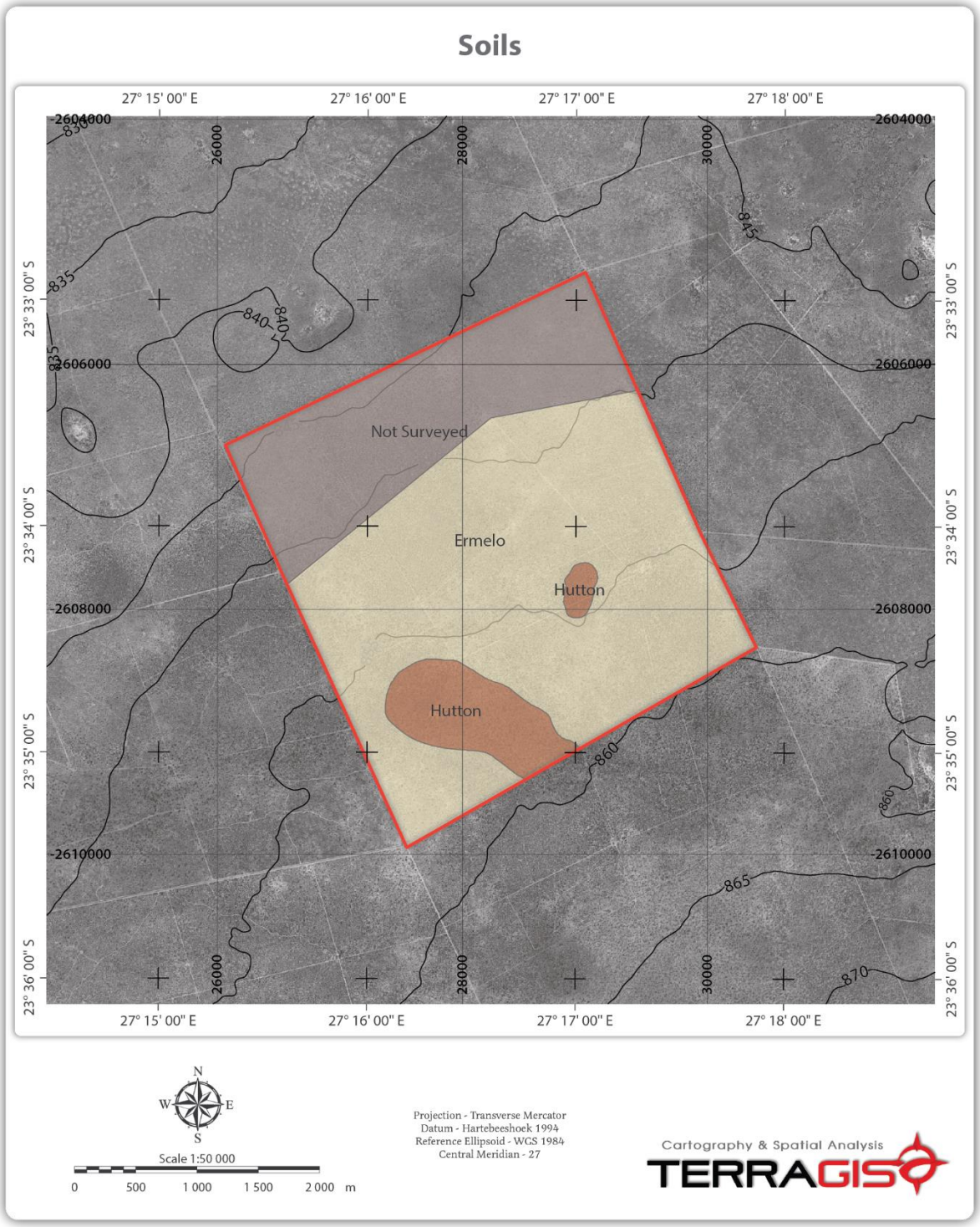


Figure 21: Soil map for Gruisfontein Project area

6.2.2.2 Hydropedological Functioning

The area is characterised by sandy, well drained soils which evolved under oxidising conditions. Hydromorphic soils or signs of wetness (i.e. mottles, bleaching, gleying) were not encountered. The soils show a high infiltration rate and a high saturated hydraulic conductivity.

After and during rainfall events, water rapidly infiltrates the soils and percolates through the profile. The matric potential of these sandy soils is low and therefore the water holding capacity of the soils is low. The slightly elevated silt and clay content of the Hutton soils should result in soils with a slightly higher water holding capacity – compared to the soils of the Ermelo soil form. The slight increase in clay and silt content in the Hutton soils corresponds with the more frequent occurrence of thorn trees (i.e. *Acacia* species) whereas broad-leaved trees (i.e. *Terminalia* species) dominates the soils of the Ermelo soil form.

Surface run-off can occur during high intensity rainfall events where the rate of rainfall surpasses the infiltration rate of the soils. The area is undulating and accumulation of water at low points is not prolonged enough to cause changes in the soil morphological features.

Small (less than 2 m in diameter) depressions were noted. These depressions may sporadically contain water. It is postulated that these depressions are wet directly after a rainfall event but dries out relatively quickly – probably within days if not hours. Augering was done at these sites and no signs of prolonged water logging (i.e. mottles, bleaching, gleying) were noted. An increase in silt and clay content was noted within the first one centimeter of the soil. Deeper augering reveals soils similar in morphology to that of the surrounding area.

6.2.2.3 Current Land Use

The land use in the vicinity and within the project area is that of cattle and game farming, including hunting and tourism opportunities. While some disturbance has occurred within the project area due to these and related activities, most of the farm Gruisfontein comprises natural vegetation.

Development in the immediate region is mainly limited to low-density residential dwellings and related outbuildings, low-density infrastructure associated with cattle and game farming, as well as lodges and accommodation facilities situated mostly towards the north and bordering the Limpopo River.

Existing large-scale infrastructure in the vicinity and within 50 km of the project area of the farm Gruisfontein include the significant Grootegeluk Colliery, Eskom's Matimba Coal Fired Power Station and Eskom's new Medupi Coal Fired Power Station which is currently under construction. Several other infrastructure projects, particularly mining-related projects, are also currently being considered for environmental authorisation.

6.2.2.4 Land Capability

The soils fall into the arable land capability class. These soils are deep (>150 cm), exhibit adequate internal and external drainage, do not show rockiness or any other factor which could adversely affect ploughibility and are suited to irrigation.

The soils fall into Class 2 [Suitable for irrigation with slight limitations (such as undulating topography), moderately well drained, moderately slow or moderately rapid permeability or moderate depth of soil] or Class 3 [Low suitability with moderately severe limitations, imperfect or somewhat excessively drained soils, slow or rapid permeability or shallow soils].

The availability of ground/surface water will dictate if these soils can be irrigated. High temperatures and high evaporation rates dominate this area and no surface water is present. The Limpopo River is situated approximately 7 km north of the site. The groundwater level is approximately 17 to 22 meters below surface. It is uncertain if boreholes will yield adequate water supply for large scale irrigation to be possible.

The soils of the area exhibit lower levels of Ca, Mg, K and PO_4 than is required by maize. This can be amended with soil ameliorants. The sandy nature of the soils (low organic carbon and clay/silt content) probably manifests as a poor capacity to retain nutrients. Fertilisation and soil amelioration costs, as well as costs associated with irrigation, will be significant if the area was to be developed for crop production.

The rainfall, on average, is relatively low (401 mm to 600 mm per year) and high average temperatures (high evaporation) dictate that hydrophytic crops (most agricultural crops, especially broad leaved such as spinach, cabbage etc.) will suffer from draught stress under dry-land crop production. The crops that will be able flourish under dry-land crop production are drought resistant plants such as sisal.

If the soils can be irrigated (meaning sufficient groundwater reserves are present) the soils will be classified as high potential arable soils. If irrigation is not possible, the soils will be classified as low potential arable land.

6.2.3 Terrestrial Ecology

6.2.3.1 Flora

6.2.3.1.1 Vegetation Type

The vegetation within the study area is representative of the Limpopo Sweet Bushveld vegetation type. Species characteristic of the reference state was well-represented throughout, including the woody species *Boscia albitrunca*, *Commiphora pyracanthiodes* and *Terminalia sericea*, as well as grasses such as *Enneapogon cenchroides, Eragrostis lehmanniana*, *Schmidtia pappophoroides* and *Stipagrostis uniplumis*.

A noticeable change in vegetation structure within the southern section of the study area was evident, i.e. there was an increase in species diversity (especially noticed for forb and woody species) and denser vegetation. The change in vegetation structure seems to be moisture driven; however, no freshwater features were identified for the area. The likely cause of the change seen within the vegetation structure is the high abundance of *Vachellia erioloba* present within the southern section of the study area. *Vachellia erioloba* is a deep-rooted tree (records of up to 60m) able to cycle nutrients from great depths to the surface, thereby potentially facilitating the growth and survival of a greater diversity of floral species.

To better describe the differences in vegetation composition, the Limpopo Sweet Bushveld vegetation within the study area was divided into two habitat units, i.e. Sweet Bushveld A and Sweet Bushveld B (denser vegetation). A third smaller habitat unit is also described, i.e. Degraded habitat.

The distribution of the habitat units within the study area is depicted in Figure 22.

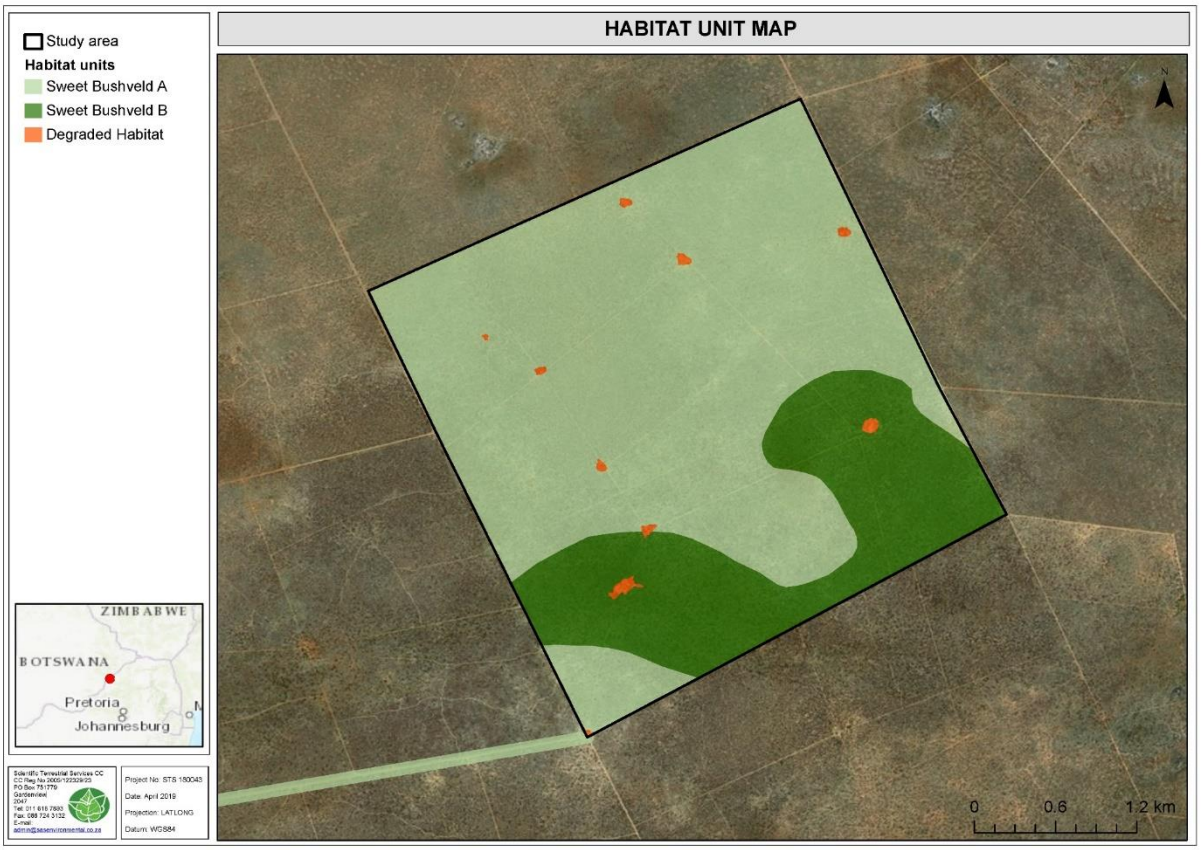


Figure 22: Habitat units identified in the Gruisfontein Project area

The three identified habitat units, and the floral sensitivities thereof are described in Table 14 to Table 16.

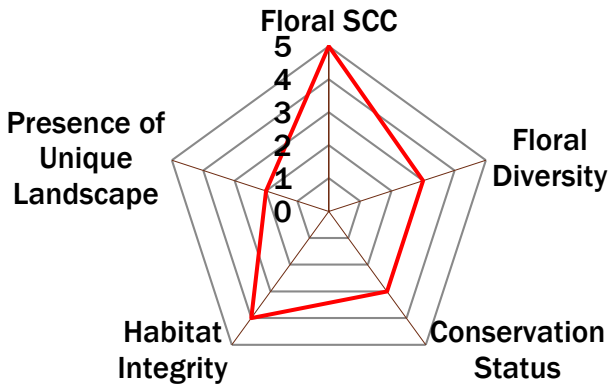
Table 14: Habitat Unit 1 - Sweet Bushveld A (STS, 2019)

Floral Habitat Sensitivity	Intermediate

Habitat Unit:

The Sweet Bushveld A habitat unit is characteristic of the Limpopo Sweet Bushveld vegetation type and can be described as short, open woodland with a grass cover of 40 – 60% and woody species mainly consisting of small trees and/or tall shrubs. The dominant woody species included *Terminalia sericea* and *Peltophorum africanum*. This habitat unit extends across the majority of the study area and, at the time of the field assessment, the vegetation showed low levels of disturbance. This was particularly evident as *Dichrostachys cinerea* was not encroaching within the study area, whereas it was seen to form dense stands within the surrounding farms.

Floral Habitat Sensitivity Graph



Reference photos of vegetation associated with, and typically occurring within, the Sweet Bushveld A habitat unit

Floral Species of Conservation Concern (SCC)	Within the Sweet Bushveld A habitat unit there were several floral SCC encountered, most of which were tree species protected under the National Forest Act, 1998 (Act 84 of 1998, as amended in September 2011) (NFA), including: • *Boscia albitrunca* (Shepherd's tree) – scattered throughout the Sweet Bushveld A; • *Sclerocarya birrea* subsp. *caffra* (Marula tree) – low abundance within Sweet Bushveld A; and • *Vachellia erioloba* (Camel Thorn) – moderately low abundance within Sweet Bushveld A. One species protected under the Limpopo Environmental Management Act, 2003, (Act 7 of 2003) (LEMA) - Schedule 12 (Protected Plants) - was present in moderately low abundances within this habitat unit, i.e. *Adenium oleifolium* (Bitterkambro). More species are expected to be present. Additionally, one species protected under the Threatened or Protected Species (TOPS) Regulations (GN 255 of 2015) under Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (NEMBA), i.e. *Harpagophytum zeyheri,* was encountered in low abundances; however, more species are expected to occur throughout the study area. Based on the results of the floral SCC assessment, the following species received a high Potential of Occurrence (POC) score and, although not recorded on site during the field assessment, these species are deemed likely to occur within the Sweet Bushveld A habitat unit: *Corchorus psammophilus* (VU), *Drimia sanguinea* (near threatened and TOPS protected), *Harpagophytum procumbens* (Devil's Claw, TOPS protected) and *Securidaca longepedunculata* (Fibre Tree, NFA protected). This habitat unit can also support additional LEMA protected species such as *Huernia zebrina* subsp. *insigniflora*, *Orbea* spp., *Stapelia gettliffei* and *Stapelia kwebensis*.
Floral Diversity	The Sweet Bushveld A habitat unit has a moderate diversity of floral species. The floral composition within this habitat unit is characteristic of the reference vegetation type, i.e. the Limpopo Sweet Bushveld, with graminoid and woody species best represented within the landscape. The well-developed grass layer included the dominant grass species *Eragrostis lehmanniana* and *Stipagrostis uniplumis* var. *uniplumis*, with *Enneapogon cenchroides*, *Perotis patens* and *Schmidtia pappophoroides* also common throughout the habitat unit. The woody layer mostly consisted of small trees and shrubs such as *Commiphora africana*, *Commiphora pyracanthoides*, *Elephantorrhiza elephantina*, *Grewia flava, Grewia flavescens, Heliotropium nelsonii Ozoroa paniculosa* and *Senegalia cinerea.* Taller tree species such as *Boscia albitrunca* (NFA), *Senegalia nigrescens* and *Vachellia erioloba* (NFA) were sparsely scattered throughout the habitat unit. *Peltophorum africanum* and *Terminalia sericea* were the dominant woody species. The forb layer was less prominent in this habitat unit than within the Sweet Bushveld B habitat unit. Scattered populations of *Adenium oleifolium* (LEMA), *Chamaecrista mimosoides*, *Commelina africana*, *Hibiscus physaloides*, *Indigofera daleoides* var. *daleoides, Indigofera ingrata* and several *Ledebouria* spp were present. A low forb diversity is characteristic of the Limpopo Sweet Bushveld vegetation type.  Some of the well-represented species within the Sweet Bushveld A habitat unit (left to right): *Peltpphorum africanum, Schmidtia pappophoroides* (gramminoid), *Commiphora pyracanthoides*, *Indigofera daleoides* var. *daleoides* and *Ozoroa paniculosa.*

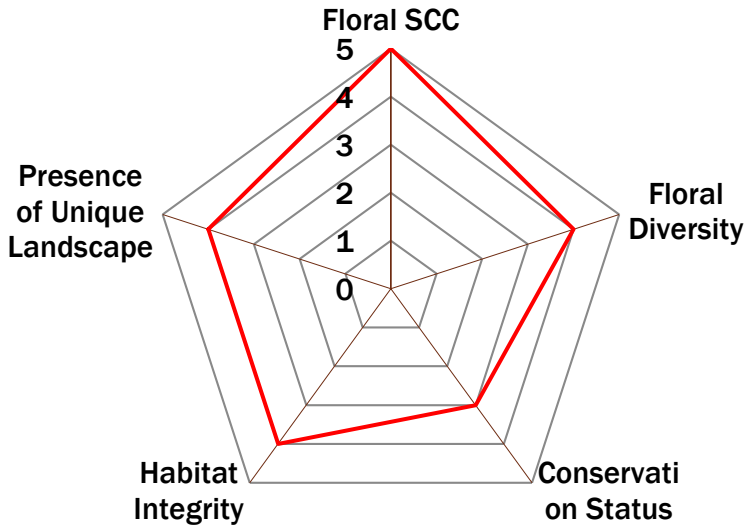
<table>
<tr><td rowspan="3">Conservation Status of Vegetation Type/Ecosystem</td><td rowspan="3">The Sweet Bushveld A habitat unit does not fall within a Threatened Ecosystem, nor within any protected or conservation areas. The Mining and Biodiversity Guidelines (2013) also does not recognise an important biodiversity area associated with this habitat unit.
The entire study area falls within a natural area as defined within the Limpopo Conservation Plan v.2 (2013), for which no management objectives, land management recommendations or land-use guidelines are prescribed (Limpopo Conservation Plan v.2: Technical Report).</td><td>Habitat integrity/Alien and Invasive species</td></tr>
<tr><td>The vegetation is intact and very few alien and invasive plant (AIP) species were recorded. The veld is in a good condition; however, Grewia flava, Grewia flavescens and Heliotropium nelsonii formed dense, encroaching stands in some sections of this habitat unit.</td></tr>
<tr><td>Presence of Unique Landscapes</td></tr>
<tr><td colspan="2">The Sweet Bushveld A habitat unit is well represented within the study area as well as the surrounding areas. No unique habitat important for floral diversity is present. However, the LEMA protected Adenium oleifolium (Bitterkambro) is present within this habitat unit and is considered to be rare in the area (Van der Walt, 2009). Therefore, Sweet Bushveld A provides important habitat for floral SCC.</td></tr>
<tr><td>Business Case, Conclusion and Mitigation Requirements:</td><td colspan="2">This habitat unit is of intermediate ecological sensitivity and importance from a floral perspective.
Proposed mining infrastructure that will impact on floral habitat, diversity and SCC associated with the Sweet Bushveld A habitat unit include:
• Majority of the proposed Open Pit and box cut;
• Sections of both the hard and soft overburden dump, as well as of the discard dump (the eastern portion of the study area);
• CHPP Plant;
• Pollution Control Dam (PCD);
• Sections of the Water Management System (trenches around footprint area); and
• Sections of the Internal roads.
The most significant impacts on floral ecology will mainly be associated with the clearing of vegetation during the construction phase of the project. This will include the loss of several individuals of tree species protected under the NFA and several plant species protected under LEMA and the TOPS regulations. Loss of some species diversity can be expected due to possible edge effects during the operational phase of the proposed mining project, including the potential proliferation of AIPs and encroachment of species such as Dichrostachys cinerea, Grewia flava, Grevia flavescens and Heliotropium nelsonii in response to mining-related disturbances.
Mining activities within this habitat unit will have a direct impact floral habitat and diversity within the study area and in order to ensure that the impacts on floral ecology be as low as possible, the following recommendations are made to minimise the impact on floral species:
• All possible steps must be taken to ensure that infrastructure does not unnecessarily encroach so to prevent negative impacts due to construction-related disturbances;
• An AIP Control Plan should be implemented throughout the project so to both prevent the spread of AIPs into natural areas as well as to control current AIP populations;
• Spills and /or leaks from equipment must be immediately remedied and cleaned up to ensure that these chemicals do not enter into the soils;
• To minimise the need for additional vegetation clearance, existing access roads are to be used to gain access to the proposed infrastructure as far as possible;
• Before any construction activities can occur a detailed walk down of the area must take place, preferably within their flowering season (or fruiting season for some species), during which all protected species should be marked; and
• Permits from the relevant authorities, i.e. Limpopo Department of Economic Development and Tourism (LEDET) and Department of Agriculture, Forestry and Fisheries (DAFF), should be obtained before removal, cutting or destruction of protected species or floral SCC before any proposed mining activities may take place.</td></tr>
</table>

Table 15: Habitat Unit 2 -Sweet Bushveld B (STS, 2019)

Floral Habitat Sensitivity	Moderately High

The Sweet Bushveld B habitat unit is also characteristic of the Limpopo Sweet Bushveld vegetation type but differs from the Sweet Bushveld A habitat unit in that there is a higher diversity of grasses, woody species and especially forbs. A noticeably lower abundance of *Terminalia sericea* was also evident. The denser vegetation seems to be moisture-driven as indicated by the presence is *Combretum imberbe* (Leadwood) and a particularly high abundance of *Vachellia erioloba* (Camel Thorn). Moreover, the increased shade caused by the increase in woody species allows for less moisture to evaporate. This habitat unit is located within the southern portion of the study area.

Floral Habitat Sensitivity Graph



Typical view of Forb-rich Bushveld habitat unit associated with the study area, with an increase in the number of taller woody species such as *Combretum imberbe* (bottom left), *Burkea africana* (bottom middle) and *Vachellia erioloba* (bottom right).

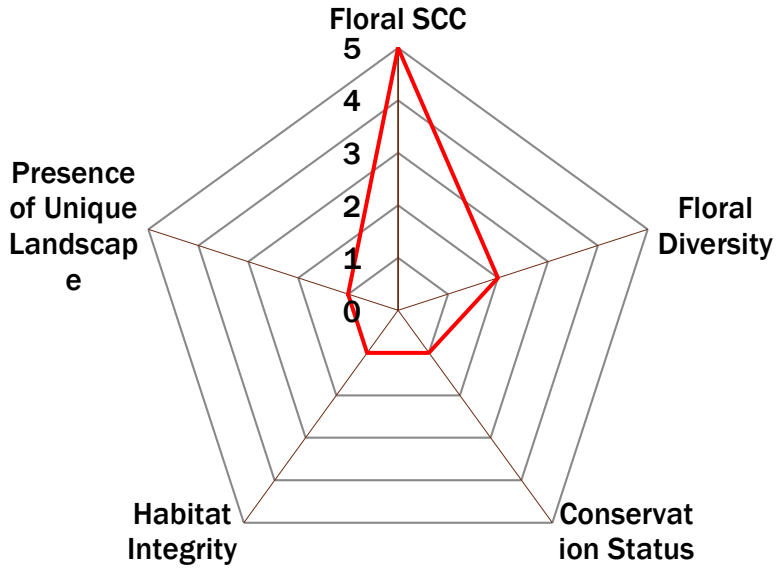
Floral Species of Conservation Concern (SCC)	Within the Sweet Bushveld B habitat unit there were several floral SCC encountered, i.e. several tree species protected under the NFA: • *Boscia albitrunca* (Shepherd's tree) – scattered throughout the habitat unit; • *Combretum imberbe* (Leadwood) – restricted distribution within the habitat unit**;** and • *Vachellia erioloba* (Camel Thorn) – moderately high abundance within the habitat unit, particularly clustered within the south-western section of the study area. Based on the results of the floral SCC assessment, the following species received a high Potential of Occurrence (POC) score and is deemed likely to occur within the Sweet Bushveld B habitat unit: *Drimia sanguinea* (near threatened and TOPS protected), *Harpagophytum procumbens* and *H. zeyheri* (Devil's Claw, TOPS protected), *Sclerocarya birrea* subsp. *caffra* (NFA protected) and *Securidaca longepedunculata* (Fibre Tree, NFA protected). Similar to the Sweet Bushveld A habitat unit, this habitat unit can also support several LEMA protected species such as *Huernia zebrina* subsp. *insigniflora*, *Orbea* spp., *Stapelia gettliffei* and *Stapelia kwebensis*.
Floral Diversity	Floral diversity within Sweet Bushveld B is moderately high with a well-developed graminoid, forb and woody layer. The graminoid layer included several species that were not encountered within Sweet Bushveld A and that are associated with areas where additional water is available, i.e. *Digitaria eriantha, Eragrostis pallens, Kyllinga alba* (sedge) and *Panicum coloratum*. The forb layer was noticeably more species-rich than within the adjacent Sweet Bushveld A habitat unit and included species such as *Commelina benghalensis (*a common species in shaded environments and thus corresponds to the denser woody vegetation), *Hibiscus palmatus* (mainly grows on alluvial soils), *Eriospermum cooperi* (fairly common), *Portulaca kermesina* (a species of sandy soils in hot and dry deciduous woodland and on the margins of pans), *Tricliceras glanduliferum* (widespread and common species) and *Vigna unguiculata* subsp. *dekindtiana* var *huillensis* (rare in the area). The increase in woody species diversity is accompanied by an overall denser vegetation and a taller canopy as more tree species are present, including *Burkea africana, Combretum hereroense, Commiphora africana* and *Vachellia nilotica* subsp. *kraussiana*. The shrub layer also increased in diversity with *Blepharis subvolubilis*, *Lantana rugosa*, *Lycium schizocalyx*, *Phyllanthus parvulus* and *Sida cordifolia* subsp. *cordifolia* more commonly occurring.  Well-represented species within the Sweet Bushveld B habitat unit (left to right): *Combretum hereroense, Hibiscus palmatus, Eragrostis pallens, Portulaca kermesina* and *Tylosema esculentum*.

<table>
<tr><td rowspan="4">Conservation Status of Vegetation Type/Ecosystem</td><td rowspan="4">The Sweet Bushveld B habitat unit does not fall within a Threatened Ecosystem, nor does it fall within any protected or conservation areas. The Mining and Biodiversity Guidelines (2013) does not recognise an important biodiversity area associated with the Sweet Bushveld B habitat unit.
The entire study area falls within a natural area for which no management objectives, land management recommendations or land-use guidelines are prescribed (Limpopo Conservation Plan v.2: Technical Report).</td><td>Habitat integrity/Alien and Invasive species</td></tr>
<tr><td>The habitat unit is representative of the reference state and is associated with low diversity and abundance AIPs. Some areas had high abundances of Aristida congesta subsp. congesta, which is an indication of veld degradation and likely a result of grazing pressures. However, the habitat unit as a whole is intact with habitat integrity still moderately high.</td></tr>
<tr><td>Presence of Unique Landscapes</td></tr>
<tr><td>This habitat unit is unique due to increased moisture availability. The vegetation is noticeably more species-rich than adjacent habitat units, which indicates that this habitat unit provides suitable growing conditions for a wider range of floral species.
The highest density of Vachellia erioloba (NFA protected) individuals were encountered within this habitat unit, along with Combretum imberbe (NFA) that was exclusively found within this habitat unit.</td></tr>
<tr><td>Business Case, Conclusion and Mitigation Requirements:</td><td colspan="2">The Sweet Bushveld B habitat unit is of moderately high floral ecological importance and sensitivity which can mainly be attributed to the presence of floral SCC (NFA protected species), a high diversity of species and the presence of natural habitat with moderately high integrity.
Most of the proposed mining activities and infrastructure will be located within this habitat unit:
Southern section of the proposed Open Pit and box cut;
PCD, RoM stockpile and Temporary Discard Dump;
Most of the Discard Dump (the eastern portion of study area);
A large section of the Soft Overburden Dump and the southern portion of the Hard Overburden Dump;
Plant Infrastructure Area;
Electrical substation;
Workshop & Wash bay;
Office, Training & Parking;
Sections of the Water Management System (trenches around footprint area); and
Sections of the Internal roads.
The construction phase will have a significant negative impact on the numbers of protected NFA tree species within this habitat unit and will likely pose a threat to LEMA and TOPS species within the footprint area associated with this habitat unit. Operational-phase impacts will include several potential threats to floral diversity and habitat integrity within the study area such as chemical leaks, dust pollution as well as AIP proliferation and bush encroachment in response to mine-related disturbances.
Were the proposed activities to proceed, the following recommendations are made to minimise the impact on floral ecology associated with the Sweet Bushveld B habitat unit:
The footprint areas of all surface infrastructure must be minimised to what is essential;
Any disturbance of sensitive floral habitat and species of conservation concern must be actively avoided;
An AIP Control Plan and Erosion Control Plan must be developed and implemented during all phases of development, to lower the risk of erosion and the increase in proliferation of AIPs within the study area; and
Due to high abundances of floral SCC present within this habitat unit, permits should be obtained from DAFF to remove, cut or destroy any protected species before construction of infrastructure takes place. Consequently, before any construction activities can occur, a detailed walk down of the area must take place, preferably within their flowering or fruiting season, during which all protected species should be marked (i.e. LEMA, NFA and TOPS species).</td></tr>
</table>

Table 16: Habitat Unit 3 – Degraded (STS, 2019)

Floral Habitat Sensitivity	Moderately Low
This habitat unit is characterised by either a lack of vegetation or by areas of increased floral species associated with disturbed areas as well as AIP proliferation due to disturbances such as overgrazing, regular vehicular movement and anthropogenic structures. Within the study area, the extent of the Degraded Habitat is small and restricted to the sources of disturbance.	

Floral Habitat Sensitivity Graph



Typical view of areas that have been significantly degraded.

Anthropogenic water source for cattle where little to no vegetation remains.

Encroachment of *Heliotropium* spp. along the gravel road, which serves as a corridor of disturbance along which pioneer species (or AIPs) can be transported.

<table>
<tr><td>Floral Species of Conservation Concern (SCC)</td><td colspan="2">The only floral SCC encountered within this habitat unit was Combretum imberbe (Leadwood) and Vachellia erioloba (Camel Thorn) which is a species protected under the NFA. These species were present before any anthropogenic activities lead to disturbance of the habitat unit, and it is unlikely that they will be able to expand their range within this habitat unit.
Due to the current level of habitat disturbance, this habitat unit does not provide favourable growing conditions for floral SCC that have not yet established.</td></tr>
<tr><td>Floral Diversity</td><td colspan="2">Floral diversity was low and dominated by forb species that are indicators of disturbed veld such as Commelina benghalesis, Heliotropium lineare, Heliotropium ciliatum, Mollugo cerviana var. cerviana (alien species), Portulaca oleraceae (alien species), Portulaca quadrifida, Sesamum alatum and Tribulus terrestris. Woody species that were able to establish along the edges of this habitat unit also included species associated with disturbed habitat, e.g. Dichrostachys cinerea, Elephantorrhiza elephantina, Grewia bicolor, Grewia flava and Heliotropium nelsonii.
 
Well-represented floral species within the Degraded Habitat unit (left to right): mat-forming Tribulus terrestris with Vachellia erioloba in the background, several Solanum species were present, Heliotropium lineare and Portulaca oleraceae (alien species).</td></tr>
<tr><td rowspan="3">Conservation Status of Vegetation Type/Ecosystem</td><td rowspan="3">This habitat unit is not considered important for the conservation of floral species as native vegetation is degraded by the presence of heavy grazing.</td><td>Habitat integrity/Alien and Invasive species</td></tr>
<tr><td>Habitat is transformed and dominated by species that are indicative of disturbed areas with AIP species such as Portulaca oleraceae present.</td></tr>
<tr><td>Presence of Unique Landscapes</td></tr>
<tr><td></td><td colspan="2">No unique landscapes important to flora were present.</td></tr>
<tr><td>Business Case, Conclusion and Mitigation Requirements:</td><td colspan="2">This habitat unit is of moderately low ecological importance and sensitivity from a floral perspective. Development potential can be optimised for this habitat unit, but care must be taken to limit edge effects on the surrounding natural areas. To minimise the impact to floral species within this habitat unit, as well as to reduce potential impacts to adjacent more sensitive habitat units, the following recommendations are made:
• Demarcate floral SCC (tree species protected under the NFA) within and along the edges of this habitat unit, or obtain the required permits from DAFF to remove or destroy these species; and
• An AIP Control Plan and Erosion Control Plan must be developed and implemented during all phases of development, to lower the risk of erosion and the increased proliferation of AIP species within the study area.</td></tr>
</table>

6.2.3.1.2 Protected species

No South African National Biodiversity Institute (SANBI) Red Data Listed (RDL) species were encountered during the field assessment; however, there are favourable growing conditions within the study area for several RDL plants and though these species were not found on site, it by no means suggests that they do not occur within the study area. A thorough walk-down of any area to be impacted by construction activities will be necessary. A Rescue and Relocation Plan is recommended if any RDL species are encountered on site.

The following protected species listed under the NFA were observed within the study area at the time of the assessment (Figure 23):

- *Boscia albitrunca* (Shephard's tree)*;*
- *Combretum imberbe* (Leadwood);
- *Sclerocarya birrea* subsp*. caffra* (Marula)*;* and
- *Vachellia erioloba* (Camel Thorn).

In terms of this act, protected tree species may not be cut, disturbed, damaged or destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold, except under licence granted by the DAFF.

Figure 23: Protected tree species (NFA) encountered within the study area during the field assessments, i.e. (left to right) Boscia albitrunca, Combretum imberbe, Sclerocarya birrea subsp. caffra and Vachellia erioloba

One species listed as protected under LEMA Schedule 12 was observed during the field assessment (Figure 24), namely *Adenium oleifolium*.

If individuals or communities of these species will be disturbed by construction/operational activities, they must be relocated to suitable, similar habitat in close proximity to where they were removed from, but outside the disturbance footprint after obtaining the relevant permits from the LEDET.

Figure 24: Several specimens of Adenium oleifolium were found in the Sweet Bushveld A habitat unit.

One species protected under the NEMBA TOPS regulations was encountered (Figure 25), namely *Harpagophytum zeyheri*. Restricted activities for which a permit is required include international import/export/re-export, gathering/plucking/collecting, conveying/moving/translocation, growing/ breeding/propagating, selling/buying/receiving/giving/donating, as well as nursery possession.

Figure 25: Several specimens of Harpagophytum zeyheri were found in the Sweet Bushveld A and the Sweet Bushveld B habitat units

6.2.3.1.3 Medicinal plant species

A moderately high diversity of medicinal species is present with most of the species being common and widespread and not confined to the study area. Some of the medicinal species that could be negatively impacted by the proposed mining activities due to being protected species (NFA or TOPS) include *Harpagophytum zeyheri* (TOPS), *Boscia albitrunca* (NFA), *Combretum imberbe* (NFA), *Sclerocarya birrea* subsp. *caffra* and *Vachellia erioloba* (NFA). Most of the medicinal plants found within the study area, however, is unlikely to be significantly impacted locally and regionally by the proposed activities.

Table 17: Dominant traditional medicinal floral species identified in the project area (STS, 2019)

Species	Common name	Plant parts used	Medicinal uses
Forb species			
Chamaecrista mimosoides	Fishbone dwarf cassia	Unsure	Used in traditional medicine to treat various skin disorders, dysentery, and loss of appetite in children.
Commelina africana	Common yellow commelina	Various parts	The Ndebele use a decoction of the roots in the treatment of venereal diseases and as a medicine for women suffering unduly during the menstrual period. The ash of the plant is used as one of the ingredients in a Sotho

Species	Common name	Plant parts used	Medicinal uses
			charm application to the loins for sterility and an infusion is drunk for the same purpose.
Commelina benghalesis	Benghal blue wandering Jew	Various parts	In Zulu culture the plant is used as a poultice and it is also taken to reduce high blood pressure. It is used by the Sotho for treating barren women. It is used to treat infertility, burns, sore throats, sore eyes, dysentery, rashes and leprosy. The mucilage from the flowering parts is used to treat infants' thrush and bruised leaves are used for burns in Tanzania. The juice is used in East Africa for ophthalmia and sore throats. It is also used in the Phillippines to bathe sore eyes and for urethral pain and in India as demulcent, refrigerant and laxative. The leaf decoctions are taken for malaria in Madagascar.
Harpagophytum sp. (LEMA)	Devil's claw	Roots (secondary)	It's a popular treatment for rheumatism and arthritis. Also formulated into an ointment for treatment of boils, sores and ulcers. Traditionally used as a tonic for treatment of digestive complaints, pain, during and after labour.
Portulaca kermesina	Haaskos	Leaves	Used to treat skin irritations and has been recorded to have antibacterial properties.
Pterodiscus ngamicus	Botswana-sandkambro	Roots	Pieces of the rootstock mixed with milk and boiled are used as a tonic to strengthen the body.
Sansevieria aethiopica	Common bowstring hemp	Rhizomes and leaves	The plant is a popular remedy for ear and tooth ache. It's traditionally for treatment of haemorrhoids, ulcers and intestinal worms.
Xenostegia tridentata subsp *angustifolia*	Miniature morning-glory	Herb	Used in traditional medicine to treat stomach complaints and headaches.
Woody species			
*Boscia albitrunca (*NFA*)*	White-stem Shepherds-tree	Root	Root decoctions are used to treat haemorrhoids. Plant used both medicinally and magically.
Burkea africana	Wild seringa	Roots	The roots are used to treat stomach pain and tooth ache.
Combretum imberbe	Leadwood	Bark, flowers, roots, leaves	Parts of this tree are used by various tribes in a number of ways: smoke that comes from the burning leaves has been used to relieve coughs, colds and chest complaints. The flowers can also be used as a cough mixture. The leaves are believed to have magical powers. For treatment of diarrhoea and stomach pains, root decoctions are used. A combination of roots and leaves are taken against bilharzia.
Combretum apiculatum subsp. *apiculatum*	Red bushwillow	Leaves, stems	Medicinally, a decoction of the leaves has been used as a steam bath and as an enema to relieve stomach disorders. As treatment for conjunctivitis, an ash from the burnt stem is mixed with white clay and water and the resulting paste is spread over the face.
Combretum hereroense	Russet bushwillow	Bark, Roots	Root infusions used as enemas to treat stomach complaints; root decoctions treat venereal disease. Bark used for heart disease and heartburn. Dried young shoots used for the treatment of tonsillitis and coughs.
Commiphora africana	Poison-grub corkwood	Bark and fruit	Washed bark mixed with salt is applied to snake bites. Stomach ailments are treated with the fruit. Abdominal spasms and fever are treated with the resin that has been made into a plaster. Several parts of the plant used for cosmetic uses such as perfumes and lotions. Soft sappy stems wood and clean stems are used
Dichrostachys cinerea	Sickle Bush	Roots, bark, leaves and fruit	Pods are very nutritious and eaten by game and stock. The wood is hard and durable, used as fencing posts. Roots, bark, leaves and fruit used in traditional medicine.
Elephantorrhiza elephantina	Elandsbean	Underground rhizomes,	Traditional remedy for a wide range of ailments, including diarrhoea and dysentery, stomach disorders,

Species	Common name	Plant parts used	Medicinal uses
		commonly referred to as roots, are used	haemorrhoids and perforated peptic ulcers, and as emetics. It is popular for the treatment of skin diseases and acne.
Grewia bicolor	White-leaved resin	Bark and roots	Bark used medicinally. Roots used to treat chest complaints; tannins present in the roots.
Grewia flava	Velvet Raisin Bush	Bark & fruit	The bark is used for making baskets, and an intoxicating drink is made from the fruit. Porridge is made from dried fruit
Grewia villosa	Mallow raisen	Roots	Roots used medicinally.
Peltophorum africanum	African wattle	Roots, bark, leaves	There are also various medicinal uses recorded. Roots are used to heal wounds, toothache and throat sores; root, leaves and bark used to clear intestinal parasites and relieve stomach problems; bark relieves colic; stem and root used for diarrhoea and dysentery. It is also used to treat eyes.
Sclerocarya birrea subsp. *caffra* (NFA)	Marula	Bark	Bark widely used for medicinal purposes (proven antihistamine and anti-diarrhoea properties) and to obtain a pale brown dye. Fruit is edible, eaten fresh or made into a jelly.
Senegalia mellifera	Black-thorn	Gum	Gum applied to mouth ulcers and to treat oral thrush.
Sida cordifolia subsp. *cordifolia*	Heart-leaf Sida	Herb	Used as a medicine for various ailments, e.g. dysentery (Van der Walt, 2009).
Terminalia sericea	Silver-cluster leaf	Bark, roots	Roots reputedly poisonous but widely used medicinally or treating stomach complaints and for relieving colic, diarrhoea, menstrual cramps, stomach disorders, eye infections, respiratory complaints, infertility venereal diseases and as an antidote to poisons. Extracts used as eye lotions and hot infusions of the root's underlayers makes a fermentation for treating pneumonia. Bark used to treat diabetes and wounds. A glucoside, nerifolin, has been isolated from parts of the plant, which has an effect on heart and pulse rate.
Vachellia erioloba	Camel thorn	Various parts of the plant	Dry powdered pods can be used to treat ear infections. The gum can be used for the treatment of gonorrhoea and the pulverized, burned bark can be used to treat headaches. The root can be used to treat toothache. To treat tuberculosis, the root is boiled for a few minutes and the infusion is swirled around in the mouth and spat out.
Vachellia nilotica subsp. *kraussiana*	Scented pod thorn	Bark, leaves and other parts of the tree	The bark exudes an edible gum and is used medicinally. Other parts of the tree were used to treat eye diseases, or as a tranquillizer and even as an aphrodisiac. A root extract was used in the treatment of tuberculosis, impotence, diarrhoea, haemorrhages, toothache, dysentery and gonorrhoea. Extracts made from the leaves are used in the treatment of menstrual problems, eye infections, sores (specifically those caused by leprosy), ulcers, indigestion and haemorrhage.
Vachellia tortilis subsp. *heteracantha*	Umbrella thorn	Bark	Bark used in traditional medicine.
Waltheria indica	Meidebossie	Various parts of the plant	The plant is used for barrenness by Shangaan woman. The roots, leaves and whole plant have been used to combat sexually transmitted infections, urinary tract infections, and a variety of infant illnesses in Limpopo.

6.2.3.1.4 Alien and invasive plant (AIP) species

Dominant AIP species identified in the project area are listed below.

Table 18: Dominant AIP species identified during the field assessment.

Species	English name	NEMBA Category	Habitat Unit
Mollugo cerviana var *cerviana*	Thread-stem carpetweed	Not listed	Degraded Habitat
Portulaca oleraceae	Common purslane	Not listed	Degraded Habitat

It is clear that a very low diversity and abundance of AIP species currently occur within the study area. The presence of these species was limited to the Degraded Habitat Unit and the exclusion of these species within the natural areas is likely due to a lack of opportunity seeing that the area is largely isolated from anthropogenic sources of introduction such as towns or developments.

6.2.3.1.5 Bush encroachment

The project area is largely in an undisturbed condition and the farm is well-managed as was evident with the low levels of bush encroachment in comparison to neighbouring farms. On farms surrounding the project area it was evident that *Dichrostachys cinerea* was heavily encroaching, whereas this was not the case for the study area, thus indicating that the veld has not been greatly disturbed. However, in areas where there was increased disturbance such as selective grazing pressures, bush encroachment by *Grewia flava*, *Grewia flavescens* and several *Heliotropium* spp. was evident. This encroachment by these species is of a low grade and to avoid further impacts to habitat integrity it is recommended that bush encroachment be managed, especially with any potential disturbances caused by the proposed mine activities.

6.2.3.2 Fauna

6.2.3.2.1 Field assessment

As indicated earlier in this report, three habitats namely, Sweet Bushveld A, Sweet Bushveld B and Degraded Habitat are associated with the project area. Except for the Degraded Habitat unit, the habitat units were noted to be relatively intact, with high levels of habitat connectivity and currently sustaining a moderately high diversity of faunal species. Following the assessments, it can be concluded that the ecological sensitivity of the habitat units is moderately high (Sweet Bushveld A and Sweet Bushveld B) and moderately low (Degraded Habitat). However, the degraded habitat cannot be overlooked in terms of faunal importance as this habitat unit is associated with the current artificial water points which are considered important for all species. The site assessment further indicated that several faunal Species of Conservational Concern (SCC) are likely to make use of the project area, either permanently or on a periodic basis whilst foraging. The presence of faunal SCC as well as the moderately high abundance and diversity of common faunal species from all classes further indicates the overall importance of the project area and the habitat therein.

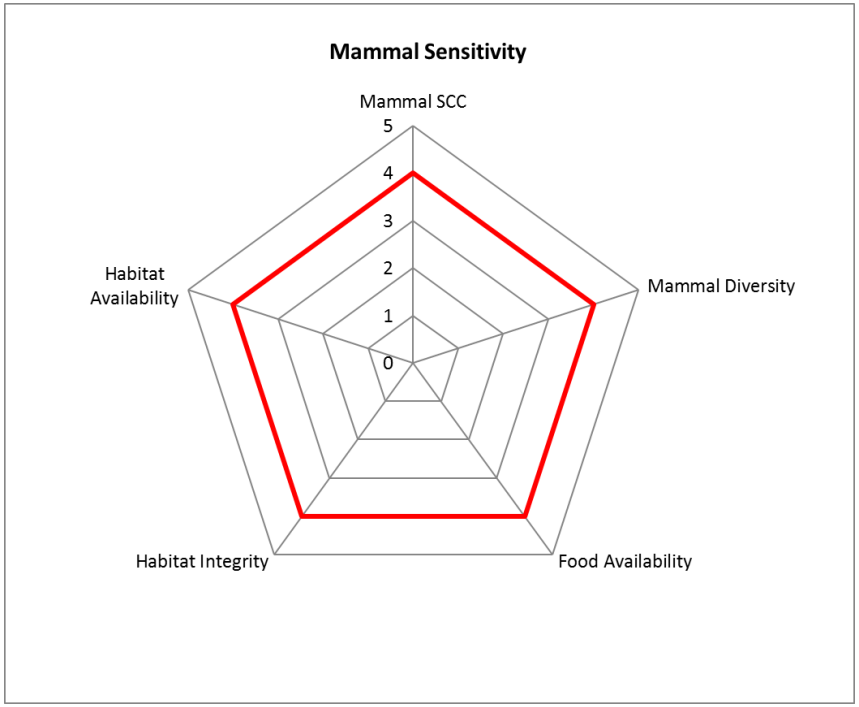
The faunal categories covered in this assessment are mammals, avifauna, reptiles, amphibians, general insects and arachnids. The results pertaining to each faunal class are discussed in detail in Table 19 to Table 24.

Table 19: Mammal species

Mammal Habitat Sensitivity	Moderately High

Photograph Notes: *Phacochoerus aethiopicus* (Warthog) top and bottom right; *Oryx gazelle* (Gemsbok) middle and bottom left, *Sylvicapra grimmia* (Common Duiker) middle right.

Mammal Sensitivity Graph:



Photographs:

Faunal Species of Conservation Concern (SCC)	During field assessments it was noted that the locality, available habitat and size of the study area would predispose it to the probable presence of several mammal SCC. These species are listed as SCC due to an increased level of persecution, decreasing populations or the loss of habitat, the latter resulting in these species becoming increasingly weary and hard to detect. In such instances the use of spoor, scat, local knowledge and infrared camera traps is considered vital. *Oryx gazelle* (Gemsbok, TOPS) was observed a number of times on the camera traps that were set out in the study area. Additional SCC observations included spoor of *Hyaena brunnea* (Brown Hyaena, NT) whilst an indivudal *Felis lybica* (African Wild Cat, VU) was observed running across the road. Additional species previously observed wihtin the study area (pers.comms Hein Schonfeldt) include *Panthera pardus* (Leopard, VU), *Orycteropus afer* (Aardvark, TOPS), *Acinonyx jubatus* (Cheetah, VU) and *Hippotragus niger* (Sable, VU, TOPS).
Faunal Diversity	Mammal diversity varied across the study area, however species appeared to be more abundant in the northern half of the study area. Food and water resources were readily available throughout the study area, with the northern portion of the study area appearing to have a higher abundance of mammals. This may be attributable to the fact that at the time of the assessment there was a higher level of human activity and movement of cattle in the southern half of the study area, resulting in mammal species that are more elusive and density avoidant moving to the north of the study area. This, however is likely to fluctuate, with mammal species moving throughout the study area in search of food resources. Mammal species observed either directly or via spoor/scat/dung include but are not limited to *Sylvicapra grimmia* (Common Duiker), *Aepyceros melampus* (Impala), *Tragelaphus strepsiceros* (Kudu), *Hystrix africaeaustralis* (Cape Porcupine), *Phacochoerus aethiopicus* (Warthog), *Felis lybica* (African Wild Cat), *Galerella sanguinea* (Slender Mongoose), *Canis mesomelas* (Black-backed Jackal), *Lepus saxatilis* (Scrub Hare) and *Cryptomys hottentotus* (Common Mole-rat) amongst others.
Habitat integrity	Habitat integrity of the study area with regards to mammal species is considered to be moderately high. Although there are areas of disturbance, as a whole the integrity is sufficient to provide food resources and space requirements for species. Fences are located throughout the property, however as these are small cattle fences, they do not limit or inhibit the movement of mammals within the study area. Additionally, there was very limited evidence of AIP species proliferation in the study area, mostly being isolated around the degraded habitat areas.

Habitat Availability	**Food Availability**
Habitat provision for mammal species is moderately high within the study area. The sweet bushveld habitat units provide a varying degree of floral diversity, with well-developed herbaceous and woody layers that satisfy the various habitat requirements for a diversity of species. The small and scattered nature of the degraded habitat does not detract from habitat continuity or connectivity for mammal species.	The degraded habitat unit provides the lowest levels of food resources for mammal species; however, the majority of these areas are associated with watering holes, which are important for water provision to mammal species. The low level and suitability of food resources in the degraded areas are as a result of the concentrated movement of mammal species through these areas when accessing the water, leading to higher levels of grazing and browsing. As such, the degradation of these small pockets is considered to be an indirect impact as a result of the placement of the water holes. The remaining areas of the sweet bushveld habitat units provided suitable and varied food resources for both grazers and browsers within the study area.

Business Case, Conclusion and Mitigation Requirements:	Overall the mammal sensitivity associated with the study area is considered to be moderately high, with a moderately high diversity of species being observed. Species abundance levels vary within the study area in accordance with available food resources and current anthropogenic and farming activities. The proposed mining activities and associated infrastructure will lead to the loss of approximately half the useable habitat and food resources within the study area, leading to a decreased diversity and abundance within the study area. In addition, the mining activities will lead to the displacement of mammal species, pushing them into the remaining habitat in the north of the study area, which will likely lead to increased levels of intra and inter species competition for space and food resources. Impacts to mammal species within the study area will be significant in terms of the loss of habitat, species diversity and abundance. Where the proposed activities are to proceed, the following recommendations are made to minimise (although not prevent) the impact to mammal species within the study area: • The footprint areas of all proposed surface infrastructure areas must be minimised to what is absolutely essential; • Disturbance of and direct persecution of SCC must be avoided; • No hunting or trapping/snaring is to occur within the study area; • Down lighting should be used wherever possible to limit the night glow effect and the amount of light emitted from the mine so as to limit insect attraction and consequently the attraction of bat species; • An AIP Control Plan must be developed and implemented during all phases of development, to manage the proliferation of AIPs within the study area; and • If any mammal SCC needs to be removed and relocated, the relavent provincial authority must be contacted and the neccesary permits obtained prior to this.

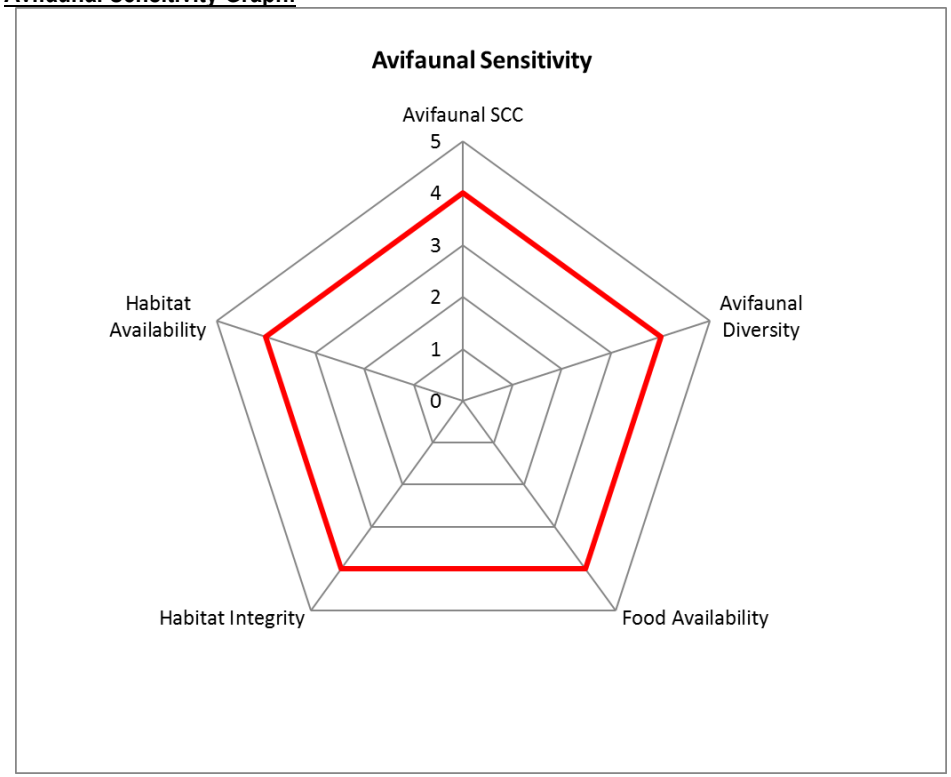
Table 20: Field assessment results pertaining to avifaunal species within the study area

Avifaunal Habitat Sensitivity	Moderately High

Photograph Notes:

Top: *Coracias caudatus* (Lilac-breasted Roller) left and *Upupa africana* (African Hoopoe) right;
Middle: *Turdoides bicolor* (Southern Pied Babbler) left and *Circaetus pectoralis* (Black-breasted Snake Eagle) right;
Bottom: *Quelea quelea* (Red-billed Quelea) left and *Prinia flavicans* (Black-chested Prinia) right.

Avifaunal Sensitivity Graph:



Photographs:

Faunal Species of Conservation Concern (SCC)	No avifaunal SCC were observed during the site assessment, however species such as *Torgos tracheliotos* (Lappet-faced Vulture, EN), *Gyps africanus* (White-backed Vulture, CR) and *Buphagus erythrorhynchus* (Red-billed Oxpecker, Threatened Limpop SoER 2004) have been previously recorded within the pentad (2330_2715). These listed species may occur wihtin the study area, using the available habitat for foraging and in the case of the vultures, large trees for nesting, notably large *Acacia* spp, of which there are numerous in the study area. The image to the right idicates a large solitary nest observed within the study area, however the nest was unused and it is not possible to verify which large avifaunal species consturcted the nest. In addition to the species mentioned above, although not recorded for the pentads 2330_2715 and 2335_2715, there remains the possiblity that species such as *Aquila rapax* (Tawny Eagle, VU), *Ardeotis kori* (Kori Bustard, NT) and *Polemaetus bellicosus* (Martial Eage, VU). These species may utilise the study area for breeding as well as for forgaing. Vegetation clearance activities will have a negative impact on avifaunal SCC, leading to a loss of potential breeding sites as well as foraging grounds. In addition, these impacts are likely to extend beyond the study area boundaries affecting avifaunal SCC within the surrounding areas through decreased breeding, nesting and foraging opportunities whilst also potentially impacting upon flight paths and movement patterns. 
Faunal Diversity	Avifaunal diversity within the study is considered moderately high, with numerous avifauna of all size classes being observed. Species observed are all known to occur and thrive within the more arid bushveld areas of Limpopo, being well adapted to the generally drier habitats herein. The majority of avifaunal species observed were insectivores and mixed feeders, feeding on both seeds and insects. Predatory avifauna were not readily observed, but such species often occur at lower abundances and forage over greater distances. Species observed on site other than those listed above and below include *Turdoides bicolor* (Southern Pied Babler), *Turdoides jardineii* (Arrow-marked Babler), *Batis molitor* (Chinspot Batis), *Corythaixoides concolor* (Grey Go-away-bird), *Pternistis natalensis* (Natal Spurfowl), *Lamprotornis nitens* (Cape Glossy Starling), *Tchagra senegalus* (Black-crowned Tchagra), *Granatina* (Violet-eared Waxbill), *Cercotrichas leucophrys* (White-browed Scrub-robin) and *Turtur chalcospilos* (Emerald-spotted Wood-dove) amongst others.
Habitat integrity	Habitat integrity of the study area with regards to avifaunal species is considered to be moderately high. Although there are some areas of disturbance and of increased grazing, notably around the current watering points, as a whole the habitat integrity is sufficient to provides food resources, space requirements and nesting sites for a diversity of avifaunal species. Unlike other species, avifauna are less restricted in terms of movement by farm related infrastructures such as fences and buildings and are capable of utilising the whole study area unrestricted.

Habitat Availability	**Food Availability**
The varying vegetation stratum, open space areas comprising of forbs and herbaceous material and the densely wooded patches provide an extensive mosaic of habitat for avifaunal species. Large trees provide suitable nesting and roosting areas for large avifauna and raptors, as well as vantage points for hunting. The medium sized trees and denser wooded areas are well utilised by small to medium sized avifauna, which were seen actively foraging amongst the branches and along the ground during the site investigation.	Food resources are abundant within the study area for avifaunal species, notably in the summer months following good rains. Grass seeds form a staple food resource for granivorous species, of which a number are heavily reliant on as they cannot readily supplement the loss of this food resource with other food items. Food availability will be higher during the summer months as the overall food resource production of the herbaceous and woody layer increases, and as such a higher abundance of avifaunal can be supported. The seasonal increase in insect abundance is further important as insects provide an energy rich source of food for avifaunal species. Small mammals as well as lizards and skinks are an important food resource for larger avifauna, with large raptors often preying on rodents, hares and sometimes other small birds.

Business Case, Conclusion and Mitigation Requirements:	Overall the avifaunal sensitivity associated with the study area is considered moderately high, with a moderately high diversity of species being observed. Species abundance levels vary within the study area in accordance with available food resources and current anthropogenic and farming activities. The proposed mining activities and associated infrastructure will lead to the loss of approximately half the useable habitat and food resources within the study area, leading to a decreased avifaunal diversity and abundance. In addition, the mining activities will lead to the displacement of avifaunal species, pushing them into the habitat both to the north of the study area as well as into the surrounding areas, which is likely to lead to increased levels of intra and inter species competition for space and food resources. Impacts to avifaunal species within the study area will be significant in terms of the loss of habitat, species diversity and abundance. Where the proposed activities are to proceed, the following recommendations are made to minimise (although not prevent) the impact to avifaunal species within the study area: • The footprint areas of all proposed surface infrastructure areas must be minimised to what is absolutely essential; • Disturbance of and direct persecution of SCC must be avoided; • Areas excluded from mining activities should be designated conservation areas and managed accordingly; • Where overhead powerlines are constructed, it must be insured that bird flappers are placed on these structures in order to increase the visibility of the hanging cables in order to minimise bird strikes and mortality rates; • No poisons are to be used for small mammal pest control as poisoned small mammals may be consumed by raptors, owls or scavenging species which may lead to the death of such avifauna; • An AIP Control Plan must be developed and implemented during all phases of development, to manage the proliferation of AIPs within the study area; and • Large trees which are evidently being used for breeding by raptors (nests present) are to be left and not cut down.

Table 21: Amphibian species

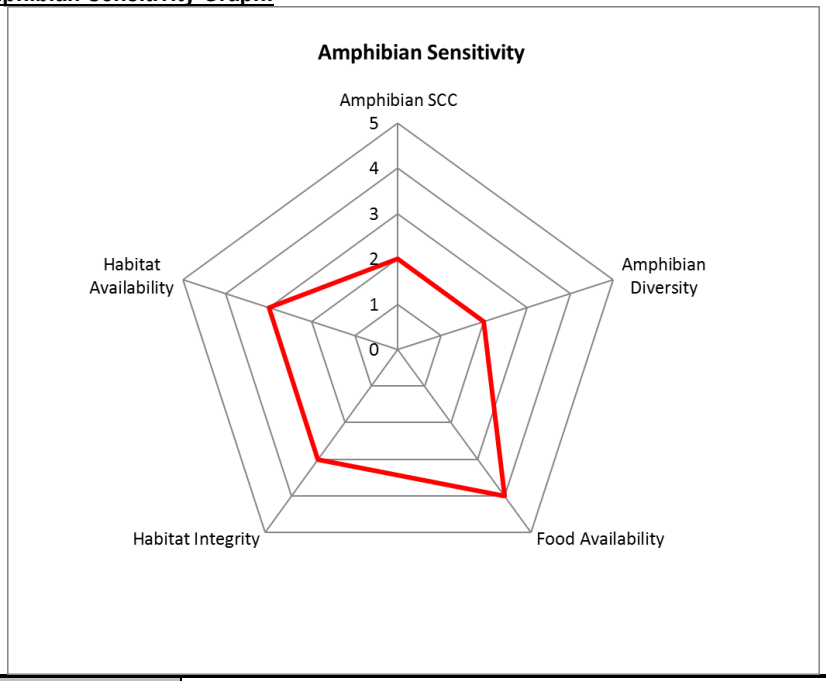
Amphibian Habitat Sensitivity	Intermediate	Photographs:

Photograph Notes:

Top: Image of a water point located in the south eastern portion of the study area where overflowing water troughs may present temporary areas of usage for some avifaunal species such as *Ptychadena anchietae* (Plain Grass Frog) and *Tomopterna cryptotis* (Tremelo Sand Frog);

Bottom: Open sandy areas with patchy herbaceous layer is likely to be utilised by *Breviceps adspersus* (Bushveld Rain Frog), notably when breeding as mating pairs can easily dig into the sandy substrate.

Amphibian Sensitivity Graph:



Faunal Species of Conservation Concern (SCC)	During the field assessment of the study area no amphibian SCC were observed. The study area provided limited habitat for amphibian species as there where no natural pans or seasonal water bodies present.

Faunal Diversity	Amphibian diversity of the study area is deemed to be moderately low, largely due to the arid nature and lack of permanent and seasonal water bodies necessary for continued sustainability of amphibian species. Although there were no water bodies observed, not all amphibian species are permanently reliant on these, notably some species of toads which are able to survive for long periods away from water. Although the study area can sustain amphibian species that are more water independent, these species do still require water bodies for breeding. Species that have been previously recorded in the QDS 2327CB and that may occur within the study area include *Breviceps adspersus* (Bushveld Rain Frog), *Sclerophrys garmani* (Olive Toad), *Ptychadena anchietae* (Plain Grass Frog) and *Tomopterna cryptotis* (Tremelo Sand Frog). *Breviceps adspersus* is the only species recorded for the QDS that does not require water bodies for breeding, as the breeding pair creates a breeding chamber in the soil in which the eggs are laid and hatch.
Habitat integrity	No permanent natural freshwater resources were observed within the study area. However, the overall habitat of the study area is still considered to be relatively intact and has sufficient food resources with limited fragmentation. As there are no permanent or seasonal water bodies within the study area, the habitat integrity for amphibian species is considered to be intermediate.

Habitat Availability	**Food Availability**
Limited habitat is available to freshwater dependant amphibian species; however, the study area does provide suitable levels of habitat to species which are able to survive for extended periods of time away from water resources.	The high insect abundance provides an ideal and consistent food resource for amphibian species.

Business Case, Conclusion and Mitigation Requirements:	Overall the amphibian sensitivity associated with the study area is considered intermediate. The lack of temporary and permanent surface water areas is a primary driver behind the decreased amphibian sensitivity, with only species that are largely water independent expected to occur within the study area The proposed mining activities and associated infrastructure will lead to the loss of approximately half the study area, with the loss of habitat and food resources being most notable. As there are no water bodies (permanent or seasonal), the impact to amphibian species is expected to be lower than to that of other faunal species. Impacts to amphibian species within the study area are not expected to be as significant in terms of the loss of habitat, species diversity and abundance. Where the proposed activities are to proceed, the following recommendations are made to minimise the impact to possible amphibian species: • The footprint areas of all proposed surface infrastructure areas must be minimised to what is absolutely essential; • Amphibian species found within the mining footprint area during the clearing and construction phase should be carefully relocated to suitable similar habitat within the study area, but outside of the disturbance footprint; and • Areas excluded from mining activities should be designated conservation areas and managed accordingly.

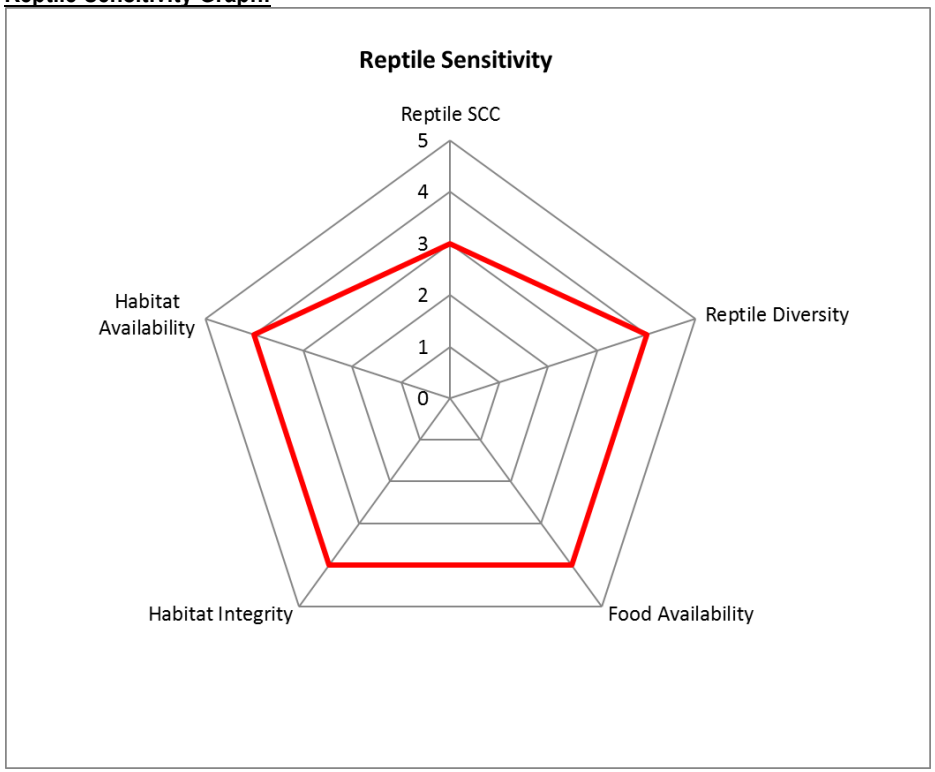
Table 22: Reptile species

Reptile Habitat Sensitivity	Moderately High

Photograph Notes:

Top: *Stigmochelys pardalis* (Leopard Tortoise) left and *Heliobolus lugubris* (Bushveld Lizard) right;
Middle: *Acanthocercus atricollis* (Southern Tree Agama); and
Bottom: *Nucras holubi* (Holub's Sandveld Lizard).

Reptile Sensitivity Graph:



Photographs:

Faunal Species of Conservation Concern (SCC)	No reptile SCC were recorded during the assessment, however *Python natalensis* (African Python, VU and TOPS listed) has an increased probability of occuring wihtin the study area as the study area provides suitable habitat and food resources for this species.

<table>
<tr><td>Faunal Diversity</td><td colspan="2">Reptile diversity within the study area is considered to be moderately high, with a notable abundance of smaller skinks and sand lizards. The diversity of reptile species is largely attributable to the relatively undisturbed nature of that habitat, increased food resources, as well as the deeper soils in which reptiles can burrow. Reptile species observed include Heliobolus lugubris (Bushveld Lizzard), Trachylepis striata (Striped Skink), Stigmochelys pardalis (Leopard Tortoise) and Acanthocercus atricollis (Southern Tree Agama).

Additional reptiles that have been previously recorded by the Animal Demography Unit (ADU) ReptileMAP for the QDS include Elapsoidea sundevallii longicauda (Long-tailed Garter Snake), Ptenopus garrulus (Common Barking Gecko) and Ichnotropis capensis (Ornate Rough-scaled Lizard) amongst others. It is likely that the study area will present an even higher reptile diversity than that which was observed and listed above. Reptiles are inherently secretive and shy, making their detection and identification in the field difficult over short periods of time.</td></tr>
<tr><td>Habitat integrity</td><td colspan="2">Habitat integrity of the study area with regards to reptile species is considered to be moderately high. Reptiles are inherently adaptable and capable of surviving in a myriad of habitats. The study area has limited areas of disturbance/degradation and as such it enables for a greater diversity and abundance of reptile species to exist. Increased food resources and intact habitat ensure resource provision for species throughout the study area.</td></tr>
<tr><td colspan="2">Habitat Availability</td><td>Food Availability</td></tr>
<tr><td colspan="2">The study area provides suitable habitat for a diversity of reptiles species. The deeper sandy soils allow for the excavation of burrows in which to escape predation whilst the dense bushes and tall trees are readily utilised by larger more arboreal species. Dead / fallen over trees also provide additional habitat, basking areas and areas in which smaller reptiles can seek refuge.</td><td>Food resources are abundant and widely available throughout the study area for reptile species. Insect abundance is high, providing a continued and reliable food resource for many of the smaller and medium sized reptiles. Rodents, hares, small antelope and avifaunal nestlings provide a suitable food resource for larger predatory snakes.</td></tr>
<tr><td>Business Case, Conclusion and Mitigation Requirements:</td><td colspan="2">Overall the reptile sensitivity associated with the study area is considered moderately high, with a moderately high diversity of species being observed. The proposed mining activities and associated infrastructure will lead to the loss of approximately half the useable habitat and food resources within the study area, leading to a decreased diversity and abundance within the study area.

Where the proposed activities are to proceed, the following recommendations are made to minimise (although not prevent) the impact to reptile species within the study area:
• Personnel working at the mine are to be educated and made aware about snakes in the area, and that they are not to be harmed;
• Nominated personnel/volunteers working at the mine should be trained on how to catch, handle and relocate snakes that are found within the mine premises;
• Workspace areas and buildings are to be kept clean, avoiding the unnecessary collection of rubbish and food waste, as this will attract rodents leading to an influx of predatory snakes;
• As far as possible natural vegetation between buildings must be left intact and not cleared;
• No hunting/killing or trapping/capturing (unless for specific relocation reasons) is to occur within the study area;
• The footprint areas of all surface infrastructure must be minimised to what is absolutely essential; and
• Disturbance of and direct persecution of SCC and other reptile species must be avoided.</td></tr>
</table>

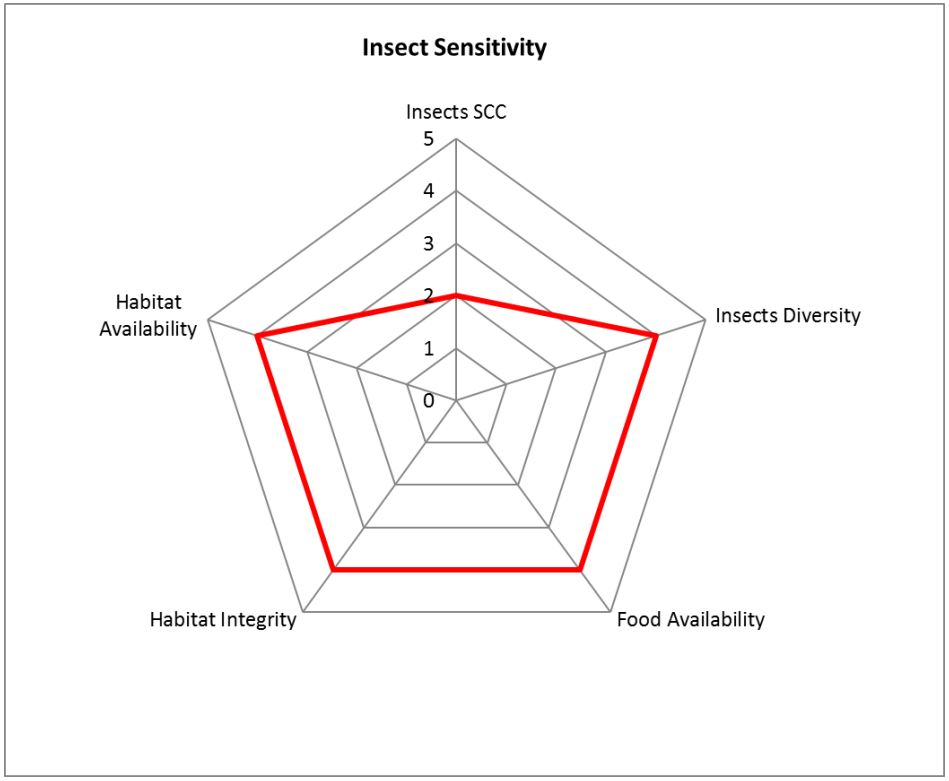
Table 23: Insect species

Insect Habitat Sensitivity	Moderately High

Photograph Notes:

Top: Genus *Platypleura* (Cicada) left and Family Psychidae (Bagworm) right;
Middle: *Cyligramma latona* (Cream-striped Owl) left and *Pachylomera femoralis* (Flattened Giant Dung Beetle) right, and
Bottom: *Cupidopsis jobates jobates* (Tailed Meadow Blue) left and *Acrea axina* (Little Acrea) right;

Insect Sensitivity Graph:



Photographs:

Faunal Species of Conservation Concern (SCC)	During the field assessment no insect SCC were observed. The insect species listed for the province of Limpopo are further unlikely to occur wihtin the study area as it is out of there known distribution range whilst the study area also lacks suitable food resources and host plants for some of the species.
Faunal Diversity	The study area has a moderately high insect diversity, with the several species belonging to the Coleoptera, Orthoptera, Hymenoptera, Odonata and Lepidoptera families being observed. The greatest diversity of insect species observed were that of the Orders Coleoptera and Lepidoptera. This increase in diversity and abundance is important for the overall ecological functioning of the study area, as many of these species serve as pollinators, remove detritus material and harvest and bury dung and scat below the surface, helping to cycle nutrients back into the soil. Additionally, insects serve as a food resource for many other faunal species and as such a high insect diversity and abundance is paramount to ensuring the continued sustainability of other faunal species from various classes.
Habitat integrity	The habitat integrity is considered to be moderately high. AIP proliferation was limited and restricted to the degraded areas, with the remaining areas being dominated by indigenous vegetation. Additionally, grazing by cattle has not led to significant impacts or degradation of the herbaceous layer through overutilisation. Habitat continuity within the study area has not be disrupted, and although cattle fences are present, these do not limit the movement and migration of insect species.

Habitat Availability	**Food Availability**
Insect species utilise a variety of habitat types at various strata levels in the habitats, from ground dwelling species to more arboreal species. The study area provides varying types of habitat for insect species in terms of sandy areas for species that burrow to fallen and dead trees in which numerous small terrestrial insects and larvae inhabit and seek refuge.	The herbaceous layer comprising of grasses and forbs provide extensive food resources for herbivorous insect species, whilst leaves of the larger trees and shrubs are utilised by the larval (caterpillar) stages of many species of the Order Lepidoptera. Predatory insect species feed upon several smaller insect species as well as small arachnids and in some instances small reptiles. Flowering species provide nectar and pollen resources across the study area which are important food and energy sources for species belonging to the Lepidoptera and Hymenoptera Order.

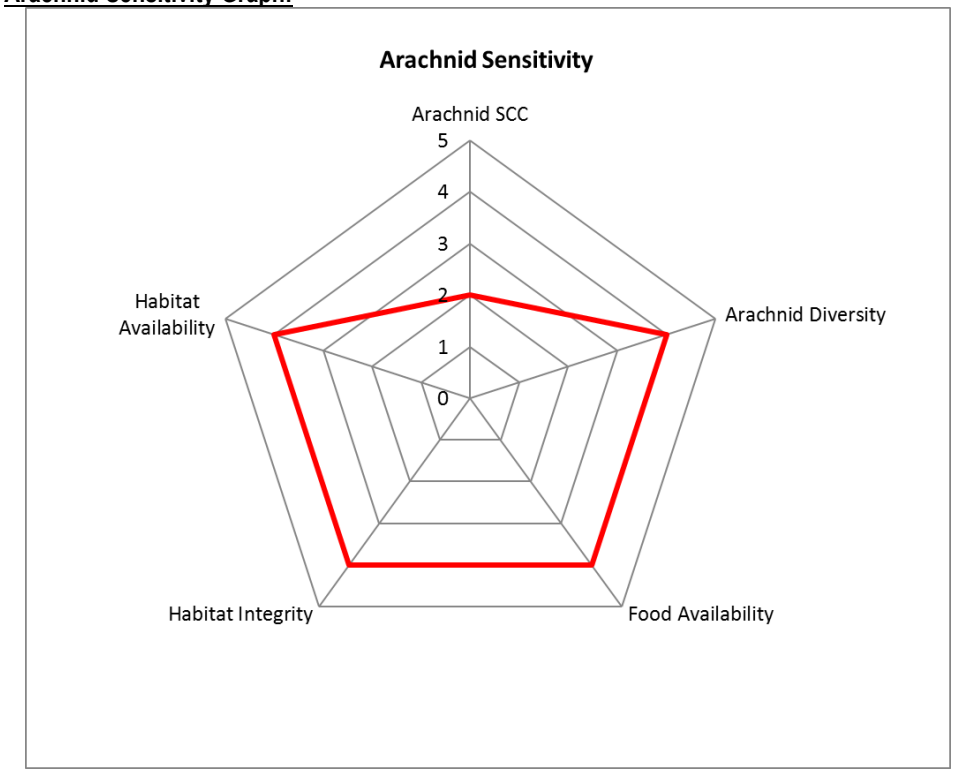
Business Case, Conclusion and Mitigation Requirements:	Overall the insect sensitivity associated with the study area is considered moderately high, with a moderately high diversity of species being observed. The proposed mining activities and associated infrastructure will lead to the loss of habitat and food resources, resulting in a decreased diversity and abundance of insect species in the impacted areas, which is likely to have a knock on impact to insect abundance levels within the larger study area. Insect species are considered a vital and important link in the ecosystem, fulfilling many vital ecological roles, including pollination, removal of dead animal and plant material and clearing of dung and scat. Insect species also serve as a vital food resource for many of the other faunal species. As such the loss of insect abundance and diversity will have a significant knock on effect on other faunal species in the study area. Impacts to insect species within the study area will result in the localised loss of habitat, species diversity and abundance, whilst edge effects such as additional lighting, dust and footprint creep will impact on insect species in the immediate vicinity of the mine. Where the proposed activities are to proceed, the following recommendations are made to minimise the impact to insect species within the study area: • Downlighting and as few external lights as needed are to be used for all lighting requirements at night. Additionally, yellow lights of lower frequencies are to be used in order to limit insect attraction; • As far as possible and where feasible pockets of natural vegetation between buildings and mine infrastructure must be left intact and not cleared, and • The footprint areas of all surface infrastructure must be minimised to what is absolutely essential.

Table 24: Arachnid species

Arachnid Habitat Sensitivity	Moderately High	Photographs:

Photograph Notes:
Top: Family Lycosidae (Wolf Spiders) left and Family Eresidae (Velvet Spiders) right; and
Bottom: *Argiope lobata* (Black-lobed Garden Orb-web Spider).

Arachnid Sensitivity Graph:



Faunal Species of Conservation Concern (SCC)	The Limpopo SoER (2004) makes no provision for arachnid species. As such alternative databases such as the NEBA TOPS list as well as the IUCN were used in order to ascertain the likelihood of arachnid SCC occuring wihtin the study area. Following the analysis of these databases as well as the site assessment and identification of observed arachnid species it has been concluded that arachnids listed as SCC nationally are unlikely to occur within the study area.

Faunal Diversity	Arachnid species are notoriously hard to detect over a relatively short period of time, which can often lead to the under estimation of diversity and abundance. Taking this into consideration, habitat conditions for arachnids as well as available desktop resources were analysed, including information on arachnid occurrences and species diversity for the QDS was collected from databases such as iNaturalist and the Animal Demography Unit (ADU). Taking into consideration the species observed whilst on site, plus the additional species recording as per the information presented in the various databases, it can be assumed that the overall arachnid diversity of the study area will be moderately high. Scorpions species, although not observed during the field investigation are likely to be prolific within the study area, often favouring areas where they can seek refuge under fallen trees / dead logs or dense shrubs. The following arachnid species have been recorded in the region and may occur within the study area, namely *Parabuthus mosambicensis, Parabuthus transvaalicus, Opistophthalmus glabrifrons, Opisthacanthus asper, Hadogenes troglodytes, Pterinochilus lapalala, Idiothele nigrofulva, Ceratogyrus darlingi, Augacephalus junodi* and *Uroplectes flavoviridis* amongst others.
Habitat integrity	Habitat integrity of the study area with regards to arachnid species is considered to be moderately high. Arachnids are capable of surviving in areas of extreme aridity, whilst also showing an inherent resilience to habitat degradation. As the study area shows limited areas of disturbance/transformation it enables for a greater diversity and abundance of arachnid species to exist. Increased food resources combined with intact habitat contribute to the moderately high habitat integrity associated with the study area.

Habitat Availability	**Food Availability**
Many arachnid species only venture out during the safety of night, opting to seek refuge under rocks, bark and dead trees during the day. Areas of refuge such as within the study area were provided under dense shrubs as well as fallen trees and logs. The woody layer within the study area provides ample areas for web building spiders to construct their webs, whilst the sandy soils provide an ideal substrate in which burrowing species can dig into and construct burrows. The sandy areas between grass tufts in addition provide ideal hunting grounds for arachnids that actively hunt their prey, such as species in the Family Lycosidae (Wolf Spiders).	Arachnid species are predatory, preying predominantly on invertebrates and in some instances small reptiles. As these prey species appear to be well represented within the study area and in high abundance, it can be inferred that arachnid species have sufficient suitable food resources available to them in order to ensure their continued survival within the study area.

Business Case, Conclusion and Mitigation Requirements:	Overall the arachnid sensitivity associated with the study area is considered to be moderately high, with a moderately high diversity of species expected The proposed mining activities and associated infrastructure will lead to the loss of habitat and food resources which may lead to a decreased diversity and abundance of arachnid species. Although not formally protected, the threat to scorpion and spider species that seek refuge in subsurface burrows must be highlighted. Vegetation clearing and the removal of topsoil will directly threaten these individuals and concurrently the diversity of such arachnids in the study area. Should the proposed activities proceed, the following recommendations are made to minimise (although not prevent) the impact to arachnid species within the study area: • Personnel working at the mine are to be educated and made aware about the larger scorpions and spiders in the area, and that they are not to be harmed; • Mine workers are to be educated on how to safely and carefully capture and relocate such species should they be found within mine buildings / offices; • As far as possible natural vegetation between buildings must be left intact and not cleared; • Prior to the clearing of vegetation footprint specific assessments are to be undertaken in order to mark the locations of baboon spider burrows. Once marked, the spiders should be carefully excavated and relocated to similar habitat in the vicinity of the mine, but outside of the development footprint. All relocations are to be overseen by a suitably qualified specialist; and • The footprint areas of all surface infrastructure must be minimised to what is absolutely essential.

6.2.3.2.2 Faunal SCC assessment

During the field assessment, it is not always feasible to identify or observe all species within the study area, largely due to the secretive nature of many faunal species, possible low population numbers or varying habits of species. As such, to specifically assess an area for faunal SCC, a Probability of Occurrence (POC) matrix is used, utilising several factors to determine the probability of faunal SCC occurrence within the study area. The species listed below are considered to have a significant probability of occurring within the focus area.

Table 25: Faunal SCC Probability of Occurrence Score (POC) for the focus area

Scientific name	Common Name	Conservation listing	POC %
Mammals			
Panthera pardus	Leopard	VU	100%
Felis lybica	African Wild Cat,	VU	100%
Acinonyx jubatus	Cheetah	VU	100%
Oryx gazelle	Gemsbok	NEMBA TOPS	100%
Hyaena brunnea	Brown Hyaena	NT	80%
Hippotragus niger	Sable	VU	100%
Orycteropus afer	Aardvark	NEMBA TOPS	100%
Avifauna			
Gyps africanus	White Backed Vulture	CR	80%
Ardeotis kori	Kori Bustard	NT	90%
Torgos tracheliotos	Lappet-faced Vulture	EN	80%
Buphagus erythrorhynchus	Red-billed Oxpecker	T	80%
Polemaetus bellicosus	Martial Eagle	VU	80%
Aquila rapax	Tawny Eagle	VU	80%
Gyps coprotheres	Cape Vulture	EN	80%
Reptiles			
Python natalensis	African Python	VU	90%

*LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN. T = listed as threatened but with no specific status for the Limpopo Province

The study area is expected to provide suitable habitat and food resources for several faunal SCC. It must be noted however that species such as *Hyaena brunnea, Panthera pardus, Acinonyx jubatus, Gyps africanus* and *Gyps coprotheres* as well as some of the other large raptors may only utilise the study area for foraging purposes, as no direct evidence was available at the time of assessment that indicated the permanent presence of these species in the study area. The remaining SCC identified above all have an increased likelihood of inhabiting and breeding within the study area. Habitat loss and transformation, loss of habitat connectivity and artificial water resources, edge effects as well as increased levels of persecution and vehicle related collisions will result in a decrease in SCC numbers and diversity. Such losses will further strain current conservation efforts in the region, placing increased pressure on the surrounding areas and remaining populations.

6.2.3.2.3 Detail avifaunal assessment

Feathers Environmental Services was appointed to conduct a stand-alone avifaunal impact assessment to address comments received from IAP, Ms. Kerri Wolter of VulPro NPC. The avifaunal impact assessment is based on a desktop review and the findings of a three-day site visit to the study area, conducted on 22-24 July 2019.

An assessment of the current SABAP2 data yielded a total of 222 bird species recorded across seven pentad grid cells, surrounding the proposed Gruisfontein Project location, during the SABAP2 atlassing period to date. The presence of these species in the broader area provides an indication of the diversity and abundance of species that could potentially occur, particularly where suitable avifaunal habitat persists. Of the 222 species, 17 of these are of regional conservation concern i.e. regional Red List species. In addition, three species are near endemic to South Africa and a further 25 species are endemic to southern Africa. White Stork *Ciconia ciconia*, which is not listed, but is protected internationally under the *Bonn Convention on Migratory Species* was also recorded.

Each of the Red List species have been recorded in low numbers. The low report rates can be attributed to the fact that the area have not been surveyed extensively and are unlikely to be an accurate reflection of the true densities within the area. Suitable natural habitat, to support these and other Red List species, exists throughout the study area, so it is likely that an increase in survey effort will undoubtedly yield a greater diversity and density of species.

White-backed Vulture *Gyps africanus*, Lappet-faced Vulture *Torgos tracheliotos* and Cape Vulture *Gyps coprotheres* are well represented in the area. Vultures are a far-ranging species and are likely to forage extensively across the study area, as carcasses become available. There are four known Cape Vulture colonies and two roosts within a 100 km radius of the proposed Gruisfontein Project site. The establishment of the mine at the proposed location will not directly affect the breeding activities at these colonies, but it is important to consider the fact that these birds are likely to forage in the areas surrounding the Gruisfontein property. The vultures' ability to traverse vast distances and the high proportion of time they spend foraging outside protected areas and particularly in the vicinity of powerlines makes them especially vulnerable to negative interactions (both collision and electrocution) with the expanding powerline network across the region and in particular the powerline infrastructure that forms part of this project.

White-backed Vultures are especially prevalent in the study area, with SABAP2 report rates of 60% and the presence of at least 110 nest locations recorded in a 70 km radius surrounding the Gruisfontein Project site. Although breeding at some of the White-backed Vulture nest locations surveyed during the July 2019 site visit has ceased, large trees persist in the broader study area and are likely to continue to support the breeding activities of this species. In addition, 14 vulture restaurants have been established within a 50 km radius of the project location, the closest of which is located 3 km north of the northern boundary of the Gruisfontein property (Figure 26).

Given the proximity of the historical and existing nest locations and the availability of food to the proposed mine development area, displacement impacts associated with habitat loss and disturbance are likely for White-backed Vultures and may result in breeding failure if unmitigated. Similarly, collision and electrocution impacts associated with the powerline infrastructure are potentially additional sources of direct mortality.

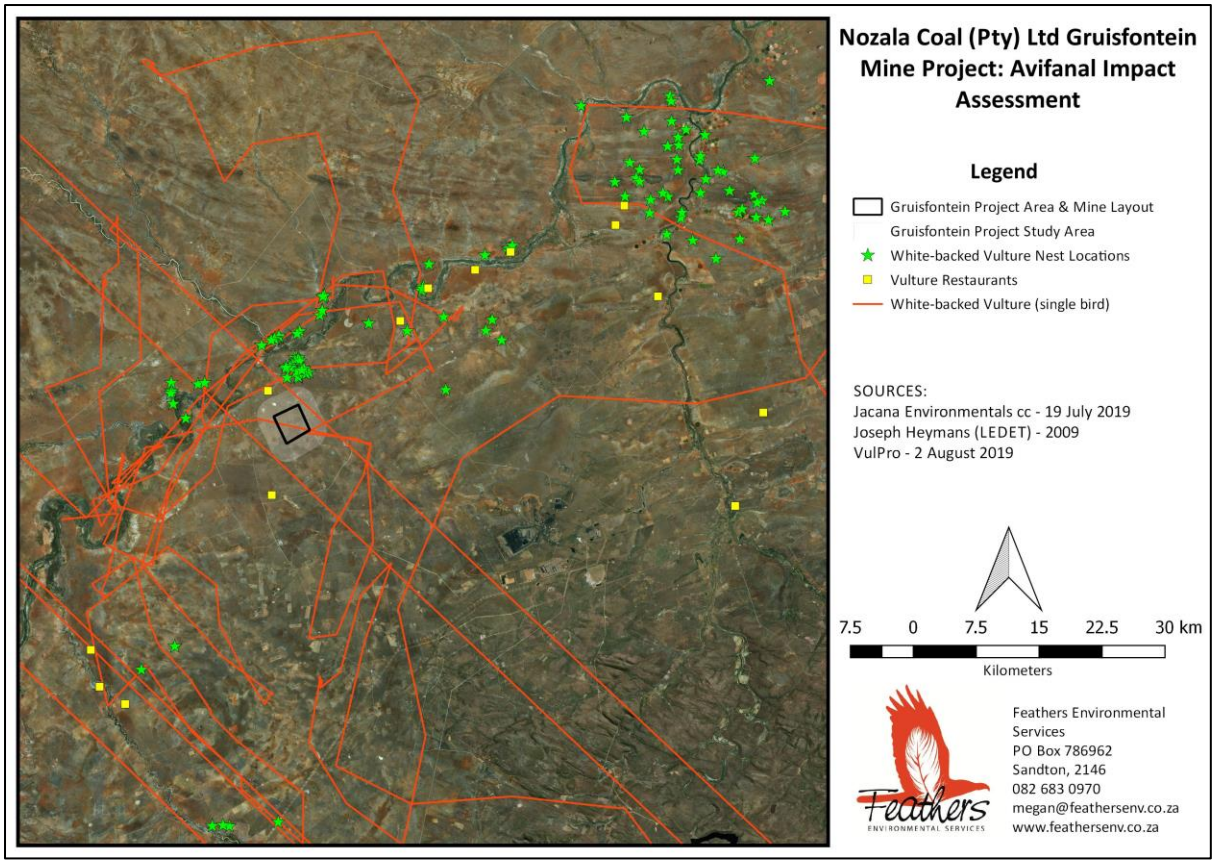


Figure 26: White-backed Vulture nest and vulture restaurant locations

A single winter survey was conducted on 22-24 July 2019. In order to describe the avifaunal community present, a concerted effort was made to sample the avifauna in all the primary habitats that were available at the proposed mine development site and within the larger study area by applying three survey techniques. All species observed and heard during the site visit were noted. The site visit produced a combined list of 49 species, covering both the project development area and to a limited extent, the surrounding area. Except for the three vulture species, no additional Red List species were observed during the site visit. Most observations were of small passerine species that are common to this area.

Table 26: Avifaunal sitings during the specialist survey

Species	Scientific Name	Species	Scientific Name
Babbler, Southern Pied	*Turdoides bicolor*	Masked-weaver, Southern	*Ploceus velatus*
Barbet, Acacia Pied	*Tricholaema leucomelas*	Mousebird, Red-faced	*Urocolius indicus*
Batis, Chinspot	*Batis molitor*	Oxpecker, Red-billed	*Buphagus erythrorynchus*
Bee-eater, Little	*Merops pusillus*	Pipit, African	*Anthus cinnamomeus*
Buffalo-weaver, Red-billed	*Bubalornis niger*	Quelea, Red-billed	*Quelea quelea*
Bulbul, African Red-eyed	*Pycnonotus nigricans*	Roller, Lilac-breasted	*Coracias caudatus*
Bulbul, Dark-capped	*Pycnonotus tricolor*	Roller, Purple	*Coracias naevius*
Bunting, Golden-breasted	*Emberiza flaviventris*	Sandgrouse, Double-banded	*Pterocles bicinctus*
Crow, Pied	*Corvus albus*	Scimitarbill, Common	*Rhinopomastus cyanomelas*
Dove, Namaqua	*Oena capensis*	Scrub-robin, White-browed	*Erythropygia leucophrys*
Drongo, Fork-tailed	*Dicrurus adsimilis*	Shrike, Crimson-breasted	*Laniarius atrococcineus*

Species	Scientific Name	Species	Scientific Name
Finch, Scaly-feathered	*Sporopipes squamifrons*	Shrike, Magpie	*Corvinella melanoleuca*
Flycatcher, Marico	*Bradornis mariquensis*	Sparrow-weaver, White-browed	*Plocepasser mahali*
Francolin, Crested	*Dendroperdix sephaena*	Starling, Burchell's	*Lamprotornis australis*
Go-away-bird, Grey	*Corythaixoides concolor*	Starling, Cape Glossy	*Lamprotornis nitens*
Goshawk, Gabar	*Melierax gabar*	Snake-eagle, Black-chested	*Circaetus pectoralis*
Goshawk, Southern Pale Chanting	*Melierax canorus*	Tchagra, Black-crowned	*Tchagra senegalus*
Guineafowl, Helmeted	*Numida meleagris*	Turtle-dove, Cape	*Streptopelia capicola*
Helmet-shrike, White-crested	*Prionops plumatus*	Vulture, Cape	*Gyps coprotheres*
Hoopoe, African	*Upupa africana*	Vulture, Lappet-faced	*Torgos tracheliotos*
Hornbill, African Grey	*Tockus nasutus*	Vulture, White-backed	*Gyps africanus*
Hornbill, Southern Yellow-billed	*Tockus leucomelas*	Waxbill, Black-faced	*Estrilda erythronotos*
Korhaan, Red-crested	*Lophotis ruficrista*	Waxbill, Blue	*Uraeginthus angolensis*
Lapwing, Blacksmith	*Vanellus armatus*	Waxbill, Violet-eared	*Uraeginthus granatinus*
Lark, Sabota	*Calendulauda sabota*		

Each of these species has the potential to be displaced by the proposed Gruisfontein Mine Project as a result of habitat transformation and disturbance. However, some species have persisted despite existing disturbance within the study area. This resilience, coupled with the fact that similar habitat is available throughout the broader area, means that the displacement impact will not be of regional or national significance.

Several passerine nests were observed during the survey, mostly belonging to Southern Masked Weavers. The faunal assessment conducted in January 2019, noted a large solitary nest observed within the study area. This nest was not present during the July 2019 survey, however communication with Mr. Hein Schonfeldt (Gruisfontein 230LQ property owner) revealed that the nest was occupied by a pair of Wahlberg's Eagles *Hieraaetus wahlbergi*, that bred successfully in the nest on a couple of occasions (Figure 27). A severe hailstorm in the area destroyed the nest and the birds have not returned. Mr. Schonfeldt also confirmed the presence of breeding Western Barn Owls *Tyto alba* at the homestead. No other raptor nests or other possible breeding sites were noted during the site survey.

The proposed development area is located within a single primary vegetation division namely the Savanna Biome and is comprised Limpopo Sweet Bushveld vegetation. Savanna is particularly rich in raptors and forms the stronghold for the Red List species recorded in the broader project area by SABAP2 such as Bateleur *Terathopius ecaudatus*, Martial Eagle *Polemaetus bellicosus*, Tawny Eagle *Aquila rapax*, Lanner Falcon *Falco biarmicus*, African White-backed Vulture and Lappet-faced Vulture. Apart from Red List species, it also supports several non-Red List raptor species, such as Wahlberg's Eagle *Hieraaetus wahlbergi,* Brown Snake-Eagle *Circaetus cinereus*, the migratory Steppe Buzzard *Buteo vulpinus*, African Harrier Hawk *Polyboroides typus*, Jackal Buzzard *Buteo rufofuscus*, *and* African Hawk Eagle *Aquila spilogaster*. Apart from raptors, woodland in its undisturbed state is suitable for a wide range of other, non-raptorial Red List species, including Kori Bustard *Ardeotis kori*, Marabou Stork *Leptoptilos crumeniferus*, Abdim's Stork *Ciconia abdimii* and European Roller *Coracias garrulus.*

Figure 27: Wahlberg's Eagle and chick on the Gruisfontein property (photo credit: Hein Schönfeldt)

There are several pans within the larger region. When these pans hold water (which is only likely after exceptional rainfall events), they could attract water birds, while large raptors and vultures could use them for bathing and drinking. When the pans are dry, they may be covered with grass, which is attractive to several large terrestrial species for foraging, roosting and breeding. Man-made impoundments (boreholes, dams and those waterbodies linked to mining activities), although artificial in nature, can be very important for variety of species.

Red List species recorded in the study area by SABAP 2 that are likely to be attracted to the pans include Greater Flamingo, Yellow-billed Stork *Mycteria ibis,* Saddle-billed Stork *Ephippiorhynchus senegalensis,* Greater Painted-snipe *Rostratula benghalensis* and Black-winged Pratincole *Glareola nordmanni.* Common species in the study area that may utilise the pans include Comb Duck *Sarkidiornis melanotos*, Yellow-billed Duck *Anas undulata*, Common Greenshank *Tringa nebularia*, Egyptian Goose *Alopochen aegyptiacus*, Ruff *Philomachus pugnax*, Blacksmith Lapwing *Vanellus armatus,* Crowned Lapwing *Vanellus coronatus*, African Sacred Ibis *Threskiornis aethiopicus* and Hadeda Ibis *Bostrychia hagedash.*

The habitat within which the proposed study area is located is relatively homogenous with little variation in sensitivity (rated to be moderate to high) from an avifaunal perspective. Areas that supported a density of non-Red List species (i.e. cattle feeding and drinking stations) are in fact degraded in habitat terms and unlikely to regularly support a diversity and/or abundance of Red List species. Although the site visit identified two nest locations on the Gruisfontein property, the presence of these do not necessarily increase the sensitivity of the project area given the species breeding at these locations. Therefore, there were no specific areas within the confines of the project boundary that were designated as highly sensitive no-go areas.

6.2.4 Surface Water

The Gruisfontein project area is located in the Limpopo Water Management Area within the A41E quaternary catchment, which covers an area of nearly 1 950 km^2. Refer to Figure 28.

The flat topography and deep sandy soils result in a very low run-off component in the area. The dominant surface drainage feature is the Limpopo River, which flows from southwest to northeast and passes about 6.5 km to the northwest of Gruisfontein. The Limpopo River also forms the boundary between South African and Botswana. There are no significant dams in this catchment.

The A41E catchment is a largely undeveloped catchment with limited water resources and limited water uses. A significant portion of the water used in the area is sourced from underground aquifers due to the low assurance of the run-of-river yields.

There is no documented surface drainage feature in the immediate vicinity of Gruisfontein. This was confirmed by the soil survey results that indicated that there are no soils with a wetland land capability present on the site and no signs of regular water logging at any depth in the soil profile were noted.

Several ephemeral pans occur in the larger area. No pans have however been identified on the Gruisfontein project area.

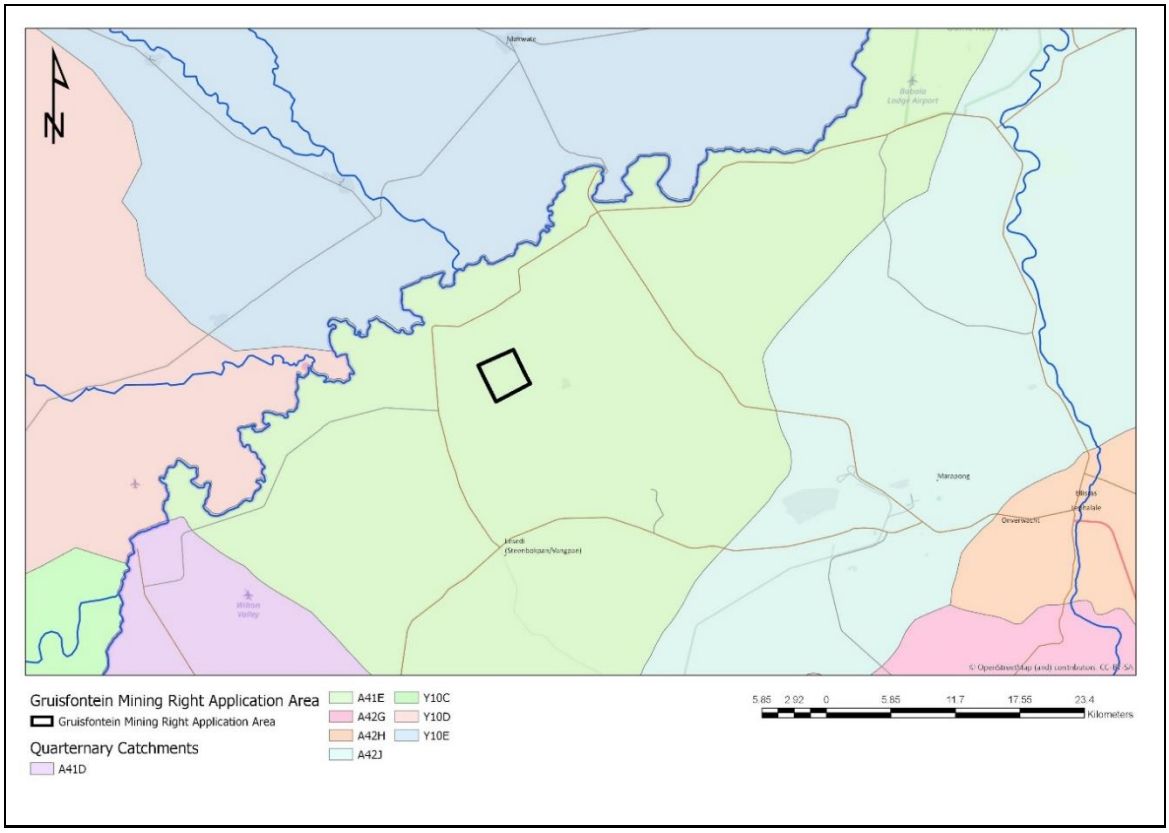


Figure 28: Quaternary catchments and perennial drainage lines

6.2.5 Groundwater

6.2.5.1 Hydrocensus

A hydrocensus/groundwater user survey was conducted on and around Gruisfontein by Aquatico Scientific in November 2018. A total of 33 boreholes or other groundwater localities were located during the survey and their positions are indicated in Figure 29. The hydrocensus boreholes extended for a radius of about 3.5 km around the Gruisfontein farm. All equipped private user boreholes were found to be used for domestic and/or livestock watering or a combination of the two.

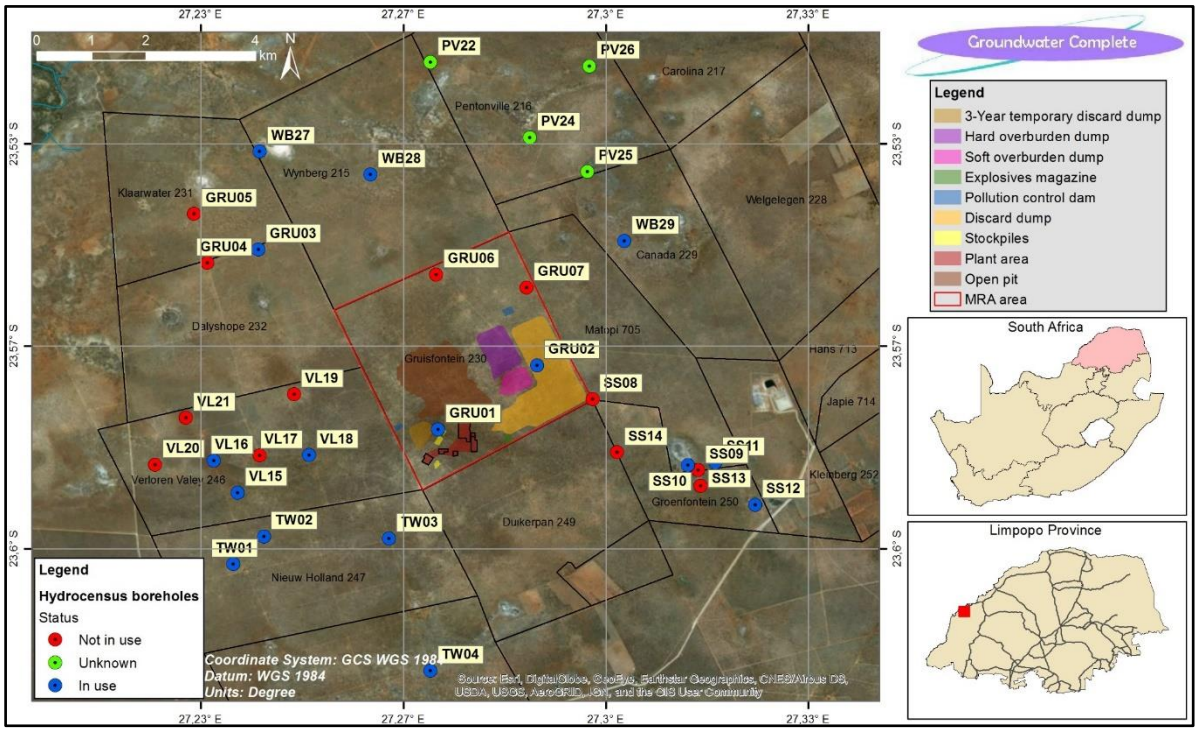


Figure 29: Positions of boreholes located during the hydrocensus/user survey

The hydrocensus reports are attached as Appendix 6.

6.2.5.1.1 Groundwater quality

Groundwater quality data was analysed for 20 user boreholes that were located and sampled during the hydrocensus/user survey. A water sample was also collected at the Sasol minipit (SS Pit) located nearly 3 km to the east of the Gruisfontein MRA area.

The samples were analysed at a SANAS accredited laboratory for a wide range of chemical and physical indicator parameters. The data was evaluated by comparing the inorganic concentrations with the South African National Standards for drinking water (SANS 241:2015).

The positions of these boreholes are indicated in Figure 30, while the results of the analyses are provided in Table 27.

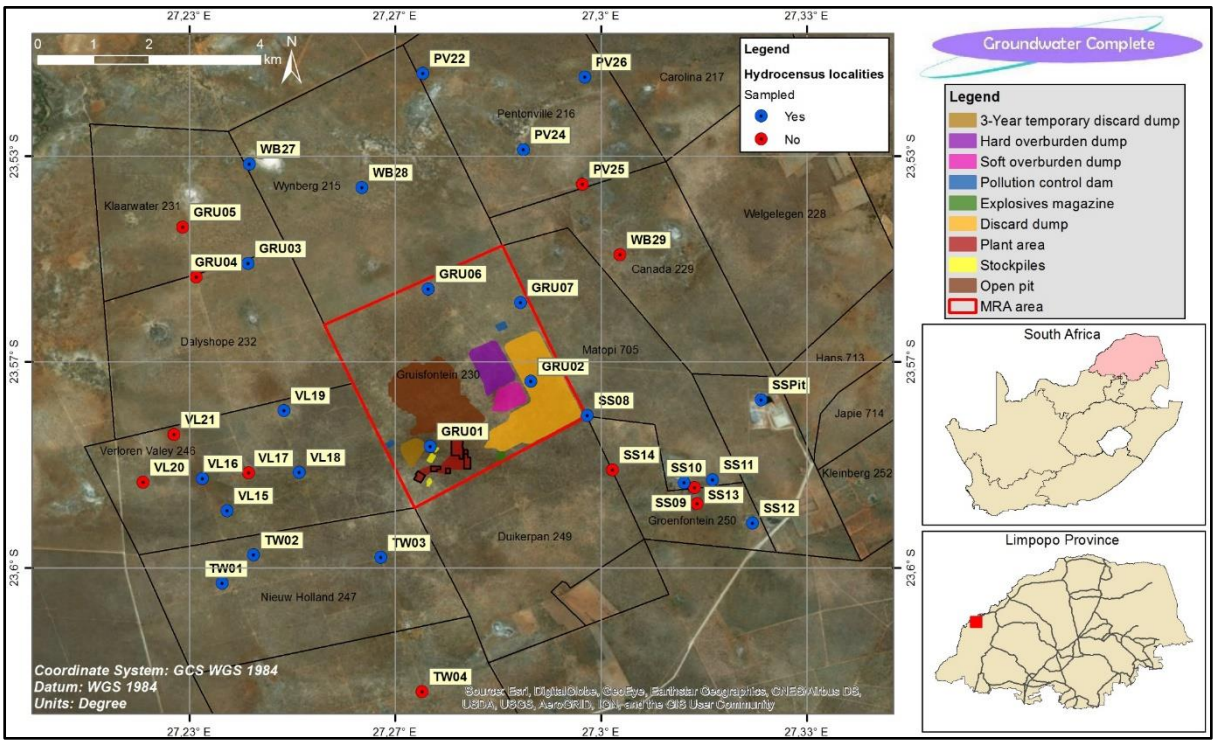


Figure 30: Distribution of groundwater quality data points

The four main factors usually influencing groundwater quality are:

- Annual recharge to the groundwater system;
- Type of bedrock where ion exchange may impact on the hydrogeochemistry;
- Flow dynamics within the aquifer(s), determining the water age; and
- Source(s) of pollution with their associated leachates or contaminant streams.

Where no specific source of groundwater pollution is present up gradient from the borehole, only the first three factors play a role.

Table 27: Concentrations of chemical and physical indicator parameters

BH ID	pH	EC	TDS	Ca	Mg	Na	K	Cl	SO_4	NO_3	F	Al	Fe	Mn	NH_4	PO_4	Total Hard.	Tot Alk
Unit	*-*	*mS/m*	*mg/l*															
TW01	8.07	119	823	65.9	39.4	180	13	289	64.5	0.569	0.56	<0.002	<0.004	<0.001	0.015	<0.005	327	274
SS10	6.53	70.4	469	22.8	17.9	117	12.3	173	30.1	0.439	<0.263	<0.002	<0.004	0.228	0.879	<0.005	131	152
SS11	7.42	101	692	43.1	24.7	171	12.2	276	38.5	1.05	<0.263	<0.002	<0.004	0.223	0.024	<0.005	209	199
SS12	7.26	82	559	36.1	28.4	130	6.33	164	15.4	9.68	0.773	<0.002	<0.004	0.254	0.019	<0.005	207	221
VL15	7.04	96.8	692	54.7	29.7	154	11	174	31.3	0.47	0.646	<0.002	<0.004	0.087	0.16	<0.005	259	383
VL16	7.3	111	813	50.7	37.9	191	5.64	213	56.5	1.96	1.01	<0.002	<0.004	<0.001	0.016	<0.005	283	406
VL18	7.27	81	544	32.1	24.4	143	3.46	147	18.1	4.05	0.611	<0.002	<0.004	<0.001	0.013	<0.005	181	258
VL19	7.78	108	666	35.8	42.3	147	11	402	<0.141	0.422	1.24	<0.002	<0.004	0.109	0.152	<0.005	264	39.8
TW02	7.42	117	810	66.5	36.5	174	15	291	51.6	0.486	0.546	<0.002	<0.004	0.257	0.159	<0.005	316	284
PV24	7.73	178	1243	114	54.4	239	23.8	560	68.9	1.67	1.02	0.01	<0.004	0.004	0.113	<0.005	508	286
PV26	7.65	205	1432	131	54.8	290	24.8	659	94.3	0.971	1.3	<0.002	<0.004	0.036	0.659	<0.005	552	282
WB27	7.94	133	922	83	39.5	188	20.6	359	47	0.555	1.05	<0.002	<0.004	<0.001	1.12	<0.005	370	296
WB28	7.75	256	2126	277	118	195	24	549	71.1	162	1.05	<0.002	<0.004	<0.001	0.022	<0.005	1179	284
TW03	7.26	111	769	30.8	21.9	217	13.1	256	52.2	1.02	0.532	<0.002	<0.004	<0.001	0.013	<0.005	167	285
SS08	8.34	56.6	381	19.6	31.1	89.3	4.55	84.9	<0.141	0.598	<0.263	<0.002	<0.004	<0.001	0.043	<0.005	177	244
GRU03	8.21	75.7	532	45.5	24.2	113	6.11	141	23.9	8.77	0.711	<0.002	<0.004	<0.001	0.011	0.011	213	228
SS Pit	8.89	155	1088	26.5	37.5	305	17.5	372	101	3.67	1.61	<0.002	<0.004	<0.001	0.026	<0.005	220	344
GRU01	7.37	84.8	577	33.7	24.1	153	5.49	180	9.35	0.597	0.673	<0.002	<0.004	0.038	0.498	<0.005	183	275
GRU02	7.96	73.2	514	37.4	16.7	133	6.41	82.8	33.4	8	0.717	<0.002	<0.004	<0.001	0.026	<0.005	162	275
GRU06	7.71	69.2	510	46.6	19.2	120	6.17	84.7	39.3	8.55	0.642	0.003	<0.004	<0.001	0.482	0.022	196	254
GRU07	7.75	72.9	479	39.7	16.6	114	6.01	78	35.1	7	0.686	0.009	<0.004	<0.001	0.032	<0.005	168	259

Notes: ***Red*** *– Parameter value exceeds maximum concentration allowed in drinking water for health effects (SANS 241:2015).*

Blue *– Parameter value exceeds maximum concentration allowed in water for domestic use for aesthetic effects (SANS 241:2015).*

Shaded – Four boreholes on Gruisfontein farm

One of the most appropriate ways to interpret the type of water at a sampling point is to assess the plot position of the water quality on different analytical diagrams like a Piper, Expanded Durov and Stiff diagrams. Of these three types, the Expanded Durov diagram (EDD) probably gives the most holistic water quality signature. The layout of the fields of the EDD is shown in Figure 31.

Although never clear-cut, the general characteristics of the different fields of the diagram could be summarised as follows:

- Field 1: Fresh, very clean recently recharged groundwater with HCO_3 and CO_3 dominated ions.
- Field 2: Field 2 represents fresh, clean, relatively young groundwater that has started to undergo mineralization with especially Mg ion exchange.
- Field 3: This field indicates fresh, clean, relatively young groundwater that has undergone Na ion exchange (sometimes in Na - enriched granites or felsic rocks) or because of contamination effects from a source rich in Na.
- Field 4: Fresh, recently recharged groundwater with HCO_3 and CO_3 dominated ions that has been in contact with a source of SO_4 contamination or that has moved through SO_4 enriched bedrock.
- Field 5: Groundwater that is usually a mix of different types – either clean water from fields 1 and 2 that has undergone SO_4 and NaCl mixing / contamination or old stagnant NaCl dominated water that has mixed with clean water.
- Field 6: Groundwater from field 5 that has been in contact with a source rich in Na or old stagnant NaCl dominated water that resides in Na rich host rock/material.
- Field 7: Water rarely plots in this field that indicates NO_3 or Cl enrichment or dissolution.
- Field 8: Groundwater that is usually a mix of different types – either clean water from fields 1 and 2 that has undergone SO_4, but especially Cl mixing/contamination or old stagnant NaCl dominated water that has mixed with water richer in Mg.
- Field 9: Old or stagnant water that has reached the end of the geohydrological cycle (deserts, salty pans etc.) or water that has moved a long time and / or distance through the aquifer or on surface and has undergone significant ion exchange because of the long distance or residence time in the aquifer.

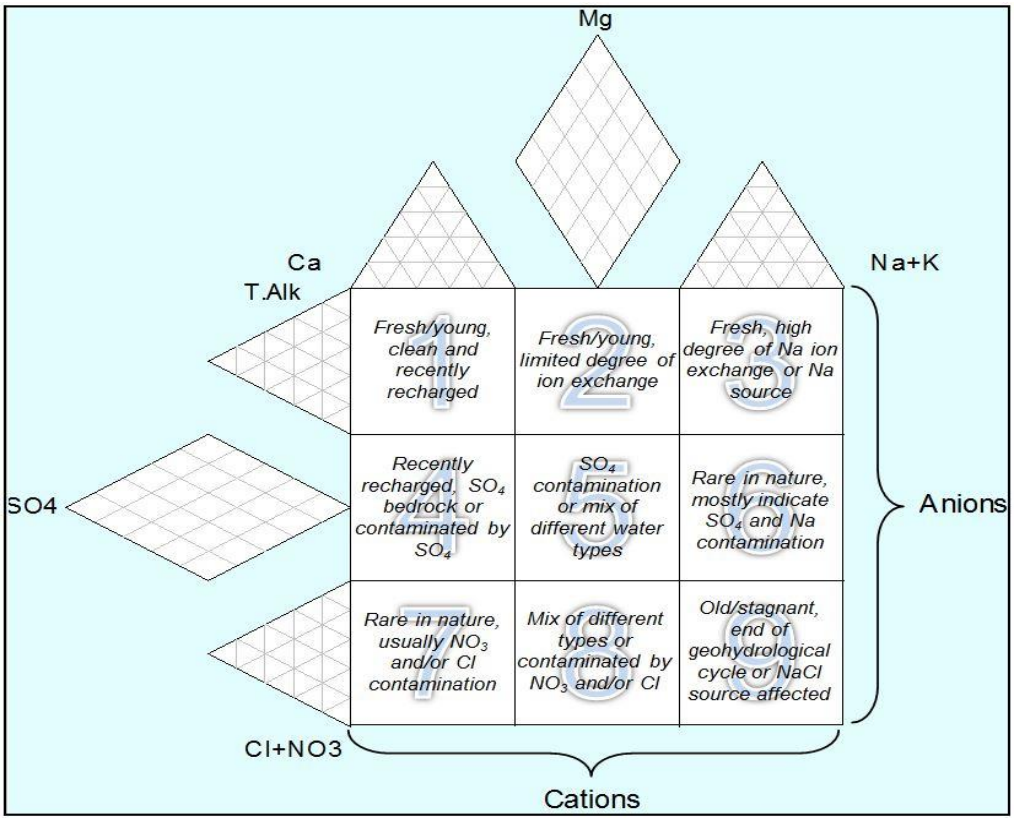


Figure 31: Layout of fields of the EDD

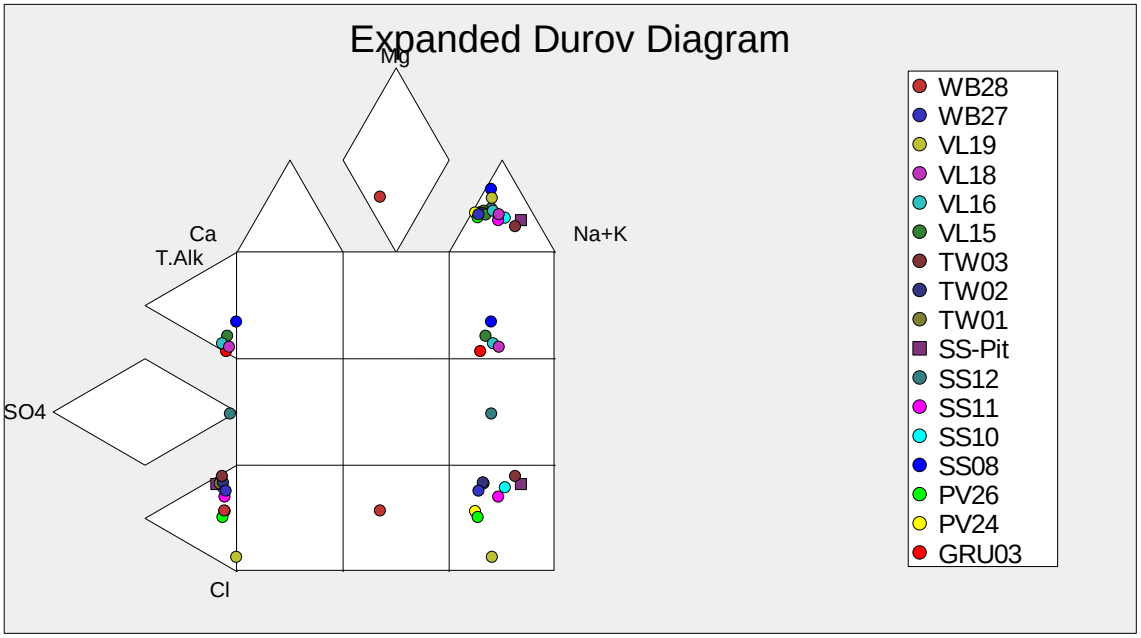


Figure 32: EDD of groundwater quality on farms around Gruisfontein

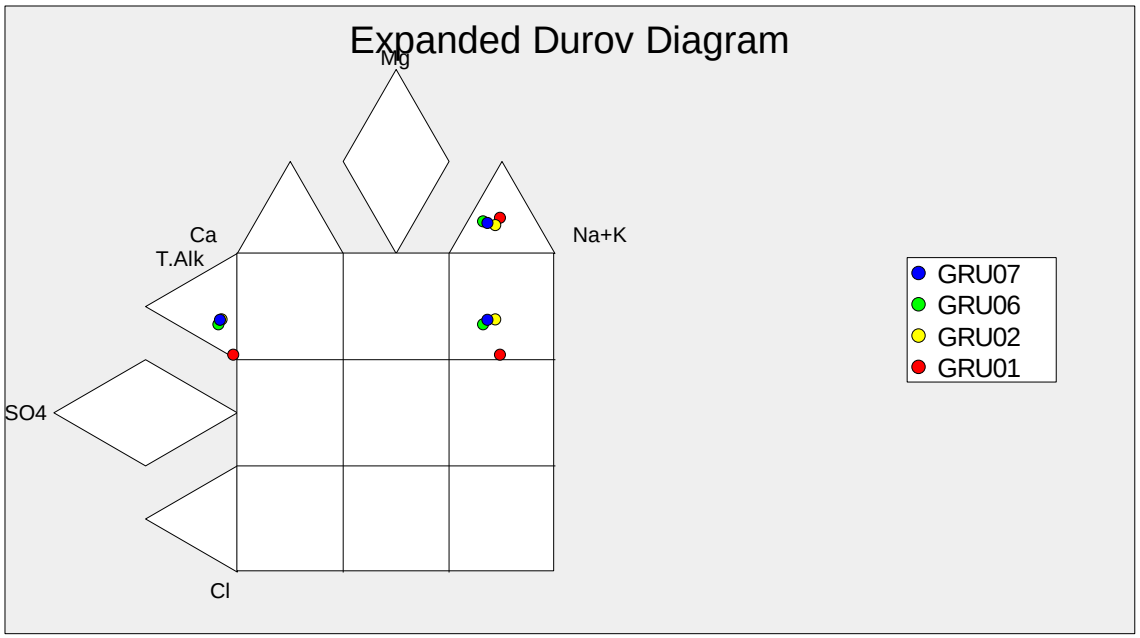


Figure 33: EDD of Gruisfontein groundwater quality

Total dissolved solids (TDS) is a good indicator of the overall quality of groundwater, as it provides a measure of the total amount/weight of salts that are present in solution. An increase in TDS will therefore indicate an increase in the total inorganic ion content of the groundwater. Groundwater from user boreholes around Gruisfontein display a relatively wide range of groundwater TDS concentrations of between 380 mg/l and 2130 mg/l. The lower end indicates good groundwater quality with water in only three boreholes exceeding the SANS guideline concentration of 1 200 mg/l. Water from the SS pit is also below the guideline concentration at 1 088 mg/l.

Groundwater TDS concentrations in the four boreholes on the Gruisfontein farm vary between 480 mg/l and 580 mg/l, which is in the lower part of the hydrocensus population.

Groundwater **pH** under natural conditions is affected by the chemical composition and redox status of the aquifer host rock/s. At very low pH levels dissolved toxic metal ions are present, which can lead to severe health problems if consumed. At low pH levels (less than ± 4.5) the water will have a sourly taste. At high pH levels there is a health hazard due to the de-protonated species and water will have a soapy taste. Groundwater pH values on and around Gruisfontein vary between 7 to 8.9, which are well within recommended SANS ranges for drinking water purposes.

Groundwater **nitrate** contamination in a rural environment may potentially originate from nitrate-based fertilisers, sewage treatment facilities, pit latrines and animal feedlots or kraals. In the Gruisfontein area only the last two activities are generally present. The groundwater nitrate content of uncontaminated groundwater is usually less than 2 mg/l. Groundwater nitrate concentrations around Gruisfontein generally vary between 0.4 mg/l and 10 mg/l, which are below the maximum permissible SANS value of 11 mg/l. User borehole WB28 is however the exception and displayed a very high groundwater nitrate concentration of 162 mg/l, far exceeding the maximum content of 11 mg/l allowed in drinking water (SANS 241:2015). **This borehole is used for livestock watering, but it poses a health risk even to livestock**. Concentrations of between ±7 mg/l and 10 mg/l were measured in boreholes GRU02, 03, 06, 07 and SS12. These concentrations are high for the project area given

that the average ambient/unaffected groundwater nitrate content is expected to be just under 1 mg/l. Except for GRU03 all abovementioned boreholes are situated within or close to kraals.

Magnesium is an alkaline metal that occurs naturally in groundwater. Except for diarrhoea when consumed at very high concentrations (>200 mg/l), no significant health risks are associated with the intake of magnesium. No guideline concentration is therefore specified for magnesium in SANS 241:2015 for drinking water purposes. Groundwater magnesium concentrations are relatively low and vary between ± 17 mg/l and 55 mg/l.

Chloride usually has no health effects when consumed at concentrations generally found in fresh groundwater. Sensitive groundwater users may experience nausea and vomiting at chloride concentrations in excess of ± 1 200 mg/l. The maximum permissible SANS value for chloride is 300 mg/l. Groundwater from user boreholes around Gruisfontein display chloride concentrations of between ±150 mg/l and 660 mg/l. Chloride concentrations measured in the four boreholes to the north of Gruisfontein exceed the guideline concentration.

Sodium is the dominating cation in most boreholes and varies between 90 mg/l and 290 mg/l.

On Gruisfontein the groundwater chloride content varies between 78 mg/l and 180 mg/l. The chloride content provides an indication of the effective recharge percentage to the aquifer. Based on the general trend of groundwater chloride content the effective recharge will be slightly higher in the central Gruisfontein area and lower towards the north.

The **manganese** concentrations are generally below 0.1 mg/l or below the detection limit (0.005 mg/l) in Gruisfontein boreholes and those further north. In the southern user boreholes manganese content varies between 0.1 mg/l and 0.25 mg/l. All concentrations are below the SANS guidelines of 0.4 mg/l and 1.5 mg/l respectively. The slightly higher manganese content in the southern boreholes may be a result of the geology of the aquifer host rocks.

According to the EDD (Figure 32) groundwater around Gruisfontein is dominated by sodium on the anion side (plot in fields 3, 6 and 9). The exception is WB28, which plots in field 8 due to its very high nitrate content. On the cation side the split is about even between those dominated by bicarbonate alkalinity (field 3) and chloride (field 9). Borehole GRU03 plots in field 6 not because sulphate dominates, but because the anion content is divided nearly equally between bicarbonate alkalinity and chloride.

On Gruisfontein itself the four analysed samples plot in field 3 of the EDD (Figure 33), indicating relatively fresh groundwater where sodium has exchanged calcium and dominates the cation content, while bicarbonate alkalinity dominates the anion content.

Summary:

- According to SANS 241:2015, groundwater from most of the user boreholes is suitable for human consumption and domestic use.
- Exceptions do however occur with some elevated inorganic salinities (TDS, chloride, sodium) exceeding the maximum concentrations allowed in drinking water.

- **The highest risk borehole in terms of drinking water for humans and even livestock is WB28.** This borehole displayed a nitrate concentration of 168 mg/l, which far exceeds the maximum content of 11 mg/l allowed in drinking water. It is strongly recommended that this borehole not be used since it poses a health risk to livestock.
- The most apparent reason for the high nitrate content in WB28 and five other user boreholes is their proximity to kraals where livestock urine and waste are believed to be responsible for the nitrate contamination.
- Groundwater within the Gruisfontein MRA area is generally of good quality, suitable for human consumption and dominated by sodium cations, while bicarbonate alkalinity dominates the anion content.

6.2.5.1.2 Groundwater level

Groundwater level measurements were taken at 26 user boreholes during the hydrocensus/user survey of November 2018, providing a good distribution of water levels over the project area. Only 19 of the boreholes were equipped and in use at the time of the survey, which means that some of the water levels are bound to have been affected to various extents by abstraction.

The groundwater level depths vary between approximately 9 and 31 meters below surface. Deeper water levels were generally measured to the south of Gruisfontein in the slightly higher surface topographies. The shallower water levels were measured north and north-west of Gruisfontein in the downgradient groundwater flow direction and lower surface topographies. On Gruisfontein itself the rest water levels vary between 17 and 22 mbs. A thematic map of groundwater depths is provided in Figure 34, while groundwater elevations are indicated in Figure 35.

Clear anomalies were recorded as well, which is expected to be mostly caused by groundwater abstraction. The deeper levels thus do not represent static water levels and were discarded during interpolation of static groundwater level contours.

Gravity dictates that groundwater will always flow from high to low hydraulic heads (groundwater elevations). Under natural/unaffected conditions, a strong correlation generally exists between the surface topography and groundwater elevations, meaning that groundwater elevations tend to follow the surface topography.

Despite some localized impacts on groundwater levels, groundwater still follows the trend of the surface topography, i.e. from south/south-east to north/north-west.

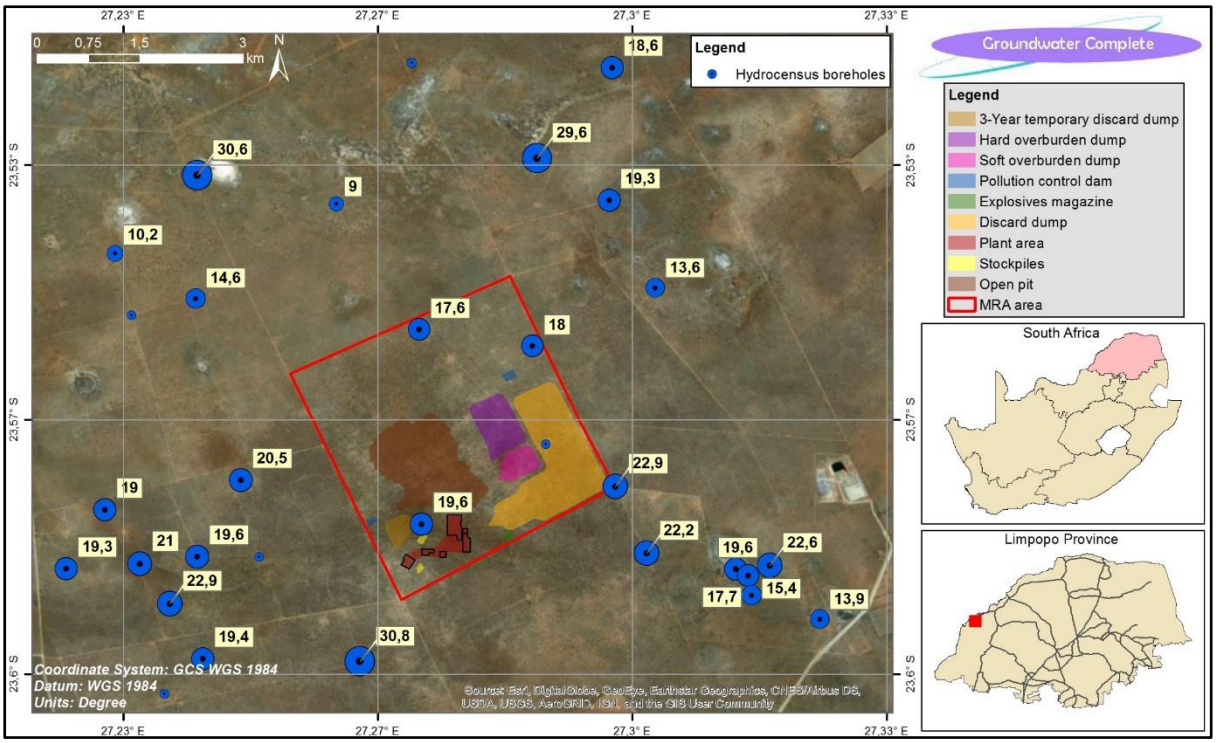


Figure 34: Thematic map of groundwater level depths (mbs)

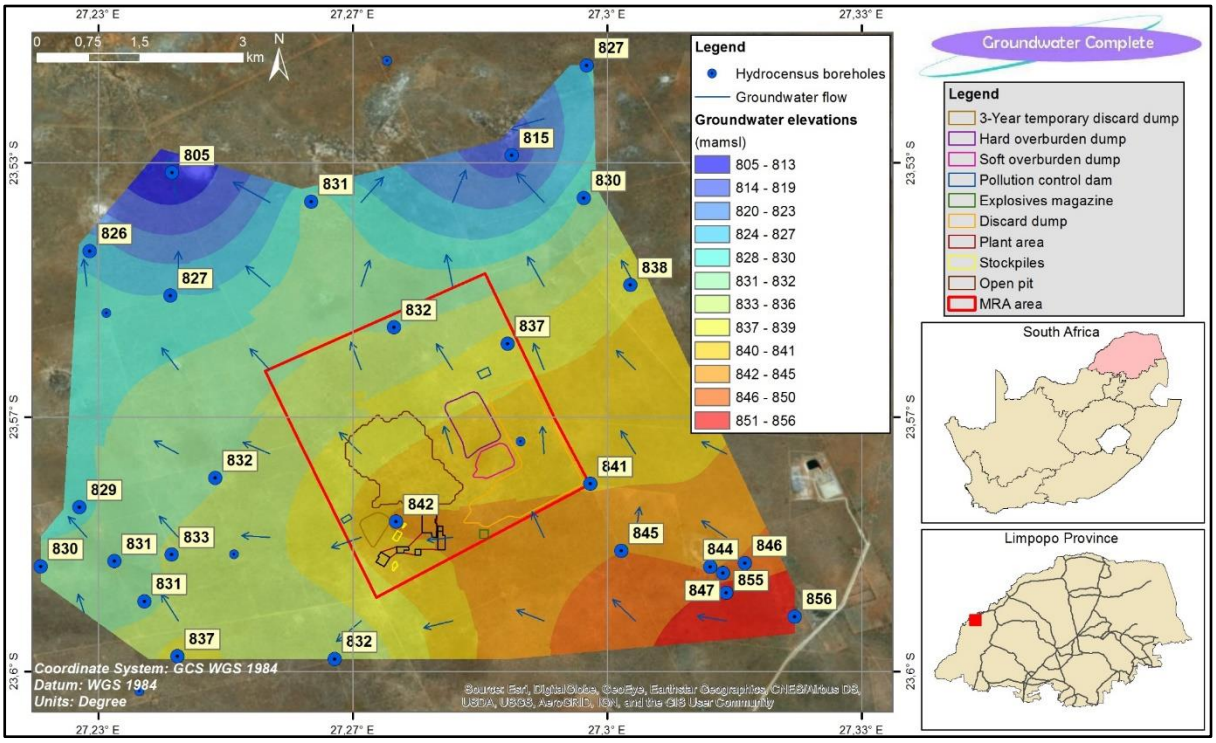


Figure 35: Contour map of groundwater level elevations (mamsl)

6.2.5.2 Aquifer Characterisation

6.2.5.2.1 Groundwater vulnerability

The Groundwater Vulnerability Classification System was developed as a first order assessment tool to aid in the determination of an aquifer's vulnerability/susceptibility to groundwater contamination. This system incorporates the well-known and widely used Parson's Aquifer Classification System as well as drinking water quality guidelines as stated by the Department of Water Affairs and Forestry. This system is especially useful in situations where limited groundwater related information is available and is explained in Table 29 and Table 30. The project area achieved a score of 8 (Table 28) and the underlying aquifer can therefore be regarded as having a medium vulnerability.

Table 28: Groundwater vulnerability rating for project area

	Rating
Depth to groundwater level	1
Groundwater quality	3
Aquifer type	4
Total score:	**8**

Table 29: Groundwater vulnerability classification system

Rating	**4**	**3**	**2**	**1**
Depth to groundwater level	0 – 3 m	3 – 6 m	6 – 10 m	>10 m
Groundwater quality *(Domestic WQG*)*	Excellent (TDS < 450 mg/l)	Good (TDS > 450 < 1 000 mg/l)	Marginal (TDS > 1 000 < 2 400 mg/l)	Poor (TDS > 2 400 mg/l)
Aquifer type *(Parsons Aquifer Classification)*	Sole aquifer system	Major aquifer system	Minor aquifer system	Non-aquifer system

** WQG = Water Quality Guideline.*

Table 30: Groundwater vulnerability rating

Vulnerability	**Rating**
Low vulnerability	≤ 4
Medium vulnerability	> 4 ≤ 8
High vulnerability	≥ 9

6.2.5.2.2 Aquifer classification

Information collected during the hydrocensus, aquifer testing and assessment of numerous exploration borehole logs and geological maps as well as experience from numerous studies conducted in similar geohydrological environments suggest that two possible aquifer types may be present in the project area. For the purpose of this study an aquifer is defined as a geological

formation or group of formations that can yield groundwater in economically useable quantities. Aquifer classification according to the Parson's Classification system is summarised in Table 31**.**

The first possible aquifer is a shallow, semi-confined or unconfined aquifer that occurs in the transitional soil and weathered bedrock zone or sub-outcrop horizon and often displays characteristics of a primary porosity aquifer (i.e. weathered zone aquifer). Yields in this aquifer are generally low (less than 0.5 l/s) and the aquifer is usually not fit for supplying groundwater on a sustainable basis. Consideration of the shallow aquifer system becomes important during seepage estimations from pollution sources to receiving groundwater and surface water systems because the lateral seepage component in this aquifer often dominates the flow. According to the Parsons Classification system, this aquifer is usually regarded as a minor- and in some cases a non-aquifer system.

The second aquifer system is the deeper double porosity aquifer that is hosted within the sedimentary rocks of the Karoo Supergroup (i.e. fractured rock aquifer). Groundwater yields, although more heterogeneous, can be higher. This aquifer system usually displays semi-confined or confined characteristics with piezometric heads often significantly higher than the water-bearing fracture position. Fractures may occur in any of the co-existing host rocks due to different tectonic, structural and genetic processes. According to the Parsons Classification system, the aquifer could be regarded as a minor aquifer system, but also a sole aquifer system since groundwater is the only source of water in the project area.

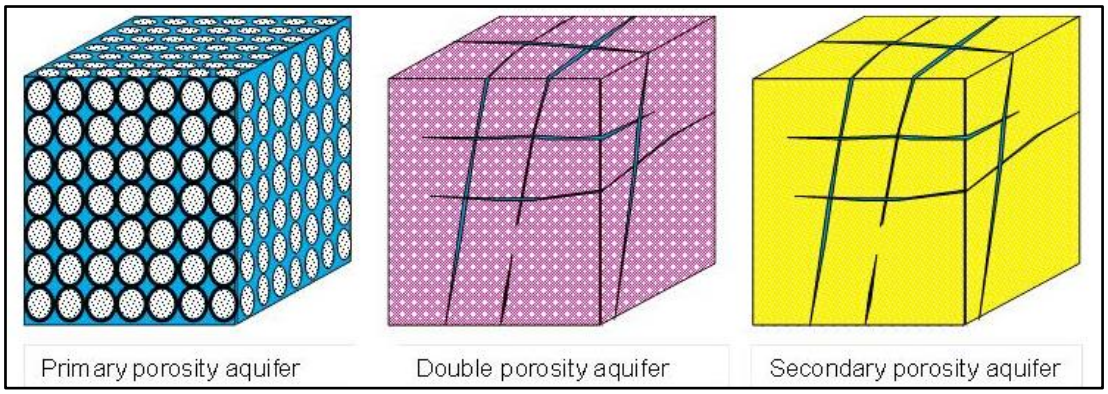


Figure 36: Types of aquifers based on porosity

Table 31: Parsons Aquifer Classification (Parsons, 1995)

Sole aquifer system	An aquifer that is used to supply 50% or more of domestic water for a given area, and for which there is no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.
Major Aquifer System	Highly permeable formation, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good (less than 150 mS/m).
Minor Aquifer System	These can be fractured or potentially fractured rocks that do not have a primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large volumes of water, they are important both for local suppliers and in supplying base flow for rivers.

Non-Aquifer System	These are formations with negligible permeability that are generally regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks, although impermeable, does take place, and needs to be considered when assessing the risk associated with persistent pollutants.
Special Aquifer System	An aquifer designated as such by the Minister of Water Affairs, after due process.

6.2.5.2.3 Aquifer protection classification

The combination of Aquifer Vulnerability Classification rating and Aquifer System management Classification provides a protection level referred to as Groundwater Quality Management Classification (GQM).

GQM = Aquifer System Management (ASM) x Aquifer Vulnerability (AV)

Table 32: Groundwater Quality Management Classification

ASM Classification		**AV Classification**		**GQM**		**Gruis-fontein GQM**
Class	**Points**	**Class**	**Points**	**Index**	**Level of protection**	
Sole Source Aquifer System	6	High	3	<1	Limited	**12**
Major Aquifer System	4			1 - 3	Low	
Minor Aquifer System	2	Medium	2	3 – 6	Medium	
Non-aquifer System	0	Low		6 – 10	High	
Special Aquifer System	0 - 6		1	>10	Strictly non-degradation	

The GQM for Gruisfontein calculates to 12, which indicates a very high level protection where strictly no degradation is allowed for groundwater users. The high score is a direct result of its classification as a sole-source aquifer. The classification protection level of prevention of degradation therefore doesn't have as much to do with the aquifer itself but more with the aquifer around the proposed activities where groundwater users rely on groundwater as the only source of water for their livelihood. It is therefore crucial that a comprehensive groundwater monitoring program is implemented and followed with diligence should the project go ahead.

6.2.5.2.4 Aquifer Delineation

Because the main aquifer is a fractured rock type and fractures could assume any geometry and orientation, the physical boundary or 'end' of the aquifer is very difficult to specify or quantify. Aquifer boundary conditions that are generally considered during the delineation process are described below:

- No-flow boundaries are groundwater divides (topographic high or low areas/lines) across which no groundwater flow is possible.
- Dolerite dykes or faults with major displacement may also act as barriers for horizontal groundwater flow and thus cause local 'boundaries' for the aquifer.

- Constant head boundaries are positions or areas where the groundwater level is fixed at a certain elevation and does not change (perennial rivers/streams or dams/pans).

Topographic highs and lows were used to roughly delineate the aquifer system underlying the project area (Figure 37) in combination with major faults and dyke structures. Based on this delineation the aquifer as it relates to the proposed project covers an area of approximately 252 km^2.

Please note that more geological structures may occur within the project area that have not yet been identified, neither have the hydraulic properties of the known structures been determined during this investigation. The aquifer boundaries as indicated in Figure 37 are therefore considered to be conceptual and should be confirmed through field testing.

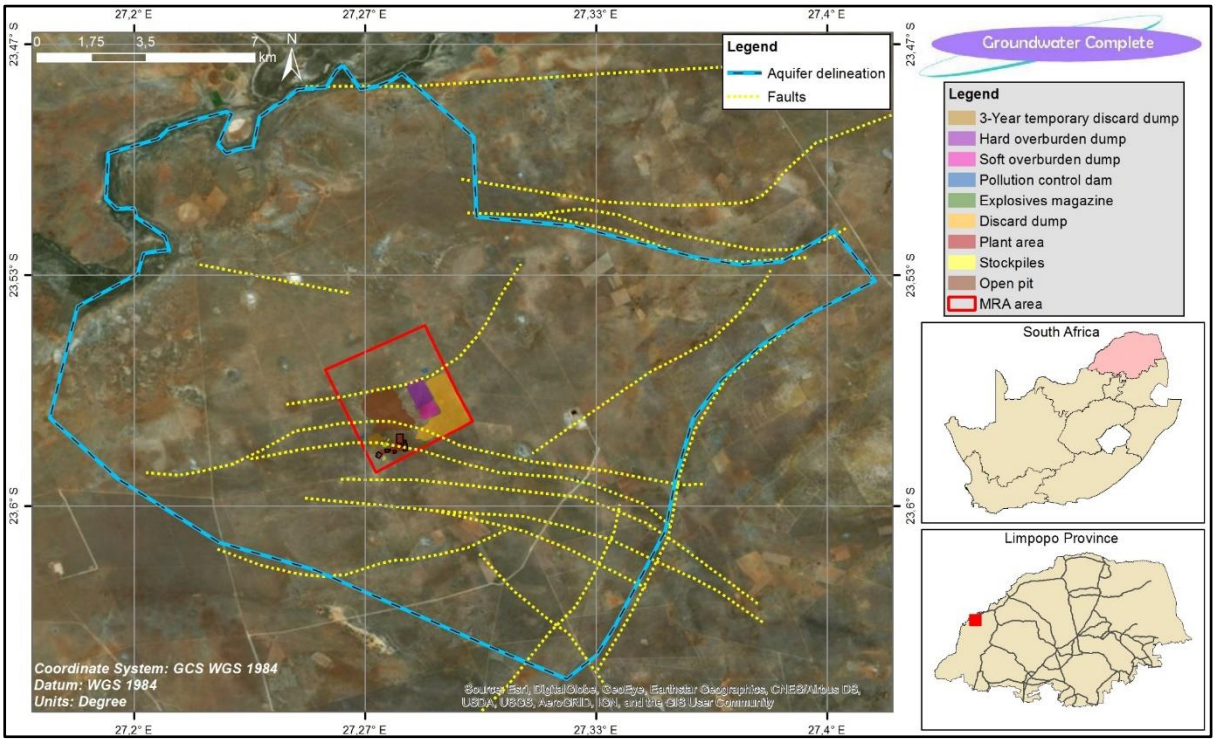


Figure 37: Aquifer delineation for Gruisfontein project area

6.2.6 Air Quality

6.2.6.1 Existing sources of pollution

Currently, a detailed emissions inventory for the area under investigation has not been undertaken. Based on an aerial photo and site description of the area, the following sources of potential air pollution have been identified:

- Power stations (Matimba & Medupi {under construction})
- Veld fires;
- Domestic fuel burning;
- Vehicle entrainment;
- Agriculture;
- Mining operations; and
- Existing ash facility.

A qualitative discussion on each of these source types is provided in the subsections which follow. These subsections aim to highlight the possible extent of cumulative impacts which may result due to the proposed operations.

6.2.6.1.1 Power stations

The burning of coal for power generation can result in emissions being generated. At the power stations surrounding the ash facility, various mitigation measures have been put in place at the stations to reduce the emissions before entering the atmosphere. These include bag filters or electrostatic precipitators (ESPs) for the removal of particulate matter and ash, scrubbers for sulphur dioxide and over air burners for oxides of nitrogen. These mitigation measures are highly efficient with up to 99% of all emissions being captured or removed.

In addition, particulate matter and nuisance dust are expected from the existing ash facility associated with the power stations, and specifically from the working face and transfer and tipping points during normal operations. Water sprays are in place for mitigation to reduce the air quality impacts associated with the facility.

6.2.6.1.2 Veld fires

A veld fire is a large-scale natural combustion process that consumes various ages, sizes, and types of flora growing outdoors in a geographical area. Consequently, veld fires are potential sources of large amounts of air pollutants that should be considered when attempting to relate emissions to air quality. The size and intensity, even the occurrence, of a veld fire depends directly on such variables as meteorological conditions, the species of vegetation involved and their moisture content, and the weight of consumable fuel per hectare (available fuel loading).

Once a fire begins, the dry combustible material is consumed first. If the energy released is large and of sufficient duration, the drying of green, live material occurs, with subsequent burning of this material as well. Under suitable environmental and fuel conditions, this process may initiate a chain reaction that results in a widespread conflagration. It has been hypothesized, but not proven, that the nature and amount of air pollutant emissions are directly related to the intensity and direction (relative to the wind) of the veld fire and are indirectly related to the rate at which the fire spreads.

The factors that affect the rate of spread are:

- weather (wind velocity, ambient temperature, relative humidity);
- fuels (fuel type, fuel bed array, moisture content, fuel size); and
- topography (slope and profile).

However, logistical problems (such as size of the burning area) and difficulties in safely situating personnel and equipment close to the fire have prevented the collection of any reliable emissions data on actual veld fires, so that it is not possible to verify or disprove the hypothesis.

The major pollutants from veld burning are particulate matter, carbon monoxide, and volatile organics. Nitrogen oxides are emitted at rates from 1 to 4 g/kg burned, depending on combustion temperatures. Emissions of sulphur oxides are negligible (USEPA, 1996). A study of biomass burning in the African savanna estimated that the annual flux of particulate carbon into the atmosphere is estimated to be of the order of 8 Tg C, which rivals particulate carbon emissions from anthropogenic activities in temperate regions (Cachier *et al*, 1995).

6.2.6.1.3 Domestic fuel burning

It is anticipated that the lower income households in the Marapong Village and other villages in the area surrounding the site are likely to use coal and wood for space heating and/ or cooking purpose. The problems facing Eskom around the impact of particulates generated indoors as a result of the use of coal and wood are not unique. Similar problems are reported around the world in poor communities which either lack access to electricity or lack the means to fully utilise the available supply of electricity (Van Horen et al. 1992).

Globally, almost 3 billion people rely on biomass (wood, charcoal, crop residues and dung) and coal as their primary source of domestic energy. Exposure to indoor air particulates from the combustion of solid fuels is an important cause of morbidity and mortality in developing countries. Biomass and coal smoke contain a large number of pollutants and known health hazards, including particulate matter, carbon monoxide, nitrogen dioxide, sulphur oxides (mainly from coal), formaldehyde, and polycyclic organic matter, including carcinogens such as benzo[a]pyrene (Ezzati and Kammen, 2002).

Monitoring of exposures in biomass-burning households has shown concentrations are many times higher than those in industrialized countries. The latest Air Quality Objectives, for instance, required the monthly average concentration of PM10 (particulate matter < 10 µm in diameter) to be < 200 µg/m3 (annual average < 100 µg/m^3). In contrast, a typical 24-hr average concentration of PM10 in homes using biofuels may range from 200 to 5000 µg/m^3 or more throughout the year, depending on the type of fuel, stove, and housing. Concentration levels, of course, depend on where and when monitoring takes place, because significant temporal and spatial variations may occur within a house. Field measurements, for example, recorded peak concentrations of ≥ 50000 µg/m^3 in the immediate vicinity of the fire, with concentrations falling significantly with increasing distance from the fire. Overall, it has been estimated that approximately 80% of total global exposure to airborne particulate matter occurs indoors in developing nations. Levels of CO and other pollutants also often exceed international guidelines (Ezzati and Kammen, 2002).

6.2.6.1.4 Vehicle entrained dust

The force of wheels of vehicles travelling on unpaved roadways causes the pulverisation of the surface material. Particles are lifted and dropped from the rotating wheels and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed. The quantity of dust emissions from unpaved roads varies linearly with the volume of traffic as well as the speed of the vehicles. These types of roads could also be used, and new ones may be created to ensure access to the new facility where access cannot be obtained from the main roads in the area. The movement of construction vehicles and other infrastructure parts will result in unusually heavy loads being placed on the roads, which is likely to result in additional damage to the road surface (USEPA, 1996).

6.2.6.1.5 Agriculture

Agricultural activity can be considered a significant contributor to particulate emissions, although tilling, harvesting and other activities associated with field preparation are seasonally based. The main form of agriculture in the area is Game Farming.

Little information is available with respect to the emissions generated due to the growing of crops. The activities responsible for the release of particulates matter would however include:

- Particulate emissions generated due to wind erosion from exposed areas;
- Particulate emissions generated due to the mechanical action of equipment used for clearing of fences and roads, tilling and harvesting operations; and
- Vehicle entrained dust on paved and unpaved road surfaces.

6.2.6.1.6 Mining operations

Exxaro's Grootegeluk Colliery is currently the only commercial coal mining operation in the Waterberg Basin. The mine produces coal for the use in the nearby Matimba and Medupu power station. In addition, the Sasol bulk sample operation (prospecting) is situated to the east of Gruisfontein, on the farm Groenfontein 250 LQ. All aspects from blasting, to material handling and transport of coal can result in particulate emissions to the atmosphere from these mine operations. These mines need to ensure their own environmental obligations are met, by compliance to criteria outlined in their EMPs and air quality permits.

6.2.6.2 Baseline Air Quality Monitoring

Baseline monitoring is undertaken by the Department of Environmental Affairs at their Marapong site ~70km south-east of the site, however this monitoring station is currently not reporting to the SAAQIS online system for addition into this report.

Ambient monitoring of Total Suspended Particulates was undertaken between the 22nd and 24th January 2019. Ambient monitoring was undertaken for 24 hours at each sampling point, and then sampled again for a further 24 hours with new filters.

The results indicate an ambient particulate load well below the National Standard PM_{10} daily average guideline of 75 µg/m^3. The results indicate that the proposed mining operation will be impacted on by surrounding mining, and power generation operations.

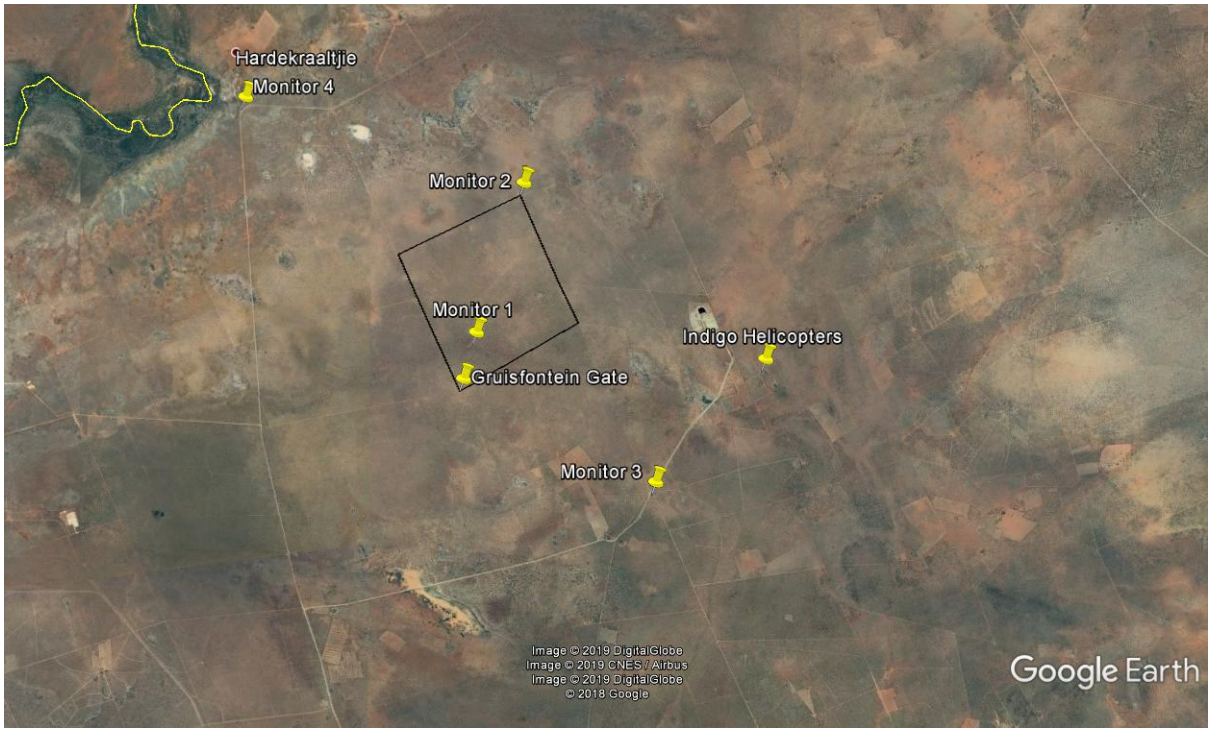


Figure 38: Ambient air quality monitoring points

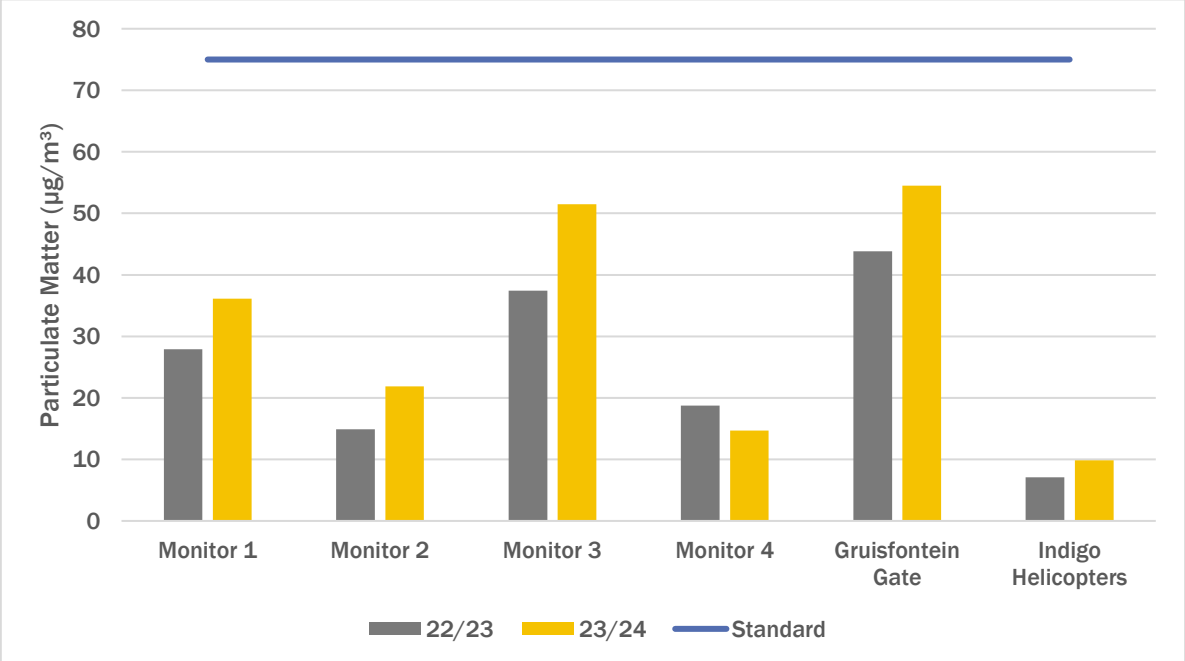


Figure 39: Ambient monitoring results for the 22/23rd January and 23/24th January

6.2.7 Ambient Noise

6.2.7.1 Identified noise sources

The focus area is located far from busy roads, railway lines and industrial activities and the existing ambient sound levels are low and typical of an undeveloped, natural soundscape.

Existing land use and/or environmental components that may contribute or change the sound character in the area include:

- **Topography**: The area is relatively flat plains. There are little natural features that could act as noise barriers considering practical distances at which sound propagates.
- **Surrounding Land Use**: The area in the vicinity of the proposed development is currently classified as Vacant or Unspecified. Previous site visits revealed that the area is mainly wilderness with game ranches forming a large part of the agricultural activities (cattle farming).
- **Roads**: There are several gravel district roads that traverses the area. There are no other roads or railway lines within 2,000 m from the proposed development. Based on observations made during this and previous site visits, the gravel roads do not carry any traffic of acoustic significance.
- **Residential areas**: Excluding farm dwellings, there are no residential areas within 5,000 m.
- **Other industrial and commercial processes**: The Grootegeluk Coal Colliery is approximately 20 km east south-east from the proposed development. It is too far to influence the ambient sound levels in the vicinity of the proposed development. There are also several collieries planned directly adjacent to the proposed mine.
- **Ground conditions and vegetation**: The area falls within the Savannah biome, with the vegetation type being bushveld. The ground is covered with grasses, shrubs and trees and would be considered as 50% acoustically absorbent. This influences the propagation of the sound from the mine, as the fraction of sound that is reflected from the ground would be influenced as certain frequencies would be partly absorbed by the ground surface.

6.2.7.2 Ambient sound levels

Ambient (background) sound levels were measured by Enviro Acoustic Research (EAR) over a one night-time period from 21 to 22 January 2019, augmented with several short, 10-minute measurements. The sound measurement locations are indicated in Figure 40, together with a summary of the sound levels determined.

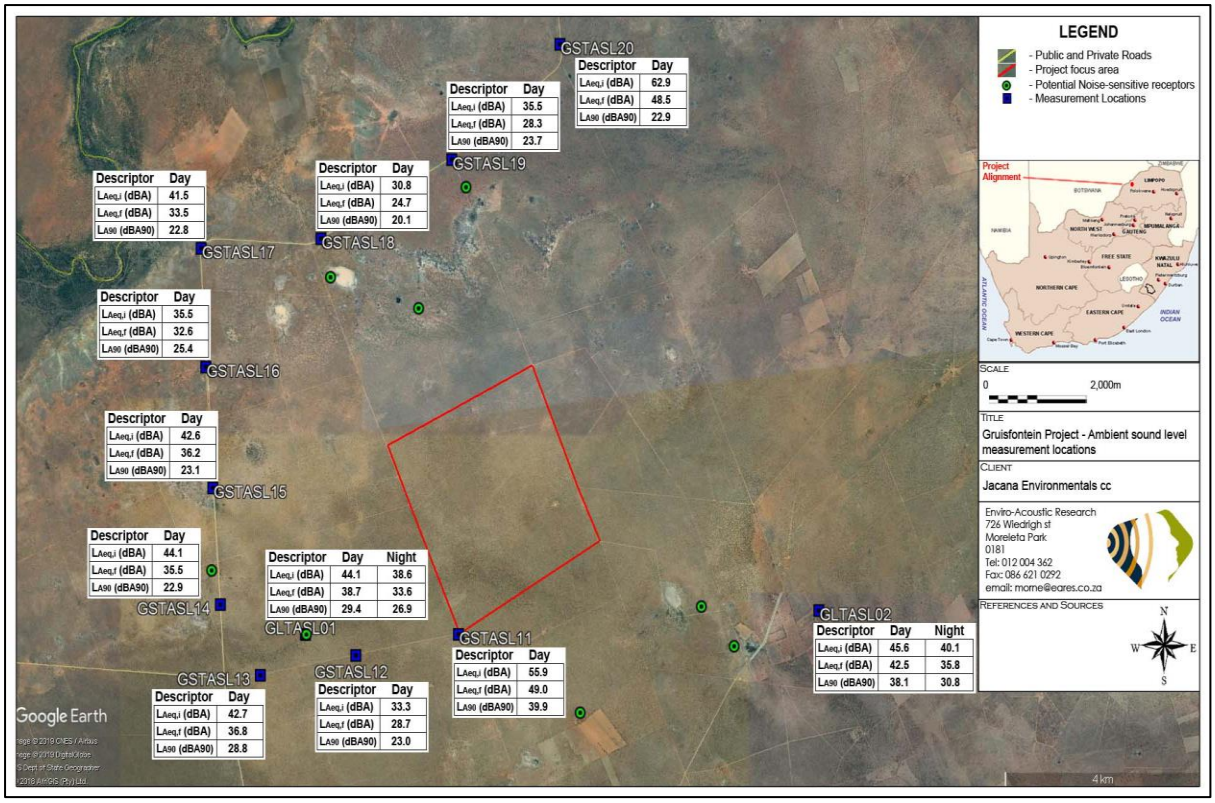


Figure 40: Localities where ambient sound levels were measured

6.2.7.2.1 Long-term ambient sound measurements

The ambient sound levels measured at GLTASL01 and GLTASL02 are provided Table 33 and Table 34, respectively.

Table 33: Sound levels considering various sound level descriptors at GLTASL01

	$L_{Amax,i}$ (dBA)	$L_{Aeq,i}$ (dBA)	$L_{Aeq,f}$ (dBA)	$L_{A90,f}$ (dBA90)	$L_{Amin,f}$ (dBA)	Comments
Day arithmetic average	-	44	39	29	-	-
Night arithmetic average	-	39	34	27	-	-
Day minimum	-	32	29	-	24	-
Day maximum	71	59	55	-	-	-
Night minimum	-	31	27	-	23	-
Night maximum	73	54	49	-	-	-
Day 1 equivalent	-	44	38	-	-	Late afternoon and evening
Night 1 Equivalent	-	44	38	-	-	8-hour night equivalent average
Day 2 equivalent	-	51	43	-	-	Morning only

Table 34: Sound levels considering various sound level descriptors at GLTASL02

	$L_{Amax,i}$ (dBA)	$L_{Aeq,i}$ (dBA)	$L_{Aeq,f}$ (dBA)	$L_{A90,f}$ (dBA90)	$L_{Amin,f}$ (dBA)	Comments
Day arithmetic average	-	46	42	38	-	-
Night arithmetic average	-	40	36	31	-	-
Day minimum	-	38	36	-	27	-
Day maximum	82	57	55	-	-	-
Night minimum	-	34	30	-	<18	-
Night maximum	72	60	53	-	-	-
Day 1 equivalent	-	45	40	-	-	Late afternoon and evening
Night 1 Equivalent	-	48	42	-	-	8-hour night equivalent average
Day 2 equivalent	-	45	39	-	-	Morning only

The **$L_{Aeq,i}$**, **$L_{Aeq,f}$** and **$L_{A90,f}$** sound level descriptors at both locations indicate a location that are generally quiet to very quiet. **L_{Amax}** levels exceeded 65 dBA less than 10 times at night with the source unknown. When more than 10 sound events occur at night (where the noise level exceeds 65 dBA) it may disturb the sleep of people. Ambient sound levels are typical of a rural noise district (the existing rating level).

6.2.7.2.2 Short-term ambient sound measurements

Several single measurements were collected to augment the longer-term ambient sound levels measured at GLTASL01 and GLTASL02. The results are presented in Table 35.

Considering the ambient sound levels measured onsite, as well as the developmental character of the area, the acceptable zone rating level would be typical of a rural noise district (35 dBA at night and 45 dBA during the day) as defined in SANS 10103:2008.

Table 35: Summary of singular noise measurements

Measurement location	$L_{Aeq,i}$ level (dBA)	$L_{Aeq,i}$ level (dBA)	$L_{Aeq,i}$ level (dBA)	$L_{Aeq,f}$ level (dBA)	L_{A90} Level (dBA90)	Comments
GSTASL11	66	56	27	49	40	Birds dominating, with birds in trees close to microphone generating significant noise. Frogs (suspected) clearly audible and significant. Some wind gusts at times with minimal influence on sound levels.
GSTASL12	43	33	18	29	23	Birds dominating with frogs clearly audible. Some minor wind induced noises at times.
GSTASL13	58	43	22	37	29	Birds dominating. Birds in tree close to microphone.
GSTASL14	58	44	19	36	23	Birds dominating.
GSTASL15	52	43	20	36	23	Birds dominating.
GSTASL16	50	36	22	33	25	Birds dominating. Insects clearly audible (bees).
GSTASL17	56	42	20	33	23	Birds dominating. Voices from people in area. Insects. Some wind induced noises.
GSTASL18	47	31	17	25	20	Birds and insects.
GSTASL19	46	36	21	28	24	Birds dominant. Insects audible. Some wind induced noises with Aeolian sounds at times from powerlines. Wind induced noises from tree.
GSTASL20	81	63	19	48	23	Birds dominating. Bird in tree close to microphone generating high noise levels. Insects audible. Slight wind induced noises at times.

6.2.8 Cultural and Heritage Resources

6.2.8.1 Palaeontology

The Gruisfontein Project area falls within the Waterberg Coalfield which comprises of the Lower Carboniferous sediments of the Vryheid and overlying Grootegeluk Formations in the Karoo Supergroup. Rocks of the Karoo Supergroup are internationally acclaimed for their rich palaeontological heritage. In particular the Karoo documents the catastrophic End Permian Extinction and subsequent proliferation of life, early dinosaurs and the emergence of mammals. Since the Karoo hosts several coal seams, and coal is formed from plant remains it follows that these rocks host a well-documented palaeoflora. Fossil plants offer an opportunity to study palaeoecology and have been allocated a very high palaeontological sensitivity by SAHRA.

The palaeontological study indicates that there is a very high likelihood of the occurrence of fossils, typically palaeoflora of *Glossopteris*, *Dadoxylon* and *Vertebraria* within the lower Karoo strata. The Lisbon Formation may contain trace fossils such as *Cruziana* and *Skolithos*, with also a possibility of dinosaur fossils such as *Euskelsaurus* and *Massospondylus*.

The property contains no outcrops or disturbances which exposes the underlying rock formations. The shales and coal beds will only be exposed during the mining operations, and it is therefore unlikely that fossils will be observed before the mining and associated infrastructure development takes place.

6.2.8.2 Stone Age remains

Surveys of adjacent areas determined that Middle Stone Age (MSA) remains are present at pans, usually where the calcrete base was exposed as well as in isolated settings. This calcrete formed during a cold period with alternating wet and dry episodes that allowed calcium carbonate to precipitate on to the land surface. Some MSA artefacts occurred in the calcrete, and so they predate this geo-morphological formation. These artefact assemblages typically include radial cores, triangular points, convergent scrapers and flakes. They represent what is called a Post Howieson's Poort Industry and thus date to between 60,000 and 40,000 years ago. These Post Howieson's Poort artefacts were made from quartz and quartzite pebbles that formed part of the ferricrete horizon found underneath the calcrete. This ferricrete is an iron-rich formation derived from the Waterberg sandstones to the south. The stones and iron-rich soil must have first washed down during a high-rainfall period and then formed under arid conditions, perhaps about 200,000 years ago. If Early Stone Age artefacts occur in the study area, they will lie under this ferricrete horizon.

Although no pans occur within the Gruisfontein project area, the area probably contains subterranean MSA deposits. The MSA is regarded as of low significance and can only be dealt with as chance finds when exposed.

6.2.8.3 Iron Age

Although no Iron Age sites were observed in the project area, previous surveys surrounding Gruisfontein indicate that the area contains cattle outposts of farming communities living in the Limpopo Valley. During a survey in 2011, an isolated potshard was recorded at coordinates -23.582486° 27.265748° (Site RSV689/004) and this find is mentioned in the Digby Wells Fatal Flaw

Analysis (2017). This find is on the western border fence between Verloren Valey and Gruisfontein (Verloren Valey side). During the recent site visit by R&R Cultural Resource Consultants no pottery was found on the Gruisfontein side of the fence.

6.2.8.4 Graves and burials

No graves or burial sites were recorded in the Gruisfontein project area. According to the African farm-caretaker, no people were buried on the farm because their homes were somewhere else.

6.2.8.5 The built environment

The farm contains structures such as cattle kraals, cattle loading platform, concrete reservoirs, sheds, water troughs, etc. None of these features are regarded as older than 60 years or contain any intrinsic design, architecture or pioneer building material and methods that require further assessment.

6.2.9 Socio-Economic Character

6.2.9.1 Towns and settlements

The main settlement in Lephalale LM is the Lephalale town that consist of Ellisras and Onverwacht, with a large settlement to the North-West called Merapong (28 km south-east from the proposed development). The closest settlement is Lesedi located on the farms Steenbokpan and Vangpan approximately 14 km south of the proposed development. Lesedi consist of approximately 400 households and 1 474 people.

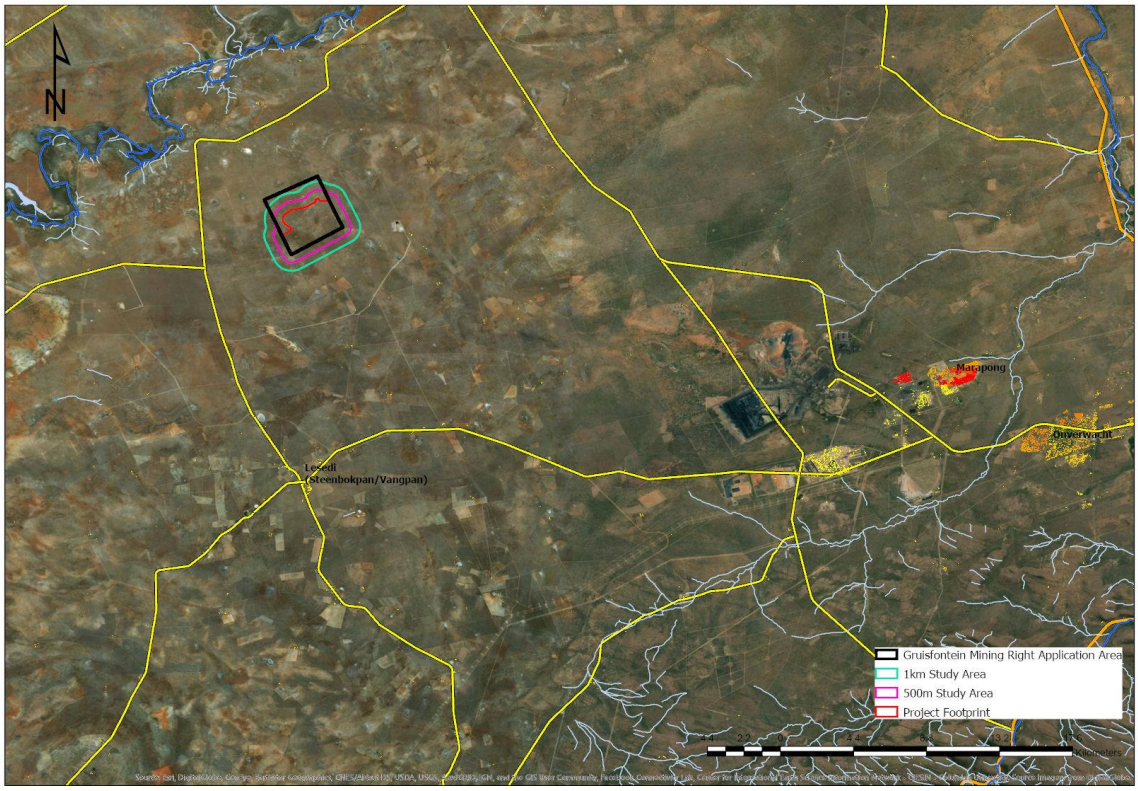
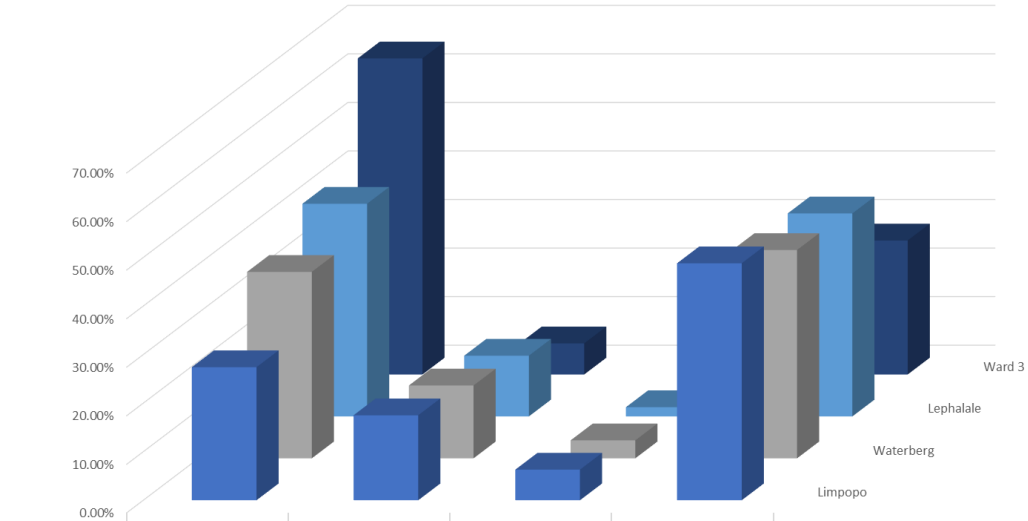


Figure 41: Settlements

6.2.9.2 Economic Profile

6.2.9.2.1 Employment profile



	Employed	Unemployed	Discouraged work-seeker	Other not economically active
Limpopo	27.40%	17.50%	6.30%	48.80%
Waterberg	38.40%	15%	3.70%	42.90%
Lephalale	43.80%	12.50%	1.90%	41.80%
Ward 3	65.10%	6.40%	0.90%	27.60%

Figure 42: Employment Profile

Employment is the primary means by which individuals who are of working age may earn an income that will enable them to provide for their basic needs and improve their standard of living. As such, employment and unemployment rates are important indicators of socio-economic well-being.

The Census 2011 data indicates that the Lephalale LM had about 80 694 people within the working-age population. Of these, 58.2% of the people were economically active, while 41.8% of the working age population were not economically active (NEA), that is, persons aged 15–64 years, excluding discouraged jobseekers. The employed labour in the LM was estimated at 35 328, while the unemployed population was estimated at 10 101, reflecting an unemployment rate of 12.5%. This was lower than the country's unemployment rate of 29.7%.

In terms of the structure of employment, the agricultural sector was the most important economic sector in the LM, contributing 24.5% of the total employment opportunities. This was followed by the trade and mining sectors, which made contributions of 20.3% and 16.9% to the total employment, respectively. One of the goals outlined in the NDP (2011-2030) is to ensure development of a stable economy. Essentially, a stable economy is less reliant on the primary and secondary sectors than the tertiary sector, as an economy easily affected by trade and global economic spin-offs is unstable. Therefore, an economy dominated by the tertiary or services sector is more desirable as it reduces the risks associated with fluctuations in demand for commodities. Over the period between 2003 and

2013, the mining and transport sectors were the only sectors that showed significant growth in employment, while the other sectors fluctuated between periods of growth and decline.

6.2.9.2.2 Income profile

In order to determine the people's living standards as well as their ability to pay for basic services such as water and sanitation, the income levels of the population are analysed and compared to the income level in the province in general.

Table 36: Income Profile

	Limpopo	Waterberg	Lephalale	Ward 3
R0	10%	7%	12.9%	4%
Under R4800	4%	3%	3%	2%
R5k - R10k	9%	6%	6%	3%
R10k - R20k	24%	24%	17%	24%
R20k - R40k	17%	20%	21%	13%
R40k - R75k	13%	15%	16%	11%
R75k - R150k	12%	11%	11%	12%
R150k - R300k	8%	7%	8%	15%
R300k - R600k	2%	2%	4%	7%
R600k - R1.2M	0.4%	0.5%	1%	2%
R1.2M - R2.5M	0.2%	0.2%	0%	0.3%
Over R2.5M	0.2%	0.2%	0%	0.4%
Unspecified	0.2%	4.1%	0.1%	6.3%

The average household income in the Lephalale LM is about R10,052, with 12% of the households earning no income at all. Overall, 46.2% of the households within the local municipality earns up to R3200 per month. 72.1% of the households earn their salaries in the formal sector. On average 89.7% of the income bearing population brings an income into the household, this includes pensions and social grants.

6.2.9.2.3 Economic structure

The structure of the economy and the composition of its employment provide valuable insight into the dependency of area on specific sectors and its sensitivity of fluctuations of global and regional markets. Knowledge of the structure and the size of each sector are also important for the economic impact results' interpretation, as it allows the assessment of the extent to which the proposed activity would change the economy, its structure and trends of specific sectors.

The Limpopo Province contributes about 7.1% to the country's GDP. The LM contributes approximately 12.2% to the economy of the Waterberg District and made a contribution of 2.9% to the Province's economy.

With the expected development of the mining industry in the area and establishment of new associated industries, employment opportunities within both the mining and secondary industry are expected to grow. These developments are expected to maximise local economic spin-offs leading to the creation of new employment opportunities in the services sector, thus contributing to the sustainable development of the local economy.

Currently, mining is the largest and predominant contributor to the Waterberg regional economy, which is sustained by extensive and rich mineral resources located in the north-eastern and western

parts of the District. Extensive current and planned mining activities are mainly located in the Lephalale area. The growth of the Lephalale economy in the past few years was largely stimulated by the primary sector, particularly mining. More than 60% of the local economy is derived from the mining activities, and specifically coal mining. These activities are directly dependent on the demand for coal created by the local energy generating sector, thus it can be suggested that the sustainability of the existing local employment opportunities is indirectly reliant on the future growth of the local electricity generating industry and other industries that use coal as production inputs. Mining has shown significant growth in contribution to the GDP-over the past decade. Agricultural contribution on the other hand, has declined. The propelled growth of the mining sector is primarily due to the advance in development of the Limpopo Coal, Energy and Petrochemical Cluster. All these developments will result in an accompanying accelerated population growth impact in the region and will put strain on the following key economic enabling drivers:

- Effective transport network;
- Water supply;
- Service management;
- Reliable and sustainable electricity provision;
- Skilled labour supply; and
- TFR rail network.

Lephalale LM comprises 1 378 000 ha and consists of varied topography (steeper in the Waterberg on the southeast). More than 60% of Lephalale LM area has moderate or better soil potential, but climate (especially rainfall) is the greatest limiting factor, so that irrigation is the preferred method of cultivation to obtain long-term results. The agricultural potential of the area is intimately associated with topographical, pedological (soil) and climate determinants. As a general trend the potential for dry land cropping decreases with the rainfall distribution from south to north and west to east. Soil factors do play a role in that shallow, sandy and very high clay content which also lead to a slight reduction in potential due to decreased water storage/ plant water supply capacity. Threats to this aspect of the land include erratic rainfall and high input costs.

The importance of tourism industry to the economy of the area is likely to continue to grow into the future. This is likely to be related to the hunting and ecotourism industries but could also be linked to any expansion of the industrial operations and the related business tourism. The existing importance of the business tourism sector, and its strong links to the mine and power station are also viewed as important. The challenge faced by the tourism industry in the area is to increase leisure/ecotourism visitors in the summer seasons. This would relate to ecotourism rather than hunting.

6.2.9.3 Land use

Lephalale is defined by Limpopo Growth and Development Strategy as a coal mining and petrochemical cluster. The area is currently experiencing growth driven by mining expansion and the development of the Medupi power station, although this is decreasing as the Medupi project is near final completion. The coal to liquid project that was investigated by Sasol is currently placed on hold, if this project goes ahead it could broaden the opportunities for cluster formation. The local economy is dominated by the coal mine and the power station. Three clusters that are most relevant to

Lephalale are firstly Coal & Petrochemical, secondly red meat via livestock farming and thirdly Game farming, breeding and its associated Ecotourism.

6.2.9.3.1 Mining and power generation

Minerals that are mined in the area include coal, methane gas, aggregate which are the influence behind most town development and expansion. Coal and petroleum mining in Lephalale have been taking place and with the coal power stations constructed and those proposed, it is envisaged that further mining is foreseen.

The existing Matimba Power Station is designed to generate 4 000 MW and is the largest direct dry-cooled power station in the world. Coal is supplied to Matimba by means of a conveyer belt system from the Grootegeluk mine. The Medupi power station is slightly bigger than Matimba and produces 4 800 MW. Additional to Matimba and Medupi three new Eskom power stations CF3, CF4 and CF5 are planned for the future as well as a further two by independent power producers envisaged by the private sector (Lephalale IDP, 2018). The success of mining development in the region hinges on several key factors:

- Effective transport network;
- Water supply;
- Service management;
- Electricity provision; and
- Skilled labour supply.

Besides the mineral extraction process, the emergence of new mining communities impacts significantly on housing development, retail and service supply demands.

Exxaro's Grootegeluk Colliery is currently the only commercial coal mining operation in the Waterberg Basin. At present annual production of Grootegeluk coal mine is 15.3 Mt/a. It is the largest opencast coal mine of its kind in the world. The mine is currently being expanded. Other mining projects that have secured mining rights include the Boikarabelo Coal mine, Temo Coal, Waterberg Coal Mine, etc.

Without the Matimba, Medupi and other power stations to consume the high-ash coal, the Grootegeluk coal mine and envisaged other possible mines will not be economically viable. The low-grade Waterberg coal with its high ash content and low yields is a significant stumbling block to further development from coal, other than power generation and coal-to-liquid fuel plants.

6.2.9.3.2 Livestock farming

Agriculture is a major land use in Lephalale (in terms of geographic area) with 47% of land in the municipal area consumed, and contributes considerably to the region's economy (Lephalale IDP, 2018). Within the project study area, it is estimated that approximately 10 000 hectares are utilised for grazing of either livestock or game farming, covering approximately 10 properties within a 1 km radius from the MRA area.

In the table below the respective estimated grazing areas, cattle numbers and LSU for the study area are presented.

Category	MRA Area	1 km radius around MRA
Total property extent	1 140 ha	9 348 ha
Estimated grazing hectares	1 082 ha	8 792 ha
Hectares for other land use[2]	58 ha	556ha
Large Stock Units	87	276
Livestock	103	293

In the study area livestock numbers and specifically cattle numbers have declined considerably in the past number of years, gradually making way for game farming. At present the ratio between cattle and game on the commercial farms appears to be around 40% cattle and 60% game for the area. In some of the areas it is as low as 10% for cattle.

The estimated economic parameters include the potential revenue generation, employment generation, income to low-income households and net-present value.

Table 37: Livestock farming economic value

Category	Mining Right Area	1 km radius around MRA
Estimated turnover per annum	R604 500	R1 906 149
Net-Present Value over life of mine at current values	R4 729 432	R 14 913 154
Employment generation	2	9
Estimated wages per annum	R76 056	R 342 252
Estimated wages to low income households	R60 845	R 273 802
Net-present value of wages over life of mine	R595 040	R 2 677 680

For the purpose of the assessment, employee numbers earning minimum wages as per the Department of Labour guidelines (2018) were used in the calculations. The employment numbers are inclusive of livestock and hunting activities.

To determine the livestock revenue, a carrying capacity of 1 cattle for every 8 ha and a calfing ratio of 90% was assumed. The future of cattle in the area is largely dependent on the future of the game farming and related activities in the area. The cumulative development of mining may have an impact on livestock farming. If the impact is high on game, the related cattle farming can stabilise at present levels as further development might not be feasible. The projected growth in the area could even stimulate the demand for meat and an optimistic possible scenario is that a switch back to cattle can take place.

[2] Includes roads, infrastructure, residential, water management, and mining

6.2.9.3.3 Game farming

The core of South Africa tourism industry is based on wildlife tourism. Private game reserves and game farms which forms part of wildlife tourism constitute most of the wildlife products in South Africa. On these private reserves and game farms, hunting is one of the major income generators for product owners. Most of South Africa's hunting takes place in five of the nine provinces: The North West, the Eastern Cape, Limpopo, the Northern Cape and the Free State, the last three being the most popular.

In 2014 Van der Merwe et al (May 2014) undertook a research study to determine the economic impact of hunting in the Limpopo, Free State and Northern Cape Provinces. The aim of this study was to analyse the economic impact of hunting on the regional economies of three of South Africa's most important hunting provinces. The study used economic multipliers, input-output analysis, and related modelling processes through input-output (supply-use) tables and social accounting matrices (SAM). The results differed significantly for the three provinces, with Limpopo receiving the biggest impact (R2.6 billion) and the Free State having the highest multiplier (2.08).

The geographical location of the game farms, the number of farms and the species available all influenced the magnitude of the economic impact of hunters over and above the traditional determinants of economic impact analysis.

According to information contained in this study, hunting is an important source of income for the South African wildlife industry. The greater part of this industry takes place on privately-owned farms and game reserves, which constitute 17.9% of the total land suitable for agriculture in South Africa. The number of game farms in South Africa has increased sharply since the early 1990s, and in 2014 it was estimated to be more than 9 000 farms, which translates into 14.7 million hectares. Based on a study which were undertaken in 2002, fifty percent of South Africa's 9 000 game farms are situated in the Limpopo Province and about 80% of the country's hunting takes place here.

In South Africa, hunting is primarily of two types, biltong and trophy hunting. The combined contribution by trophy and biltong hunting to the South African economy for the 2009 and 2010 season was close to R 6 billion. In 2010, hunters spent an estimated total of R 1.5 billion on licences (hunting licences and permits), travel, supplies and services directly connected with hunting in Limpopo. Of the total spending by all hunters, biltong hunters spent an estimated 94% and trophy hunters only 6%. Spending on game/species accounted for 45% of total expenditure, accommodation and food for 22%, new equipment for 10%, fuel and transport for 9% and meat processing services for 5%. All other expenditures accounted for approximately 9% of the total expenditure for 2010. Biltong hunters contributed an estimated R 1.4 billion, and trophy hunters an estimated R88.2 million to the Limpopo economy in 2010.

The analysis of the results of the study (Van der Merwe et al, 2014) indicated that the direct economic impact of spending by the two types of hunters (trophy and biltong) in the regions (in the order of R1.5 billion for Limpopo), produced an additional R 1.1 billion in Limpopo. This is equivalent to an aggregated production multiplier in the order of 1.78 in Limpopo. The aggregated production multiplier is obtained by dividing the total impact by the direct impact. Therefore, for each rand spent by the two types of hunters, 78 cents were generated additionally in terms of indirect expenditure (Limpopo). One of the elements of the additional value added that results from the hunters' spending is employee remuneration, which in turn affects household income. The household income multiplier

thus measures the magnitude of changes both to household income and to spending and saving patterns. The impact on low-income households is particularly important, as it can be used to indicate how much hunting contributes to poverty alleviation through the provincial economy. Labour is a key element of the production process. Based on figures from the Limpopo SAM and using data on the labour force relative to the business volume and jobs per activity sector, it was possible to estimate the impact of hunter spending on job level. The research found that 17 806 jobs may depend on hunting in Limpopo, in addition to those of people permanently employed on game farms.

The economic impact of hunting is the highest in the Limpopo Province at R 2.6 billion, as indicated in Table 38 below, for the following reasons:

- 50% of South Africa's game farms are found here;
- the largest percentage (29%) of biltong and trophy hunters prefer to hunt in Limpopo;
- the most preferred species for hunting is kudu, impala, blue wildebeest and warthog, are commonly found in Limpopo; and
- Limpopo borders Gauteng, which is South Africa's wealthiest area and the province that most of the hunters come from and is also accessible by international hunters.

It is evident that the size of the overall operation (the number of game farms), the number of hunters, the species available and the geographical location of the market play a significant role in the economic impact of hunting in Limpopo.

Van der Merwe (2014) considered the direct, indirect and induced impacts of hunting on the economy. The study details how direct expenditure across the various sectors was calculated looking at the Limpopo Social Accounting Matrix, which indicates backward and forward linkages between various sectors

Table 38: Total Impact of hunter spending on regional production in Limpopo (ZAR million) (Van der Merwe et al, May 2014)

Sectors	Spending by biltong hunters	Spending by trophy hunters	Cumulative Impact of hunting activities	Production multipliers	Total Impact
Agricultural	251	8	259	1.650	442
Mining	22	1	23	1.777	40
Manufacturing	212	11	223	1.594	404
Electricity & water	36	3	39	1.932	72
Construction	14	1	15	1.897	29
Trade & accommodation	346	24	370	1.879	692
Transport and communication	121	19	140	1.730	243
Financial and Business services	326	14	340	1.762	586
Community services	53	6	59	1.322	97
Total	**R 1.381 billion**	**R 86 million**	**R 1.467 billion**	**-**	**R 2.605 billion**

Based on the study and information contained in the table above, it was possible to determine economic indicators as outlined below. It was furthermore assumed that the entire extent of the farm may be utilised for hunting. This may result in an over estimation as it is more likely that less of some of these farms are utilised for game farming.

Table 39: Hunting multipliers

Detail	Indicator
Game farms located in Limpopo	4 500
Extent of game farms in Limpopo	7.35 million hectares
Direct spending by hunters	R 200/ha
Direct spending by hunters with multiplier effect	R 354/ha

The economic value relates to the following:

Table 40: Hunting Economic value

Category	MRA Area	1 km radius around MRA
Estimated turnover[3] per annum without multiplier	R 86 343	R 1 328 758
Estimated turnover per annum with multiplier	R 153 323	R 2 359 519
Net-Present Value over life of mine at current values (with multiplier)	R 1 199 553	R 18 460 192
Employment generation	1	34
Estimated wages per annum	R 12 676	R 684 504
Estimated wages to low income households	R 10 141	R 547 603
Net-present value of wages over life of mine	R 99 173	R 5 355 360

6.2.9.3.4 Associated eco-tourism

The study area offers a variety of recreational opportunities covering hunting, eco-tourism, game viewing, hiking and bird watching. The tourism industry in the region is relatively new and is currently in a rapid growth phase. The rapid growth is resulting in significant land use changes in the broader region. Traditionally the land uses in the area were agricultural (cattle) and mining (coal). Approximately 14 years ago there was in the region of 120 000 head of cattle in the Lephalale Municipality area. This number has shrunk drastically. This is likely to indicate a change from an agricultural-based land use to an eco-tourism and hunting-based land use.

Trophy hunters, leisure and eco-tourists make use of chalets and other “bush” accommodation. Hunting and associated accommodation have low occupancy and the length of stays are of shorter duration, as they are mainly occupied by hunters during the winter (the hunting season period from June to August does not apply to trophy hunters in which case special hunting licences are obtained). Eco-tourists (which include game viewing/drives, bird watching and hiking) visiting for the outdoor and wildlife experience, visit throughout the year. Peak season is from March to October and during school holidays, long weekends and public holidays. Low season is from November to February. The

[3] Inclusive of Trophy Hunting and Biltong Hunting

biltong hunters, who are restricted to the hunting season (June to August) generally, stay in accommodation provided for by the landowner. The economic value is included as a multiplier above.

6.2.9.4 Monetary value of current activities

The economic value of production in Lephalale LM is driven by coal mining and electricity generation. By comparison, the contribution for other sectors to the value of production is relatively small. The structure of the local economy is likely to become even more concentrated if and after the coal mine expansions and additional power station construction commences.

In the calculation of the baseline of the current economic activities in the area, the following aspects were determined:

- Economic growth, i.e. the Revenue and net present value of land use activities;
- Employment creation, i.e. the impact on labour requirements; and
- Income to low income households.

In summary the following is estimated in terms of the monetary value. It should be noted however that the values are estimated based on information obtained during this study.

Table 41: Total economic value

Category	MRA Area	1 km radius around MRA
Total estimated revenue generation per annum	R 757 823	R 4 265 668
Net-Present Value over life of mine at current values	R 5 928 985	R 33 373 347
Total employment Generation	3	43
Total estimated wages per annum	R 88 732	R 1 026 756
Total wages to low income households per annum	R 70 986	R 821 405
Net-Present Value of wages over life of mine at current values	R 694 213	R 8 033 040

6.3 SENSITIVE RECEPTORS

Available information, orthophotos and satellite imagery was utilised to identify potential sensitive receptors. The following sensitive receptors have been identified:

- Residential structures, including labour tenants
- Agricultural and support infrastructure
- Surface and groundwater (boreholes, watering points, etc.)
- Hunting/tourism structures

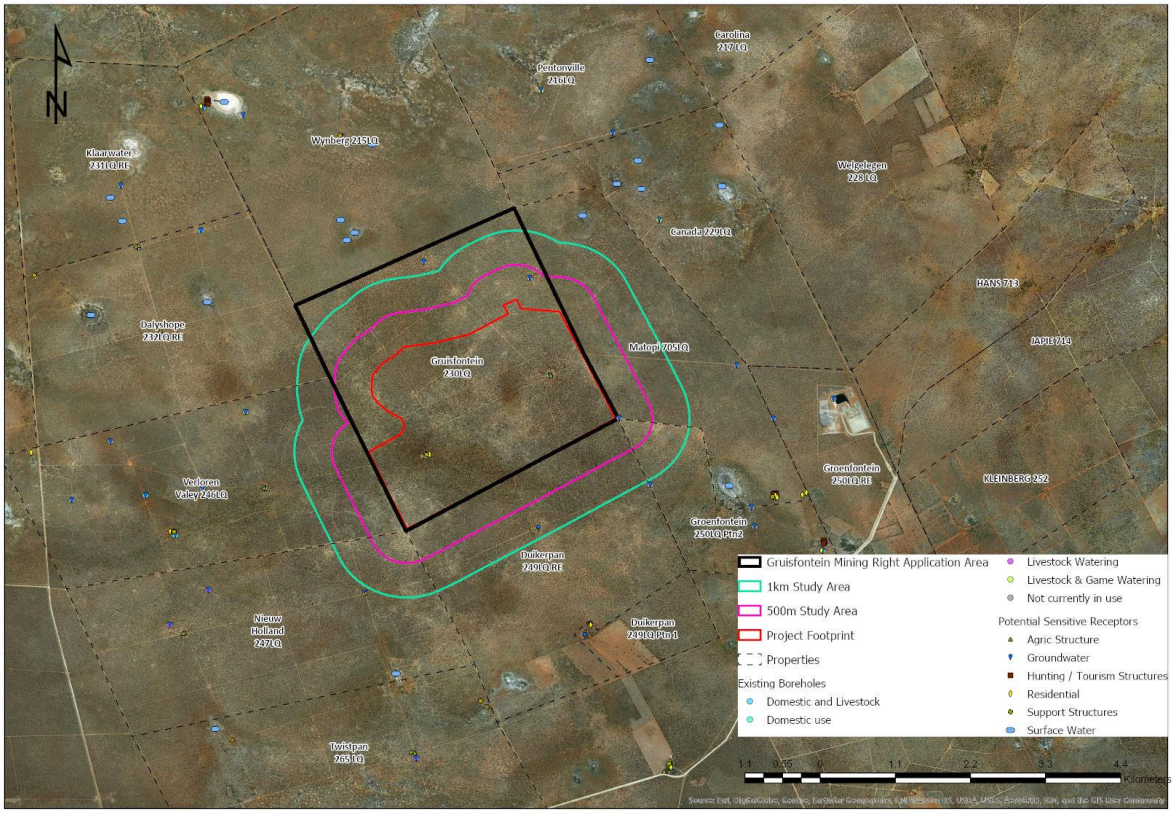


Figure 43: Sensitive Receptors

7 ENVIRONMENTAL IMPACT ASSESSMENT

7.1 RISK ASSESSMENT METHODOLOGY

According to the EIA Regulations, 'significant impact means an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment'. In line with the Regulations, and based on the qualitative findings of the activities undertaken, each potentially significant impact will be assessed with regard to:

- the nature and status of the impact;
- the extent and duration of the impact;
- the probability of the impact occurring;
- the effect of significance on decision-makings;
- the weight of significance; and
- the mitigation efficiency.

7.1.1 Impact Significance

7.1.1.1 Nature and Status

The 'nature' of the impact describes what is being affected and how. The 'status' is based on whether the impact is positive, negative or neutral.

7.1.1.2 Spatial Extent

'Spatial Extent' defines the spatial or geographical scale of the impact.

Category	Rate	Descriptor
Site	1	Site of the proposed development
Local	2	Limited to site and/or immediate surrounds
District	3	Lephalale Municipal area
Region	4	Waterberg District, and direct neighbouring district
Provincial	5	Limpopo Province
National	6	South Africa
International	7	Beyond South African borders

7.1.1.3 Duration

'Duration' gives the temporal scale of the impact.

Category	Rate	Descriptor
Temporary	1	0 – 1 years
Short term	2	1 – 5 years
Medium term	3	5 – 15 years
Long term	4	Where the impact will cease after the operational life of the activity either because of natural process or by human intervention
Permanent	5	Where mitigation either by natural processes or by human intervention will not occur in such a way or in such a time span that the impact can be considered as transient

7.1.1.4 Probability

The 'probability' describes the likelihood of the impact actually occurring.

Category	Rate	Descriptor
Rare	1	Where the impact may occur in exceptional circumstances only
Improbable	2	Where the possibility of the impact materialising is very low either because of design or historic experience
Probable	3	Where there is a distinct possibility that the impact will occur
Highly probable	4	Where it is most likely that the impact will occur
Definite	5	Where the impact will occur regardless of any prevention measures

7.1.1.5 Intensity

'Intensity' defines whether the impact is destructive or benign, in other words the level of impact on the environment.

Category	Rate	Descriptor
Insignificant	1	Where the impact affects the environment is such a way that natural, cultural and social functions and processes are not affected. Localised impact and a small percentage of the population is affected
Low	2	Where the impact affects the environment is such a way that natural, cultural and social functions and processes are affected to a limited extent
Medium	3	Where the affected environment is altered in terms of natural, cultural and social functions and processes continue albeit in a modified way
High	4	Where natural, cultural or social functions or processes are altered to the extent that they will temporarily or permanently cease
Very High	5	Where natural, cultural or social functions or processes are altered to the extent that they will permanently cease, and it is not possible to mitigate or remedy the impact

7.1.1.6 Ranking, Weighting and Scaling

The weight of significance defines the level or limit at which point an impact changes from low to medium significance, or medium to high significance. The purpose of assigning such weights serves to

highlight those aspects that are considered the most critical to the various stakeholders and ensure that the element of bias is taken into account. These weights are often determined by current societal values or alternatively by scientific evidence (norms, etc.) that define what would be acceptable or unacceptable to society and may be expressed in the form of legislated standards, guidelines or objectives.

The weighting factor provides a means whereby the impact assessor can successfully deal with the complexities that exist between the different impacts and associated aspect criteria.

<table>
<tr><th>Spatial Extent</th><th>Duration</th><th>Intensity / Severity</th><th>Probability</th><th>Weighting factor</th><th>Significance Rating (SR - WOM) Pre-mitigation</th><th>Mitigation Efficiency (ME)</th><th>Significance Rating (SR-WM) Post Mitigation</th></tr>
<tr><td>Site (1)</td><td>Short term (1)</td><td>Insignificant (1)</td><td>Rare (1)</td><td>Low (1)</td><td>Low (0 – 19)</td><td>High (0.2)</td><td>Low (0 – 19)</td></tr>
<tr><td>Local (2)</td><td rowspan="2">Short to Medium term (2)</td><td rowspan="2">Minor (2)</td><td rowspan="2">Unlikely (2)</td><td rowspan="2">Low to Medium (2)</td><td rowspan="2">Low to Medium (20 – 39)</td><td rowspan="2">Medium to High (0.4)</td><td rowspan="2">Low to Medium (20 – 39)</td></tr>
<tr><td>District (3)</td></tr>
<tr><td>Regional (4)</td><td>Medium term (3)</td><td>Medium (3)</td><td>Possible (3)</td><td>Medium (3)</td><td>Medium (40 – 59)</td><td>Medium (0.6)</td><td>Medium (40 – 59)</td></tr>
<tr><td>Provincial (5)</td><td rowspan="2">Long term (4)</td><td rowspan="2">High (4)</td><td rowspan="2">Likely (4)</td><td rowspan="2">Medium to High (4)</td><td rowspan="2">Medium to High (60 – 79)</td><td rowspan="2">Low to Medium (0.8)</td><td rowspan="2">Medium to High (60 – 79)</td></tr>
<tr><td>National (6)</td></tr>
<tr><td>International (7)</td><td>Permanent (5)</td><td>Very high (5)</td><td>Almost certain (5)</td><td>High (5)</td><td>High (80 – 110)</td><td>Low (1.0)</td><td>High (80 – 110)</td></tr>
</table>

7.1.1.7 Impact significance without mitigation (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned weightings, resulting in a value for each impact (prior to the implementation of mitigation measures).

Equation 1: Significance Rating (WOM) = (Extent + Intensity + Duration + Probability) x Weighting Factor

7.1.1.8 Effect of Significance on decision-making

Significance is determined through a synthesis of impact characteristics as described in the above paragraphs. It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required.

Rating	Rate	Descriptor
Negligible	0	The impact is non-existent or insignificant, is of no or little importance to decision making.
Low	1-19	The impact is limited in extent, even if the intensity is major; the probability of occurrence is low, and the impact will not have a significant influence on decision making and is unlikely to require management intervention bearing significant costs.
Low to Medium	20 – 39	The impact is of importance, however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels. The impact and proposed mitigation measures can be considered in the decision-making process
Medium	40 – 59	The impact is significant to one or more affected stakeholder, and its intensity will be medium or high; but can be avoided or mitigated and therefore reduced to acceptable levels. The impact and mitigation proposed should have an influence on the decision.
Medium to High	60 -79	The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.
High	80 – 110	The impact could render development options controversial or the entire project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor and must influence decision-making.

7.1.2 Mitigation

"Mitigation" is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures, amongst others, to conserve biodiversity and to protect, the users of biodiversity and other affected stakeholders from potentially adverse impacts as a result of mining or any other land use. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level. Offsetting of impacts is considered to be the last option in the mitigation hierarchy for any project.

The mitigation hierarchy in general consists of the following in order of which impacts should be mitigated:

- Avoid/prevent impact: can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases, if impacts are expected to be too high, the "no project" option should also be considered, especially where it is expected that the lower levels of mitigation will not be adequate to limit environmental damage and eco-service provision to suitable levels.
- Minimise (reduce) impact: can be done through utilisation of alternatives that will ensure that impacts on biodiversity and ecoservices provision are reduced. Impact minimisation is considered an essential part of any development project.

- Rehabilitate (restore) impact is applicable to areas where impact avoidance and minimisation are unavoidable where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land. Rehabilitation can however not be considered as the primary mitigation toll as even with significant resources and effort rehabilitation that usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:
    - Structural rehabilitation which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long terms sustainable ecological structure.
    - Functional rehabilitation which focuses on ensuring that the ecological functionality of the ecological resources on the subject property supports the intended post closure land use. In this regard special mention is made of the need to ensure the continued functioning and integrity of wetland and riverine areas throughout and after the rehabilitation phase.
    - Biodiversity reinstatement which focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local post closure land uses. In this regard special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community of community suitable for supporting the intended post closure land use.
    - Species reinstatement which focuses on the re-introduction of any ecologically important species which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species re-instatement need only occur if deemed necessary.
- Offset impact refers to compensating for latent or unavoidable negative impacts on biodiversity. Offsetting should take place to address any impacts deemed to be unacceptable which cannot be mitigated through the other mechanisms in the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity. Biodiversity offsets can be a last resort to compensate for residual negative impacts on biodiversity.

According to the DMR (2013) “Closure” refers to the process for ensuring that mining operations are closed in an environmentally responsible manner, usually with the dual objectives of ensuring sustainable post-mining land uses and remedying negative impacts on biodiversity and ecosystem services.

The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss or irreplaceable biodiversity the residual impacts should be of very high significance and when residual impacts are considered to be of very high significance, offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have medium to high significance, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance no biodiversity offset is required.

7.1.2.1 Impact significance with mitigation measures (WM)

In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it was necessary to re-evaluate the impact.

7.1.2.2 Mitigation Efficiency (ME)

The most effective means of deriving a quantitative value of mitigated impacts is to assign each significance rating value (WOM) a mitigation effectiveness (ME) rating. The allocation of such a rating is a measure of the efficiency and effectiveness, as identified through professional experience and empirical evidence of how effectively the proposed mitigation measures will manage the impact. Thus, the lower the assigned value the greater the effectiveness of the proposed mitigation measures and subsequently, the lower the impacts with mitigation.

Equation 2: Significance Rating (WM) = Significance Rating (WOM) x Mitigation Efficiency (ME)

Mitigation Efficiency is rated out of 1 as follows:

Category	Rate	Descriptor
Not Efficient (Low)	1	Mitigation cannot make a difference to the impact
Low to Medium	0.8	Mitigation will minimize impact slightly
Medium	0.6	Mitigation will minimize impact to such an extent that it becomes within acceptable standards
Medium to High	0.4	Mitigation will minimize impact to such an extent that it is below acceptable standards
High	0.2	Mitigation will minimize impact to such an extent that it becomes insignificant

7.1.2.3 Significance Following Mitigation (SFM)

The significance of the impact after the mitigation measures are taken into consideration. The efficiency of the mitigation measure determines the significance of the impact. The level of impact is therefore seen in its entirety with all considerations considered.

7.2 IMPACTS AND RISKS IDENTIFIED

The detail impact assessments are contained in the specialist reports attached as appendices and are not repeated here. Table 42 provides a summary list of the potential risks (and benefits) together with the significance, probability and duration of the impacts.

Table 42: Impact Risk Matrix Summary

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
PRE-CONSTRUCTION PHASE										
	Open Pit Mining Infrastructure area	Potential poorly planned placement of the proposed infrastructure within natural areas	Extensive and unnecessary loss of favourable floral habitat, leading to a decline in floral diversity, including a decline in floral SCC numbers. Extensive loss of faunal habitat, leading to a decline in faunal diversity, including a decline of potential faunal SCC, including potential niche breeding areas (large trees for avifaunal SCC).	Negative	Long Term	Local	Probable	High	Medium	Low to Medium
	Open Pit Mining Infrastructure area	Potential failure to develop the required management tools/plans before and at the commencement of construction activities	Extensive and unnecessary loss of favourable floral habitat, leading to a decline in floral diversity, including a decline in floral SCC numbers. Proliferation of AIPs within the study area and the surrounding areas due to a failure to implement AIP Control Plan during the pre-construction phase. If AIPs are not managed before construction activities, dispersal propagules such as seeds will end up in topsoil	Negative	Permanent	District	Improbable	Very High	High	Medium to High

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
			stockpiles and reintroduced during the rehabilitation phase.							
	All activities	Change in land use, cover & ownership	Physical and economic displacement of affected households and/or labour tenants through land acquisition	Negative	Long Term	Site specific	Definite	High	High	Medium to High
CONSTRUCTION PHASE										
	Open Pit Mining Infrastructure area	Vegetation clearing within the proposed mining and infrastructure areas as part of site preparation prior to commencement mining and related of activities	Soil erosion and dust generation during vegetation clearance activities	Negative	Long Term	Site specific	Highly Probable	Medium	Medium	Low to Medium
	Open Pit Mining Infrastructure area	Vegetation clearing within the proposed mining and infrastructure areas as part of site preparation prior to commencement mining and related of activities	Soil compaction resulting from vehicle movement during construction	Negative	Long Term	Site specific	Probable	Medium	Medium	Low to Medium
	Open Pit Mining Infrastructure area	Stripping and stockpiling of topsoil	• Loss of the original spatial distribution of natural soil forms and horizon sequences which cannot be reconstructed similarly during rehabilitation. • Loss of natural topography and drainage pattern. • Loss of original soil depth and soil volume. • Loss of original fertility and organic carbon content.	Negative	Long Term	Local	Definite	High	Medium to High	Medium to High

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
			• Soil compaction from heavy machinery traffic during earthworks and rehabilitation will adversely affect effective soil depth, structure and density, thus influencing the pedohydrology and soil fertility of the area. • Exposure of soils to weathering, compaction, erosion, and chemical alteration of nutrients, particularly nitrogen. • Exposure of the soils to acidic, neutral or alkaline mine drainage that may be high in sulphates and heavy metals. • Permanent changes in the hydrological functioning of the soils and the landscape.							
	Open Pit Mining Infrastructure area	Excavation and removal of topsoil from the proposed opencast mining blocks and infrastructure areas	Impact on low potential arable soils that comprise deep soils of the Ermelo and Hutton soil forms	Negative	Permanent	Local	Definite	High	Medium to High	Medium to High
	Open Pit Mining Infrastructure area	Site preparation and clearing of vegetation for mine related infrastructure, contractor's laydown sites as well as the initial opencast mining blocks	• Loss of floral habitat. • Loss of floral species diversity. • Potential loss of floral SCC species.	Negative	Long Term	Site specific	Highly Probable	High	Medium to High	Medium

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
			• Proliferation of AIP species in the disturbed areas.							
	Open Pit Mining Infrastructure area	Site preparation and clearing of vegetation for mine related infrastructure, contractor's laydown sites as well as the initial opencast mining blocks	• Loss of faunal habitat through vegetation clearance activities. • Loss of faunal species diversity. • Decreased faunal species habitat connectivity. • Loss of faunal food resources, artificial water points and potential breeding habitat	Negative	Long Term	Regional	Highly Probable	High	High	High
	Infrastructure area	Construction of surface infrastructure	• Potential loss of faunal SCC species. • Loss of faunal SCC breeding habitat.	Negative	Long Term	District	Highly Probable	Medium	Medium to High	Medium
	Open Pit Mining Infrastructure area	Clearance of avifaunal habitat, reducing the amount of habitat available to birds for foraging, roosting and breeding	• Displacement of Red List avifaunal species as a result of habitat loss or transformation and disturbances. • Direct mortality of Red List avifaunal species.	Negative	Permanent	Local	Definite	High	High	High
	All activities	Increased vehicle movements within the construction areas	Indiscriminate driving through the open veld leading to the loss of sensitive floral species and increased vehicle related mortalities of faunal species.	Negative	Long Term	Local	Probable	High	Medium	Low to Medium
	All activities	Increased personnel on site	• Increased risk of veld fires leading to loss of faunal and floral species as well as	Negative	Long Term	Local	Probable	High	Medium to High	Medium

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
			alteration of plant diversity. • Trapping of faunal species through the use of snares. • Hunting/ collection of common faunal species and that of SCC.							
	Open Pit Mining Infrastructure area	Vegetation clearing within the proposed mining and infrastructure areas as part of site preparation prior to commencement mining and related of activities	Clearing of topsoil from footprint areas can increase infiltration rates of water to the groundwater system, ultimately leading to an increase in groundwater levels. This potential impact is not necessarily a negative one.	Positive	Temporary	Site specific	Highly Probable	Insignificant	Low	Low
	All activities	Waste/Hydrocarbon handling	• Dumping of construction material in open space areas other than those demarcated for such waste, leading to increased habitat and species loss. • Accidental spills and/or leakages of hazardous chemicals and hydrocarbons resulting in soil contamination. • Poor handling of waste and the transport of building material can cause various types of spills (especially	Negative	Short Term	Site specific	Probable	Medium	Medium	Low to Medium

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
			hydrocarbons) that may potentially infiltrate and contaminate the underlying groundwater system.							
	Open Pit Mining Infrastructure area	Vegetation clearing within the proposed mining and infrastructure areas as part of site preparation prior to commencement mining and related of activities, construction of infrastructure	• Construction activities will generate noise, but it will mainly be limited to the project site and adjacent properties. • Noise levels will be less than 45 dBA during the day and less than 35 dB during the night.	Negative	Short Term	Local	Improbable	Low	Medium	Low to Medium
	Access / haul roads	Removal of overlying vegetation and topsoil for the construction of haul roads and upgrading of the access road	Construction activities resulting in open unprotected soils which are prone to wind erosion leading to an increase in dust and a reduction in ambient air quality in the MRA area and along the access road.	Negative	Short Term	District	Probable	Medium	Medium	Low to Medium
	Open Pit Mining Infrastructure area	Construction of surface infrastructure	Construction activities resulting in open unprotected soils which are prone to wind erosion leading to an increase in dust and a reduction of ambient air quality on and adjacent to the MRA area.	Negative	Short Term	District	Probable	Medium	Medium	Low to Medium
	Open Pit Mining Infrastructure area	Site clearing, including the removal of topsoil and vegetation within the mining and mine	• Visual intrusion on visual receptors during the construction phase.	Negative	Short Term	District	Highly Probable	High	Medium to High	Medium

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
		infrastructure footprint areas leading to high visual contrast. General construction of mining infrastructure, site clearing and removal of topsoil and vegetation, increased amount of human activity, vehicles, and other equipment.	• Visual impact on the landscape character and sense of place associated with the project area and surrounds.							
	All activities	Excavation and removal of topsoil from the proposed open cast mining blocks and infrastructure areas	Recovery of sub-surface sites during construction and/or excavation	Negative	Permanent	Site specific	Improbable	High	Medium to High	Medium
	All activities	Change in land use, cover & ownership	Economic Displacement due to Secondary Impacts and Environmental Interactions	Negative	Long Term	Local	Probable	Low	Medium to High	Medium
	All activities	Change in land use, cover & ownership	Loss of employment opportunities	Negative	Long Term	Local	Probable	Medium	Medium to High	Medium
	All activities	Change in land use, cover & ownership	Disruption of daily living and movement patterns and safety of road users	Negative	Long Term	Local	Highly Probable	High	Medium to High	Medium
	All activities	Need of human resources and recruitment	Influx of job seekers and population growth pressures	Negative	Long Term	District	Probable	High	Medium	Medium
	All activities	Need of human resources and recruitment	Creation of temporary construction employment	Positive	Temporary	District	Definite	Medium	Medium	Low to Medium
OPERATIONAL PHASE										
	Open Pit Mining	Blasting and removal of material from opencast pits	• Disturbance of faunal species in the vicinity of the mine leading to faunal species movement out of the MRA area. • Decreased breeding rates which will impact	Negative	Long Term	District	Definite	High	Medium to High	Medium to High

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
			upon faunal diversity and abundance. • Dust and sediment from active mining areas may lead to the smothering of surrounding vegetation, impacting on food resources for herbivorous species.							
		Operational phase disturbances and expansion of stockpiles and discard dumps	• Loss of floral habitat and diversity. • Further loss of floral SCC. • Increase in AIP species as a result of disturbance. • Increase in erosion as a result of disturbance.	Negative	Long Term	Local	Definite	High	Medium to High	Medium to High
	Open Pit Mining Infrastructure area	Presence of clean and dirty separation infrastructure around the project footprint	Loss of catchment yield due to dirty stormwater containment, leading to a reduction in volume of water entering the surrounding environment.	Negative	Long Term	Local	Definite	Medium	Medium	Medium
	Infrastructure area	Uncontrolled runoff from infrastructure areas	• Altered surface runoff patterns due to reduced vegetation cover and increased impermeable surfaces. • Increased flood peaks as a result of formalisation and concentration of surface runoff	Negative	Long Term	Site specific	Probable	Medium	Medium	Low to Medium

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
			leading to erosion due to concentration of stormwater runoff and the formation of preferential flow paths. • Risk of contaminated stormwater runoff (e.g. hydrocarbons, sediment, originating from impermeable surfaces).							
	Access / haul roads	Movement of operational vehicles within and outside of the active mining areas	• Increased risk of faunal mortality rates due to collisions with mine vehicles. • Risk of SCC mortalities due to collisions with mine vehicles.	Negative	Long Term	Local	Highly Probable	Medium	Medium	Low to Medium
	All activities	Increased personnel on site	• Additional pressure on floral habitat by increased human populations associated with the proposed mining activities leading to a loss of floral habitat. • An increase in the collection of plant material for medicinal purposes. • Introduction of AIP species that can outcompete and displace native floral populations and reduce floral diversity within the study area.	Negative	Long Term	District	Probable	Medium	Medium	Low to Medium

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
			• Increase in fire frequencies is a risk. • Hunting and trapping of faunal species.							
	Bulk Power	Collisions of avifaunal species with the conductors of the proposed 22kV powerline, particularly large terrestrial birds and to a lesser extent raptors. Electrocutions of avifaunal species on the live and earthed components on the 22kV powerline poles/towers and within the onsite substation.	• Mortality of avifaunal species due to collision with the 22kV powerline conductors. • Mortality of avifaunal species due to electrocution on the powerline poles/towers. • Mortality of avifaunal species due to electrocution within the onsite substation.	Negative	Long Term	Regional	Probable	High	Medium to High	Medium to High
	Traffic	Collisions of avifaunal species with the motor vehicles utilising both the proposed access and internal roads resulting in a negative direct mortality impact	Mortality of avifaunal species due to collisions with motor vehicles	Negative	Long Term	Local	Probable	High	Medium to High	Medium
	Open Pit Mining Infrastructure area	Increased ambient lighting	Increased lighting will result in the attraction of insects, which will inevitably attract several insectivorous predators, notably bats. This may result in increased risk of injury or mortality to such predatory species either from collision with operational machinery, infrastructure and	Negative	Long Term	Local	Highly Probable	High	Medium to High	Medium

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
			vehicles, or as a result of direct human conflict.							
	Open Pit Mining	Opencast mining	Opencast mining, when occurring below the water table, results in an influx of groundwater. Pit dewatering is then required to ensure dry and safe mining conditions, which ultimately leads to a lowering of the local groundwater levels.	Negative	Permanent	Local	Highly Probable	Medium	Medium	Medium
	Mine residue and stockpiling	Discard dump, overburden dumps and product stockpiling (plant area)	Contamination of surface and groundwater due to acid mine/rock drainage	Negative	Long Term	Site specific	Highly Probable	Low	Low to Medium	Low to Medium
	Water management facilities	Pollution control dam Return water dam Dirty water management	Water retaining facilities such as the planned pollution control/recycling dam are designed and constructed with the objective to prevent any poor quality water from entering the underlying aquifer and contaminating the groundwater. Poor management and maintenance of such facilities may however lead to spills and/or leakages that could contaminate the surface and groundwater resources.	Negative	Long Term	Local	Probable	High	Medium to High	Medium
	Waste management	Poor waste management Waste disposal in natural environment	Pollution of the natural environment and water resources	Negative	Long Term	District	Improbable	High	Medium to High	Medium

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
	Hydrocarbon management	Workshops and wash bay areas, storage of bulk diesel and chemicals. Organic contaminants are usually the main pollutants of concern (e.g. oil, grease, diesel, petrol, hydraulic fluid, solvents, etc.).	• Pollution of surface and groundwater as a result of accidental spillages of chemicals and hazardous material. • Leachate into the groundwater as a result of ponding/seepage.	Negative	Long Term	Local	Probable	Medium	Medium	Low to Medium
	All activities	Open pit mining, drilling & blasting, hauling activities, crushing and screening, product transport	• Operational activities will generate noise, but it will mainly be limited to the project site and directly adjacent properties. • Noise levels will be less than 45 dBA during the day-time at all receptors. • Noise levels will be less than 35 dBA during the night-time at all receptors except for the residential receptors on Verloren Valey and Duikerpan.	Negative	Short Term	District	Probable	Medium	Medium	Low to Medium
	Open Pit Mining	Drilling and blasting Handling of materials from rock face to haul truck	Increase in fugitive dust emissions (PM_{10} and dust)	Negative	Long Term	Site specific	Highly Probable	Medium	Medium	Low to Medium
	Access / haul roads Product transport	Materials handling (trucking) of ROM from open pit to stockpile area Transport of product off-site	• A large amount of dust emissions is generated by vehicle traffic over these temporary unpaved roads. • Substantial secondary emissions may be emitted from material	Negative	Long Term	Local	Highly Probable	Medium	Medium	Low to Medium

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
			moved during regular grading of the unpaved access road. • Product transport may further lead to a decrease in the regional air quality due to wind erosion of product and spillages. • Impact on well-being and livelihoods due to dust generation along transport routes.							
	Infrastructure area	Stockpiling	Particulate matter and nuisance dust are expected from the working stockpiles, transfer and tipping points during normal operations.	Negative	Long Term	Local	Highly Probable	High	Medium to High	Medium
	Infrastructure area	Plant operations	The crushing and screening process (beneficiation) will further reduce the ambient air quality in and adjacent to the infrastructure area.	Negative	Long Term	Local	Probable	High	Medium	Low to Medium
	Open Pit Mining	Blasting operation within the open pit area	• Ground vibration impact on humans and animals - safety and nuisance impacts. • Potential damage to infrastructure. • Potential for fly-rock, which could harm people and animals.	Negative	Long Term	Local	Definite	High	High	Medium to High

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
	All activities	Mining activities, drilling & blasting, processing, hauling and transport of product	• Visual intrusion of mining activities on visual receptors. • Visual impact on the landscape character and sense of place associated with the project area and surrounding area.	Negative	Medium Term	District	Definite	High	Medium to High	Medium to High
	All activities	Height of overburden and discard dumps Development of linear infrastructure such as roads and powerlines	Alteration of topography.	Negative	Long Term	District	Highly Probable	High	Medium to High	Medium to High
	All activities	24-hour mining and maintenance operation, exterior lighting around buildings, parking areas, and other work areas, security and other lighting around and on support structures and conveyors.	Visual impacts from night-time lighting.	Negative	Long Term	District	Definite	High	Medium to High	Medium to High
	Product transport	Increased traffic on roads due to product transport	• The road network will be able to handle the additional traffic, with the identified road improvements, with no detrimental impact on the traffic on any of the relevant roads. • Safety of other road users do require some intervention.	Negative	Medium Term	District	Highly Probable	Medium	Medium to High	Medium
	Open Pit Mining	Excavation and removal of topsoil from the proposed open pit	Recovery of sub-surface archaeological sites during mining operations.	Negative	Permanent	Site specific	Improbable	High	Medium to High	Medium

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
	Open Pit Mining	Excavation and removal of coal from the proposed open pit	• There is a very high likelihood of the occurrence of fossils, typically palaeoflora of *Glossopteris*, *Dadoxylon* and *Vertebraria* within the lower Karoo strata. • The Lisbon Formation may contain trace fossils such as *Cruziana* and *Skolithos*, with also a possibility of dinosaur fossils such as *Euskelsaurus* and *Massospondylus*.	Negative	Permanent	Site specific	Probable	Medium	Medium to High	Medium
	All activities	Potential pollution (Air, Vibration, Noise, Visual)	• Economic or Physical Displacement due to Secondary Impacts and Environmental Interactions (noise, visual). • Impact on Aesthetic Value and Sense of Place due to Visual intrusions and increase Nuisance Noise.	Negative	Long Term	Local	Probable	Medium	High	Medium to High
	All activities	Need of human resources and recruitment	Increase in social pathologies and crime.	Negative	Long Term	District	Probable	High	Medium	Medium
	All activities	Need of human resources and recruitment	Creation of permanent operational employment.	Positive	Long Term	District	Definite	High	High	High
	All activities	Need of human resources and recruitment	Contribution to Human Resource and Socio-economic Development Programmes	Positive	Long Term	Local	Highly Probable	Medium	Medium	Low to Medium
	All activities	Need of human resources and recruitment	Generation of tax base, revenue and GDP contribution	Positive	Long Term	National	Highly Probable	Medium	High	High

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
	All activities	Need of human resources and recruitment	Secondary benefits in the creation of electricity to supply the domestic demand, which in turn supports economic development	Positive	Long Term	National	Highly Probable	Medium	Medium	Medium
DECOMMISSIONING										
	Open Pit Mining	Backfilling of opencast pit Decommissioning/ removal of surface infrastructure	• Highly compacted soils limiting the re-establishment of natural vegetation. • Increased risk of erosion in disturbed areas. • Proliferation of AIP species leading to ongoing floral loss. • Inadequate rehabilitation of open pit mining blocks and disturbed areas leading to permanent habitat loss. • Altered vegetation communities within the study area. • Ongoing erosion, habitat loss, AIP proliferation and the loss of species diversity. • Potential permanent habitat transformation leading to a long term and significant cumulative loss of natural habitat and species in the region.	Negative	Permanent	Local	Probable	High	High	Medium to High

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
	Infrastructure area	Decommissioning/ removal of surface infrastructure	• Highly compacted soils limiting the re-establishment of natural vegetation. • Increased runoff volumes and formation of preferential surface flow paths as a result of compacted soils and unvegetated areas, leading to increased sedimentation and erosion. • Proliferation of AIP species leading to ongoing floral and faunal habitat loss. • Improper rehabilitation of disturbed areas leading to permanent floral and faunal habitat loss.	Negative	Long Term	Site specific	Definite	Medium	High	Medium to High
	Open Pit Mining Infrastructure area	Backfilling of open cast mining blocks Decommissioning/removal of surface infrastructure Rehabilitation and revegetation of project footprint area	Visual intrusion of decommissioning activities on visual receptors.	Negative	Long Term	District	Highly Probable	Medium	Medium	Medium
	Infrastructure area	Backfilling of open cast mining blocks Decommissioning/removal of surface infrastructure Rehabilitation and revegetation of project footprint area	• Migration of residual groundwater contamination plume away from rehabilitated areas. • Groundwater contamination due to acid mine/rock drainage.	Negative	Permanent	Local	Definite	High	High	High

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance
	Open Pit Mining Infrastructure area	Backfilling of open cast mining blocks Decommissioning/removal of surface infrastructure Rehabilitation and revegetation of project footprint area	Final decommissioning activities will have a noise impact lower than either the construction or operational phases.	Negative	Short Term	Local	Highly Probable	Medium	Medium	Low to Medium
	Open Pit Mining Infrastructure area	Backfilling of open cast mining blocks Decommissioning/removal of surface infrastructure Rehabilitation and revegetation of project footprint area	The decommissioning phase may result in some reduction to the ambient air quality, but to a lesser extent than the operational phase.	Negative	Long Term	Site specific	Definite	Medium	Medium	Low to Medium
	All activities	Need of human resources and recruitment	Loss of job opportunities due to downscaling of the mine employment.	Negative	Medium Term	Local	Highly Probable	Medium	Medium to High	Medium
POST-CLOSURE										
	All activities	Residual impact	Impact on ecosystem	Negative	Permanent	Regional	Highly Probable	Very High	High	High
	All activities	Residual impact	Post-closure land use and land capability	Negative	Permanent	Local	Highly Probable	Very High	High	High
	All activities	Residual impact	• Deterioration of groundwater quality within the back-filled open pit due to AMD reactions. • Decant into the shallow aquifer or on surface at the lowest surface elevations intersected by the pit.	Negative	Permanent	Regional	Highly Probable	Very High	High	High

7.3 PROPOSED MITIGATION MEASURES AND LEVEL OF RESIDUAL RISK

Table 43 lists the proposed mitigation measures that could be applied to reverse, reduce and mitigate the impacts. The residual risk level, after implementation of the mitigation measures, is also indicated.

Table 43: Proposed Mitigation Measures

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
PRE-CONSTRUCTION PHASE					
	Open Pit Mining Infrastructure area	Extensive and unnecessary loss of favourable floral habitat, leading to a decline in floral diversity, including a decline in floral SCC numbers. Extensive loss of faunal habitat, leading to a decline in faunal diversity, including a decline of potential faunal SCC, including potential niche breeding areas (large trees for avifaunal SCC).	• Minimise loss of indigenous vegetation where possible through planning and suitable layouts. • The footprint area of all proposed infrastructure should be limited to what is necessary. • Disturbance to the surrounding natural habitat should be kept to a minimal. • Access roads should be kept to existing roads so to reduce fragmentation of existing natural habitat. • Prior to construction activities faunal and floral SCC / NFA-protected tree species that will be directly impacted upon need to be marked and removed to a suitable similar habitat or nursery as part of a rescue and relocation plan. • All relevant permits are to be obtained from LEDET and DAFF prior to the removal of floral SCC. • A pre-construction inspection (avifaunal walk-through) of the final mine layout, road and powerline routes must be conducted to identify Red List species that may be breeding within footprint of the mine and the road and powerline servitudes to ensure that the impacts to breeding species (if any) are adequately managed. This is particularly important in terms of nesting avifauna, where large trees with active nests are to be marked and recorded. • Where large nests are located within tall trees, if active, they are to not be disturbed and a suitably qualified avifaunal specialist is to be consulted as to the best way forward. • Every effort must be made to select a powerline route that poses the least risk to birds, avoiding key avifaunal habitat and where possible routing the proposed powerlines alongside other infrastructure to increase conductor visibility. • High risk sections of powerline must be identified by a qualified avifaunal specialist during the pre-construction inspection, once the alignment has been finalized. If powerline marking is required, bird flight diverters must be installed according to industry standard guidelines.	Medium	Low to Medium
	Open Pit Mining Infrastructure area	Extensive and unnecessary loss of favourable floral habitat, leading to a decline in floral diversity, including a decline in floral SCC numbers. Proliferation of AIPs within the study area and the surrounding areas due to a failure to implement AIP Control Plan during the pre-construction phase. If	• Ensure that sound environmental management is in place during the planning phase. • It is recommended that prior to the commencement of construction activities that the entire construction servitude, including lay down areas and stockpile areas etc., be clearly demarcated.	Medium to High	Low to Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
		AIPs are not managed before construction activities, dispersal propagules such as seeds will end up in topsoil stockpiles and reintroduced during the rehabilitation phase.	• A Biodiversity Action Plan (BAP) must be developed proactively and implemented throughout all development phases in order to manage indigenous vegetation within the project area and avoid unnecessary loss thereof. • Prior to the commencement of construction activities on site an AIP Control Plan should be compiled for implementation throughout the construction and operational phases. • Prior to the commencement of construction activities on site, a rehabilitation plan should be developed for implementation throughout the development phases.		
	All activities	Physical and economic displacement of affected households and/or labour tenants through land acquisition	• Fair compensation negotiated and agreed with landowner based on valuation of land and economic value of the livelihood activities. • Implement a consultation programme with local stakeholders in the development of a closure plan and rehabilitation programme. • Determine the regional needs and characteristics to ensure post mining land use enhances the regional characteristics.	Medium	Negligible
CONSTRUCTION PHASE					
	Open Pit Mining Infrastructure area	Soil erosion and dust generation during vegetation clearance activities	• The footprint of the proposed infrastructure area should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint as far as practically possible. • Vegetation clearance and commencement of construction activities should be scheduled (if practical) to coincide with low rainfall conditions when the erosive stormwater and wind are anticipated to be low. • Bare soils must be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast. • All disturbed areas adjacent to the infrastructural and opencast areas must be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, in order to minimise soil erosion and dust emission. • Temporary erosion control measures may be used to protect the disturbed soils during the construction phase until adequate vegetation has established.	Medium to High	Low
	Open Pit Mining Infrastructure area	Soil compaction resulting from vehicle movement during construction	• Vegetation clearance and commencement of construction activities should be scheduled (if practical) to coincide with low rainfall conditions when soil moisture is anticipated to be relatively low, such that the soils are less prone to compaction. • Compacted soils adjacent to the mining blocks and associated infrastructure footprint must be lightly ripped to at least 50 cm below ground surface to alleviate compaction prior to re-vegetation. • Special attention should be paid to AIP control within these areas.	Medium to High	Low
	Open Pit Mining Infrastructure area	• Loss of the original spatial distribution of natural soil forms and horizon sequences which cannot be reconstructed similarly during rehabilitation.	• Prevent mixing of high-quality topsoil [A (0 - 30 cm) and B (30cm – parent material) horizons] with low quality underlying material to ensure sufficient volumes of high quality soil for rehabilitation.	Medium	Low to Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
		• Loss of natural topography and drainage pattern. • Loss of original soil depth and soil volume. • Loss of original fertility and organic carbon content. • Soil compaction from heavy machinery traffic during earthworks and rehabilitation will adversely affect effective soil depth, structure and density, thus influencing the pedohydrology and soil fertility of the area. • Exposure of soils to weathering, compaction, erosion, and chemical alteration of nutrients, particularly nitrogen. • Exposure of the soils to acidic, neutral or alkaline mine drainage that may be high in sulphates and heavy metals. • Permanent changes in the hydrological functioning of the soils and the landscape.	• Separate stripping, stockpiling and replacing of soil horizons [A (0 - 30 cm) and B (30cm – parent material)] in the original natural sequence to combat hardsetting and compaction, and maintain soil fertility. • Stockpiles should be revegetated to establish a vegetation cover as an erosion control measure. These stockpiles should be kept free of AIP species to prevent loss of soil quality. • The soil fertility status should be determined by soil chemical analysis after levelling, before seeding/re-vegetation. • Soil amelioration should be done according soil analyses as recommended by a soil specialist, in order to correct the pH and nutrition status before revegetation. • Management of soil organic matter through organic amendments and the use of mulches should receive attention with the aim of improving functional microbial diversity, nutrient cycling and re-vegetation.		
	Open Pit Mining Infrastructure area	Impact on low potential arable soils that comprise deep soils of the Ermelo and Hutton soil forms	• During the decommissioning phase the footprint should be thoroughly cleaned, and all building material should be removed to a suitable disposal facility. • The footprint should be ripped to alleviate compaction. • Stored topsoil should be replaced, and the footprint graded to a smooth surface. • The soil fertility status should be determined by soil chemical analysis after levelling, before seeding/re-vegetation. • Soil amelioration should be done according soil analyses as recommended by a soil specialist, in order to correct the pH and nutrition status before revegetation. • The footprint should be re-vegetated with a grass seed mixture as soon as possible, preferably in spring and early summer to stabilize the soil and prevent soil loss during the rainy season. • A short-term fertilizer program should be implemented based on the findings of the soil chemical status after the first year in order to maintain the fertility status. Fertility treatment should take place for a maximum of 2 to 3 years after rehabilitation until the area can be declared self-sustaining.	Medium	Low to Medium
	Open Pit Mining Infrastructure area	• Loss of floral habitat. • Loss of floral species diversity. • Potential loss of floral SCC species. • Proliferation of AIP species in the disturbed areas.	• All construction personnel will be educated in environmental awareness as part of the Induction Programme. • All floral SCC, with specific reference to species listed under LEMA and TOPS identified within the development footprint area, should be rescued and relocated to similar suitable habitat as part of a Rescue and Relocation Plan. • It is recommended that a thorough walkthrough of all footprint areas be completed to mark all protected tree species and that where feasible, infrastructure be placed around these trees (mostly applicable for linear developments and smaller infrastructure). • The construction footprint must be kept as small as possible in order to minimise the	Medium	Low to Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			impact on the surrounding environment, and vegetation clearing should be limited to what is essential. • Clearing of vegetation should take place in a phased manner to keep bare soil areas as small as possible and to limit the erosion potential. • All areas of increased ecological sensitivity, or with high abundances of floral SCC, should be designated as No-Go areas and be off-limits to all unauthorised construction vehicles and personnel. • Planning of temporary roads and access routes should take the site sensitivity plan into consideration. If possible, such roads should be constructed along existing roads and planned in such a manner that the habitat does not unnecessarily get fragmented. • Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities. • Edge effects of all construction activities, such as erosion and AIP species proliferation, which may affect natural habitat within surrounding areas, need to be strictly managed adjacent to the proposed infrastructure footprint areas. • No collection of firewood, floral SCC or medicinal floral species must be allowed by construction or mining personnel. • An AIP Control Plan must be designed and implemented in order to monitor and control AIP recruitment in disturbed areas.		
	Open Pit Mining Infrastructure area	• Loss of faunal habitat through vegetation clearance activities. • Loss of faunal species diversity. • Decreased faunal species habitat connectivity. • Loss of faunal food resources, artificial water points and potential breeding habitat.	• All construction personnel will be educated in environmental awareness as part of the Induction Programme, notably with regards to dangerous faunal species and faunal SCC. • Only vegetation within the footprint areas is to be cleared. • Planning of temporary roads and access routes should take the site sensitivity map into consideration. If possible, such roads should be constructed along existing roads and planned in such a manner that the habitat does not unnecessarily get fragmented. • Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the construction activities. • All areas of increased ecological sensitivity, outside of the mining footprint should be designated as No-Go areas and be off-limits to all unauthorised construction vehicles and personnel. • Edge effects stemming from construction activities, which may affect faunal habitat in the surrounding areas, are to be strictly managed, e.g. implement an AIP Control Plan, manage soil erosion, restrict personnel and vehicles movement to the footprint areas and ensure that sufficient dust suppress is taking place during the construction and operational phases.	Low to Medium	Medium to High

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			• A rehabilitation plan must be in place and implemented in disturbed areas where work has been completed.		
	Infrastructure area	• Potential loss of faunal SCC species. • Loss of faunal SCC breeding habitat.	• The construction footprint must be kept as small as possible in order to minimise impact on the surrounding environment and vegetation clearing should be limited to what is essential. • Prior to vegetation clearance activities a site inspection/walkdown of the footprint area is to be undertaken and the occurrence of SCC is to be marked. • Clearing of vegetation should take place in a phased manner to enable faunal species to move of on their own, whilst keeping bare soil areas at a minimum and to limit the erosion potential. • Where slow moving terrestrial species are located, if they are threatened by construction activities or vegetation clearance, they are to be carefully relocated to similar habitat in the study area by a suitably qualified specialist. Such location and removal activities are particularly important to slow moving reptile species and arachnids. • Suitably qualified and nominated personnel should undergo a snake handling course in order to safely remove any snakes that are encountered during construction activities.	Medium	Low to Medium
		• Displacement of Red List avifaunal species as a result of habitat loss or transformation and disturbances. • Direct mortality of Red List avifaunal species.	• Construction activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site must be strictly controlled to prevent unnecessary disturbance of RDL species. • Maximum use should be made of existing roads and the construction of new roads must be kept to a minimum. New roads are to be located in areas of existing high disturbance, and not encroach upon sensitive habitats. • The 22kV powerline must be constructed using a bird friendly structure (i.e. Inverted Delta-T Structure). • Additional mitigation in the form of insulating sleeves on jumpers present on strain poles, terminal poles and box transformers must also be considered. • Anti-nesting and roosting devices should be installed on all powerlines poles to avoid electrocution of avifauna. • Artificial nesting stations should be constructed in the northern portion of the study area to offset any nesting locations lost as a result of the removal of large trees in the mining footprint. A suitably qualified faunal specialist should be consulted with regards to their design and placement. • Bi-annual post construction monitoring to be conducted to assess actual impacts, determine diversity trends and assess mitigation efficacy, particularly with regards to vultures.	Medium	Medium
	All activities	Indiscriminate driving through the open veld leading to the loss of sensitive floral	• No indiscriminate driving through the veld is allowed. As far as possible vehicles are to utilise the existing roads. Where this is not	Medium	Low to Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
		species and increased vehicle related mortalities of faunal species.	feasible, new roads are to be located in areas of existing high disturbance, and not encroach upon sensitive habitats. • Speed restrictions to be placed on all vehicles within the MRA area to limit faunal and vehicle collisions. • Drivers to be educated through the Environmental Awareness Programme about the presence and importance of faunal species and instructed to actively avoid collisions with faunal species, regardless of size.		
	All activities	• Increased risk of veld fires leading to loss of faunal and floral species as well as alteration of plant diversity. • Trapping of faunal species through the use of snares. • Hunting/ collection of common faunal species and that of SCC.	• No illicit fires must be allowed during any phases of the proposed mining development. A Fire Management Plan (FMP) should be set in place to ensure that any fires that do originate can be managed and / or stopped before significant damage to the environment occurs. • No hunting or trapping of faunal species or SCC is to be allowed. Access control to the property must be implemented and perimeter fences are to be regularly inspected for signs of damage by poachers. • Well used game paths, roadsides and if applicable burrows under fences used by fauna are to be inspected for snares, which if found are to be removed and destroyed.	High	Low
	Open Pit Mining Infrastructure area	Clearing of topsoil from footprint areas can increase infiltration rates of water to the groundwater system, ultimately leading to an increase in groundwater levels. This potential impact is not necessarily a negative one.	• Mitigation not possible.	Not Efficient	Low
	All activities	• Dumping of construction material in open space areas other than those demarcated for such waste, leading to increased habitat and species loss. • Accidental spills and/or leakages of hazardous chemicals and hydrocarbons resulting in soil contamination. • Poor handling of waste and the transport of building material can cause various types of spills (especially hydrocarbons) that may potentially infiltrate and contaminate the underlying groundwater system.	• All vehicle re-fuelling is to take place within the contractor laydown area only, within a bunded area. • A Spill Management and Emergency Contingency Plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent ingress to groundwater. • Regular monitoring of soil contamination levels at selected areas within the construction footprint. • A soil chemist should be contacted when contamination occurs, and remediation actions are needed. • Solid waste must either be stored on-site in an approved waste disposal area or removed by credible contractors. • All construction related waste and material is to be disposed of at a registered waste facility, no waste or construction rubble is to be dumped in the surrounding natural habitats.	Medium to High	Low
	Open Pit Mining Infrastructure area	• Construction activities will generate noise, but it will mainly be limited to the project site and adjacent properties. • Noise levels will be less than 45 dBA during the day and less than 35 dB during the night.	• Ensure a good working relationship between mine management and all potentially noise-sensitive receptors staying closer than 2,000 m from the mine. • Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Engine bay covers over heavy equipment could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine bay should be considered, ensuring that the seam gap	Medium	Low

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			between the hood and vehicle body is minimised. • The operation should investigate the use of white-noise alarms instead of tonal reverse alarms on heavy vehicles operating on roads, within the mining area and at stockpile areas. • Establish complaints register with an open line to a relevant person that can act if there is a noise complaint.		
	Access / haul roads	Construction activities resulting in open unprotected soils which are prone to wind erosion leading to an increase in dust and a reduction in ambient air quality in the MRA area and along the access road.	• Set the speed limit for hauling vehicles and vehicles in general to as low a speed possible and enforce the speed limits specified. It is recommended the speed limit be set to 40km/h on unpaved roads. • Include speedbumps to control the speed limits. • Include a program of wet suppression of the unpaved roads with major vehicle activity. The wet suppression can typically be grey water from the mine, or the water can contain a chemical that will increase the dust trapping capability once sprayed over a surface. • Limit the load size of the vehicles to ensure the wind in transit does not pick up more dust that need be. • Limit the area of disturbance to the minimum, keeping the natural vegetation intact as long as possible.	Medium	Low
	Open Pit Mining Infrastructure area	Construction activities resulting in open unprotected soils which are prone to wind erosion leading to an increase in dust and a reduction of ambient air quality on and adjacent to the MRA area.	• All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is absolutely essential, e.g. retain as much indigenous vegetation as possible. • Bare soils can be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast.	Medium	Low
	Open Pit Mining Infrastructure area	• Visual intrusion on visual receptors during the construction phase. • Visual impact on the landscape character and sense of place associated with the project area and surrounds.	• Areas of disturbance during site clearing and construction infrastructure, where natural vegetation is removed and soils are exposed, should be kept to a minimum. • Large trees surrounding the infrastructure footprint areas should remain intact as far as possible. • Any landscaping done around offices, workshops and parking area should only include locally indigenous species. No lawns or AIP species should be introduced due to the long-term effects this may have of species composition. • The use of permanent signage and project construction signs should be minimised and not be visually obtrusive. • Linear infrastructure components should follow natural contours or existing road alignment as far as possible to avoid unnecessary and unsightly cut and fill works, lower erosion potential and avoid visual contrast. • The CHPP and all buildings such as offices and workshops should be designed to fit their surroundings through the appropriate use of colour and material selection in order to lower their visual intrusion. Painting or coating infrastructure components to match darker colours in the natural surroundings	Medium	Low to Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			may reduce the actual visibility of these components.		
	All activities	Recovery of sub-surface sites during construction and/or excavation	• A qualified archaeologist must monitor excavation activities. • Any discovery of artefacts, graves or other remains of archaeological interest should be reported to SAHRA. • Activities must cease immediately upon any discovery of cultural or heritage resources and a qualified archaeologist informed to do further assessment and reporting. • Identified sites of cultural and heritage significance must be demarcated until such time that an instruction to resume work is provided to the contractor, following consultation with the regulating authorities.	Medium	Low to Medium
	All activities	Economic Displacement due to Secondary Impacts and Environmental Interactions	• Make available land not being used for lease back by neighbouring operators. • Continuous consultation with neighbouring landowners to ensure co-existence and collaboration on mitigation measures for impacts on noise and dust. • Implement a consultation programme with local stakeholders in the development of a closure plan and rehabilitation programme. • Determine the regional needs and characteristics to ensure post mining land use enhances the regional characteristics. • Monitoring the impact on neighbouring properties.	Medium	Low to Medium
	All activities	Loss of employment opportunities	• Priority employment from local communities with the development of recruitment procedures. • Utilizing the existing skills available from the local communities with special focus on those that is bound to lose their jobs.	Medium	Low to Medium
	All activities	Disruption of daily living and movement patterns and safety of road users	• Implementation of the recommendations and mitigation measures as contained in the Traffic Impact Assessment. • Establishment of a complaint and grievance procedure.	Low to Medium	Medium
	All activities	Influx of job seekers and population growth pressures	• Development and implementation of an Influx and Land use Management Plan in collaboration with the municipality and the current landowners. • Prioritise employment from local communities with the development of recruitment procedures. • Implementation of practical skills programmes. • Induction of contractors and workforce regarding their code of conduct in the local area.	Low to Medium	Low to Medium
	All activities	Creation of temporary construction employment	• Prioritize people residing in local area. • Implementation of practical skills programmes.	Not Efficient	Low to Medium
OPERATIONAL PHASE					
	Open Pit Mining	• Disturbance of faunal species in the vicinity of the mine leading to faunal species movement out of the MRA area. • Decreased breeding rates which will impact upon faunal diversity and abundance. • Dust and sediment from active mining areas may lead to the smothering of surrounding vegetation, impacting on	• Suppress dust in order to mitigate the impact of dust on flora within a proximity of blasting. • Blasting should ideally be done during mid-afternoon and not early mornings or late afternoon/evenings when faunal species are most active. • Edge effects must be suitably managed to ensure that the surrounding habitat is not impacted upon.	Medium	Low to Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
		food resources for herbivorous species.	• Innovative blasting techniques are to be employed in order to minimise ground and air vibrations and disturbances to minimise the impacts on surrounding faunal species. • An effective dust management plan must be designed and implemented in order to mitigate the impact of dust on floral species throughout the operational phase.		
		• Loss of floral habitat and diversity. • Further loss of floral SCC. • Increase in AIP species as a result of disturbance. • Increase in erosion as a result of disturbance.	• Stockpiles, discard dumps and PCD positions, and their expansion as material is deposited, should be kept as small as possible. • No additional habitat is to be disturbed during the operational phase of the development. • Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed mining activities. No vehicles must be allowed to indiscriminately drive through sensitive habitat and natural areas. • Upon completion of construction activities and decommissioning of access road, all impacted and disturbed areas should be ripped, reprofiled and reseeded with an indigenous veld grass mixture that will assist to stabilise soils as soon as possible. • Monitoring of relocation success of rescued and relocated floral SCC should take place during the operational phase. • Manage all edge effects stemming from mining operations and infrastructure areas. • Harvesting of protected floral species by mining and operational personnel should be strictly prohibited. • An AIP Control Plan should be implemented by a qualified professional. No chemical control of AIPs to occur without a certified professional. • Implement erosion control measures where necessary to ensure that further habitat loss does not occur. • Erosion must be monitored on a continual basis throughout the operational phase, particularly in the vicinity of disturbed areas and where increased human activities will take place.	Medium	Low to Medium
	Open Pit Mining Infrastructure area	Loss of catchment yield due to dirty stormwater containment, leading to a reduction in volume of water entering the surrounding environment.	• A professional engineer should be engaged, with input from an environmental specialist, to develop a comprehensive stormwater management plan for the proposed mine. The plan must include proven effective measures for the separation and control of clean and dirty stormwater runoff. • Berms and/or cut off drains on the highwall side of the open pit and infrastructure must be constructed to prevent the influx of clean water into the managed dirty water areas. • All dirty stormwater runoff should be contained and not allowed to pollute the surrounding environment – this includes runoff potentially contaminated by activities associated with stockpile areas, service yards, parking and loading bays, as well as the CHPP. • Dirty runoff also includes areas where soils have been exposed – although no mining may have taken place in these areas, they may still contribute to increases in TSS and deterioration of water quality if released.	Low to Medium	Low to Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			• Clean water must be discharged into the natural environment in a non-erosive and controlled manner, and not allowed to form concentrated channels.		
	Infrastructure area	• Altered surface runoff patterns due to reduced vegetation cover and increased impermeable surfaces. • Increased flood peaks as a result of formalisation and concentration of surface runoff leading to erosion due to concentration of stormwater runoff and the formation of preferential flow paths. • Risk of contaminated stormwater runoff (e.g. hydrocarbons, sediment, originating from impermeable surfaces).	• As above. • Regular inspection of all infrastructure should be conducted in order to identify areas of failure prior to an incident. • All feeding conveyors/pipelines should remain sealed, and if spillages occur, should immediately be cleaned up according to the Spill Management and Emergency Contingency Plan.	Medium	Low
	Access / haul roads	• Increased risk of faunal mortality rates due to collisions with mine vehicles. • Risk of SCC mortalities due to collisions with mine vehicles.	• No indiscriminate driving through the veld is allowed. As far as possible vehicles are to utilise the existing roads. Where this is not feasible, new roads must be located in areas of existing high disturbance, and not encroach upon sensitive habitats. • Speed restrictions to be placed on all vehicles within the MRA area to limit faunal and vehicle collisions. • Drivers to be educated through the Environmental Awareness Programme about the presence and importance of faunal species and instructed to actively avoid collisions with faunal species, regardless of size.	Medium	Low to Medium
	All activities	• Additional pressure on floral habitat by increased human populations associated with the proposed mining activities leading to a loss of floral habitat. • An increase in the collection of plant material for medicinal purposes. • Introduction of AIP species that can outcompete and displace native floral populations and reduce floral diversity within the study area. • Increase in fire frequencies is a risk. • Hunting and trapping of faunal species.	• Manage all edge effects stemming from mining operations and infrastructure areas. • No collection of firewood, floral SCC or medicinal floral species must be allowed. • No uncontrolled or unsanctioned fires are allowed. A Fire Management Plan should be in place. • Implement an AIP Control Plan that includes ongoing monitoring and control of the presence and/or re-emergence of such species. • No hunting or trapping of faunal species should be allowed within the MRA area. Implement an Environmental Awareness Programme on the mine and within the surrounding communities. • Ensure strict access control and patrol boundary fences to ensure perimeter fences are in good stead whilst removing any poachers' snares encountered in the study area. • Educate mine personnel on the biodiversity of the study area and highlight the damaging effects of uncontrolled hunting/poaching to species diversity and abundance;	Medium to High	Low
	Bulk Power	• Mortality of avifaunal species due to collision with the 22kV powerline conductors. • Mortality of avifaunal species due to electrocution on the powerline poles/towers. • Mortality of avifaunal species due to electrocution within the onsite substation.	• Bird flight diverters to be maintained on sections of powerline during the operational life span of the 22kV powerline. • Insulating material to be maintained during the operational life span of the 22kV powerline. • The use of ultraviolet (UV) lights should be investigated to help avoid night-time bird collisions with tall structures and powerlines. Such lights have proven to be effective in	High	Low

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			mitigating bird strikes with powerlines for cranes and storks in Europe (Dwyer. J et al., 2019). • Post construction monitoring to include powerline surveys to evaluate collision and/or electrocution mortality and assess the efficacy of mitigation measures. • Should electrocutions occur within the onsite substation yard, mitigation can be applied reactively using a range of insulation devices. Site-specific recommendations should be sought from a suitably qualified avifaunal specialist, in conjunction with the Endangered Wildlife Trust's Wildlife & Energy Programme.		
	Traffic	Mortality of avifaunal species due to collisions with motor vehicles	• Vehicles must utilise existing roads only. • Speed restrictions to be enforced for all vehicles within the study area to limit avifaunal collisions. • Awareness initiatives to educate road users about the presence of avifaunal species utilising the roads, particularly during dusk and dawn periods. • Should collisions persist site-specific recommendations to be sought from a suitably qualified avifaunal specialist in conjunction with the Endangered Wildlife Trust's Wildlife & Transport Programme.	Medium to High	Low to Medium
	Open Pit Mining Infrastructure area	Increased lighting will result in the attraction of insects, which will inevitably attract several insectivorous predators, notably bats. This may result in increased risk of injury or mortality to such predatory species either from collision with operational machinery, infrastructure and vehicles, or as a result of direct human conflict.	• Lighting pollution and its effect on fauna (with special mention of invertebrates, bats and avifauna) must be effectively mitigated with the following guidelines in mind with due cognizance taken of health and safety requirements: • Downward facing lights must be installed and limited to essential areas. • Covers/light diffusers must be installed to lessen the intensity of illumination where possible. • Outside lights are to utilise bulbs of varying wave lengths that do not attract insects.	Medium	Low to Medium
	Open Pit Mining	Opencast mining, when occurring below the water table, results in an influx of groundwater. Pit dewatering is then required to ensure dry and safe mining conditions, which ultimately leads to a lowering of the local groundwater levels.	• No mitigation measures are available for when mining occurs below the local water table. Only by remaining above the water table can this impact be avoided. • Groundwater monitoring should be implemented for early detection of the lowering of groundwater levels.	Not Efficient	Medium
	Mine residue and stockpiling	Contamination of surface and groundwater due to acid mine/rock drainage	• Potential dirty surface areas should be lined with concrete to prevent poor quality seepage from reaching the aquifer and contaminating the underlying groundwater. • Stockpile areas should be appropriately lined to prevent potentially poor quality leachate from contaminating the underlying groundwater. • Surface areas should be bunded to prevent clean surface water runoff from being contaminated by dirty surface areas, in line with the Stormwater Management Plan. • Dedicated source monitoring boreholes should be drilled to monitor the groundwater quality conditions and for early detection of groundwater quality impacts.	Medium to High	Low
	Water management facilities	Water retaining facilities such as the planned pollution control/recycling dam are designed and constructed with the objective to prevent any poor quality water from entering the underlying	• All water retaining facilities should be lined with an impervious liner to prevent dirty water from reaching the underlying aquifer and contaminating the groundwater.	Medium to High	Low to Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
		aquifer and contaminating the groundwater. Poor management and maintenance of such facilities may however lead to spills and/or leakages that could contaminate the surface and groundwater resources.	• Water retaining facilities should be designed in line with the requirements of GN704, for a minimum of a 1:50 year rainfall event. • Clean and dirty water separation structures must be maintained throughout the life of mine - O&M Plan. • Spills should be cleaned up immediately in line with the Spill Management and Emergency Contingency Plan. • Proper management and regular inspections for leakages are strongly recommended.		
	Waste management	Pollution of the natural environment and water resources	• No operational-related waste material is to enter natural habitats. • It must be ensured that the mine process water system is managed in such a way as to prevent discharge to the receiving environment. • In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practised near the surface area to prevent the ingress of hydrocarbons into the topsoil and subsequent habitat loss. • Any waste or toxic spills from vehicles or mining infrastructure must be dealt with immediately in accordance with the waste management plan.	Medium to High	Low to Medium
	Hydrocarbon management	• Pollution of surface and groundwater as a result of accidental spillages of chemicals and hazardous material. • Leachate into the groundwater as a result of ponding/seepage.	• Surface areas should be appropriately lined/compacted to prevent poor quality seepage from reaching the aquifer and contaminating the underlying groundwater. • Hydrocarbon storage and work areas (workshops etc.) should be bunded to prevent clean surface water runoff from being contaminated by these dirty surface areas. Bulk facilities to be concrete lined and bunded to capacity of 110%. • Reclamation of soils in the event of accidental spillage. • Spills should be cleaned up immediately in line with the Spill Management and Emergency Contingency Plan.	Medium to High	Low
	All activities	• Operational activities will generate noise, but it will mainly be limited to the project site and directly adjacent properties. • Noise levels will be less than 45 dBA during the day at all receptors. • Noise levels will be less than 35 dBA during the night at all receptors except for the residential receptors on Verloren Valey and Duikerpan.	• Ensure a good working relationship between mine management and all potentially noise-sensitive receptors staying closer than 2,000 m from the mine. • Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Engine bay covers over heavy equipment could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine bay should be considered, ensuring that the seam gap between the hood and vehicle body is minimised. • The operation should investigate the use of white-noise alarms instead of tonal reverse alarms on heavy vehicles operating on roads, within the mining area and at stockpile areas. • Establish complaints register with an open line to a relevant person that can act if there is a noise complaint.	Medium	Low
	Open Pit Mining	Increase in fugitive dust emissions (PM_{10} and dust)	• Water sprays should be applied during the removal of the waste rock to reduce fugitive emissions. • Drilling and blasting activities should not be undertaken during high wind periods to avoid	Low to Medium	Low to Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			excess dust being transported across to neighbouring communities. • Monitoring of key meteorological parameters such as wind speed, wind direction, temperature, precipitation and atmospheric pressure.		
	Access / haul roads Product transport	• A large amount of dust emissions is generated by vehicle traffic over these temporary unpaved roads. • Substantial secondary emissions may be emitted from material moved during regular grading of the unpaved access road. • Product transport may further lead to a decrease in the regional air quality due to wind erosion of product and spillages. • Impact on well-being and livelihoods due to dust generation along transport routes.	• Set the speed limit for hauling vehicles and vehicles in general to as low a speed possible and enforce the speed limits specified. It is recommended the speed limit be set to 40km/h on unpaved roads. • Include speedbumps to control the speed limits where appropriate. • Include a program of wet suppression of the unpaved roads with major vehicle activity. The wet suppression can typically be grey water from the mine, or the water can contain a chemical that will increase the dust trapping capability once sprayed over a surface. • Limit the load size of the vehicles to ensure the wind in transit does not pick up more dust than need be. • Product transport trucks must be covered with tarpaulins; the covers must be secured. • Spillages along the product transport routes must be cleaned immediately. • Establishment of a Complaint and Grievance Procedure.	Medium	Low to Medium
	Infrastructure area	Particulate matter and nuisance dust are expected from the working stockpiles, transfer and tipping points during normal operations.	• Limit the height and slope of stockpiles to reduce wind entrainment. • General traffic around the stockpile areas must be limited. • Windshields (barriers) can be implemented on the slopes and surface of the stockpile, these barriers are typically large trees with good foliage. The substitute of a wind barrier is a wind shield made from a prose material.	Medium to High	Low to Medium
	Infrastructure area	The crushing and screening process (beneficiation) will further reduce the ambient air quality in and adjacent to the infrastructure area.	• Material should be kept damp during crushing and screening. • Dust suppression should be installed along all conveyors and at conveyor transfer stations.	Medium	Low to Medium
	Open Pit Mining	• Ground vibration impact on humans and animals - safety and nuisance impacts. • Potential damage to infrastructure. • Potential for fly-rock, which could harm people and animals.	• Mine to implement a vibration and air blast measurement programme to allow the monitoring of all blasts during the first year. The data must be analysed, and the blast impact assessment be reviewed and updated. • Mine not to blast in adverse meteorological conditions (overcast, strong wind blowing in direction of houses, early in the mornings, late in the afternoon). • Mine to initiate a forum to inform the close residents about the likely vibration and air blast levels, the proposed blasting schedule and warning methodology the mine will employ before a blast. • Mine to reduce the charge per delay to ensure that: o maximum ground vibration levels are less than 2.54 mm/s when blasting has to take place within 3,500m from dwellings used for residential purposes. This can be accomplished by reducing the charge per delay to less than 2,985 kg charge per delay. o maximum ground vibration levels are less than 25 mm/s when blasting has to take place within 1,600m from identified potential sensitive structures. This can be accomplished	Medium to High	Low to Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			by reducing the charge per delay to less than 13,000 kg charge per delay. • Mine to erect blasting notice boards in the area (on the main access route from the district road to the mine) with blasting dates and times highlighted. • Maintain an evacuation zone of 428m, establish an evacuation procedure with the affected parties prior to blasting. • Any evidence of fly rock must be noted, and the blast design analysed for possible improvements. • Blaster to keep full records of blast (blast design, timing, explosive mass per blast hole, stemming, subdrill, spacing, burden, etc.). • Annual photographic records to be collected at residential houses within 3.5 km from the mine.		
	All activities	• Visual intrusion of mining activities on visual receptors. • Visual impact on the landscape character and sense of place associated with the project area and surrounding area.	• Large trees surrounding the infrastructure footprint areas should remain intact as far as possible. • General housekeeping should receive priority to ensure operational areas are always neat and orderly. • Visually intrusive activities must be screened off or make use of local screening opportunities as far as is considered feasible. • Where screening opportunities from topography and vegetation are absent, natural-looking constructed landforms and vegetative or architectural screening may be used to minimise visual impacts. • All operational facilities should be actively maintained. • Backfilling of the open pit should commence as soon as possible in order to avoid discard dumps reaching maximum final heights and limit the operational size of the open pit. • Vegetation growth on dumps and stockpiles should be encouraged, and if required facilitated through seeding with a locally indigenous seed mixture. • Disturbed areas and bare soils should be revegetated as soon as possible during the operational phase. • Vehicles should be restricted to existing roads and the speed of hauling and other vehicles should be limited to minimise dust generation. • Access roads must be suitably maintained to limit and prevent erosion and dust. • Off-site visual mitigation measure that should be considered could include reclaiming unnecessary roads, removing unnecessary fencing, signage and buildings that will not be repurposed, and rehabilitating and revegetating existing erosion or disturbed areas. • If required, additional screening vegetation may be planted at receptor sites from where a clear view towards mining infrastructure of increased height exists.	Low to Medium	Medium
	All activities	Alteration of topography.	• Backfilling of the open pit should commence as soon as possible in order to avoid discard dumps reaching maximum final heights and limit the operational size of the open pit. • Vegetation growth on dumps and stockpiles should be encouraged, and if required	Medium	Low to Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			facilitated through seeding with a locally indigenous seed mixture. • The discard dump should be shaped and rounded as it increases in height and as more material is added, to blend in with the surrounding landscape, as far as possible, particularly once the discard dump reaches a height where sky-lining or changes to the horizon may occur.		
	All activities	Visual impacts from night-time lighting.	• Existing vegetation will assist in screening surrounding receptors from night-time lighting at ground level, and therefore as much existing vegetation as possible surrounding the proposed infrastructure should be retained and development footprints should remain as small as possible. • A lighting engineer should be consulted to assist in the planning and placement of light fixtures for the CHPP and all ancillary infrastructure in order to reduce visual impacts associated with glare and light trespass. • Placement of lighting outside of the project area should be avoided or strictly limited. • All outdoor lighting must be strictly controlled, and lighting shields installed where required. • The use of high light masts should be avoided to reduce sky glow. • Up-lighting of structures must be avoided, with lighting installed at downward angles that provide precisely directed illumination. • Localised and portable lighting should be used where and when the operations or maintenance work is occurring. Vehicle-mounted lights or portable light towers are preferred over permanently mounted lighting for night-time maintenance activities. • Censored and motion/ movement-activated lighting should be installed for security purposes at offices and workshops to prevent use of lights when not needed. • Minimum wattage light fixtures should be used, with the minimum intensity necessary to accomplish the light's purpose. • The use of low-pressure sodium lamps, yellow Light Emitting Diode (LED) lighting, or an equivalent reduces skyglow and wildlife impacts. Bluish-white lighting is more likely to cause glare. • Off-site hauling of product should be limited to daylight hours.	Medium	Low to Medium
	Product transport	• The road network will be able to handle the additional traffic, with the identified road improvements, with no detrimental impact on the traffic on any of the relevant roads. • Safety of other road users do require some intervention.	• Upgrade of intersection of Road D175 with Road D1675: a dedicated right turn lane on the eastern and western approaches (on D1675) to allow for the speed difference between the through traffic and slow-moving right-turning trucks and/or busses. • Upgrade of delivery access to/from Medupi off Road D1675: a dedicated right turn lane on the western approach (on D1675 coming from the Steenbokpan) to allow for the speed difference between the through traffic and slow-moving right-turning trucks. • A bitumen-based emulsion (“dust-a-side” or similar product) should be applied to the section of Road D175 between Road D1675 and the planned access to the mine, in	Medium to High	Low to Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			accordance with a regular and official maintenance program. • All proposed road upgrades and improvements are to be designed by a professional engineer and submitted for official approval, by the Roads Agency Limpopo, prior to implementation. • Spillage from loaded trucks between the mining area and the Medupi Power Station must be prevented as far as possible. Regular inspections and clean-up operations should be conducted. • The loaded trucks should be covered to prevent spillage and hazards to other road users (tarpaulins). • Speed and safety control of truck movements must be implemented, with specific reference regarding a 40km/h speed limit for truck movements within built-up areas and 80km/h on provincial roads with a regular monitoring process. • Establishment of a Complaint and Grievance Procedure.		
	Open Pit Mining	Recovery of sub-surface archaeological sites during mining operations.	• A qualified archaeologist must monitor excavation activities. • Any discovery of artefacts, graves or other remains of archaeological interest should be reported to SAHRA. • Activities must cease immediately upon any discovery of cultural or heritage resources and a qualified archaeologist informed to do further assessment and reporting. • Identified sites of cultural and heritage significance must be demarcated until such time that an instruction to resume work is provided to the contractor, following consultation with the regulating authorities.	Medium	Low to Medium
	Open Pit Mining	• There is a very high likelihood of the occurrence of fossils, typically palaeoflora of *Glossopteris*, *Dadoxylon* and *Vertebraria* within the lower Karoo strata. • The Lisbon Formation may contain trace fossils such as *Cruziana* and *Skolithos*, with also a possibility of dinosaur fossils such as *Euskelsaurus* and *Massospondylus*.	• Once the open pit mining commences, the developer should appoint a recognised suitably qualified palaeontologist to re-assess the palaeontology of the operation to develop a protocol for further assessments and/or chance fossil finds. • Any fossils such obtained should be deposited with a recognised authority such as the Council for Geoscience, Bernard Price Institute for Palaeontology or the Department of Geology and Mining, University of Limpopo.	Medium to High	Low
	All activities	• Economic or Physical Displacement due to Secondary Impacts and Environmental Interactions (noise, visual). • Impact on Aesthetic Value and Sense of Place due to Visual intrusions and increase Nuisance Noise.	• Make available land not being used for lease back by neighbouring operators. • Continuous consultation with neighbouring landowners to ensure co-existence and collaboration on mitigation measures for impacts on noise and dust. • Implement a consultation programme with local stakeholders in the development of a closure plan and rehabilitation programme. • Determine the regional needs and characteristics to ensure post mining land use enhances the regional characteristics. • Monitoring the impact on neighbouring properties. • Establish a complaint and grievance procedure.	Medium	Low to Medium
	All activities	Increase in social pathologies and crime.	• Implement health awareness programmes for workers and communities including education programmes on sexually	Medium	Low to Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			transmitted diseases and HIV/AIDS and other illnesses such as TB. • Increased security on mine premises: Properly constructed and secured fences can control access to mine site. Implementing strict access control to the project site. • Employment of local people on the mine to improve the poverty levels in the neighbouring towns and suburbs. • Code of Conduct to form part of induction of new workers with a clear statement and procedure regarding access, conduct and identification. • Establish a complaint and grievance procedure.		
	All activities	Creation of permanent operational employment.	• Prioritize people residing in local area. • Implementation of practical skills programmes.	Not Efficient	High
	All activities	Contribution to Human Resource and Socio-economic Development Programmes	• Implementation of the SLP, with a focus on local settlement residents.	Not Efficient	Low to Medium
	All activities	Generation of tax base, revenue and GDP contribution	• Optimize local involvement in on-mine business opportunities to maximize local economic growth. • Identify contracts or part of contracts that may be suitable to smaller local companies. • Facilitate and encourage the involvement of SMME's in larger contracts as sub-contractors. • Establish SMME development programmes to support upcoming and SMME businesses.	Not Efficient	High
	All activities	Secondary benefits in the creation of electricity to supply the domestic demand.	• None.	Not Efficient	Medium
DECOMMISSIONING					
	Open Pit Mining	• Highly compacted soils limiting the re-establishment of natural vegetation. • Increased risk of erosion in disturbed areas. • Proliferation of AIP species leading to ongoing floral loss. • Inadequate rehabilitation of open pit mining blocks and disturbed areas leading to permanent habitat loss. • Altered vegetation communities within the study area. • Ongoing erosion, habitat loss, AIP proliferation and the loss of species diversity. • Potential permanent habitat transformation leading to a long term and significant cumulative loss of natural habitat and species in the region.	• Ensure sound implementation of AIP Control Plan. • A bi-annual AIP clearance programme should be implemented for up to 2 years after closure. • Follow up with AIP control measures for a period of 5 years post-closure. • Where soils have been compacted, they are to be ripped and where necessary reprofiled. • Indigenous grass species are to be used for revegetation of disturbed areas. • All surface infrastructure is to be removed and waste material disposed of at a registered dump site. Waste and remnant mine related material are not to be dumped or left within the focus area. • Implement all recommendations as per the mine closure plan. • Use of a nursery developed by the mine to cultivate indigenous/endemic and SCC plant species with a focus on rehabilitation during the post-closure phase in conjunction with a suitably qualified specialist. This will assist in areas where regrowth is not to an acceptable standard. • Continue monitoring of rehabilitation activities for a minimum period of 5 years following the mine closure or until an acceptable level of habitat and biodiversity re-instatement has occurred, in such a way as to ensure that natural processes and veld succession will lead to the re-establishment	Medium	Medium

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			of the natural wilderness conditions which are analogous to the pre-mining conditions of the area.		
	Infrastructure area	• Highly compacted soils limiting the re-establishment of natural vegetation. • Increased runoff volumes and formation of preferential surface flow paths as a result of compacted soils and unvegetated areas, leading to increased sedimentation and erosion. • Proliferation of AIP species leading to ongoing floral and faunal habitat loss. • Improper rehabilitation of disturbed areas leading to permanent floral and faunal habitat loss.	• Ensure that soils are replaced, ripped and re-profiled post-closure, and that vegetation is restored (revegetated with indigenous vegetation species) to a point where succession will lead to the same conditions as the pre-mining state as a minimum. • Rehabilitation measures stipulated in Rehabilitation, Decommissioning and Closure Plan must be implemented. Implementation must be overseen by a suitably qualified Environmental Site Officer. • Where necessary hessian sheets (or similar products) are to be used in order to stabilise the soil surface until complete revegetation has occurred. Minimum of three year's post-closure monitoring to be undertaken. • Ensure sound implementation of AIP control plan. • During the removal of infrastructure and waste, remediation of contamination be found should be carried out, where this is not possible these soils are to be removed to an appropriate waste facility.	Medium	Low to Medium
	Open Pit Mining Infrastructure area	Visual intrusion of decommissioning activities on visual receptors.	• Once mining activities have been completed, it must be ensured that all surface infrastructure, including foundations to the depth specified, signage and moveable infrastructure, must be removed from site (unless otherwise agreed with stakeholders). • It must be ensured that all dumps and stockpiles have been completely removed by using this material as backfill in the open pit. • It must be ensured that that the open pit has been completely backfilled, shaped to follow natural contours and is stable. • All bare and impacted areas must be sufficiently graded, shaped and vegetated to blend in with the surroundings. • It must be ensured that revegetation takes place to a high standard to ensure that vegetation structure, height and composition as per pre-mining conditions are achieved as far as possible. Locally indigenous species should be used for this purpose. • AIP control must continue post-closure as specified in the BAP. • Erosion control measures must be implemented, or existing erosion control measures should remain in place where applicable.	Medium	Low to Medium
	Infrastructure area	• Migration of residual groundwater contamination plume away from rehabilitated areas. • Groundwater contamination due to acid mine/rock drainage.	• Deposit mine wastes in the open pit, controlling the migration of high sulphate leachate. • The horizons that are potentially acid generating, the coal middlings and carbonaceous mudstones should be placed at the bottom of the pit, where they will be submerged below the water table, preventing oxidation. • Open pit areas will be rehabilitated and vegetated as soon as possible to reduce the oxidation and the potential generation of acid-mine drainage.	High	Low

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			• Grass cover should be re-established, as soon as possible after top soiling to minimise infiltration of water through residue material. • Dedicated plume monitoring boreholes should be drilled in the down-gradient groundwater flow direction and sampled at quarterly intervals to monitor plume migration. • Should the monitoring program indicate significant plume migration, interception trenches and/or rehabilitation boreholes may be considered as a form of mitigation.		
	Open Pit Mining Infrastructure area	Final decommissioning activities will have a noise impact lower than either the construction or operational phases.	• Restrict rehabilitation activities to day-time only.	Medium	Low
	Open Pit Mining Infrastructure area	The decommissioning phase may result in some reduction to the ambient air quality, but to a lesser extent than the operational phase.	• Revegetation of exposed areas for long-term dust and water erosion control is commonly used and is the most cost-effective option. Plant roots bind the soil, and vegetation cover breaks the impact of falling raindrops, thus preventing wind and water erosion. Plants used for revegetation should be indigenous to the area, hardy, fast-growing, nitrogen-fixing, provide high plant cover, be adapted to growing on exposed and disturbed soil (pioneer plants) and should easily be propagated by seed or cuttings.	Medium	Low to Medium
	All activities	Loss of job opportunities due to downscaling of the mine employment.	• Implementation of portable skills programmes to assist employees, especially those from the local area, to re-enter the agricultural and other sectors prevalent in the Municipal area. • Establish a future forum with representation from the workforce to discuss potential difficulties and solutions.	Medium	Low to Medium
POST-CLOSURE					
	All activities	Impact on ecosystem	• Since effective mitigation through avoidance, impact minimisation and rehabilitation are deemed unlikely to adequately limit the impact on the receiving ecology, it is deemed important that an ecological offset initiative be initiated to contribute to the conservation of the area.	Low to Medium	Medium to High
	All activities	Post-closure land use and land capability	• Define, in consultation with all IAPs, the final (post-closure) land use for the mining area, including mining areas, surface and water management infrastructure, mine residue facilities, etc. • Develop a final land use plan and implementation programme as part of the closure plan, considering important issues such as ongoing operational and maintenance requirements and long-term responsibilities and ownership. • Set final closure objectives and standards to ensure conformance to the final land use plan and the requirements of the IAPs and relevant environmental legislation. • Develop a detailed closure plan five years prior to closure and obtain approval from the relevant authorities.	Medium	Medium
	All activities	• Deterioration of groundwater quality within the back-filled open pit due to AMD reactions. • Decant into the shallow aquifer or on surface at the lowest surface elevations intersected by the pit.	• Dedicated plume monitoring boreholes should be drilled in the down-gradient groundwater flow direction and sampled at quarterly intervals to monitor plume migration.	Low to Medium	Medium to High

ID	Activity	Potential Impact	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
			• Should the monitoring program indicate significant plume migration, interception trenches and/or rehabilitation boreholes may be considered as a form of mitigation. • Ongoing evaluation and reassessment of alternative options for the final water use and required associated water quality, together with the technologies required to achieve the required quality. • The final land use will also be used to evaluate the post closure water management. • Active involvement in any regional integrated water management plans developed in the area.		

7.4 ASSESSMENT OF IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

Based on the outcome of the risk assessment (Table 42) and the stakeholder concerns raised during the Public Participation process, the following aspects are regarded as potentially significant impacts and/or risks:

- Land use and Sense of Place
- Ecological impacts
- Groundwater impacts
- Air quality impacts
- Noise impacts
- Blasting impacts
- Cultural and heritage resources
- Safety impacts due to increased traffic on the roads
- Macro-economic impacts on existing agricultural activities

Below follows a brief description of the potential impacts as identified by the specialist impact assessments. For more detail, please refer to the specialist reports attached as appendices.

7.4.1 Land Use and Sense of Place

The proposed mining activities will impact low potential arable soils that comprise deep soils of the Ermelo and Hutton soil forms.

Table 44: Summary of the area (hectares) impacted upon by the proposed development

Infrastructure/Mining Area	Soil Form	Area (Ha)
3-year Temporary Discard Dump	Ermelo	4.3
CHPP Plant		2.1
Discard Dump		153.8
Electrical Substation		0.6
Explosives Magazine		1.4
Hard Overburden Dump		37.1
Internal Roads		11.3
Open Pit		125.4
Plant Infrastructure Area		1.2
Pollution Control Dam		2.6
Product Stockpile		0.6
RoM Stockpile		0.0
Soft Overburden Dump		14.1
Box-cut		2.4
3-year Temporary Discard Dump	Hutton	7.7
Box-cut		1.7
Bulk Water Supply Reservoirs		0.1
Hard Overburden Dump		2.9
Internal Roads		5.3
Office, Training & Parking		2.5
Open Pit		9.3
RoM Stockpile		1.0
RoM Tip		0.1
Soft Overburden Dump		4.1
Workshop & Wash bay		6.6
Total		**398.3**

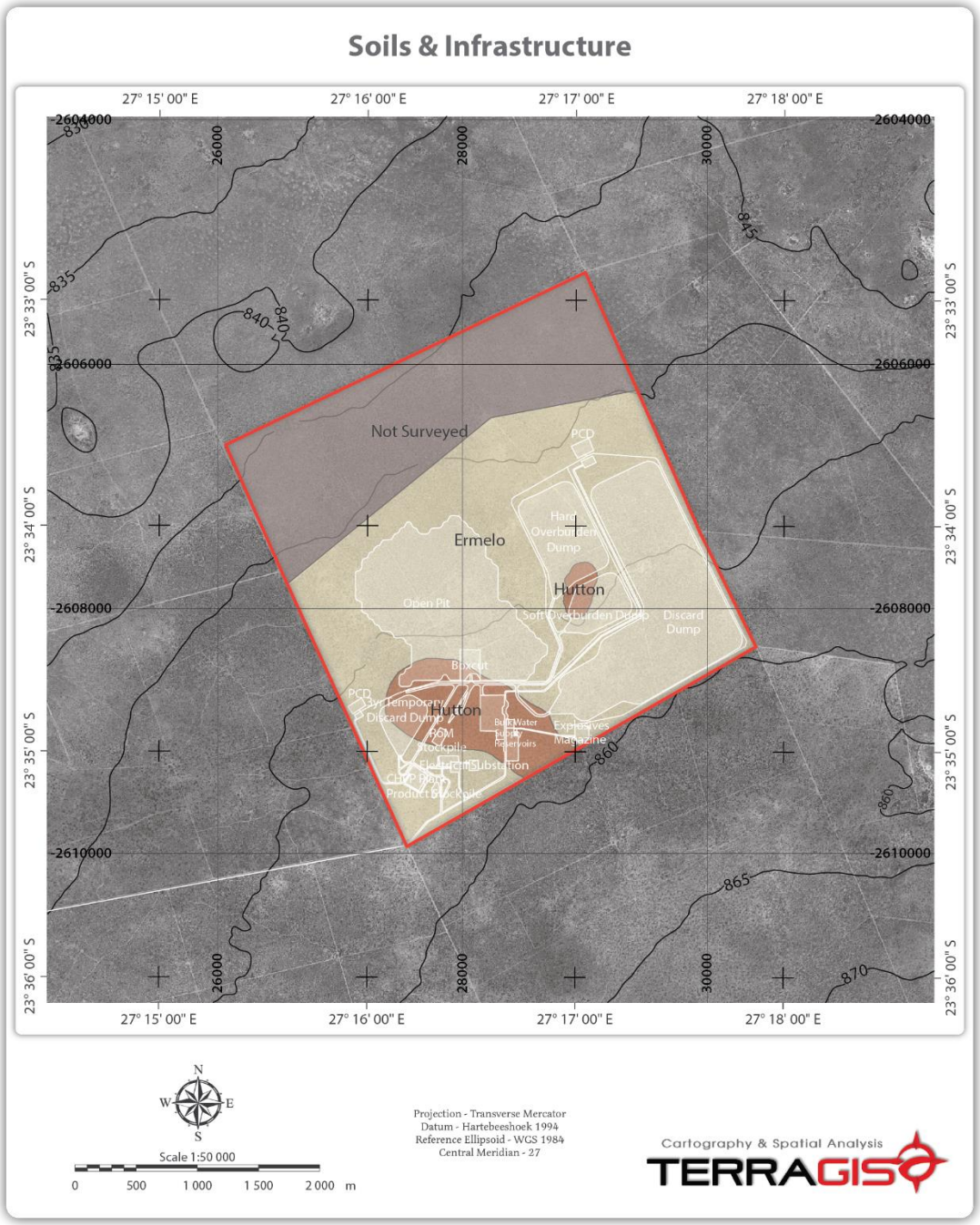


Figure 44: Soil forms and areas that will be impacted by the envisaged mining activities

From the combined viewshed analysis, it is evident that the proposed project will theoretically be visible from almost all areas within 5 km of the farm Gruisfontein and intermittently within 10 km thereof. The viewshed extends up to 20 km to the south, to include the Steenbokpan settlement and commercial centre, and up to around 15km to the east and west, but not as far as the town of Lephalale and surrounding settlements to the east and southeast. The proposed project will also theoretically be visible to the north, including certain locations adjacent to the Limpopo River, and extend beyond the South African-Botswana border.

The viewshed coverage of all project components over 12m in height are concentrated within 5 km of the project area, with the visual influence of the proposed Long-term Discard Dump extending the furthest. The viewshed analysis of individual project components, found that the Long-term Discard Dump (90m high) and CHPP (25m high) will theoretically be highly visible, while the ROM, Hard Overburden Dump (15m) and Product Stockpiles (12m high) will be moderately visible. The remaining infrastructure components, all below 5m in height or at ground level, are expected to have low visibility.

Infrastructure of 5m or lower in height, such as the Temporary Discard Dump and the Soft Overburden Dump, are unlikely to be visible to receptors beyond the boundaries of the project area, while the same is true for infrastructure at located ground level such as the Open Pit and access roads. It is also important to note that the Discard Dump, once in place from Year 4 onwards, will serve to fully or partially obscure infrastructure such as the CHPP and associated infrastructure, as well as dumps that are lower in height, from view.

It is however important to note that screening provided by existing vegetation and man-made infrastructure is likely to significantly reduce the theoretical viewshed, while increasing distance from the infrastructure will also serve to exponentially reduce visual exposure towards the project. The actual zone of visual influence of the project is smaller than the theoretical viewshed, mainly due to the effect of distance (it is highly unlikely that any infrastructure will be visible beyond 15 km of the project footprint area) and effective screening afforded by existing vegetation, particularly when considering infrastructure of less significant heights. The visual sensitivity of the proposed development is indicated in Figure 45.

The view simulation of mine infrastructure from Verloren Valey to the west and Matopi to the east is shown in Figure 46. This serves to illustrate that certain receptor sites, although located within the proposed infrastructure's theoretical zone of visual influence, benefit from effective or partial screening by existing structures and vegetation, as well as the effect of distance.

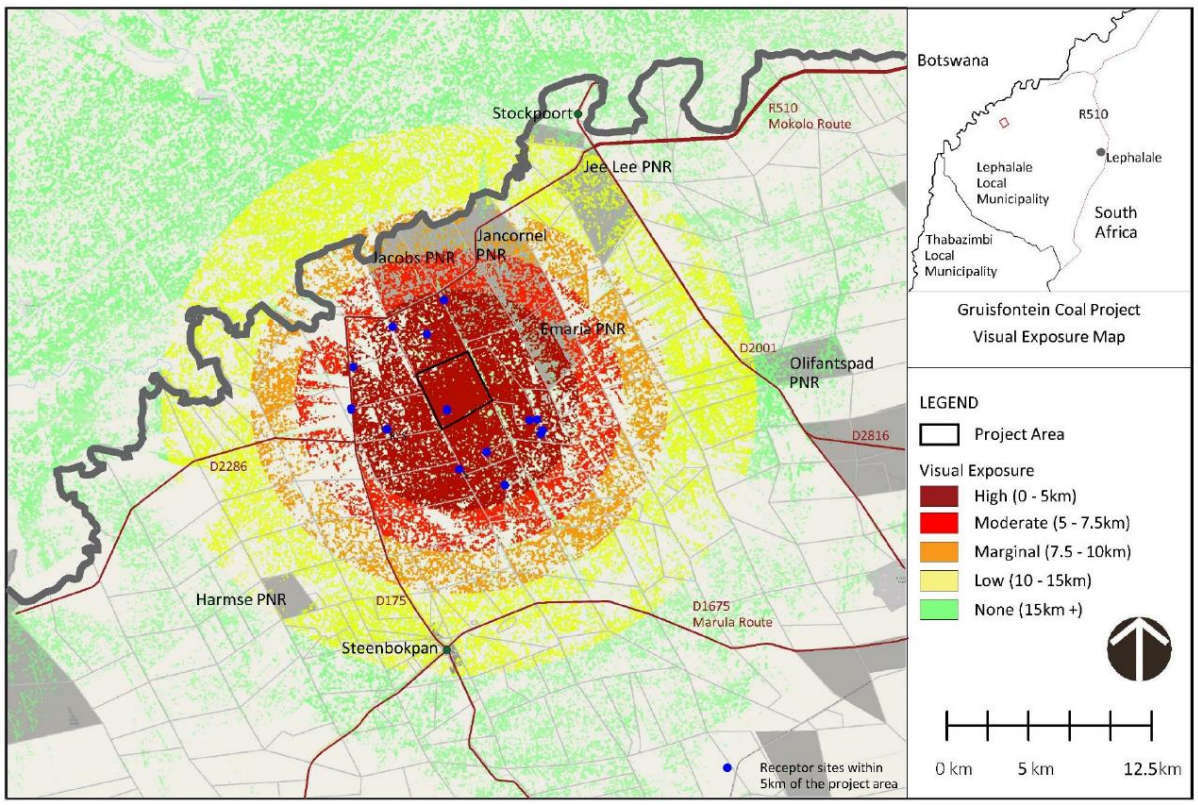


Figure 45: Visual Sensitivity

Figure 46: View simulation of mine infrastructure from Matopi (top) and Verloren Valey (bottom)

7.4.2 Terrestrial Ecology

7.4.2.1 Floral sensitivity

The proposed mining infrastructure will negatively impact on the floral communities within the study area, especially within the southern portion where most infrastructure is planned and where there is a higher abundance and diversity of floral species.

Floral SCC that will be directly affected by the proposed infrastructure layout includes NFA protected trees such as *Boscia albitrunca* (Shepard's tree); *Sclerocarya birrea* subsp. *caffra* (Marula) and *Vachellia erioloba* (Camel Thorn). Moreover, the TOPS listed *Harpagophytum zeyheri* will also be directly affected. The above-mentioned species are also of medicinal value and it can be expected that the proposed Gruisfontein Project will increase the risk of harvesting of these species as human populations in the area increase.

There is also great potential for the proliferation of AIPs or the encroachment of species such as *Dichrostachys cinerea, Grewia flava* and *Senegalis melifera*, in response to disturbances. Therefore, it will be important to manage edge effects within the study area.

Activities which are likely to negatively impact floral species within the study area include, but are not limited to, the following:

- Placement of mining infrastructure within sensitive, natural floral habitat;
- Clearing of vegetation during construction and operational activities;
- AIP proliferation and erosion in disturbed areas;
- Increased possibility of collection of medicinal plants; and
- Edge effects compromising habitat integrity through, e.g., enabling AIPs to proliferate, decreasing habitat connectivity and increasing the extent of transformed habitat with little chance of habitat restoration.

Following the assessments, it can be concluded that the ecological sensitivity of the habitat units is moderately high (Sweet Bushveld A and Sweet Bushveld B) and moderately low (Degraded Habitat) – refer to Figure 47 and Table 45.

Even with mitigation, latent impacts on the receiving floral ecological environment are deemed likely, with particular reference to impacts stemming from inadequate rehabilitation or continual disturbances, thus decreasing habitat integrity through the proliferation of AIPs and bush encroachment. The following points highlight the key latent impacts that have been identified that will be relevant within the MRA:

- Permanent loss of ecologically intact floral habitat;
- Loss of, or impairment of, and altered floral species diversity;
- AIP proliferation; and
- Permanent loss of, or impairment of and altered floral SCC and suitable habitat.

Table 45: A summary of the sensitivity of each habitat unit and implications for development (STS, 2019)

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Sweet Bushveld B	**Moderately High**	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.	This habitat unit has the highest floral ecological sensitivity and importance within the study area due to the higher species diversity and the high density and abundance of floral SCC. Most of the proposed mining infrastructure falls within this habitat unit, and due to its sensitivity, it is recommended that as far possible and feasible, the location of the infrastructure areas be reconsidered. New designs should not lead to increased habitat fragmentation. Management of AIPs and bush encroachment will be important as increased disturbances will arise from mining activities. A rehabilitation plan and fire management plan should be implemented throughout the proposed project.
Sweet Bushveld A	**Intermediate**	Preserve and enhance the biodiversity of the habitat unit and surrounds while optimising development potential.	The vegetation of the Sweet Bushveld A is intact and representative of the Limpopo Sweet Bushveld vegetation type. This habitat unit provides favourable growing conditions that support a moderate diversity of floral species, including a high diversity of floral SCC. The habitat unit as a whole is in a good ecological condition with moderately high habitat integrity. Several of the proposed mining activities fall within this habitat unit, including the majority of the proposed Open Pit. Backfilling of the Open Pit has not yet been considered and, therefore, it can be expected that floral diversity within this habitat unit, as well as within the study area, will be negatively impacted. However, floral diversity within the region will be minimally affected. All mining activities within this habitat unit should be kept to the footprint areas, and edge effects should be carefully managed. The control of AIPs and the management of bush encroachment is recommended.
Degraded Areas	**Moderately Low**	Optimise development potential.	The Degraded Habitat Unit is of moderately low sensitivity and importance from a floral ecological perspective. The vegetation within this habitat unit is no longer representative of the reference vegetation type and is dominated by species associated with disturbed areas. Several floral SCC occurs within this habitat unit, albeit along the edges thereof. These species will require permits if they will be impacted upon by mining activities. Due to the disturbed nature of this habitat unit, the vegetation is more susceptible to AIP proliferation. Thus an AIP Control Plan is recommended to control and prevent their spread.

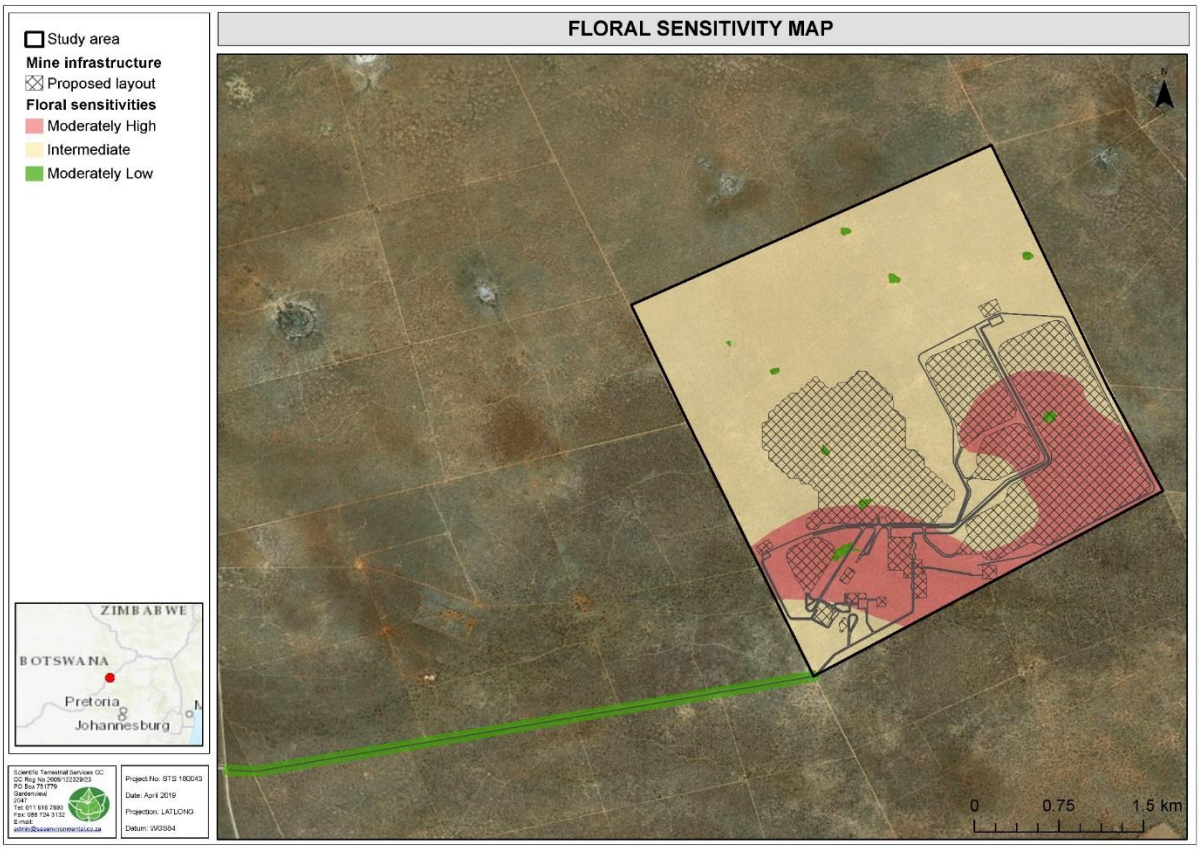


Figure 47: Floral sensitivity map

7.4.2.2 Faunal sensitivity

The proposed mining infrastructure will negatively impact on the faunal habitat and communities therein of the study area, whilst also impacting on species that range outside of the study area. The current layout plans will result in an extensive loss of habitat, faunal diversity and abundance in the southern portion of the study area, whilst impacts can be considered limited within the northern portion. Mining activities are likely to lead to a loss of habitat connectivity not just within the study area but also impact upon such connectivity on a local scale, with faunal species having to now circumnavigate the mining activities. This is of particular concern for migratory species (some avifauna) and larger mammals that have home ranges that extend beyond that of the study area. Although these species can move around the mine footprint, they will now encounter additional risks in the form of increased vehicle movement, personnel (snares and poaching) as well as overhead transmission lines (avifauna). Additionally, the proposed activities will result in the displacement of faunal species, pushing them into the surrounding habitats. This will inevitably lead to an increase in inter and intraspecific competition for habitat and resources. The increased competition rates may lead to increased mortality rates and lower breeding potential as well as further dispersal of species from the areas immediately surrounding the study area, with knock on effects being experienced beyond that of the study area. Such impacts and eventualities will lead to a lower species diversity and abundance in the study area.

In addition to the loss of habitat, it is likely that the proposed mining plans will negatively impact upon several faunal SCC species, predominantly as a result of the loss of foraging grounds and habitat. Many

of the faunal SCC expected to occur within the study area are far ranging species which require large areas of natural habitat in order to survive. The loss of habitat, lower food resources and decreased habitat connectivity will force many of the SCC to inhabit and forage in the surrounding areas, which may expose them up to increased levels of persecution and resource competition.

Activities which are likely to negatively impact faunal species within the study area include, but are not limited to, the following:

- Placement of mining infrastructure within sensitive faunal habitat;
- Clearing of vegetation during construction and operational activities;
- AIP proliferation and erosion in disturbed areas;
- Increased possibility of hunting/poaching of faunal species;
- Increased possibility of faunal species being struck by moving vehicles and of bird strikes with overhead transmission lines; and
- Edge effects compromising habitat integrity as a result of AIP proliferation, decreased habitat connectivity and an increase in the extent of degraded habitat with little chance of habitat restoration to pre-mining conditions.

Following the assessments, it can be concluded that the ecological sensitivity of the habitat units is moderately high (Sweet Bushveld A and Sweet Bushveld B) and moderately low (Degraded Habitat) – refer to Figure 48 and Table 46.

Even with extensive mitigation, significant latent impacts on the receiving faunal ecological environment are deemed highly likely. The following points highlight the key latent impacts that have been identified:

- Permanent loss of ecologically intact faunal habitat in the footprint areas;
- Continued loss of and altered faunal species diversity;
- Continued loss of faunal SCC and suitable habitat; and
- Disturbed areas are unlikely to be rehabilitated to baseline levels of ecological functioning and loss of faunal habitat, species diversity and faunal SCC will most likely be permanent.

Table 46: A summary of the sensitivity of each habitat unit and implications for the proposed development (STS, 2019)

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Sweet Bushveld A	Moderately High	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.	The majority of this habitat unit is excluded from the proposed mining footprint area, however the open cast pits, overburden dump and parts of the discard dump are located in this habitat unit and as such will result in the loss of habitat and disturbance of faunal species and possibly SCC. As such, it is imperative that all mitigation measures as stipulated in this report are implemented so as to minimise additional unnecessary habitat loss and thus the impact to the receiving environment.
Sweet Bushveld B	Moderately High	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.	The current proposed mine layout will result in a significant loss of habitat within this habitat unit even with stringent implementation of mitigation measures it is unlikely that the significance of habitat loss in this habitat can be mitigated. The loss of habitat herein will have a significant impact on species abundance and diversity in this habitat unit. All mitigation measures as stipulated in this report must be implemented to minimise additional unnecessary habitat loss as a result of footprint creep and the proliferation of AIP species.
Degraded Areas	Moderately Low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	Development within this habitat unit is unlikely to result in significant loss of habitat for faunal species, however the open cast pit and discard dump will lead to the loss of important water points, albeit artificial water points. The loss of the water points will lead to altered faunal area use. Provided that the remaining water points in the northern portion of the study area remain active the loss of the water points in the south is unlikely to have a significant impact to faunal species.

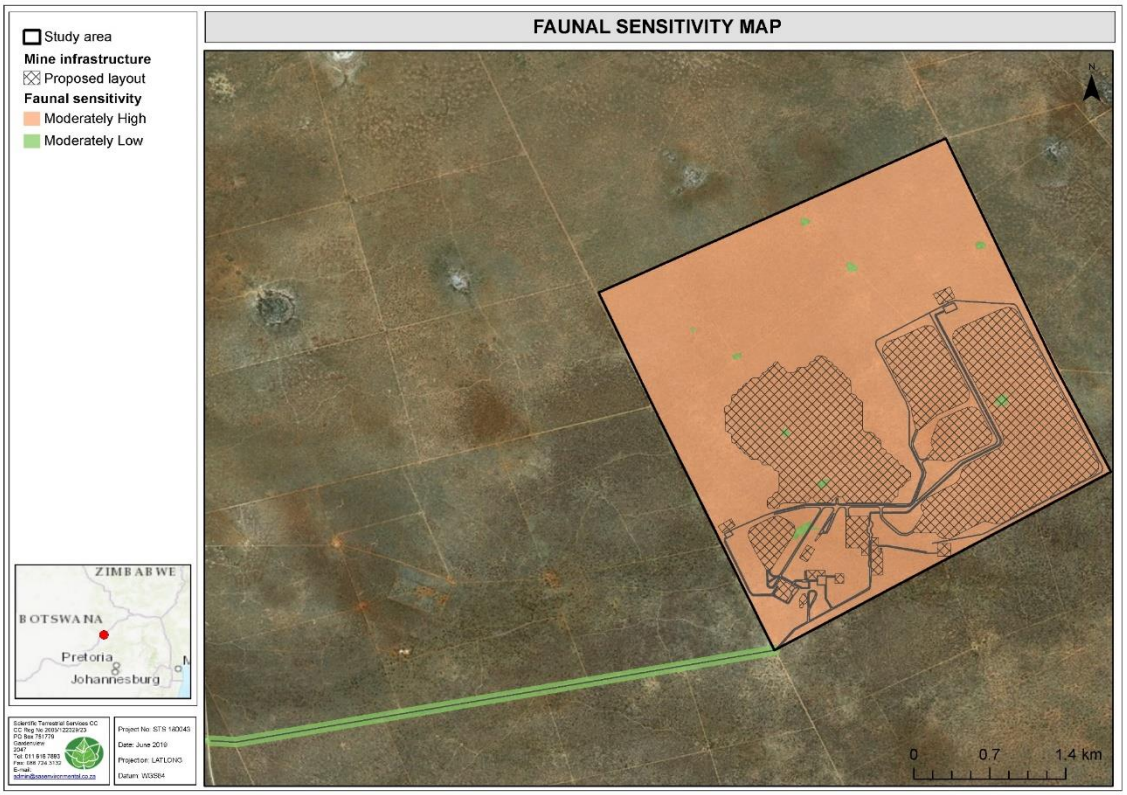


Figure 48: Faunal sensitivity map

7.4.2.3 Avifauna sensitivity

The habitat within which the proposed study area is located is relatively homogenous with little variation in sensitivity (rated to be moderate to high) from an avifaunal perspective. Areas that supported a density of non-Red List species (i.e. cattle feeding and drinking stations) are in fact degraded in habitat terms and unlikely to regularly support a diversity and/or abundance of Red List species. Although the site visit identified two nest locations on the Gruisfontein property, the presence of these do not necessarily increase the sensitivity of the project area given the species breeding at these locations. Therefore, there were no specific areas within the confines of the project boundary that were designated as highly sensitive no-go areas.

The construction of the proposed Gruisfontein mine and its ancillary infrastructure will result in impacts of medium to high significance, which can be reduced to low to medium levels through the application of mitigation measures. The avifaunal specialist concluded that sustainable development of the proposed Gruisfontein Mine projects can be achieved with acceptable levels of impact on the resident avifauna subject to the implementation of the mitigation measures proposed in the specialist report.

7.4.3 Groundwater

7.4.3.1 Groundwater quantity and level

The potential groundwater quality and water level impacts associated with the proposed new opencast mining and related activities were simulated/predicted with a numerical groundwater flow and contaminant transport model and the results are summarised below.

The pit floor was simulated to intersect the groundwater level throughout the entire life of mine and the model simulated groundwater inflow volumes for each year as follows:

Table 47: Estimated groundwater inflow volumes

Year	Volume (m^3/d)	Volume (l/s)
1	290	3.4
2	450	5.2
3	480	5.6
4	570	6.6
5	520	6.0
6	520	6.0
7	560	6.5
8	600	6.9
9	620	7.2
10	640	7.4
11	600	6.9
12	660	7.6
13	610	7.1
14	660	7.6
15	620	7.2
16	670	7.8

Groundwater inflow was simulated to increase from approximately 3.4 l/s during the first year to ±7.8 l/s at the end of the 16th and final year of mining. The proposed pit was simulated to intersect a high transmissivity geological structure.

The affected area (i.e. groundwater depression cone) was simulated to increase throughout the life of mine from approximately 0.27 km^2 during year 1 to ±3.43 km^2 at the end of the 16th and final year of mining. Impacts were simulated to extend further towards the east along a fault that acts as a preferred pathway for groundwater. The maximum drawdown increased from more or less 39 meters to a maximum of ±90 meters at mine closure.

Table 48: Summary of flow model simulations

Year	Total affected area (km^2)	Maximum drawdown (m)
1	0.27	39
2	0.45	72
3	0.70	72
4	0.92	81
5	1.10	81
6	1.31	81
7	1.55	81
8	1.73	89
9	1.94	89
10	2.14	89
11	2.32	89
12	2.47	90
13	2.72	90
14	2.98	90
15	3.21	90
16	3.43	90

The simulated groundwater depression cone at the end of LOM is indicated in Figure 49. The positions of nearby hydrocensus/user boreholes and geological structures are also indicated.

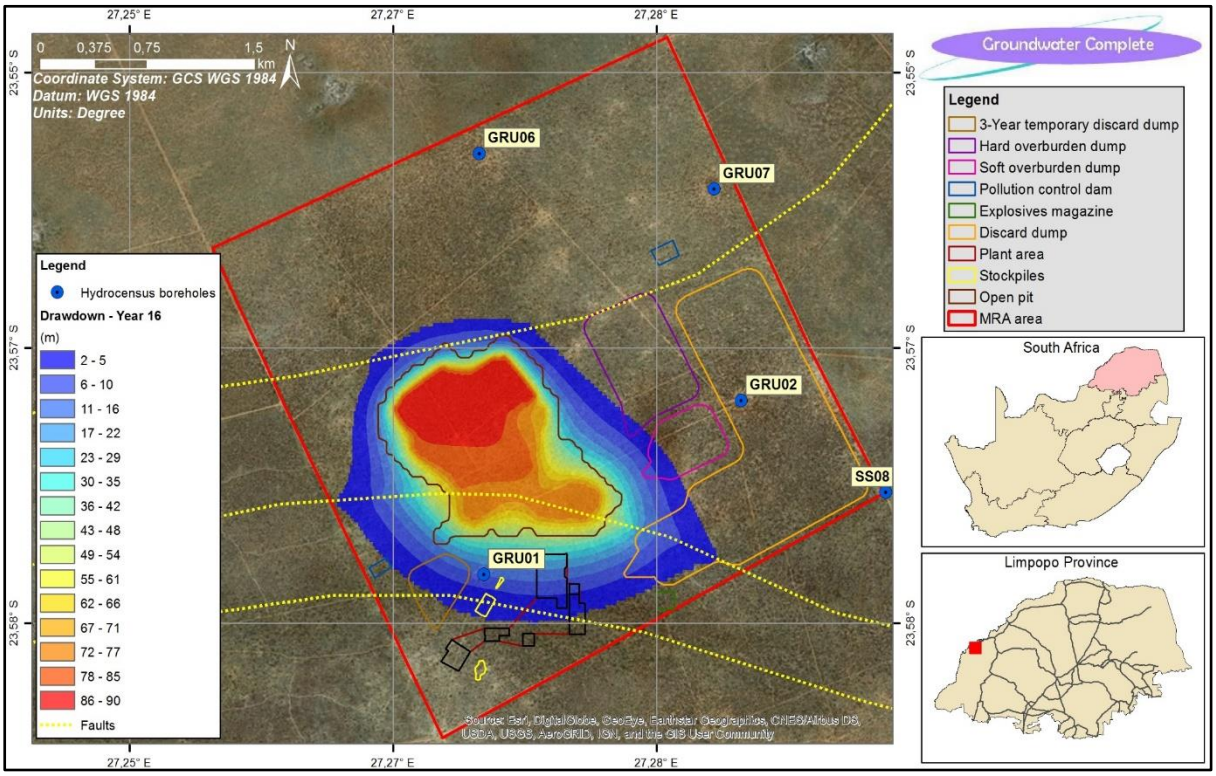


Figure 49: Model simulated groundwater depression cone – Year 16

The water level impacts were simulated to remain within the MRA area. The water levels of outside user boreholes are consequently expected to remain unaffected by the proposed opencast mining at Gruisfontein.

A time-series graph of the model simulated groundwater level elevations for the pit area is provided in Figure 50, which shows that water levels have still not fully recovered from the impacts of pit dewatering after a post closure simulation time of 50 years. The backfilled pit is consequently expected to remain a groundwater sink long after mine closure.

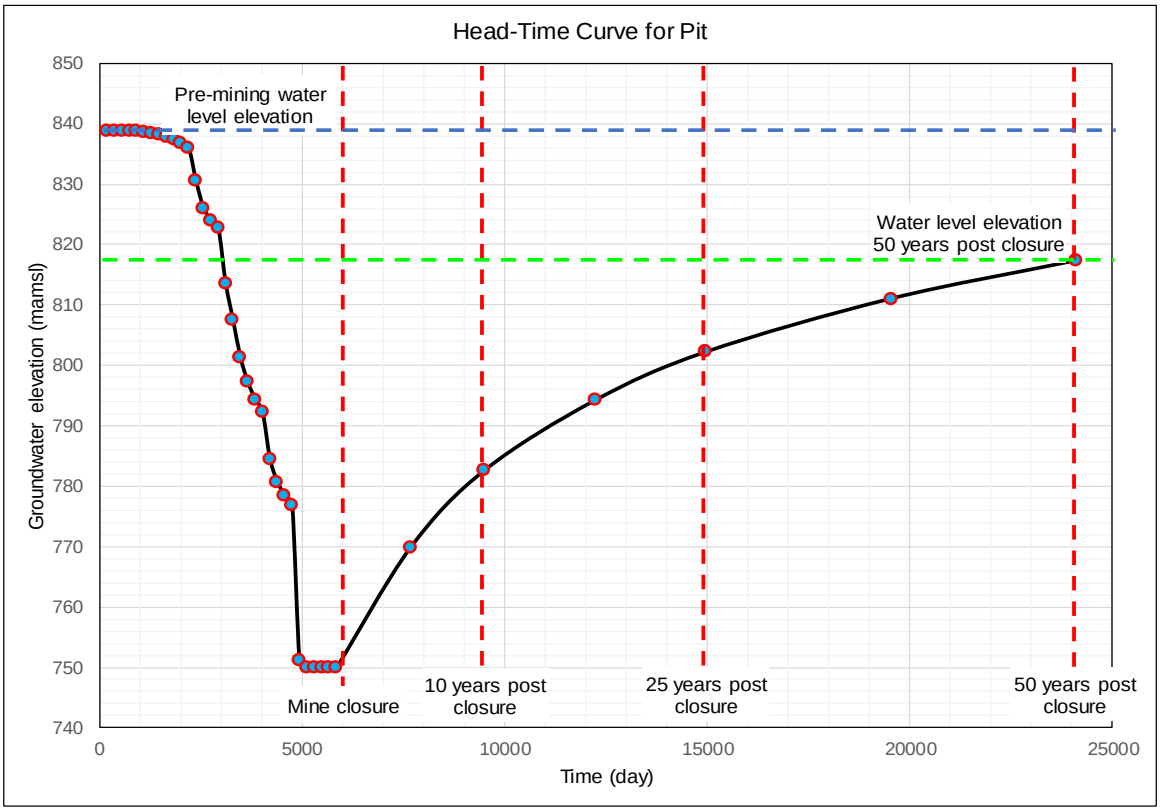


Figure 50: Model simulated groundwater level elevation for the pit area

7.4.3.2 Post-closure decant

The expected time it will take the backfilled Gruisfontein pit to fill with water was calculated with the use of volume/recharge calculations to be in the region of 160 years post closure (Table 49). Post closure decanting of the rehabilitated pit is expected to occur at a surface elevation of ±856 mamsl and at an estimated rate of approximately 150 m^3/d, or 1.7 l/s (Figure 51). Given the topography, geological profile and climate of the area, this water is not expected to daylight as actual decant.

The pit water is expected to be of poor quality due to the high potential of the backfill material to generate sulphuric acid over the long term. Without any disturbance in the pit, the effect of salinity stratification is bound to result in significantly better quality water occurring near surface where recharge occurs at high rate and with very good quality water.

Table 49: Time-to-fill calculations

General information		
	Units	**Gruisfontein Pit**
Surface area	m^2	1 347 340
Decant elevation	mamsl	856
Total void volume	m^3	113 790 980
Mean annual rainfall	m/a	0.408
Backfilled void volume		
20% Porosity	m^3	22 758 196
25% Porosity	m^3	28 447 745
30% Porosity	m^3	34 137 294
Recharge/Rainfall contribution		
8% Recharge	m^3/y	43 977
10% Recharge	m^3/y	54 971
12% Recharge	m^3/y	65 966
Groundwater contribution		
Average	m^3/y	120 450
Time to fill		
Most probable scenario (25% Ø and 10% RCH)	**Years**	**162**

Notes: *Ø = Porosity; RCH = Recharge.*

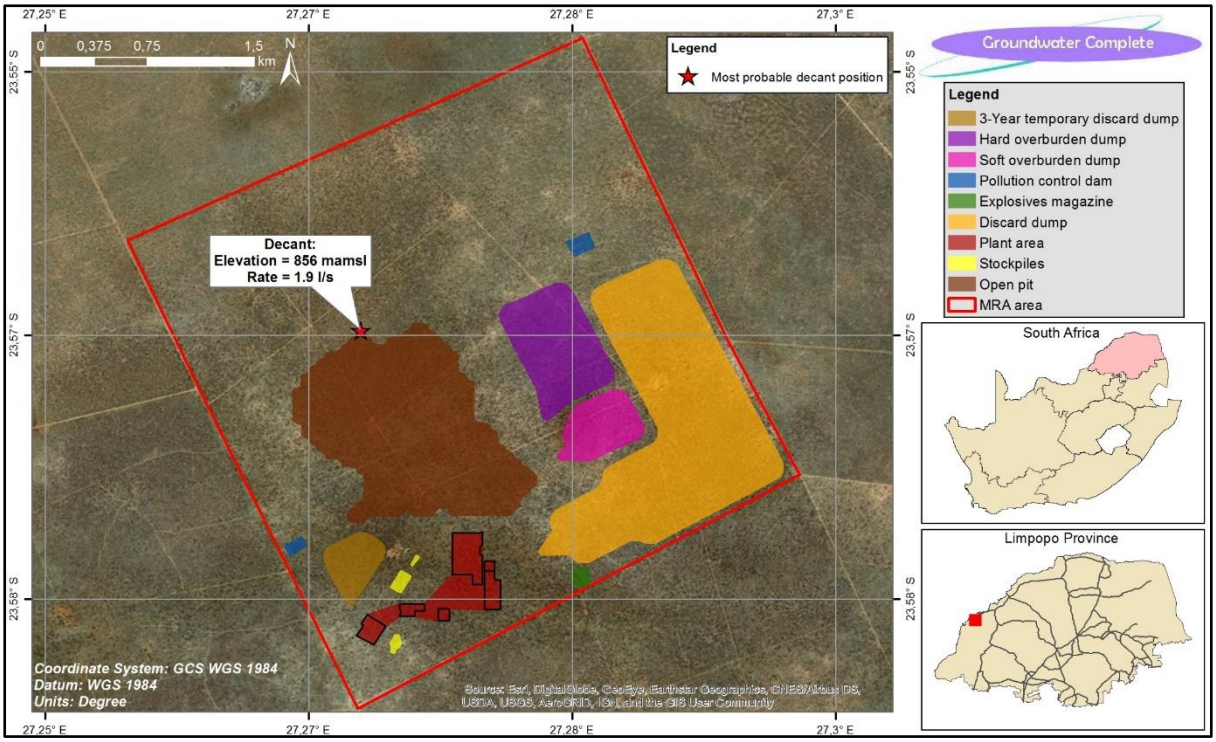


Figure 51: Most probable decant position and estimated discharge volume

7.4.3.3 Groundwater quality

A groundwater depression cone will alter hydraulic gradients and force groundwater and any potential contamination (within the affected area) to migrate towards its center. Groundwater levels therefore firstly need to recover from the impacts of pit dewatering before contamination can leave the pit area and migrate in the pre-mining/ambient downgradient direction. On the other hand, contamination emanating from the surface source areas was simulated to migrate towards the pit that will continue to act as a sink long after mine closure (Figure 52).

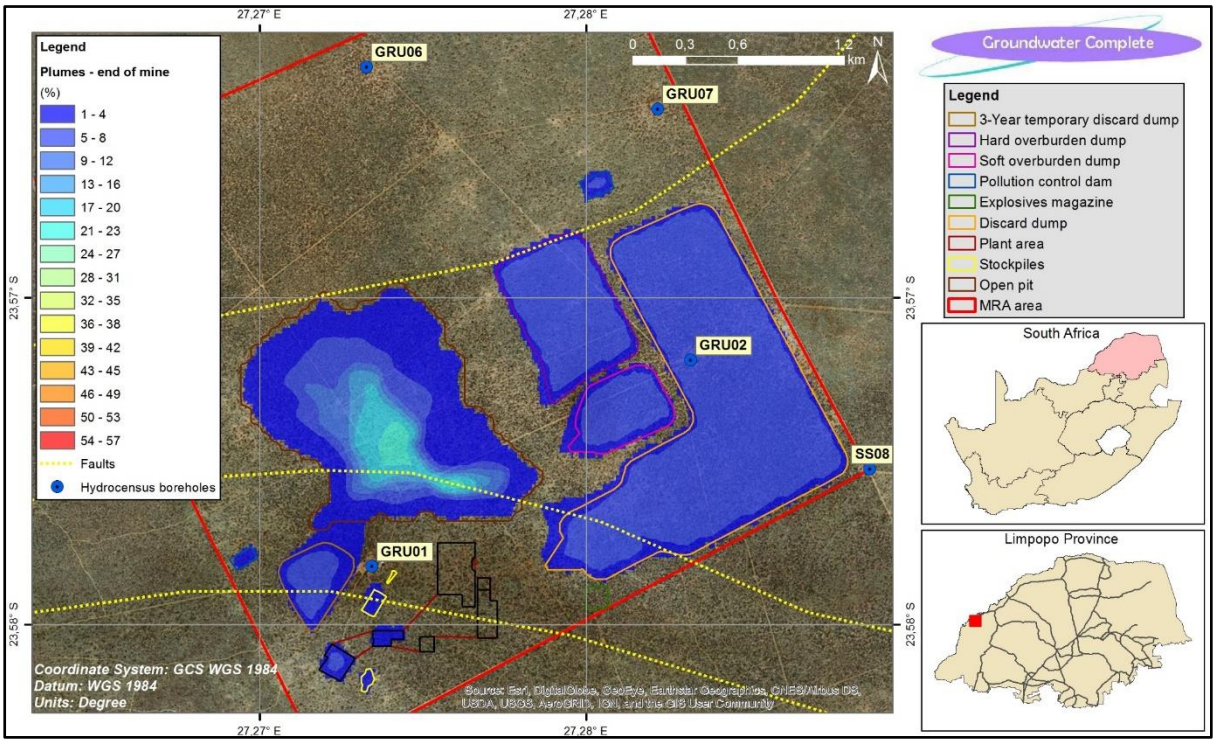


Figure 52: Model simulated groundwater contamination plume – mine closure

After rehabilitation of the mining area, the backfilled opencast pit will be the only remaining source and all surface source areas are thus removed the post closure model simulations. Residual contamination from the former source areas was however simulated to continue a path towards the pit.

At 50 years after closure, water levels have still not fully recovered from the impacts of pit dewatering, and plumes were consequently simulated to continue in a direction towards the backfilled opencast pit. Residual contamination, albeit at lower concentrations, was still simulated for most of the rehabilitated surface source areas.

The maximum plume concentrations were simulated to increase from approximately 20% at mine closure to ±60% at 50 years post closure, or 600 mg/l to 1 800 mg/l respectively if the source had a constant sulphate concentration of 3 000 mg/l (Figure 53).

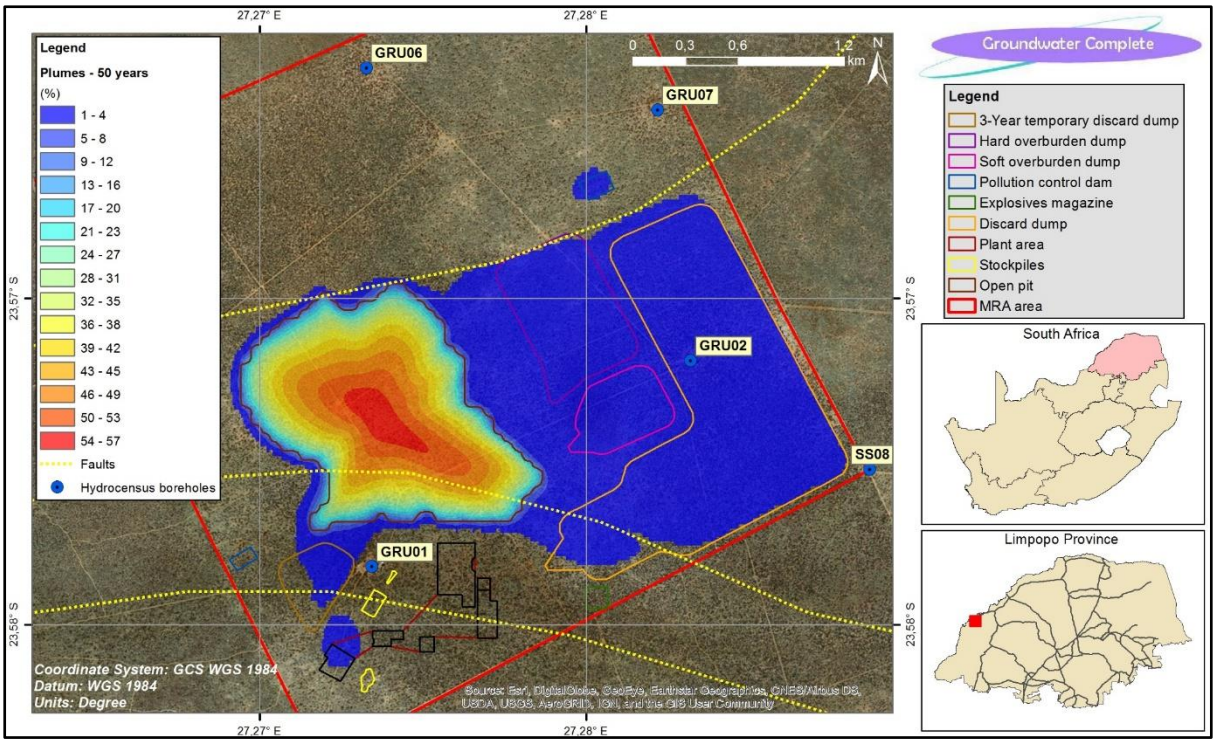


Figure 53: Model simulated groundwater contamination plume – 50 years after closure

The groundwater quality impacts (i.e. contamination plumes) were simulated to remain within the MRA area and more specifically concentrated at the pit position. The water quality of outside user boreholes is consequently expected to remain unaffected by the proposed opencast mining and related activities.

7.4.3.4 Potential acid mine drainage (AMD)

Long-term pollution effects depend on the acid generating potential of the overburden and discard material used in the backfilling of the pit, and the availability of oxygen and water for chemical reaction. Geochemical testing that was conducted for the nearby Temo Coal Project concluded that all material, over the long-term, have the potential to generate acid.

With AMD reactions becoming active, the pH and bicarbonate alkalinity values of the water can be expected to decrease. Most metals have very low solubility in water at the normal (pH 6 to 8) pH range but will go into solution as a result of the lower pH environment.

As the AMD affected water leaves the backfilled pit, it will mix with better quality water and the pH and bicarbonate values will be buffered back to more acceptable levels. Metals should also precipitate, and the sulphate and TDS concentrations should decrease through dilution.

Water collecting in the backfilled pit is expected to display a stratified quality distribution with the better quality water on top and the more saline (and with slightly higher specific gravity) water at the bottom of the pit. Furthermore, contaminant migration is expected to be retarded by the transmissivity and porosity of the host rocks. Other reactions like sorption, dispersivity and tortuosity in the aquifer also contain contamination spread and these aspects are generally referred to as the

aquifer retardation properties. Site specific geochemical testing at Gruisfontein is strongly recommended for confirmation of the acid generating potential of the underlying Karoo rocks.

7.4.4 Air quality

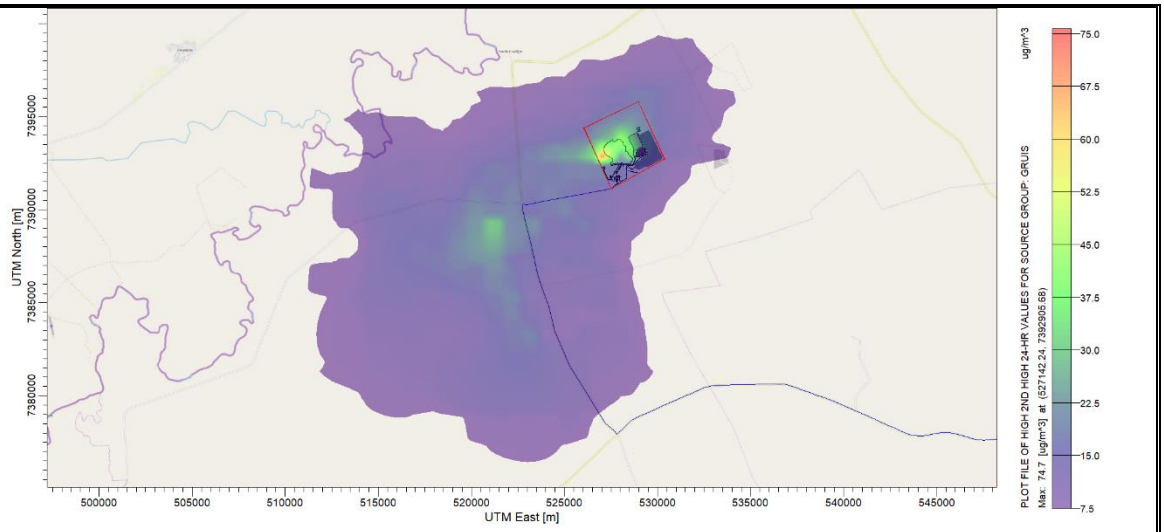
7.4.4.1 Particulate matter

The dispersion of pollutants through the air was modelled with the AERMOD software. The physical environmental parameters, such as wind, temperature, humidity and rain, influence the concentrations over distance. The modelled results are presented in Table 50 and compared with the national standards. Results are a cumulative impact showing total impacts from the site. Graphical outputs are indicated in Figure 54

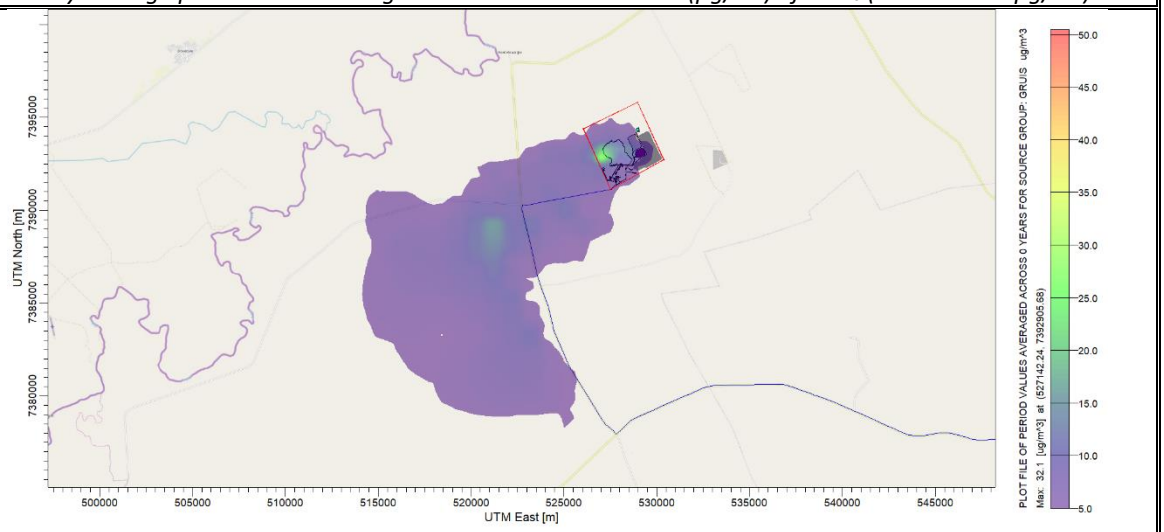
It should be duly noted that all the model runs were done as worst-case scenarios, thus no mitigation measures control efficiencies are included in the emission rate calculation. The values noted in the table below is the maximum concentration calculated throughout the model, most of the maximum concentrations are most likely to be located either on top of an area source or close to an area source. The concentration of the pollutant will decrease as it moves away towards the fence line (MRA boundary). The maximum concentration that enters the receiving environment, beyond the fence line is highlighted as the MRA Boundary concentration in the table.

Table 50: Dispersion Results from AEMOD – Worst Case Scenario (all results represented as µg/m³)

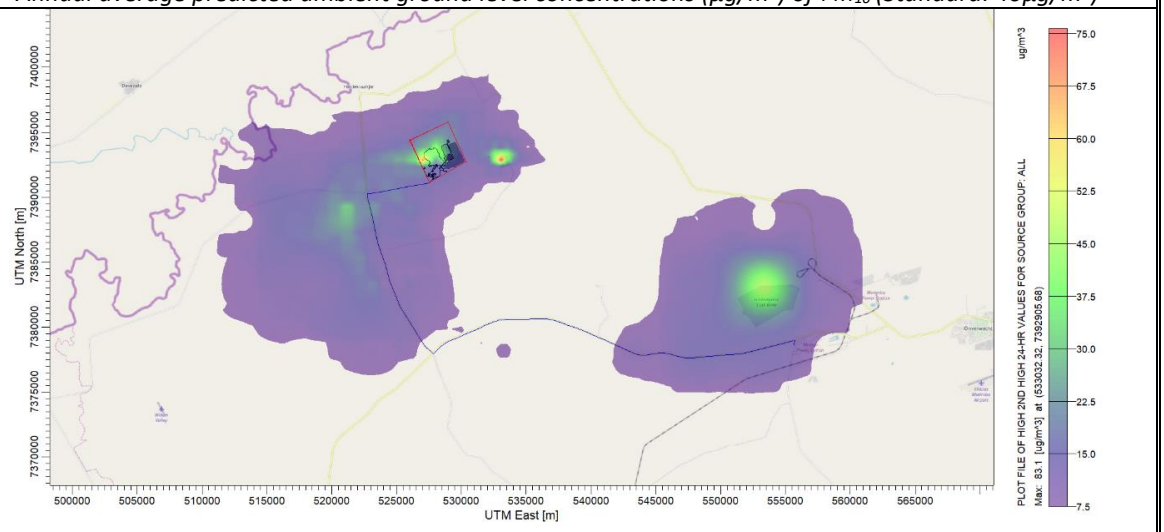
Total Project Impact			
Averaging Period	Peak	MRA Boundary	Standard
Hourly	298.93	137.04	-
Daily	74.71	29.62	75
Annual	32.12	10.24	40
Mining Impact			
Averaging Period	Peak	MRA Boundary	Standard
Hourly	280.42	130.99	-
Daily	73.26	27.14	75
Annual	29.81	6.90	40
Transport Impact			
Averaging Period	Peak	MRA Boundary	Standard
Hourly	83.60	83.60	-
Daily	29.48	29.48	75
Annual	16.48	16.48	40
Cumulative Impact (includes, Sasol, Exxaro & Eskom)			
Averaging Period	Peak	MRA Boundary	Standard
Hourly	298.93	252.26 (Sasol)	-
Daily	83.07	83.07 (Sasol)	75
Annual	33.86	33.86 (Sasol)	40



Daily average predicted ambient ground level concentrations (µg/m³) of PM_{10} (Standard: 75µg/m³)



Annual average predicted ambient ground level concentrations (µg/m³) of PM_{10} (Standard: 40µg/m³)



Daily average predicted ambient ground level concentrations (µg/m³) of PM_{10} (Standard: 75µg/m³) for the cumulative regional impact

Figure 54: Graphical outputs for Particulate Matter (PM_{10})

For the entire Receptor Grid modelled, beyond the MRA boundary, the impacts from the Gruisfontein mine are below the ambient air quality standards. When combined with the current background concentrations monitored during the study, the results are still below the health criteria standards for ambient air quality.

When the surrounding sources are included, the cumulative impact does show that exceedances do occur in the region. Overall the Gruisfontein Mine will likely contribute around 35% of the cumulative particulate matter load within the region.

7.4.4.2 Dust fallout

Dust fallout modelling indicates the areas where fallout is expected to exceed the permissible limits for residential and industrial areas (Figure 55). Therefore, it is recommended that dust fallout monitoring be undertaken to determine the effectiveness of the mitigation measures implemented.

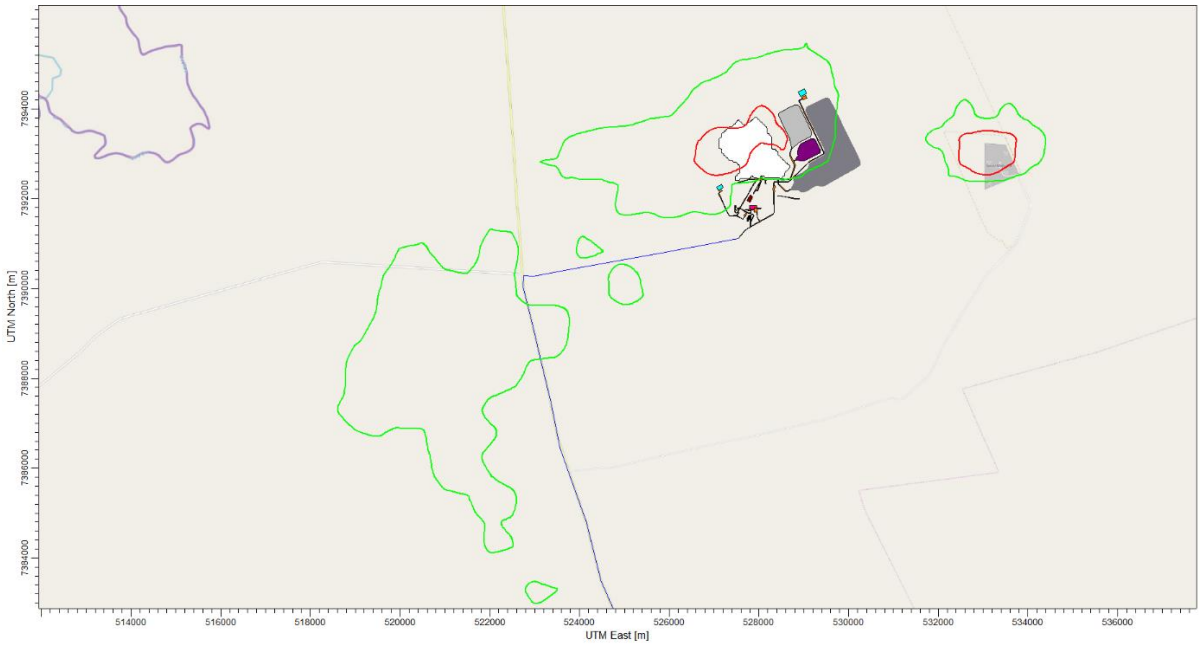


Figure 55: Air quality sensitivity map (unmitigated)

Predicted dust fallout impacts with the residential impact (600mg/m²/day) in green and the industrial (1200mg/m²/day) in orange. The area on the right is the Sasol Mafutha Mine

7.4.4.3 Carbon emissions

Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring. Based on the Carbon Dioxide Information Analysis Centre, the Environmental Sciences Division of the World Bank estimated that South Africa's annual carbon dioxide emissions are approximately 489 772 kt.

Based on a total LOM for the Gruisfontein Project effectively being 16 years, and an estimate of 48 million tons of coal available, it is estimated that the total carbon dioxide generated by the two Eskom

power stations the Gruisfontein mine will supply is 8 580 kt per year (137 280 kt over the LOM). This equates to a 1.75% contribution to the overall South African Carbon Footprint.

7.4.5 Ambient noise

Considering the ambient sound levels measured onsite, as well as the developmental character of the area, the acceptable zone rating level would be typical of a rural area (35 dBA at night and 45 dBA during the day) as defined in SANS 10103:2008.

The potential extent of the noise from construction and operational activities are presented in Figure 56.

The main findings of the impact assessment are:

- Construction activities will generate noise, but it will mainly be limited to the project site and adjacent properties. Noise levels will be less than 45 dBA during the day and less than 35 dB during the night. The projected construction noise levels are less than 35 dBA at all sensitive receptors. Noise levels only exceed 55 dBA close to the projected activities (within 250 m).
- Operational activities will generate noise, but it will mainly be limited to the project site and directly adjacent properties. Noise levels will be less than 45 dBA during the day at all sensitive receptors. Noise levels will be less than 35 dBA during the night at all sensitive receptors except for the residential receptors on Verloren Valey and Duikerpan. Mitigation is available to reduce the significance to a low significance.
- Final decommissioning activities will have a noise impact lower than either the construction or operational phases.

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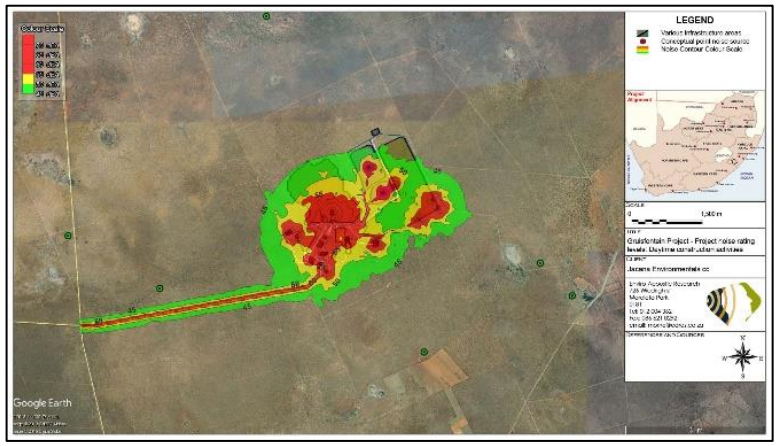
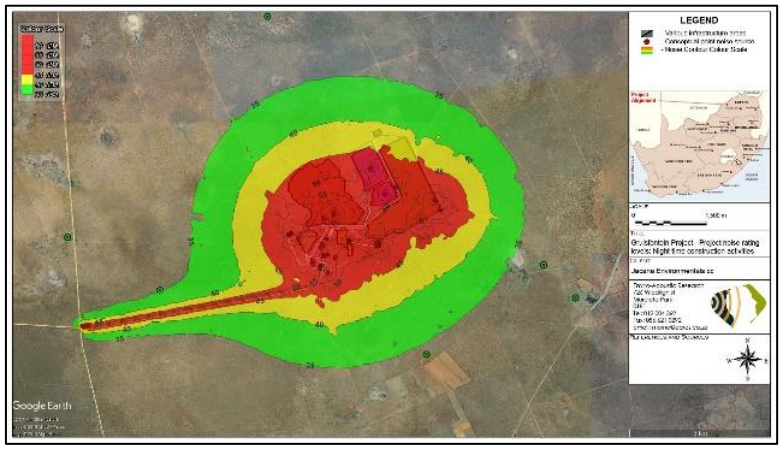
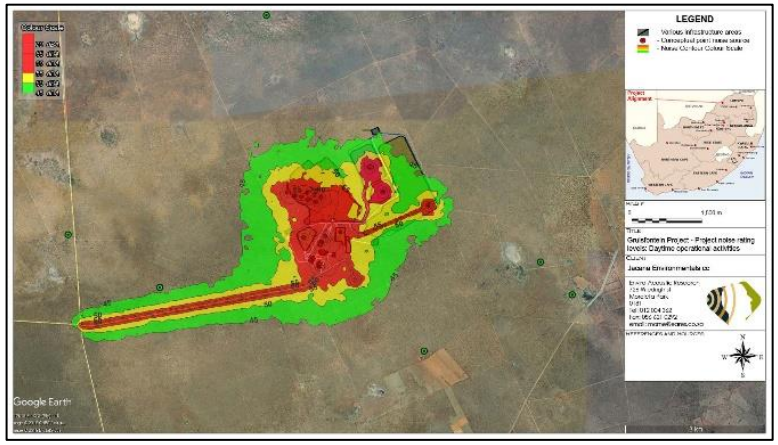


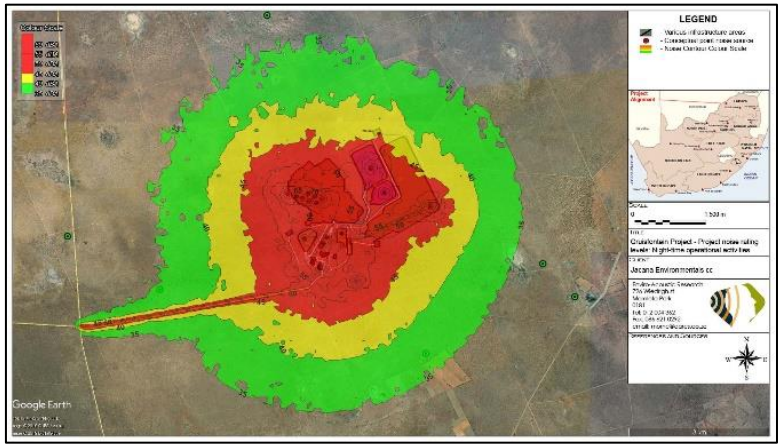
Projected conceptual daytime construction noise levels



Projected conceptual night-time construction noise levels



Projected conceptual daytime operational noise rating levels



Projected conceptual night-time operational noise rating levels

Figure 56: The potential extent of the noise from construction and operational activities

7.4.6 Blasting and vibration

Rock blasting will be required to break down rock and the coal resource. Blasting generates significant acoustic energy over a very short period of time and noise-sensitive receptors often raise blasting noises as a first concern. The blasting operation has the potential to yield secondary effects such as ground vibration, air blast, fly rock and fumes. These aspects could have a negative impact on the surrounding areas depending on the levels generated. The potential impacts considered can be described as follows:

- ***Ground vibration***: Levels greater than recommended limits may be damaging to structures. Different structures will also have different permitted levels. Ground vibration may cause damage if levels exceed the structures safe limit. People may experience ground vibration as perceptible at very low levels.
- ***Air blast***: In most cases the effect of air blast is underestimated. High levels of air blast could cause damage and normally windows are first to be damaged. Levels lower than required to induce damage may rattle windows and large roof surfaces. These effects are generally mistaken as ground vibration effect and leads to complaints. Rattling of doors and roofs is upsetting people.
- ***Fly Rock***: Fly rock can be mitigated but the possibility never eliminated. However, it can be managed properly with relative ease. Control on fly rock will also control the effects of air blast. Fly rock is greater concern when the pit is located in close proximity of houses or structures or installations.

The findings of the blasting impact assessment indicated that:

- Ground vibration levels may be disturbing (unpleasant) when blasting takes place within 3500m from residential houses (the unmitigated scenario). The impact on residences on Verloren Valey (west), Wynberg (north) and Duikerpan (2) (south) is of high significance if unmitigated – refer to Figure 57. As mitigation it is proposed that controlled blasting be done to keep the vibration levels at less than 2.54 mm/s within 3500 m from the blast.
- Ground vibration levels may pose a risk of damage to potential sensitive structures when blasting take place within 1600m from these structures (the unmitigated scenario). The impact on boreholes and agricultural structures on Gruisfontein and Duikerpan is of high significance if unmitigated – refer to Figure 57. As mitigation it is proposed that controlled blasting be done to keep the vibration levels at less than 25 mm/s at 1600 m from the blast.
- Airblast levels, while clearly audible to surrounding receptors, will be less than 120 dB and no mitigation is required.
- An exclusion zone for safe blasting was established to be at least 428 m. There are no risks of fly rock to people or residential structures but blasting close to the mine infrastructure may result in fly rock damage and the rock fragments may pose a risk to road users. Controlled blasting methods must be implemented to ensure blasted material is thrown away from mining infrastructure (Figure 58).

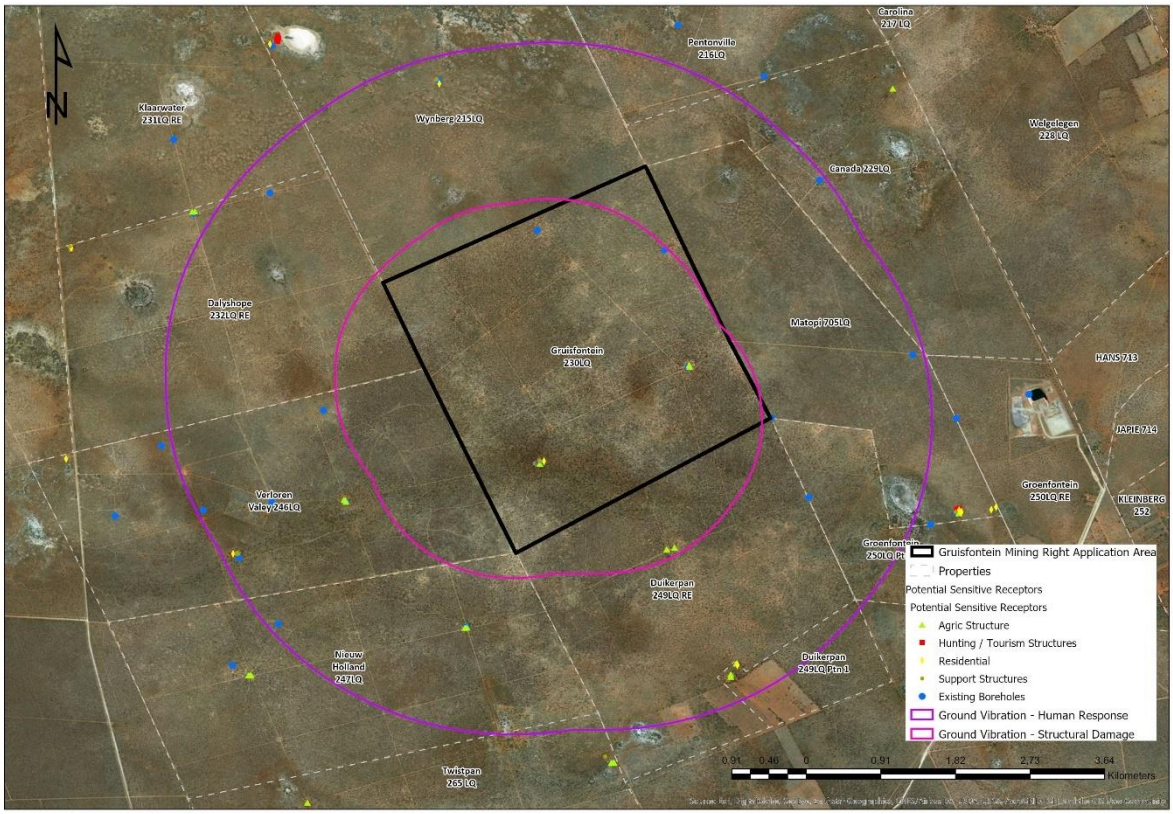


Figure 57: Projected Extend of Blasting Impacts – Ground vibration

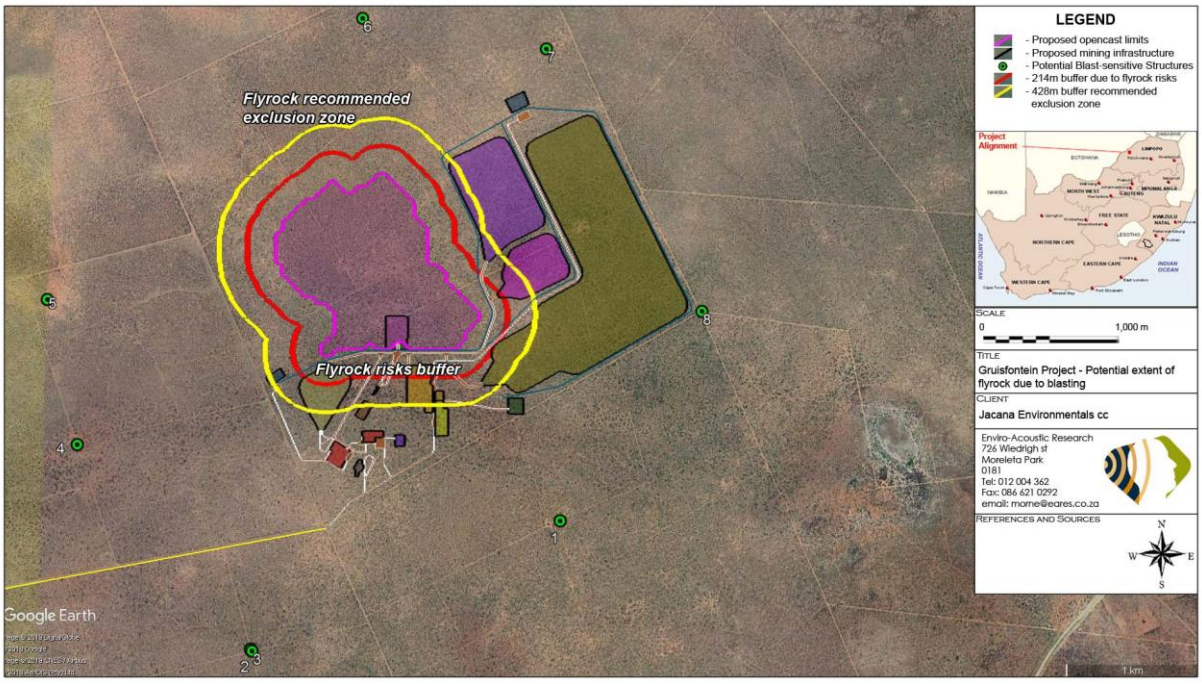


Figure 58: Projected Extend of Blasting Impacts – Fly rock risks

7.4.7 Cultural and heritage resources

No heritage sites of outstanding significance exist within the project area.

The Gruisfontein Project area probably contains subterranean Middle Stone Age (MSA) deposits. Stone flakes are only exposed by erosion or surface disturbances. The MSA is regarded as of low significance and can only be dealt with as chance finds when exposed.

The palaeontological study indicates that there is a very high likelihood of the occurrence of fossils, typically palaeoflora of *Glossopteris*, *Dadoxylon* and *Vertebraria* within the lower Karoo strata. The Lisbon Formation may contain trace fossils such as *Cruziana* and *Skolithos*, with also a possibility of dinosaur fossils such as *Euskelsaurus* and *Massospondylus*.

The property contains no outcrops or disturbances which exposes the underlying rock formations. The shales and coal beds will only be exposed during the mining operations, and it is therefore unlikely that fossils will be observed before the mining and associated infrastructure development takes place. A medium palaeontological sensitivity was allocated to the project area.

7.4.8 Traffic

The Traffic Impact Assessment (TIA) concluded that the road network surrounding the Gruisfontein Project will be able to handle the traffic, with no detrimental impact on the traffic on any of the relevant roads. Safety of other road users do require some intervention however, namely:

- Upgrade of intersection of Road D175 with Road D1675: a dedicated right turn lane on the eastern and western approaches (on D1675) to allow for the speed difference between the through traffic and slow-moving right-turning trucks and/or busses.

- Upgrade of delivery access to/from Medupi off Road D1675: a dedicated right turn lane on the western approach (on D1675 coming from the Steenbokpan) to allow for the speed difference between the through traffic and slow-moving right-turning trucks.

- A bitumen-based emulsion ("dust-a-side" or similar product) should be applied to the section of Road D175 between Road D1675 and the planned access to the mine, in accordance with a regular and official maintenance program.
- Spillage from loaded trucks between the mining area and the Medupi Power Station must be prevented as far as possible. Regular inspections and clean-up operations should be conducted.
- The loaded trucks should be covered to prevent spillage and hazards to other road users (tarpaulins).
- Speed and safety control of truck movements must be implemented, with specific reference regarding a 40km/h speed limit for truck movements within built-up areas and 80km/h on provincial roads with a regular monitoring process.

7.4.9 Socio-economic

Although the proposed Gruisfontein Project will have a potential negative impact on land value as well as employment and economic opportunities, the positive contributions from sustained employment and revenue generation from the project will significantly outweigh these over a period of 16 years. It should however be noted that with mitigation the mining infrastructure will be removed, and the area will be restored to agricultural land, in particular grazing, and the negative impacts will therefore be negated to a certain extent. Some of the land use activities may be able to resume at pre-mining levels although other activities will be at a reduced capacity due to the impact the project may have.

Table 51 presents a comparison between the estimated negative impact of the mine on current activities and the projected positive impact of the proposed mine together with the projected values of Low Household Income and direct employment opportunities.

The results show that although the proposed mine will impact negatively on the current land activities the net result is a positive improvement in benefits for the area. The current land use will suffer an economic loss of about 24.5%, but on the overall benefit the mine will produce in economic value, this

relates to 0.04% overall loss. The positive economic contribution to the Limpopo and National economies is an additional positive factor.

Table 51: Estimated Benefits Associated with the Operational Phase

Category	Total Current Land use (MRA & 1 km radius)	Potential Impacted Land-use (Cost)	Mine Development (Benefit)	Net Result Cost Benefit
Total estimated revenue generation per annum	R 5.02 million	-R 1 228 831	R 2.015 billion	R2.013 billion
NPV over life of mine at current values	R 39.3 million	-R 9 614 017	R 25.99 billion	R25.98 billion
Total direct employment generation	46	-8	500	492
Total estimated wages per annum	R 1.11 million	-R 203 450	R 240 million	R 239.8 million
Total wages to low income households per annum	R 892 391	-R 162 760	R 72 million	R 71.8 million
NPV of wages over life of mine at current values	R 8.7 million	-R 1 591 732	R 5.235 billion	R 5.233 billion

The proposed project may furthermore have a positive impact on Eskom power generation plant through a sustained and secure coal supply. The potential impact in the event that the project is not going ahead, may not significantly impact Eskom as alternative coal sources may be available.

On a national level, the project will support amongst others, following South Africa's strategies and initiatives:

- Elimination of poverty and reduction of inequality by 2030 as outlined in the NDP.
- Creation of five million jobs and reduce unemployment from 25% to 15% over the next ten (10) years as outlined on the New Growth Path (2010), which aims to address unemployment, inequality and poverty by unlocking employment opportunities in South Africa's private sector.
- State's drive towards ensuring greater economic growth, buoyant and sustained job creation and the eradication of poverty.

7.4.10 Cumulative Impacts

Cumulative impacts can be defined as the combined impact that a series of developments, either present, past or future, will have on the environment of the receiving landscape and surrounds, over a period of time.

In defining the expected cumulative impact towards which the proposed Gruisfontein Project will contribute, it is important to note its location within the Waterberg Coalfield, a region earmarked and targeted for mining development.

Existing large-scale infrastructure in the vicinity and within 50 km of the project area of the farm Gruisfontein include the significant Grootegeluk Colliery, Eskom's Matimba Coal Fired Power Station and Eskom's new Medupi Coal Fired Power Station which is currently under construction. Several other infrastructure projects, particularly mining-related projects, are also currently being considered for environmental authorisation and a number of other mineral rights (prospecting and mining rights)

are held by various companies in the region of the proposed Gruisfontein Project, as indicated in Figure 3.

Considering the number of prospecting and planned mining developments in the region and its location within an environmental zone designed in terms of the Waterberg District EMF as a mining focus area, it is highly likely that the current environment and landscape character will change to that of a more industrial and developed environment in the near future.

The potential cumulative impacts associated with the Gruisfontein Project include the impact on the following environmental aspects:

- Bulk water and power requirements
- Vegetation clearance and impact on the terrestrial ecology, including protected fauna and flora species
- Land use / land capability
- Groundwater drawdown impact zone
- Ambient air quality and noise levels
- Impact on Sense of Place and landscape character

The following cumulative socio-economic impacts need to be considered:

- Community health impacts
- Increased regional economic development and job creation
- Regional community development and investment (SLP)
- Increased traffic along provincial roads
- Social capital and services
- Infrastructure requirements and housing
- Water and sanitation

It is noted that several of the adjacent mineral right holders were consulted during the public participation process, including Anglo Operations, Exxaro and Sasol Mafutha Mining. The purpose of these meetings was to inform the mineral right holders of the proposed Gruisfontein Project and to request for the sharing of relevant environmental information to assist with the quantification of the cumulative impact in the region. Numerous requests were made to the said parties – please refer to records attached in Appendix 1-9.

Limited information was obtained, and hence the cumulative impact associated with the Gruisfontein Project in conjunction with the other planned mining developments in the region could not be quantified.

It would therefore be important, once all the EIA processes of the mineral right holders in the region have been concluded, to conduct a Regional Strategic EIA to determine the cumulative effects of the proposed mining developments in the area. This should be initiated by the Competent Authority, in conjunction with the relevant stakeholders and authorities responsible for the environment.

7.5 CONCLUSIONS AND RECOMMENDATIONS OF SPECIALIST REPORTS

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
Soils, Land Use and Land Capability	The study area comprises soils of the Ermelo (89% of the site) and Hutton (11 % of the site) soil forms. These soils are sandy in nature (the Hutton soils display a slightly higher silt content), deeper than 150 cm at all augering sites (approximately 724 holes were augered), exhibit good internal and external drainage (high saturated hydraulic conductivity), are uniform in colouration, do not contain rocks or layers impeding root development, do not contain free carbonates (*in situ* testing with a 10 % HCl solution was conducted) and no signs of regular water logging at any depth in the profile was noted. The soils fall into the arable land capability class. The soils can be irrigated if sufficient groundwater reserves are available (falls into Class2/3). Crop production under dry-land conditions is possible for crops adapted to a low rainfall and high evaporation environment. Sisal, ground nut and cotton are example of such crops – a detailed agricultural potential study based on precision farming principles should be conducted if crop production is to be considered. Most food crops, especially broad-leafed vegetables, will suffer under dry-land cultivation. The area comprises low potential arable soils when dry-land cultivation is the only option. If areas large enough in size for it to be economically viable (this will depend on crop type, market size, transport costs etc.) can be irrigated, the soils fall into the high potential arable land class. The reason why these soils do not fall into the grazing land capability class when dry-land crop production is the only option is because i) the criteria for assessing land capability classes does not include climatic conditions and ii) draught resistant plants such as sisal can be planted here. The proposed mining activities will impact arable soils that comprise deep soils of the Ermelo and Hutton soil forms. Impacts include stripping and stockpiling of topsoil and the compaction of soils during the construction of facilities such as discard dumps, overburden stockpiles, pollution and run-off control dams and any other possible footprint structures. Heavy machinery traffic on the soil surface and possible chemical pollution of soil through polluted water or seepage from certain geological materials could constitute further potential impacts on the soil. The farm is currently used as a game and cattle farm. The impact of the mining activities on the current land use will be high (significance rating of 44 for opencast area and 40 for infrastructure area). If mitigation and rehabilitation measures are to be implemented post-mining, the impact is predicted to be moderate to low (significance rating of 30 for opencast area and 9 for infrastructure area). The impact of the mining activities on the land capability will be high (significance rating of 48 for opencast area and 48 for infrastructure area). If mitigation and rehabilitation measures are to be implemented post-mining, the impact is predicted to be moderate to low (significance rating of 30 for opencast area and 9 for infrastructure area). The impact of the mining activities on the hydropedolgy will be high (significance rating of 52 for opencast area and 44 for infrastructure area). If mitigation and rehabilitation measures are to be implemented post-mining, the impact is predicted to be moderate to low (significance rating of 33 for opencast area and 10 for infrastructure area). Monitoring of soil quality should be done throughout the life or mine and post-closure. This entails assessing soil contamination levels at selected areas (i.e. the vicinity of pollution control dams, stockpiles, wash-bays etc.) as well	Mitigation measures were included as appropriate – refer to refer to Table 43 and EMPr. Soil monitoring is included in the monitoring programme – refer to Section 5 of the EMPr.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	as the fertility levels of stockpiled soils. A soil chemist should be contacted when contamination occurs, and remediation actions are needed. The soils of the Hutton and Ermelo soils can be stripped and stockpiled together. It is, however, important to stockpile the A- and B- and C/rocky-horizons separately. The soils should be placed in the pit, during rehabilitation, in such a way that the horizon sequence resembles that of the soil prior to excavation. This means, the C-horizon (rock and saprolite) must first be placed after which the B-horizon will be placed and lastly the A-horizon will be placed, thus ensuring the most fertile soil layer being on top and least fertile layer at the bottom.	
Terrestrial ecology (flora)	Three habitat units for the study area was defined based on the results of the field assessment, namely Sweet Bushveld A, Sweet Bushveld B and Degraded habitat. The ecological sensitivity of the habitat units varied between moderately high (Sweet Bushveld B), intermediate (Sweet Bushveld A) and moderately low (Degraded Habitat). The study area is largely in an undisturbed condition and the farm is well-managed as was evident with the low levels of bush encroachment in comparison to neighbouring farms. Within the study area, several NFA protected tree species are present, the majority of which were recorded within the southern section where most of the proposed mine infrastructure is proposed. The Gruisfontein coal mine project will thus impact not only on habitat integrity and floral diversity within the study area but will lead to a large reduction in the number of individual floral SCC. It is recommended that infrastructure within the southern-most section be reconsidered; however, new placements should not hinder habitat connectivity. The perceived impact significance of the proposed mining activities prior to mitigation affecting floral habitat, diversity and SCC are medium-low to medium-high significance impacts. If effective mitigation takes place, many of the impacts may be reduced to a low to medium significance rating. It is thus deemed essential that a cogently developed, documented and managed biodiversity management plan be implemented and maintained throughout the life of the proposed Gruisfontein coal mine. The objective of this study was to provide sufficient information on the floral ecology of the area, together with other studies on the physical and socio-cultural environment, in order for the EAP and the relevant authorities to apply the principles of Integrated Environmental Management (IEM) and the concept of sustainable development. The needs for conservation as well as the risks to other spheres of the physical and socio-cultural environment need to be compared and considered along with the need to ensure economic development of the country. It is the opinion of the ecologists that this study provides the relevant information required in order to implement IEM and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principle of sustainable development.	Mitigation measures were included as appropriate – refer to refer to Table 43 and EMPr. Terrestrial monitoring is included in the monitoring programme – refer to Section 5 of the EMPr. A Rescue & Relocation Plan will be developed for the floral and faunal SCC. A BAP will be developed as part of the management actions identified in the EMPr – refer to Section 3 of the EMPr. Note: The surface infrastructure will remain in the southern part of the farm, for reasons indicated in Table 10.
Terrestrial ecology (fauna)	Three habitats namely, Sweet Bushveld A, Sweet Bushveld B and Degraded Habitat are associated with the study area. With the exception of the Degraded Habitat unit, the habitat units were noted to be relatively intact, with high levels of habitat connectivity and currently sustaining a moderately high diversity of faunal species. Following the assessments, it can be concluded that the ecological sensitivity of the habitat units is moderately high (Sweet Bushveld A and Sweet Bushveld B) and moderately low (Degraded Habitat). However, the degraded habitat cannot be overlooked in terms of faunal importance as this habitat unit is associated with the current artificial water points	Mitigation measures were included as appropriate – refer to refer to Table 43 and EMPr. Terrestrial monitoring is included in the monitoring programme – refer to Section 5 of the EMPr.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	which are considered important for all species in the study area. The site assessment further indicated that several faunal SCC are likely to make use of the study area, either permanently or on a periodic basis whilst foraging. The presence of faunal SCC as well as the moderately high abundance and diversity of common faunal species from all classes further indicates that the overall importance of the study area and the habitat therein. The perceived impact significance of the proposed mining activities prior to mitigation affecting faunal habitat, diversity and SCC are predominantly of medium to high significance impacts. If effective mitigation takes place, many of the impacts may be reduced to a low to medium, however it must be noted that even with mitigation the loss of habitat through vegetation clearance will still be medium-high, as habitat will still be permanently lost. It is thus deemed essential that a cogently developed, documented and managed biodiversity management plan be implemented and maintained throughout the life of the proposed Gruisfontein coal mine. The objective of this study was to provide sufficient information on the faunal ecology of the area, together with other studies on the physical and socio-cultural environment, in order for the EAP and the relevant authorities to apply the principles of IEM and the concept of sustainable development. It is the opinion of the ecologists that this study provides the relevant information required in order to implement IEM and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principle of sustainable development.	A Rescue & Relocation Plan will be developed for the floral and faunal SCC. A BAP will be developed as part of the management actions identified in the EMPr – refer to Section 3 of the EMPr.
Terrestrial ecology (avifauna)	The habitat within which the proposed study area is located is relatively homogenous with little variation in sensitivity (rated to be moderate to high) from an avifaunal perspective. Areas that supported a density of non-Red List species (i.e. cattle feeding and drinking stations) are in fact degraded in habitat terms and unlikely to regularly support a diversity and/or abundance of Red List species. Although the site visit identified two nest locations on the Gruisfontein property, the presence of these do not necessarily increase the sensitivity of the project area given the species breeding at these locations. Therefore, there were no specific areas within the confines of the project boundary that were designated as highly sensitive no-go areas. The construction of the proposed Gruisfontein mine and its ancillary infrastructure will result in impacts of medium to high significance, which can be reduced to low to medium levels through the application of mitigation measures. It is anticipated that sustainable development of the proposed Gruisfontein Mine projects can be achieved with acceptable levels of impact on the resident avifauna subject to the following recommendations: • A pre-construction inspection (walk-through) of the final mine layout, road and powerline routes must be conducted to identify Red List species that may be breeding within footprint of the mine including the road and powerline servitudes to ensure that the impacts to breeding species are adequately managed. • The 22kV powerline must be constructed using a bird friendly structure (i.e. Inverted Delta-T Structure). • Additional mitigation in the form of insulating sleeves on jumpers present on strain poles, terminal poles and box transformers must also be considered. • Insulating material to be maintained during the operational life span of the 22kV powerline. • Should electrocutions occur within the on-site substation yard, mitigation can be applied reactively using a range of insulation devices. Site-specific recommendations should be sought from a suitably qualified avifaunal specialist, in conjunction with the Endangered Wildlife Trust's Wildlife & Energy Programme.	Mitigation measures were included as appropriate – refer to refer to Table 43 and EMPr. Avifaunal monitoring is included in the monitoring programme – refer to Section 5 of the EMPr. Pre-construction inspection to be conducted.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	• Every effort must be made to select a powerline route that poses the least risk to birds, avoiding key avifaunal habitat and where possible routing the proposed powerlines alongside other infrastructure in an effort to increase conductor visibility. • High risk sections of powerline must be identified by a qualified avifaunal specialist during the pre-construction inspection (walk-through) phase of the project, once the alignment has been finalized. If powerline marking is required, bird flight diverters must be installed according to industry standard guidelines. • Bird flight diverters to be maintained on sections of powerline during the operational life span of the powerline. • Construction activity should be restricted to the immediate footprint of the infrastructure. The recommendations of the ecological study must be strictly implemented. • Access to the remainder of the site must be strictly controlled to prevent unnecessary disturbance of Red List species. • Maximum use should be made of existing roads and the construction of new roads must be kept to a minimum. New roads are to be located in areas of existing high disturbance, and not encroach upon sensitive habitats. • Speed restrictions to be enforced for all vehicles within the study area to limit avifaunal collisions. • Awareness initiatives to educate road users about the presence of avifaunal species utilising the roads, particularly during dusk and dawn periods. • Should bird collisions with motor vehicles persist site-specific recommendations to be sought from a suitably qualified avifaunal specialist in conjunction with the Endangered Wildlife Trust's Wildlife & Transport Programme. • Bi-annual post construction monitoring to be conducted, using a variety of comparable survey techniques, to assess actual impacts, determine diversity trends & assess mitigation efficacy, particularly with regards to vultures. • In addition to this, the normal suite of environmental good practices should be applied, such as ensuring strict control of staff, vehicles and machinery on site and limiting the creation of new roads as far as possible.	
Groundwater	The affected area (i.e. groundwater depression cone) was simulated to increase throughout the life of mine from approximately 0.27 km^2 during year 1 to ±3.43 km^2 at the end of the 16th and final year of mining. Note that the water level impacts were simulated to remain within the MRA area. The water levels of outside user boreholes are consequently expected to remain unaffected by the proposed opencast mining at Gruisfontein. The maximum water level drawdown was simulated to increase from more or less 39 meters to a maximum of ±90 meters at mine closure. Water levels were simulated not to have fully recovered from the impacts of pit dewatering after a post closure simulation time of 50 years. The backfilled pit is consequently expected to remain a groundwater/contamination sink long after mine closure. Residual contamination from the rehabilitated surface source areas was simulated to migrate towards the pit, while contamination generated by the pit was simulated to remain restricted to its borders. The maximum plume concentrations were simulated to increase from approximately 20% at mine closure to ±60% at 50 years post closure, or 600 mg/l to 1 800 mg/l respectively if the source had a constant sulphate concentration of 3 000 mg/l.	Mitigation measures were included as appropriate – refer to refer to Table 43 and EMPr. Quarterly groundwater monitoring is included in the monitoring programme – refer to Section5 of the EMPr.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	Note that the groundwater quality impacts (i.e. contamination plumes) were simulated to remain within the MRA area and more specifically concentrated at the pit position. The water quality of outside user boreholes is consequently expected to remain unaffected by the proposed opencast mining and related activities. The expected time it will take the backfilled Gruisfontein pit to fill with water was calculated with the use of volume/recharge calculations to be in the region of 160 years post closure. Post closure decanting of the rehabilitated pit is expected to occur at a surface elevation of ±856 meters mamsl and at an estimated rate of approximately 150 m^3/d, or 1.7 l/s. Given the topography, geological profile and climate of the area it is our opinion that this water is not expected to daylight as actual decant. The pit water is expected to be of poor quality due to the high potential of the backfill material to generate sulphuric acid over the long term. Post closure recharge to the backfilled opencast pit is expected to be more or less seven times higher (10% of MAP) than the pre-mining figure of approximately 1.5%. The aquifer's response to this increase should be monitored and a dedicated water level monitoring borehole should ideally be drilled into the backfilled pit for this purpose. Groundwater monitoring (i.e. sampling and water level measurements) should be conducted at quarterly intervals and the schedule re-assessed by a qualified geohydrologist at a later stage in terms of stability of water levels and quality. If the sampling program requires changes, it should be done so in consultation with the appropriate authorities. Groundwater samples should be analysed at a SANAS accredited laboratory for chemical and physical constituents normally associated with a coal mining environment. Site specific geochemical tests should be conducted at Gruisfontein for confirmation of the acid generating potential of the underlying Karoo rocks. Twelve dedicated source monitoring boreholes are deemed necessary. Borehole positions should be finalised with the aid of a geophysical survey, preferably not magnetic. A borehole depth of 30 meters is usually sufficient in a coal mining environment. Steel casing should be inserted well through the loose weathered zone, and perforated PVC casing the full length/depth of the borehole. A concrete collar should be constructed around the completed borehole, which will help support the steel casing and prevent surface water runoff from flowing into the borehole. Boreholes should be completed with a lockable cap to prevent vandalism, and clearly marked in the field with a nameplate.	
Air quality	The modelled results presented in the tables above indicated the possible worst-case future concentrations of pollutants that can be found in the region as a result of the proposed mining activities. The worst case is derived from the emission sources not being mitigated and the concentration level is the second highest concentration calculated from the model.	Mitigation measures were included as appropriate – refer to refer to Table 43 and EMPr. Monthly dust fallout monitoring is included in the monitoring

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	For the entire Receptor Grid modelled, beyond the MRA boundary, the impacts from the Gruisfontein mine are below the ambient air quality standards. When combined with the current background concentrations monitored during the study, the results are still below the health criteria standards for ambient air quality. When the surrounding sources are included, the cumulative impact does show that exceedances do occur in the region. Overall the Gruisfontein Mine will likely contribute around 35% of the cumulative particulate matter load within the region. Based on the information provided, the baseline assessment and the impact assessment and modelling results, no impacts have been identified which would result in this project having a significant impact on the local environment. To this end, the mitigation measures identified need to be implemented to limit and further reduce impacts on the surrounding environment. Dust fallout modelling indicates areas where fallout is expected to exceed the permissible limits for residential and industrial areas, and it is recommended that dust fallout monitoring be undertaken to determine the effectiveness of the mitigation measures implemented.	programme – refer to Section 5 of the EMPr.
Noise	This ENIA covers the proposed development of a coal mine west of Lephalale, Limpopo. Conceptual scenarios were developed for the construction and operational phase with the potential noise rating levels calculated using a sound propagation model. The output indicated a potential noise impact of low significance during all phases of the project. Mitigation is not required, though generic measures are highlighted to ensure that noise generation is always managed. These measures may include: • Ensure a good working relationship between mine management and all potentially noise-sensitive receptors staying within 2,000m from the mine. • Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Engine bay covers over heavy equipment could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine bay should be considered, ensuring that the seam gap between the hood and vehicle body is minimised. • The operation should investigate the use of white-noise alarms instead of tonal reverse alarms on heavy vehicles operating on roads, within the plant and stockpile areas as well as the dumps. • The mine must implement a line of communication (i.e. a help line where complaints could be lodged). All potential sensitive receptors should be made aware of these contact numbers, or alternative means to communicate issues. The mine should maintain a commitment to the local community and respond to concerns in an expedient fashion. Sporadic and legitimate noise complaints could develop and if valid, should be investigated. • All employees and contractors should receive induction that includes an environmental awareness component (noise). This is to allow employees and contractors to realize the potential noise risks that activities (especially night-time activities) pose to the surrounding environment. It is the opinion of the Author that the increase in noise levels does not constitute a fatal flaw. It is therefore the recommendation that the project should be authorized (from a noise impact perspective).	Mitigation measures were included as appropriate – refer to refer to Table 43 and EMPr. Noise monitoring is included in the monitoring programme – refer to Section 5 of the EMPr.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
Blasting	The potential impacts of ground vibration, air blast levels and fly rock risks were determined using methods provided by the USBM. A site-specific blast design was not available, and two blast designs were conceptualised based on available information. In total four options were assessed, namely unmitigated options with up to 17 blast holes fired simultaneously for the average and maximum borehole depths, and mitigated options where controlled blasting (times blasts) are used to only fire one blast hole at a time. This assessment indicated that: • That ground vibration levels may be disturbing when blasting take place within 3,500m from residential houses (the unmitigated scenario). The impact may be of high significance and mitigation is available and proposed that will reduce the vibration levels to less than 2.54 mm/s within 3,500 m from the blast; • That ground vibration levels may pose a risk of damage to potential sensitive structures when blasting take place within 1,600m from these structures (the unmitigated scenario). The impact may be of high significance and mitigation is available and proposed that will reduce the vibration levels to less than 25 mm/s at 1,600 m from the blast; • Air blast levels, while clearly audible to surrounding receptors, will be less than 120 dB; • There are no risks of fly rock to people or residential structures but blasting close to the mine infrastructure may result in fly rock damage and the rock fragments may pose a risk to road users. Management measures are available to ensure the risks are minimised. The mine must know that community involvement needs to continue throughout the project. This is especially true for opencast mining projects close to residential dwellings. Blasting relates impacts are definite to upset the community and complaints will be one of the tools that the community may use to express their annoyance with the project, rather than a rational reaction to the vibration or air blast level itself. At all stages surrounding receptors should be informed about the project, providing them with factual information without setting unrealistic expectations. Even with the best measures, blasting related impacts will be perceived and the community members may complain. It is therefore in the best interest of the mine to continually monitor and manage the blast in an effort to improve and minimise potential blasting effects. It is however highly recommended that the mine conduct a detailed photographic survey at all houses and structures located within 3,500m from the mine (from the opencast boundary limit) before the construction phase start. This should include a survey of all water boreholes to determine the status of each borehole. It is concluded that, if the mine considers the recommendations in this report (incorporated in the Environmental Management Plan), that blasting risks do not constitute a fatal flaw. It is, therefore, the recommendation that the Gruisfontein Colliery is authorized (from a blasting impact perspective) subject to compliance with the conditions of the EMP.	Mitigation measures were included as appropriate – refer to refer to Table 43 and EMPr.
Traffic	It is concluded that the road network, surrounding the Gruisfontein Project, will, with the improvements identified in Section 4.2 of the report, be able to handle the traffic with no detrimental impact on the traffic on any of the relevant roads. It is therefore recommended that the proposed Gruisfontein Project, including the identified required road works and the project access road onto Road D175, be approved from a traffic point of view, by the relevant road	Mitigation measures and recommendations were included as appropriate – refer to refer to Table 43 and EMPr.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	authorities, on condition that all improvements be constructed to the applicable standards of the provincial authority. However, it is in addition recommended that negotiations between the operator of the Gruisfontein Project and the Roads Agency Limpopo (RAL) towards the identified improvements, should also allow for project specific agreement on the following matters: • Responsibility towards road maintenance, when transport trucks serving the Gruisfontein Project are found to be overloaded in terms of the applicable standard and required axle loads of the specific trucks. • Addressing and attending to possible spillage from loaded trucks between the mining area and the Medupi Power Station, such as suitable covering required for loads (tarpaulins) with a regular monitoring process. • Speed and safety control of truck movements, with specific reference regarding a 40 km/h speed limit for truck movements within built-up areas and 80 km/h on provincial roads with a regular monitoring process.	
Visual	From the findings of the VIA, it may be concluded that the proposed project will have an overall moderate to low significance visual impact on the receiving environment in its current condition, should effective mitigation measures be implemented. This is mainly due to the relative isolation of the project area in relation to sensitive visual receptors, the relatively short period (3 - 5 years) when infrastructure heights will be at a maximum, and importantly, the existing vegetation in the area that provides high levels of visual screening. The majority of infrastructure components, such as the CHPP and open pit, will be effectively obscured from view from the surrounding visual receptor sites identified, such as residential, tourism and hunting infrastructure on surrounding farms, regional and district roadways, and protected/ conservation areas. Adjacent landowners and residents utilising farm roads and natural bushveld areas on their properties may however be exposed to occasional views of infrastructure components below 30m in height, depending on their location in relation to the infrastructure. Although the proposed Long-term Discard Dump will serve to screen the CHPP, support infrastructure and various lower stockpiles from views from the northeast, east and southeast, this infrastructure is expected to reach a final height of up to 90m around Year 16 of the mining operation and may be at least partially visible up to 15km from the project area from all viewing directions during this time period (possibly up to 3 to 5 years), prior to backfilling taking place. The following mitigation measures should therefore be considered: • For vegetation screening to be effective, it is essential that as much existing vegetation present between the proposed Gruisfontein project footprint area and sensitive visual receptors remain intact. Although this requirement extends beyond the boundaries of the farm Gruisfontein, as much as possible should be done within the project area itself to avoid loss of vegetation, and particularly large trees, around project infrastructure and along the periphery of the site. • Backfilling of the open pit should commence as soon as possible, and it should be aimed that the maximum height of 90m of the proposed Long-term Discard Dump is never reached. • The proposed Long-term Discard Dump should be shaped to blend in with the environment as far as possible, as it increases in height and as more material is added (i.e. straight edges and corners should be avoided when viewed	Mitigation measures and recommendations were included as appropriate – refer to refer to Table 43 and EMPr. Visual monitoring is included in the monitoring programme – refer to Section 5 of the EMPr.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	in profile), particularly once the Discard Dump reaches a height where skylining or changes to the horizon may occur. • Vegetation growth on the Discard Dump should be encouraged, and if necessary, facilitated, through revegetation with a locally indigenous seed mixture to mitigate short-term visual infrastructure once the Discard Dump reaches its maximum height. Night-time lighting within the area with its low district brightness, should be carefully managed to prevent night-time visual impacts by implementing, amongst others, the following mitigation measures: • As much existing vegetation around the proposed infrastructure as possible should be retained to screen night-time lighting at ground level. • Placement of material on infrastructure such as discard dumps of increased heights during the night-time should be avoided. • A lighting engineer should be consulted to assist in the planning and placement of light fixtures. • Placement of lighting outside of the project area should be avoided or strictly limited. • All outdoor lighting must be strictly controlled, and lighting shields installed where required. • Movement-activated lighting should be installed for security purposes at offices and workshops to prevent use of lights when not needed. • The type of luminaries used should be carefully considered. • The use of high light masts and up-lighting of structures should be avoided to reduce sky glow. • Lighting use should be minimised during construction and night-time operations. Localised and portable lighting should be used where and when the operations or maintenance work is occurring. • Off-site hauling of product should be limited to daylight hours. Once mining activities have been completed, the following must be ensured: • All surface infrastructure, including signage and temporary, moveable infrastructure, must be removed from site (unless otherwise agreed with stakeholders). • All surface dumps and stockpiles must be completely removed by using this material as backfill in the open pit. • The open pit must be completely backfilled, shaped to follow natural contours and be stable. • All bare and impacted areas must be sufficiently graded, shaped and vegetated to blend in with the surroundings. • Revegetation, using locally indigenous species, must take place to a high standard to ensure that pre-mining land uses are achieved as far as possible. It should however by noted, that visual contrast within the project area itself (which, at ground level, will not be highly visible to surrounding receptors) is likely to result in a long-term, residual visual impact, as the pre-development vegetation structure, composition and height is unlikely to be achieved in the short to medium-term. • AIP control and management must take place during all development phases and continue post-closure.	

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	• Soft erosion control measures must be implemented if required where erosion risks exist, or erosion control measures put in place during the operational phase of the project should remain in place where applicable. Based on the findings of this VIA, it has been determined that sufficient information is available to guide the competent authority in the decision-making process from a visual perspective. Based on the available information and visual analyses set out in this report, no foreseeable fatal flaws are associated with the project from a visual impact perspective, provided that effective mitigation measures be implemented, and potential residual visual impacts managed throughout the life of the project. In this regard specific mention is made of planning for rehabilitation and revegetation from the time of project initiation.	
Cultural heritage	The Gruisfontein Project area probably contains subterranean Middle Stone Age (MSA) deposits. The MSA is regarded as of low significance and can only be dealt with as chance finds when exposed. From a heritage management perspective there is no reason why the proposed development may not continue subject to the recommended mitigation measures. From a heritage resources management point of view, we have no objection with regard to the development. The discovery of undetected heritage remains must be reported to the archaeologist, who will then comply with the necessary legal requirements.	Mitigation measures and recommendations were included as appropriate – refer to refer to Table 43 and EMPr. A qualified archaeologist must monitor excavation activities during construction and topsoil stripping over the LOM to identify any undetected sub-surface sites.
Palaeontology	This study indicates that there is a very high likelihood of the occurrence of fossils, typically palaeoflora of *Glossopteris*, *Dadoxylon* and *Vertebraria* within the lower Karoo strata. The Lisbon Formation may contain trace fossils such as *Cruziana* and *Skolithos*, with also a possibility of dinosaur fossils such as *Euskelsaurus* and *Massospondylus*. The property contains no outcrops or disturbances which exposes the underlying rock formations. The shales and coal beds will only be exposed during the mining operations, and it is therefore unlikely that fossils will be observed before the mining and associated infrastructure development takes place. The developer of the mining project must be made aware of the fact that coal mining is by definition the mining of fossil plant material. Once the open pit mining commences, the developer should appoint a recognised suitably qualified palaeontologist to re-assess the palaeontology of the operation in order to develop a protocol for further assessments and/or chance fossil finds. Any fossils such obtained should be deposited with a recognised authority such as the Council for Geoscience, Bernard Price Institute for Palaeontology or the Department of Geology and Mining, University of Limpopo.	Mitigation measures and recommendations were included as appropriate – refer to refer to Table 43 and EMPr. Once the open pit mining commences, the developer should appoint a recognised suitably qualified palaeontologist to re-assess the palaeontology of the operation in order to develop a protocol for further assessments and/or chance fossil finds.
Socio-economic	Recent legislation in South Africa, such as the Broad-Based Socio-Economic Empowerment Charter (BBSEEC) for the Mining Industry and the Mineral and Petroleum Resources Development Act (MPRDA) have confirmed the requirement for mining companies to assess the social impacts of their activities from start to closure, and beyond. Unless a mining operation has considered the social impact and documented it, the Department of Minerals	Mitigation measures and recommendations were included as appropriate – refer to Table 43 and EMPr.

Aspect	Conclusions/Recommendations	Notes / Deviations from Recommendations
	Resources (DMR) will not issue a mining right to the applicant (MPRDA Regulations, 2002). Mining companies also have to compile and implement a Social and Labour Plan (SLP) to promote socio-economic development in their affected communities and to prevent or reduce negative social impacts. Therefore, although the growth of the South African economy is of strategic importance, consideration should be given to social and natural resources when considering proposed developments. In view of the concept of sustainability the proposed project will have to contribute towards achieving sustainable development whilst contributing towards achieving these higher-level objectives. Although the proposed Gruisfontein Project will have a potential negative impact on land value as well as employment and economic opportunities, the positive contributions from sustained employment and revenue generation from the project will significantly outweigh these over a period of 16 years. It should however be noted that with mitigation the mining infrastructure will be removed, and the area will be restored to agricultural land, in particular grazing, and the negative impacts will therefore be negated to a certain extent. Some of the land use activities may be able to resume at pre-mining levels although other activities will be at a reduced capacity due to the impact the project may have. The proposed project may furthermore have a positive impact on Eskom power generation plant through a sustained and secure coal supply. The potential impact if the project is not going ahead, may not significantly impact Eskom as alternative coal sources may be available. From an economic perspective it is recommended that the project proceed as it will positively contribute towards the local, regional and national economy through its capital investment, creation of employment opportunities and revenue generation potential. The project is also in line with National, Provincial and Local development planning. On a national level, the project will support amongst others, following South Africa's strategies and initiatives: • Elimination of poverty and reduction of inequality by 2030 as outlined in the National Development Plan. • Creation of five million jobs and reduce unemployment from 25% to 15% over the next ten (10) years as outlined on the New Growth Path (2010), which aims to address unemployment, inequality and poverty by unlocking employment opportunities in South Africa's private sector. • State's drive towards ensuring greater economic growth, buoyant and sustained job creation and the eradication of poverty. Implementing management measures and commitments as outlined in the EMPr will ensure that the project is executed within the framework of sustainable development, which will ensure that potential negative impacts are minimised, and positive impacts enhanced.	The social management plan will be implemented and reviewed on a regular basis.

7.6 ASSUMPTIONS, UNCERTAINTIES AND KNOWLEDGE GAPS

7.6.1 Terrestrial Ecology (Flora)

- The floral assessment is confined to the study area and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment.
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral communities and populations had been accurately assessed and considered and the information provided is considered sufficient to allow informed decision making to take place and facilitate integrated environmental management.
- Sampling by its nature means that not all individuals are assessed and identified. Some species and taxa within the study area may, therefore, have been missed during the assessment. This is particularly relevant within arid regions where many floral species only respond to a good rain event, e.g. many bulbous plants only emerge and flower after sufficient rains.
- A single field assessment was undertaken from the 22nd to the 23rd of January 2019 (summer season), to determine the ecological status of the study area, and to "ground-truth" the results of the desktop assessment. A more accurate assessment would require that assessments take place in all seasons of the year. However, on-site data was significantly augmented with all available desktop data, together with project experience in the area, and the findings of this assessment are an accurate reflection of the ecological characteristics of the study area.

7.6.2 Terrestrial Ecology (Fauna)

- The faunal assessment is confined to the study area and does not include the neighboring and adjacent properties; these were however considered as part of the desktop assessment.
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal communities have been accurately assessed and considered and the information provided is considered sufficient to allow informed decision making to take place and facilitate integrated environmental management.
- Due to the nature and habits of most faunal taxa, the high level of surrounding anthropogenic activities, it is unlikely that all species would have been observed during a field assessment of limited duration. Therefore, site observations were compared with literature studies where necessary.
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the study area may therefore have been missed during the assessment.
- A single field investigation was undertaken from the 22nd to the 23rd of January 2019 (summer season), to determine the ecological status of the study area, and to "ground-truth" the results of the desktop assessment. A more accurate assessment would require that field investigations take place in all seasons of the year. However, on-site data was significantly augmented with all available desktop data, together with project experience in the area, and

the findings of this assessment are an accurate reflection of the ecological characteristics of the study area.

7.6.3 Terrestrial Ecology (Avifauna)

- The avifaunal report is the result of a short-term study and is based on a three-day site visit to the proposed development area. No long-term, seasonal monitoring was conducted by the avifaunal specialist**.** This assessment relies upon secondary data sources with regards to bird occurrence and abundance such as the SABAP2 and IBA projects. These comprehensive datasets provide a valuable baseline against which any changes in species presence, abundance, and distribution can be monitored. However, primary information on bird habitat and avifaunal species occurrence collected during the site visit and together with professional judgement, based on extensive field experience since 2006, was used directly in determining which species of conservation importance are likely to occur within suitable avifaunal habitat types within the proposed development area. Based on these findings, the specialist was able to identify and assess the anticipated impacts and provide recommendations for mitigation.
- The site visit to the study area and the resultant observations were made in a single season (i.e. winter), during which time various species may not have been present in the study area and therefore may not be a true indication of all bird species potentially present in the area.
- By virtue of their mobility, the assessment of bird presence and abundance cannot be confined to the proposed Gruisfontein project site, therefore the study area was defined as a 2 km zone around the proposed development area. Avifaunal sensitivity has been defined for this study area i.e. the proposed Gruisfontein project site in addition to the 2km zone surrounding the proposed development.
- Although the proposed Gruisfontein mine and its ancillary infrastructure are located largely within a single pentad grid cell (2330_2715), a larger area is necessary to obtain a dataset that is large enough (encompassing nine pentad grid cells) to ensure that reasonable conclusions about species diversity and densities, in a particular habitat type, can be drawn. Coverage by SABAP2 has not been as extensive with a total of 20 full protocol data cards being completed across seven of the nine pentads. These surveys should provide a reasonably accurate snapshot of the avifauna in the study area but are unlikely to be an accurate reflection of the true densities within the pentads.
- The focus of this assessment is primarily on the potential impacts on regional Red List and priority species i.e. species that are vulnerable to the displacement and collision impacts associated with the construction and operation of the proposed Gruisfontein mine and its ancillary infrastructure. The impact on non-Red List species is also assessed, albeit in less detail. Furthermore, much of the mitigation recommended for Red List species will also protect non-Red List species in the study area.
- The routing and proposed structure configuration for the grid connection (i.e. 22kV powerline) was not available for assessment. This is a potentially serious limitation since the powerline could potentially pose a collision and electrocution risk to birds.
- Predictions in this study are based on experience of these and similar species in different parts of South Africa, through the authors' experience working in the avifaunal specialist field since 2006. However, bird behaviour can't be reduced to formulas that will hold true under all circumstances. It must also be noted that, it is often not possible to entirely eliminate the risk

of the disturbance and displacement impacts associated with the construction and operational activities. Our best possible efforts can probably not ensure zero impact on birds. Assessments such as this attempt to minimise the risk as far as possible, and although the impacts associated with the proposed developments will be unavoidable, they are likely to be temporary and of medium to low significance.

- The above limitations need to be stated as part of this assessment so that the reader fully understands the complexities. However, they do not detract from the confidence that this author has in the findings of this impact assessment report and subsequent recommendations for this project.

7.6.4 Groundwater

The numerical groundwater model, despite all efforts and advances in software and algorithms, remains a very simplified representation of the very complex and heterogeneous interacting aquifer systems underlying the project area. The integrity of a numerical model depends strongly on the formulation of a sound conceptual model and the quality and quantity (distribution, length of records etc.) of input data.

Nonetheless, a numerical model can still be used quite successfully to assess the effectiveness of various management and remediation options/techniques, especially if the shortcomings in information and assumptions made in the construction and calibration of the model are clearly listed and considered by the modeller during modelling.

The main purpose is thus not to try and predict what the exact groundwater level or quality would be at a certain position at a specific moment in the future. The heterogeneity of the natural groundwater system is simply too great to accurately incorporate and simulate accurately in the model. The purpose is therefore to rather evaluate what the relative magnitude or contribution of certain impacts would be on the larger groundwater regime.

7.6.5 Air Quality

- As no long term on-site, meteorological data was available during the current investigation, it was decided to make use of measured data from the South African Weather Services Lephalale Meteorological Station to describe the micro meteorological aspects of the area.
- All information provided regarding mining rates, infrastructure layouts and mining methodology is assumed to be correct.

7.6.6 Ambient Noise

While it is difficult to define the character of a measured noise in terms of numbers (third octave sound power levels), it is difficult to accurately model noise levels at a receptor from any operation. The projected noise levels are the output of a numerical model with the accuracy depending on the assumptions made during the setup of the model. The assumptions include the following:

- That octave sound power levels selected for processes and equipment accurately represent the sound character and power levels of these processes and equipment. The determination

of octave sound power levels is subject to errors, limitations and assumptions with any potential errors carried over to any model making use of these results.

- Sound power emission levels from processes and equipment changes depending on the load the process and equipment is subject to. While the octave sound power level is the average (equivalent) result of several measurements, this measurement relates to a period that the process or equipment was subject to a certain load (work required from the engine or motor to perform action). Normally these measurements are collected when the process or equipment is under high load. The result is that measurements generally represent a worse-case scenario.
- As it is unknown which processes and equipment will be operational (when and for how long), modelling considers a scenario where processes and equipment are under full load for a set time period. Modelling assumptions complies with the precautionary principle and operational time periods are frequently overestimated. The result is that projected noise levels would be likely over-estimated.
- Modelling cannot capture the potential impulsive character of a noise that can increase the potential nuisance factor.
- The XYZ topographical information is derived from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global DEM data, a product of Japan's Ministry of Economy, Trade, and Industry (METI) and the National Aeronautical and Space Administration (NASA). There are known inaccuracies and artefacts in the data set, yet this is still one of the most accurate data sets to obtain 3D-topographical information.
- The impact of atmospheric absorption is simplified, and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify.
- Acoustical characteristics of the ground are over-simplified with ground conditions accepted as uniform. Fifty percent (50%) soft ground conditions will be modelled as the area where the construction activities are proposed is well vegetated and sufficiently uneven to allow the consideration of soft ground conditions.

7.6.7 Blasting

It is not the purpose of this assessment to calculate exact vibration levels, or the precise level of the air overpressure but to use various tools to identify potential issues of concern. Due to unknowns this assessment leans towards a precautious approach, rather over-estimate the distance that fly-rock may travel, the ground vibration or the level of an air blast. However, the following assumptions and limitations must be noted:

- No blast design report was available for this project, though a blast design was available for a proposed project in the area. Information was identified and used from this blast design report to ensure that a worst-case scenario was assessed.
- This impact assessment does not make a statement on the acceptability of the blast design (viable bench height, fracturing, powder factors, etc.) and only assesses the potential impacts considering the available information.
- A square blast pattern (diamond tie-in for timing the blast) is considered for the mine.

- A delay of 25ms per charge (with a maximum of 17 holes per charge) will be used in the unmanaged situation as reported. The managed situation would be the blasting of 1 hole per charge using delays.
- None of the structures were visited to confirm the status of each house. It is highly recommended that the mine complete a survey of all structures and boreholes (location, depth, yield, static water level, ground water quality, usage, etc.) located within 2,000 m from the proposed opencast limits to determine the status and state of the structures before the construction of the mine start.
- There is a dwelling located within the mining infrastructure area. It is accepted that the mine will resettle the residents.
- Stemming will be between 20x borehole diameter and 1x the burden to manage blasting impacts. The stemming material will be an 8 – 13 mm aggregate.
- Overburden (hard overburden from surface to first coal seam) range between 20 and 31 m. This assessment will consider the average borehole depth (discussion, Mr. Michael Wright) as well as the potential maximum blast borehole (31 m).
- Attenuation rates for ground vibration levels, air blast levels and fly rock distances are site-specific. Empirical formulas have been developed by several researchers, yet all these equations use constants that should be developed considering site specifics. These site constants can initially be assumed but should be refined considering the results of blasting vibration and air pressure measurements. This data must be analysed and with the information used to update this report.
- Calculations are based on an ideal situation, with the bedrock having constant characteristics, whereas in practice the geology is complex with faults, dykes, folds, stratigrapical layers etc. This means that each blast may different.
- This report assumed that blasting will take place during the afternoon when atmospheric conditions are the most unstable; a potential inversion layer is high with no overcast conditions

7.6.8 Visual

- No specific visual specialist guidelines exist for the Limpopo Province specifically and therefore, the Guidelines for Involving Visual and Aesthetic Specialists in the EIA Process (Oberholzer, 2005), prepared for the Western Cape Department of Environmental Affairs and Development Planning (DEA & DP) was used in determining the development category and the level of visual input required, and as a general guideline in developing the VIA.
- Assessing visual impacts always contain an element of subjectivity and certain aspects are based on the informed judgement of the assessor. As such, visual impacts may be difficult to assess or quantify because a person's perception is affected by more than only the immediate environmental factors and because visual and scenic resources often have cultural or symbolic meaning (Oberholzer, 2005).
- All desktop information contained in this study and databases consulted, as well as the input data such as proposed infrastructure heights, are based on the most recent information available and are assumed to be accurate at the time of assessment.

- Although the proposed stockpiles and discard dumps may never reach the stipulated final design heights as indicated in the report due to this material being used in progressive backfilling, the worst-case scenario was considered in developing viewsheds and elevation profiles and in assessing the potential visual impacts.
- Not all properties where potential sensitive visual receptors reside (and where important potential observation points are located) could be accessed at the time of assessment due to property owners and residents being out of town. Such properties include certain residential and tourism structures located within 5 km of the proposed project, such as the residence on the farm Pentonville, located approximately 3.75 km north of the project area, the hunting lodge of the farm Wynberg, located approximately 3.2 km northeast of the project area and the residence (labour tenant) on the farm Duikerpan, located around 2.43 km south of the project area.
- Due to the wide distribution of residential buildings, outbuildings, support infrastructure and hunting/ tourism destinations in the area, beyond 5km of the project, field verification of these locations and determination of the visual exposure at these locations were not undertaken.
- The study does not include an assessment of the visual impact beyond the border of South Africa, although the viewshed generated extends into neighbouring Botswana.

7.6.9 Cultural Heritage

No limitations were experienced but it must be noted that archaeological remains are generally subterranean and may have been missed. Such remains may only become visible during disturbances.

7.6.10 Socio-economic

- Data accuracy: The information supplied in relation to baseline employment, agricultural activities, size of farming area and crop yield were based on information collected during a social scan undertaken. It is assumed the information is accurate close to accurate. The information supplied by the applicant in relation to employment and revenue and closure liability for the proposed mining development is assumed to be accurate. Information, which were used in some calculations, were sourced from third parties. Errors with this information could possible effect the results of the calculations and therefore the assessment.
- Land values: Land values were based on average land values according to property valuation tables within the Lephalale area. The true value of the land is however determined by a range of factors and could therefore most likely be higher or lower than the value used in this report.
- Period: The economic assessment was based on period of potential impact of 16 years.
- NPV: A discount rate of 10% was utilised in all NPV calculations.
- Agricultural Activities: NPV and PV calculations for agricultural activities were determined over a period of 16 years, which excluded 2 years for permitting and licensing and excluded 3 years for downscaling and rehabilitation.
- Wage Rates: Wages for the farm workers were based on rates provided by the Department of Labour (2018). Wages for mine employees were based on the labour values included in the

Mine Works Programme. No temporary or seasonal employment was considered in calculating the employment value for agricultural activities.

- Gruisfontein Revenue & Employment: The revenue and employment figures provided for the opencast and plant activities only made provision up to Year 10, even though the life of these activities will be 16 years. The provided current term numbers were therefore applied to the remaining 6 years before the PV and NPV calculations were made.
- Strategic importance of the project and no-go option: It is assumed that the strategic importance of the project, is supported by the national and provincial government and therefore their policies.
- Technical suitability: It is assumed that the Gruisfontein Coal Project and its sites identified represent a technically suitable site.
- Financial Sustainability: It is assumed that the Applicant, which has assessed the need for the Project, has produced a business case determining financial sustainability. This SEA has therefore not evaluated these aspects of the Project.
- Information available: This study was carried out with the information available to the specialists at the time of executing the study, within the available timeframe and budget. The sources consulted are not exhaustive and additional information which might strengthen arguments or contradict information in this report might exist.
- Evidence-based Approach: The specialists did endeavour to take an evidence-based approach in the compilation of this report and did not intentionally exclude scientific information relevant to the assessment.
- Socio-economic Sensitive Environments: Areas that might yield socio-economic sensitivities have been identified through a desktop study utilising available Mapping, Orthophotos and Google Earth™, and where possible verified with landowners. The areas that have been marked are the sensitive areas visible to the socioeconomic specialists at the time of the study, which are near the proposed project location under investigation.
- Demographic data: The demographic data used in the study is largely based on the 2011 Census. While this data does provide useful information on the demographic profile of the affected area, the data are dated and should be treated with care. Where possible, reference is made to the latest demographic data contained in local Integrated Development Plans and other documents.
- Sense of Place: Assessment of the impact on sense of place is based on the specialist's opinion as sense of place is a very personal experience and is not easily measurable.
- Decommissioning Impacts: Socio-economic impacts associated with the eventual decommissioning of the mine at the end of its life are briefly discussed but are not subject to detail assessment. This omission is motivated by the fact that predictions concerning the characteristics of the receiving socio-economic environment at the time of decommissioning are subject to a large margin of error, thus significantly reducing the accuracy of the impact assessment.

8 DETAILS OF PUBLIC PARTICIPATION PROCESS

The Public Participation Report is attached as Appendix 1 and reflects the Public Participation conducted to date. It should be noted that the Public Participation Process has not yet been concluded and will be further implemented in line with legislative requirements for the EIA and decision-making Phases.

Below a summary of the Public Participation Process to date.

8.1 PUBLIC PARTICIPATION TO DATE

8.1.1 Register of Interested and Affected Parties

A preliminary list of potential IAPs was compiled during September 2018 and updated during the process. The register includes all relevant Government Departments and other agencies, landowner, neighbouring landowners, communities and Environmental Interest groups/NGO's.

The following Authorities are included in the IAP Register due to their relevancy to the project:

- Limpopo Department of Mineral Resources (DMR)
- Limpopo Department of Economic Development, Environment and Tourism (LEDET)
- Limpopo Department of Water and Sanitation (DWS)
- Limpopo Department of Rural Development and Land Reform (DRDLR): Regional Land Claims Commission
- Limpopo Department of Agriculture, Forestry and Fisheries (DAFF)
- Limpopo Department of Roads and Transport (DRT)
- Limpopo Department of Transport
- Waterberg District Municipality
- Lephalale Local Municipality

Additional Authorities and Agencies included in the IAP register are:

- South African Heritage Resource Agency (SAHRA)
- Limpopo Heritage Resource Agency (LIHRA)
- Environmental NGO's and Advocacy Groups
- Business Associations
- Hunters Associations
- Farmers Associations

The IAP register will be maintained and updated throughout the process as required by the 2014 EIA Regulations, as amended in 2017. Refer to Appendix 1-1 for a copy of the IAP Register.

8.1.2 Written Notice of Application

The following written notifications were sent prior to and in the announcement of the project and application:

- Introduction to the Project and Specialist Access Request (Appendix 1-2)
- Notice of Intent to apply for a Mining Right and Background Information Documents (BID) (Appendix 1-3)
- Mining Right and integrated EA application, and the availability of the DSR (Appendix 1-3)
- Availability of the FSR (Appendix 1-3)

Table 52: Notification table

Stakeholder Group	IAP	Method of Notification	Date of Notification
Organs of State	Relevant Authorities contained in the Authority Register	Notification & BID emailed	5 April 2019
		Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
		Notification of the availability of the FSR	11 June 2019
Municipalities	District and Local Municipalities as contained in the IAP Register	Notification & request for meeting Notification & BID emailed	26 Sept 2018 5 April 2019
		Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
		Notification of the availability of the FSR	11 June 2019
Landowner, Lawful Occupier, Community	Landowners identified as contained in the Property Register	Notification of specialist access & request for introductory meeting Advertisement placed / On-site notices Notification & BID emailed	26 Sept 2018 5 April 2019 5 April 2019
		Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
		Notification of the availability of the FSR	11 June 2019
	Traditional Authorities / Leaders	Not applicable	-
	Communities	Advertisement placed / On-site notices Notification & BID emailed / hand-delivery	5 April 2019 4-5 April 2019
		Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
		Notification of the availability of the FSR	11 June 2019
Other IAPs	Environmental NGO's / Conservation Organisations	Advertisement placed / On-site notices / Notification & BID emailed	5 April 2019
		Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
		Notification of the availability of the FSR	11 June 2019
	Other, as registered	Advertisement placed / On-site notices / Notification & BID emailed	5 April 2019
		Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
		Notification of the availability of the FSR	11 June 2019

The announcement of the intent to submit the Mining Right application was sent to all IAPs and contained the following information:

- Details of the proposed application which is subjected to public participation
- Explanation of the proposed project's nature, location and planned activity
- Stating the required regulated processes in terms of the relevant legislations
- Stating where further information on the application can be obtained
- Stating the manner in which a person can become involved / register as an IAP

8.1.3 Advertisements

The following advertisements (Appendix 1-4) were placed for announcing the project and application:

Table 53: Advertisement Table

Type of Media	Name of Media	Distribution	Date of placement
Newspaper	Mogol Post	Limpopo Province	5 April 2019

8.1.4 On-Site Notifications

The following on-site notifications (Appendix 1-5) were placed for announcing the project and application:

Table 54: On-site notices table

Location of Notice	Name of Location	Coordinate of Placement	Date of placement
Project Property Boundary	Gruisfontein Farm Gate	23.5902781°S; 27.2697844°E	4 April 2019
Neighbouring Communities	Road at Gruisfontein Turn-off	23.5984611°S; 27.2225083°E	4 April 2019
Public Places	Steenbokpan General Dealer	23.7097631°S; 27.2736321°E	4 April 2019
	Lesedi Multi-purpose Centre	23.7153675°S; 27.2784599°E	4 April 2019

8.1.5 Availability of Project Documentation

The following documents were made available during the process:

Table 55: Public Documents table

Document	Timeframe	Date of availability	Date of comment closure
BID & Registration Form	Pre-Application Phase	5 April 2019	18 April 2019
Draft Scoping Report	Scoping Phase	25 April 2019	28 May 2019
Final Scoping Report	Scoping Phase	11 June 2019	N/A

8.1.6 IAP Engagements and Meetings

The following engagements took place and records are attached as follows:

- Introduction to the project and specialist access request (Appendix 1-2)
- Notice of intent to apply for a Mining Right application and BID (Appendix 1-3)
- Notice of Mining Right and EA application, and the availability of the DSR (Appendix 1-3)
- Pre-application meetings held with landowners, neighbouring landowners and surrounding Mineral Right holders, minutes of these meetings are attached (Appendix 1-6)
- Comments received during the Pre-application Phase, Application Announcement Phase and Scoping Phase, as contained in the Comments and Response Report attached (Appendix 1-7)
- Written submissions received on the above notifications and meetings (Appendix 1-8)
- Information request report (Appendix 1-9)

Table 56: Engagement session table

Party	Type of Engagement	Date of Engagement
AFFECTED PARTIES		
Landowners		
Project Landowners	Introduction to the Project and Specialist Access Request (App 1-2)	26 September 2018
	Pre-Application Phase Meeting with Landowner: Hein Schönfeldt & Piet Nel (Gruisfontein) (App1-6)	10 October 2018
	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
Lawful occupier/s of the land	Introduction to the Project and Specialist Access Site Visit	29 October 2018
	Notification of Intent to submit a Mining Right Application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
Municipality		
Ward Councillors	Request to attend introduction meeting	26 September 2018
	Pre-Application Phase Meeting with Lephalale Municipality (App 1-2)	10 October 2018
	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
Local Municipality	Request to attend introduction meeting (App 1-2)	26 September 2018
	Pre-Application Phase Meeting with Lephalale Municipality (App 1-6)	18 October 2018
	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
District Municipality	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019

Party	Type of Engagement	Date of Engagement
	Notification of availability of FSR	11 June 2019
Traditional Leaders		
Traditional Authorities	No Traditional Authority on property	Not applicable
Communities		
Communities residing on Application area	No communities residing on property	Not applicable
Neighbouring Communities: Lesedi Community at Steenbokpan, 14km south of application area	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
Organs of State		
DMR	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
LEDET	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
DWS	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
DRDLR	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
DAFF	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
SAHRA / LIHRA	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
OTHER AFFECTED PARTIES		
Adjacent landowners		
Pentonville 216 LQ	Introduction to the Project and Specialist Access Request (App 1-2)	26 September 2018
	Pre-Application Phase Meeting with Adjacent Landowner: Bekker Pelser	10 October 2018
	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
Verloren Valey 246 LQ	Introduction to the Project and Specialist Access Request (App 1-2)	26 September 2018
	Pre-Application Phase Meeting with Adjacent Landowner: Louw & Retha Swanepoel	10 October 2018
	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019

Party	Type of Engagement	Date of Engagement
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
Canada 229 LQ / Wynberg 215 LQ	Introduction to the Project and Specialist Access Request (App 1-2)	26 September 2018
	Pre-Application Phase Meeting with Adjacent Landowner: Tarina Pelser	10 October 2018
	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
Sasol Mafutha Mining (Pty) Ltd (Matopi 705 LQ and Groenfontein 250 LQ)	Introduction to the Project and Specialist Access Request (App 1-2)	26 September 2018
	Pre-Application Phase Meeting with Representative: Hennie Schoeman and Bertie Botha	17 October 2018
	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
Lategan, Viljoen & Pretorius Inc (Nieuw Holland 247 LQ & Duikerpan 249 LQ RE)	Introduction to the Project and Specialist Access Request (App 1-2)	26 September 2018
	Pre-Application Phase Meeting with Attorney and Representative of Landowners: Hardus Steenkamp & Daniel Steenkamp	3 October 2018
	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
Anglo Operations (Pty) Ltd (Klaarwater 231 LQ and Dalyshop 232 LQ)	Introduction to the Project and Specialist Access Request (App 1-2)	26 September 2018
	Pre-Application Phase Meeting with Representative: Christopher Harding, Wilda Meyer, Marthinus van Wyk, Leonore van Wyk and Rudi van Wyk	19 October 2018
	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
INTERESTED PARTIES		
Exxaro Grootgeluk Mine	Pre-Application Phase Meeting with Representative: Johan Wepener	11 October 2018
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
Temo Coal (Pty) Ltd / Mining Right Holder	Project BID sent (Minutes of meeting held with other mining right holder)	29 August 2019
	Project meeting held with representative: Jan Britz	12 Sept 2019
Mining Right Holder / Minnasvlakte, Smitspan, Massenberg, RE of Hooikraal	Pre-Application Phase Meeting with Representative: Jan Brits	1 November 2018
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019
Vulpro	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019

Party	Type of Engagement	Date of Engagement
	Notification of availability of FSR	11 June 2019
All other parties on register	BID sent for intent to submit a Mining Right application (App1-3)	5 April 2019
	Notice sent of Mining Right and EA application, and the availability of the DSR	25 April 2019
	Notification of availability of FSR	11 June 2019

8.2 SUMMARY OF ISSUES RAISED BY IAPs

Table 57: Comments and Response Summary

Interested and Affected Parties		Date Comments Received	Issues raised	EAPs response to issues as mandated by applicant	Consultation Status (consensus, dispute, not finalised)
AFFECTED PARTIES					
Landowners					
Project Landowners	X	10 Oct 2018	Railway construction concerns.	Nozala is looking at selling their coal locally so for now it will be transported by trucks.	Not finalised
		10 Oct 2018	Borehole use and drilling.	The specialist will take samples from all existing boreholes and no further drilling is envisaged at this stage.	Consensus
Municipal					
Ward Councillor	X	18 Oct 2018	Water source concerns.	The company is busy considering their options in terms of water supply for the construction and operational phases.	Not finalised
		18 Oct 2018	Is there any formal agreement with Eskom?	There have not been agreements or any formal discussion in that regard.	Not finalised
		18 Oct 2018	Employment during construction phase.	Currently the construction employment cannot be confirmed.	Not finalised
District Municipality	X	15 Apr 2019	Kindly outline the dust suppression strategies to be used throughout the project.	This will be finalised during the EIA Phase.	Not finalised
Local Municipality	X	18 Oct 2018	Traffic Impacts	The Traffic Impact Assessment will take this into consideration.	Not finalised
	X	18 Oct 2018	Groundwater	This will be finalised during the EIA Phase	Not finalised
	X	18 Oct 2018	Will the SLP only focus on Ward 3?	The project is located in Ward 3 with the closest settlement being Steenbokpan, so the first focus would be there.	Not finalised
	X	18 Oct 2018	Will your assessments include a Rehabilitation Plan?	A full rehabilitation and closure plan will be developed as part of the Environmental Management Programme.	Consensus
	X	18 Oct 2018	Protected Species	The Ecological Study will identify any protected species in the project area.	Consensus
	X	18 Oct 2018	Shareholding	In terms of shareholding, Nozala Coal is aware of the requirements of the mining charter, further discussions directly with Nozala will need to be scheduled.	Not finalised
Organs of State					
DMR	X	6 May 2019 28 May 2019	EA application acknowledged Mining Right application accepted	Noted.	Not finalised
LEDET	X	22 May 2019	The Department has reviewed the Scoping Report and is satisfied with the findings on the receiving environment and the plan of study outlined. From an	Noted.	Consensus

Interested and Affected Parties		Date Comments Received	Issues raised	EAPs response to issues as mandated by applicant	Consultation Status (consensus, dispute, not finalised)
			environmental point of view the proposed site is compatible with the proposed activity.		
DWS			No comments received yet.		
DRDLR			No comments received yet.		
DAFF			No comments received yet.		
SAHRA / LIHRA	X	20 May 2019	Accept HIA's recommendations. The recommended field-based PIA must be conducted by a suitably qualified palaeontologist, and the recommended HIA must be conducted by a suitably qualified archaeologist.	A final HIA report consisting of an archaeological impact assessment and PIA will be submitted as part of the EIAR.	Not finalised
Communities					
Community members residing on application area			Not applicable no communities residing.		
OTHER AFFECTED PARTIES					
Adjacent landowners					
Landowners adjacent to the project area	X	10 Oct 2018	Is another mine in the area viable?	The resource estimation indicates that the mine is viable, but it largely depends on the demand for coal.	Consensus
	X	10 Oct 2018	Can you obtain and utilise information from other drilling programmes and specialist studies on neighbouring properties?	Yes, information will be requested from neighbouring mineral right holders.	Consensus
	X	10 Oct 2018	The impacts of supporting infrastructure such as roads, rail and water pipelines are a concern, where will these be placed.	Concerns will be addressed during the EIA phase.	Not finalised
	X	10 Oct 2018	Impact on game hunting due to noise.	Impacts will be assessed during the EIA phase.	Not finalised
	X	10 Oct 2018	Dewatering of groundwater	Impacts will be assessed during the EIA phase.	Not finalised
	X	11 Oct 2018	Consideration of cumulative impacts seeing that there are many other mining projects in the area	Impacts will be assessed during the EIA phase.	Not finalised
	X	12 Oct 2019	How will the coal be transported?	Along the southern border of Verloren Valey, the existing road will have to be upgraded to allow for haul trucks.	Not finalised
	X	12 Oct 2019	Where will the mine get their water from?	According to the water balance done by Deltabec, from boreholes and recycling of water.	Not finalised
	X	12 Oct 2019	Have you identified sensitive areas? We are aware of sensitive areas (wetlands) in the area.	No wetlands have been identified on the farm Gruisfontein. We are aware of several ephemeral pans on the surrounding farms.	Not finalised
	X	12 Oct 2019	Where will your workers stay during your mining activities?	During construction, housing is planned on the mine site. During operational phase we have assumed that most of the employees/contractors will stay in Steenbokpan, management will probably live in Lephalale.	Not finalised
Adjacent communities	X	10 Apr 2019	Include Community members. Give Skills Development.	Skills development will form part of the SLP which will focus on the nearest communities first.	Not finalised

Interested and Affected Parties		Date Comments Received	Issues raised	EAPs response to issues as mandated by applicant	Consultation Status (consensus, dispute, not finalised)
(members from Steenbokpan)	X	11 Apr 2019	In support of proposed project.	Noted.	Consensus
	X	17 Apr 2019	Emerging black farmers needs to be given opportunities to grow.	Community development projects will be focussed on the needs of the community.	Not finalised
INTERESTED PARTIES					
All other parties on register	X	17 Oct 2018	Impacts on tenants leasing the properties from Sasol must be considered.	Impacts will be assessed during the EIA phase.	Not finalised
		19 Oct 2018	Anglo American: We are concerned what impact your mining will have on the properties we own and can assure you that the other landowners will also not be happy about the impact on groundwater resources. We have done extensive investigations on the groundwater.	Impacts will be assessed during the EIA phase.	Not finalised
VulPro	X	29 May 2019	Screening study prior to construction of powerlines. How does Nozala Coal intend to meet environmental sustainability targets? Identification of Protected Species, especially avifaunal species. Standalone avifaunal study. The impacts of vehicle-bird collision fatalities should be assessed in detail during the EIA phase. Appropriate seasonal site visits.	The final routing will only be determined during the final design and planning phase, which will only be conducted after securing the mining right. The recommendation for a screening study prior to determining the final powerline route will be included as a mitigation measure in the EIAR. This aspect will be dealt with in detail during the EIA phase and included in the EMPr for the proposed development. Protected floral and faunal species, including avifaunal species, will be identified as far as possible and the potential impacts assessed during the EIA phase. The necessary mitigation measures will be identified to avoid and/or reduce the potential impacts as far as practically possible. An avifaunal study will be conducted as part of the EIA phase. The Plan of Study was updated accordingly. This will be addressed within the terrestrial ecology specialist study during the EIA phase. EIA studies are bound to the timeframes stipulated in the 2014 EIA Regulations, as amended in 2017. The specialist studies and EIAR will identify any shortcomings and/or knowledge gaps and make appropriate recommendations for further work prior to commencement of activities, for inclusion in the EA conditions.	Not finalised

A detailed Comment and Response Report (CRR) is attached as Appendix 1-7. Copies of written submissions are included in Appendix 1-8.

8.3 FURTHER IAP ENGAGEMENT SESSIONS

8.3.1 Availability of the EIAR/EMPr

The draft EIAR/EMPr will be made available for 30 calendar days. Notification will be sent to all registered IAPs indicating where copies of the report can be accessed. Hard copies of the reports will be submitted to relevant Authorities and will also be placed in the Public Places. The report will be available for download or a Compact Disc can be posted on request. Provision will be made to facilitate access to the report by communities.

8.3.2 Authority engagement

The draft EIAR/EMPr will be provided to all relevant Departments (including District and Local Municipal representatives) for their comments and inputs.

8.3.3 Public Meeting

A combined Community and Public Meeting will be held where all IAPs will be provided with an opportunity to raise concerns, make comments and/or suggestions to the EAP and the Applicant. The meeting will be held within the Municipal area in proximity to the communities. The proceedings will be translated into Ndebele.

8.3.4 Engagement of neighbouring communities

An Information Pamphlet, translated into Ndebele, will be distributed in the local community (Steenbokpan), and community members invited to the meeting.

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9 ENVIRONMENTAL IMPACT STATEMENT

9.1 PROPOSED IMPACT MANAGEMENT OUTCOMES

The environmental and social management objectives and impact management outcomes are presented in Table 58.

Table 58: Proposed management objectives and outcomes for the Gruisfontein Project

Aspect	Management Objectives	Impact Management Outcomes (Performance Target)
Land capability	To re-instate suitable grazing capabilities over the reclaimed portions of the mine site	• Development of a Rehabilitation, Decommissioning and Closure Plan • Establishment of a self-sustaining, grazing land capability over the reclaimed areas
Ecology	Minimise impact on the biodiversity habitat in the area and protected species	• Limit the clearance of vegetation and topsoil to 830 ha (disturbed footprint) • Implementation of a Rescue and Relocation Plan • Implementation of a Biodiversity Action Plan (BAP) • Implementation of an AIP Control Plan
	To re-establish an appropriate mix of grassland and other native flora species in the reclaimed areas to enable the natural re-instatement of biodiversity over time	• Establish an indigenous nursery • Establishment of a sustainable vegetation cover to facilitate the final grazing land capability requirements
Water resources	Prevent erosion and downstream siltation	• Implement SWMP to separate clean & dirty water
	Limit the impact of the groundwater quality and yields	• Groundwater monitoring demonstrates that the surrounding groundwater users are not impacted in terms of quality or yield • Implementation of compensation strategy if the above cannot be demonstrated
Air quality	Limit the risk of dust exposure to the general public	• Dust fallout < 600 mg/m^2/day on MRA boundary • PM_{10} (24-hour) < 75 µg/m^3 on MRA boundary

Noise	Limit the noise impact on sensitive receptors	• Rural noise level
		  ○ Day: 45 dB
		  ○ Night: 35 dB
		• Increase in ambient noise levels (on MRA boundary) < 7 dB

Blasting	Limit the blasting impact on sensitive receptors Prevent any structural damage to infrastructure	• Air blast < 120 dB on MRA boundary • Maximum ground vibration levels < 2.54 mm/s when blasting within 3 500m from dwellings used for residential purposes • Maximum ground vibration levels < 25 mm/s when blasting within 1 600m from identified potential sensitive structures • Maintain exclusion zone of 428m

Aspect	Management Objectives	Impact Management Outcomes (Performance Target)
Heritage / Palaeontology	Prevent any impact on heritage and palaeontological material	• No damage to heritage and palaeontological material without the necessary investigations and permits
Post-mining land use	Establish a post-mining land use that will sustain rural agricultural activities once mining is concluded, whilst providing an acceptable overall aesthetic appearance aligned to the surrounding landscape	• Define, in consultation with all IAPs, the final (post-closure) land use for the mining area, including mining areas, surface and water management infrastructure, roads and powerlines • Development of a Rehabilitation, Decommissioning and Closure Plan
Local community / adjacent landowners	Prevent vehicle and pedestrian accidents due to increase in traffic	• Implementation of road upgrades as proposed in the TIA • No fatal accidents
	Maximise social benefits (employment, procurement, etc.) to local communities	• Percentage of local employment set at 70% (SLP)
	Identify and establish livelihood retention projects to create off-mine livelihoods during and post-mining	• Successful implementation of Social and Labour Plan
	Equip employees with portable skills that can be used in other sectors post-mining	• Successful implementation of Social and Labour Plan

Appropriate monitoring should be implemented to ensure compliance with the objectives and outcomes as proposed.

Since effective mitigation through avoidance, impact minimisation and rehabilitation is unlikely to adequately limit the impact on the receiving ecology, an ecological offset initiative must be initiated to contribute to the conservation of the area. In particular, initiatives focused on the involvement of surrounding landowners and management of land to create ecological corridors linking the various areas currently functioning as conservation areas.

In addition, Nozala Coal must contribute to Strategic Environmental tools, programmes and projects within the province. The method of contribution must be agreed with LEDET.

9.2 ASPECTS FOR INCLUSION AS CONDITIONS OF AUTHORISATION

It is essential that all the mitigation measures as listed in Table 43 be implemented. The following are considered critical to minimise the negative impacts associated with the proposed activities:

9.2.1 Pre-Construction Activities (Planning and Design)

- A thorough walkthrough of all footprint areas be completed to mark all protected tree species and where feasible, infrastructure should be placed around these trees.
- A protected and RDL floral and faunal (smaller species) relocation, monitoring and management plan must be designed and implemented by a suitably qualified specialist and should address all species which can be successfully rescued and relocated.
- Apply for the necessary protected species permits for relocation and/or destruction from LEDET and DAFF.
- A pre-construction avifaunal walkthrough of the final mine layout, road and powerline routes must be conducted to identify Red List species that may be breeding within footprint of the mine and the road and powerline servitudes to ensure that the impacts to breeding species are adequately managed.
- High risk sections of the powerline must be identified by a qualified avifaunal specialist during the avifaunal walkthrough, once the alignment has been finalised. If powerline marking is required, bird flight diverters must be installed according to industry standard guidelines.
- Every effort must be made to select a powerline route that poses the least risk to birds, avoiding key avifaunal habitat and where possible routing the proposed powerlines alongside other infrastructure to increase conductor visibility.
- Develop and implement a comprehensive stormwater management plan to separate and control clean and dirty stormwater runoff.
- Develop and implement a Biodiversity Action Plan (BAP), including avifaunal plan.
- Develop and implement an Alien and Invasive Plant (AIP) Control Plan.
- Establish an indigenous nursery.
- A lighting specialist should be consulted to assist in the planning and placement of light fixtures for the mining facility and all ancillary infrastructure in order to reduce visual impacts associated with glare and light trespass.
- Develop the Social Management and Monitoring Strategies as indicated in the EMPr.
- Implement the environmental monitoring programme.
- Develop a detail waste management procedure and obtain the necessary agreements and permissions in place.
- All proposed road upgrades and improvements are to be designed by a professional engineer and submitted for official approval by RAL, prior to implementation.
- Initiate application for Integrated Water Use Licence (IWUL).

9.2.2 Construction Phase

- Temporary erosion control measures must be used to protect the disturbed soils during the construction phase until adequate vegetation has established.

- Solid waste must either be stored on-site in an approved waste disposal area or removed by credible contractors, in line with the waste management procedure.
- Implement an Environmental Awareness Programme on the mine and within the surrounding communities.
- Conduct pre-blast surveys prior to any blasting events.
- A qualified archaeologist must monitor excavation activities.
- Site specific geochemical tests should be conducted for confirmation of the acid generating potential of the underlying Karoo rocks.
- Establish and implement a Complaints and Grievance Procedure.
- Development of an Air Quality Management Plan (AQMP).
- Establishment of a local labour recruitment committee to monitor recruitment procedures and results.

9.2.3 Operational Phase

- Investigate blasting techniques to minimise ground and air vibrations and disturbances to minimise the impacts on surrounding sensitive receptors and faunal species.
- Maintain an evacuation zone of 428m, establish an evacuation procedure with the affected parties prior to blasting.
- Ongoing eradication and control of AIP species in and around the mine area and its associated infrastructure.
- Clean and dirty water separation structures must be maintained throughout the life of mine – Operations and Maintenance Plan.
- Regular assessment of erosion and sedimentation must take place.
- Ongoing revision of the groundwater flow and geochemical models.
- A qualified archaeologist must monitor excavation activities during topsoil stripping over the LOM.
- A qualified palaeontologist must monitor coal excavation activities over the LOM.
- Ongoing implementation and review of the environmental monitoring programme.
- Ongoing implementation and monitoring of the Social Management and Monitoring Strategies.
- Implement health awareness programmes for workers and communities including education programmes on sexually transmitted diseases and HIV/AIDS and other illnesses such as TB.
- Develop a detailed Rehabilitation, Decommissioning and Closure Plan in line with the requirements of GN R.1147.
- Conduct rehabilitation trials in line with the Rehabilitation, Decommissioning and Closure Plan.
- Determination of ecological offset programme(s) together with relevant stakeholders and authorities.
- Nozala Coal must contribute to Strategic Environmental tools, programmes and projects within the province. The method of contribution must be agreed with LEDET.

9.3 REASONED OPINION AS TO WHETHER THE ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED

To be concluded once comments are received on this Draft EIAR.

10 OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

10.1 IMPACT ON THE SOCIO-ECONOMIC CONDITIONS OF ANY DIRECTLY AFFECTED PARTY

Refer to Section 7.4.9 of this report.

10.2 IMPACT ON ANY NATIONAL ESTATE

Refer to Section 7.4.7 of this report.

10.3 OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) OF THE ACT

As indicated in Section 5.1 of this report, no alternatives site locations have been considered as mining can only be undertaken in areas where economically mineable resources occur. This area was established through extensive prospecting and geological modelling. Infrastructure to support the Gruisfontein Project has been laid out and engineered to best suit the topography and mining pit layout and is described in Section 2 of this report.

The only real alternative to the mine is the No-Go Option. The farm has been developed as a cattle and game farm. The land belongs to a private company, and no eco-tourism facilities have been developed. Based on the macro-economic analysis of the baseline activities, the revenue generated by the existing farm activities is estimated at R 757 823 per annum. Only three direct employment opportunities are sustained by the farming activities on Gruisfontein. The total income to low-income households are estimated at R 70 986 per annum.

The main consequence of the No-Go Option is the loss of opportunity to develop a viable mineral resource with an estimated LOM of 16 years which has the potential for increased economic benefits on local, provincial and national level in terms of employment and the contribution to the GDP, as well as further economic opportunities downstream of the mine.

Other socio-economic benefits that will be lost include:

- Skills development opportunities
- Community development through LED projects
- Local procurement and SMME opportunities

10.4 FINANCIAL PROVISION

Refer to Section 7 of the EMPr.

10.5 TIME PERIOD FOR EA

Environmental Authorisation is required for a minimum of 30 years.

10.6 UNDERTAKING

10.6.1 Undertaking regarding correctness of information

I, Maria Catharina Eksteen, herewith undertake that the information provided in the foregoing report is correct and that the comments and inputs from stakeholders and IAPs have been correctly recorded in the report.

Signature of EAP

Date: 13 September 2019

10.6.2 Undertaking regarding level of agreement

I, Maria Catharina Eksteen, herewith undertake that the information provided in the foregoing report is correct and that the level of agreement with IAPs and stakeholders has been correctly recorded and reported herein.

Signature of EAP

Date: 13 September 2019

11 APPENDICES

Appendix 1	Public Participation Report and Records	
Appendix 2	Curriculum Vitae – EAP	
Appendix 3	Soil and Land Capability Assessment	Rossouw Associates
Appendix 4	Terrestrial Ecological Assessment	Scientific Terrestrial Services
Appendix 5	Avifaunal Assessment	Feathers Environmental Services
Appendix 6	Hydrocensus Investigation	Aquatico
Appendix 7	Geohydrological Investigation	Groundwater Complete
Appendix 8	Air Quality Impact Assessment	EBS Advisory
Appendix 9	Environmental Noise Impact Assessment	Enviro Acoustic Research
Appendix 10	Phase 1 Heritage Impact Assessment	R&R Cultural Resource Consultants
Appendix 11	Palaeontological Assessment	Chris Jones
Appendix 12	Blast Impact Assessment	Enviro Acoustic Research
Appendix 13	Visual Impact Assessment	Field and Form Landscape Services
Appendix 14	Traffic Impact Assessment	Avzcons Civil Engineering Consultant
Appendix 15	Socio-Economic Impact Assessment	Diphororo Development
Appendix 16	Gruisfontein Stormwater Management Plan	Delta Built Environment Consultants
Appendix 17	Gruisfontein Water Balance	Delta Built Environment Consultants
Appendix 18	Gruisfontein Mine Residue Design and Lining Specification	Delta Built Environment Consultants
Appendix 19	Site Maps and Plans	