NHLABATHI MINERALS (PTY) LTD

RIETKOL MINING OPERATION

FINAL SCOPING REPORT
MAY 2021

DMR Ref: MP 30/5/1/2/2/10268 MR

RIETKOL MINING OPERATION - NHLABATHI MINERALS (PTY) LTD

FINAL SCOPING REPORT – MAY 2021

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mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

FINAL SCOPING REPORT

PROPOSED RIETKOL MINING OPERATION

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: Nhlabathi Minerals (Pty) Ltd

TEL NO: 013 665 7900

FAX NO: 013 665 7910

POSTAL ADDRESS: PO Box 157, Delmas, 2210

PHYSICAL ADDRESS: Consol House, Osborn Road, Wadeville, Gauteng, RSA

FILE REFERENCE NUMBER SAMRAD: MP 30/5/1/2/2/10268 MR

IMPORTANT NOTICE

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

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

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or 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.

OBJECTIVE OF THE SCOPING PROCESS

1) The objective of the scoping process is to, through a consultative process—

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

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

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

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

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

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

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

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In terms of the NEMA 2014 EIA Regulations contained in GN R982 of 04 December 2014 (as amended) the Scoping Report must comply with Appendix 2 of the NEMA 2014 EIA Regulations (GN R982 of 04 December 2014).

Legal Requirement		**Relevant Section in Scoping Report**
(1)	A scoping report must contain the information that is necessary for a proper understanding of the process, informing all preferred alternatives, including location alternatives, the scope of the assessment, and the consultation process to be undertaken through the environmental impact assessment process, 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 9
(b)	the location of the activity, including (i) the 21-digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; (iii) where the required information in terms (i) and (ii) and is not available, the coordinates of the boundary of the property or properties;	Section 2&3
(c)	a plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is- (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Figure 3
(d)	a description of the scope of the proposed activity, including- (i) all listed and specified activities triggered;	Section 4.8 Table 8
	(ii) a description of the activities to be undertaken, including associated structures and infrastructure;	Section 4
(e)	a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process;	Section 5
(f)	a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location;	Section 6
(g)	a full description of the process followed to reach the proposed preferred activity, site and location of the development footprint within the site, including- (i) details of the alternatives considered;	Section 7.1
	(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 7.2
	(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 not including them;	Section 7.3 Table 14
	(iv) the environmental attributes associated with the alternative focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 8
	(v) the impacts and risks which have informed the identification of each alternative, including the nature, significance,	Section 9

Legal Requirement			Relevant Section in Scoping Report
		consequence, extent, duration and probability of such identified impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	
	(vi)	the methodology used in identifying and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	Appendix 6
	(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;	Section 9.14.1 Table 61
	(viii)	the possible mitigation measures that could be applied and level of residual risk;	Section 9.14.2 Table 62
	(ix)	the outcome of the site selection matrix;	N/A
	(x)	if no alternative, including alternative locations for the activity were investigated, the motivation for not considering such; and	Section 7.1.5
	(xi)	a concluding statement indicating the preferred alternatives, including preferred location of the activity;	Section 7.1.6 Table 9
(h)	a plan of study for undertaking the environmental impact assessment process to be undertaken, including-		Section 10
	(i)	a description of the alternatives to be considered and assessed within the preferred site, including the option of not proceeding with the activity;	Section 10.1
	(ii)	a description of the aspects to be assessed as part of the environmental impact assessment process;	Section 10.2
	(iii)	aspects to be assessed by specialists;	Section 10.3
	(iv)	a description of the proposed method of assessing the environmental aspects, including aspects to be assessed by specialists;	Section 10.3 Appendix 6
	(v)	a description of the proposed method of assessing duration and significance;	Section 10.4 Appendix 6
	(vi)	an indication of the stages at which the competent authority will be consulted;	Section 10.5 Appendix 8
	(vii)	particulars of the public participation process that will be conducted during the environmental impact assessment process;	Section 10.5 Appendix 8
	(viii)	a description of the tasks that will be undertaken as part of the environmental impact assessment process; and	Section 10
	(ix)	identify suitable measures to avoid, reverse, mitigate or manage identified impacts and to determine the extent of the residual risks that need to be managed and controlled.	Section 9.14.2 Table 62
(i)	an undertaking under oath or affirmation by the EAP in relation to- (i) the correctness of the information provided in the report; (ii) the inclusion of comments and inputs from stakeholders and interested and affected parties; and (iii) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;		Section 12

Legal Requirement		Relevant Section in Scoping Report
(j)	an undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment;	Section 12
(k)	where applicable, any specific information that may be required by the competent authority; and	Section 11
(l)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	Section 11

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GLOSSARY OF TERMS

TERM / ABBREVIATION	MEANING
ABA	Acid-base accounting
AEL	Atmospheric Emissions Licence
AH	Agricultural Holding
AHs	Agricultural Holdings
AMD	Acid Mine Drainage
AQA	National Environmental Management: Air Quality Act 39 of 2004
AQMP	Air Quality Management Plan
BAP	Biodiversity Action Plan
Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate
BM&C	Blast Management & Consulting
CARA	Conservation of Agricultural Resources Act 43 of 1983
CBA	Critical Biodiversity Area
CFP	Chance Find Protocol
COPD	Chronic obstructive pulmonary disease
CRR	Comments and Response Report
DAFF	Department of Agriculture, Forestry and Fisheries
dBA	Decibels
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
DEMC	Desired Ecological Management Class
DM	District Municipality
DMRE	Department of Mineral Resources and Energy
DoA	Department of Agriculture
DSR	Draft Scoping Report
DWS	Department of Water and Sanitation
Ecological integrity	Overall functioning of the ecological system as a whole
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Ecological Importance and Sensitivity Classification
EMC	Ecological Management Class
EMPr	Environmental Management Programme
ESA	Ecological Support Area
ESP	Exchangeable sodium percentage

TERM / ABBREVIATION	MEANING
FAII	Fish Assemblage Integrity Index
FSR	Final Scoping Report
GC	Groundwater Complete
GDP	Gross Domestic Product
GN	Government Notice
GPS	Global Positioning system
HIA	Heritage Impact Assessment
HPA	Highveld Priority Area
IAPs	Interested and Affected Parties
IBA	Important Bird Area
IDPs	Integrated Development Plans
IHAS	Invertebrate Habitat Assessment System
IHIA	Intermediate Habitat Integrity Assessment
ISP	Internal Strategic Perspective
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
LM	Local Municipality
LOM	Life of Mine
LSA	Late Stone Age
Mamsl	Meters above mean sea level
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Run-off
mbs	Meters below surface
MBSP	Mpumalanga Biodiversity Sector Plan
MDARDLEA	Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs
MDEDET	Mpumalanga Department of Economic Development, Environment and Tourism
MEGDP	Mpumalanga Economic Growth and Development Path
MNCA	Mpumalanga Nature Conservation Act 10 of 1998
MPRDA	Mineral and Petroleum Resources Development Act 28 of 2002
MRA	Mining Right Application
Mt	Million tonnes
Mtpa	Million tonnes per annum

TERM / ABBREVIATION	MEANING
MTPA	Mpumalanga Tourism and Parks Agency
NBA	National Biodiversity Assessment
NDP	National Development Plan
NEMA	National Environmental Management Act 107 of 1998
NEMBA	National Environmental Management: Biodiversity Act 10 of 2004
NEMWA	National Environmental Management: Waste Act 59 of 2008
NFA	National Forest Act 84 of 1998
NFEPA	National Freshwater Ecosystem Priority Areas
NHRA	National Heritage Resources Act 25 of 1999
NWA	National Water Act 36 of 2008
NWCS	National Wetland Classification System
OES	One Environmental System
PCD	Pollution Control Dam
PEMC	Present Ecological Management Class
PES	Present Ecological State
PFD	Process Flow Diagram
PIA	Palaeontological Impact Assessment
PM	Particulate matter
PRECIS	Pretoria Computer Information Systems
QDS	Quarter Degree Square
RDL	Red Data List
RDM	Resource Directed Measures
REC	Recommended Ecological Category
RHP	River Health Programme
RoM	Run of Mine
RWD	Return Water Dam
RWQO	Receiving Water Quality Objective
SAM	Social Accounting Matrix
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SDF	Spatial Development Framework
SEIA	Socio-Economic Impact Assessment
SIA	Social Impact Assessment
STS	Scientific Terrestrial Services
SUR	Strict Unemployment Rate
TDS	Total Dissolved Solids
TOPS	Threatened or Protected Species

TERM / ABBREVIATION	MEANING
TSP	Total suspended particulates
TWQR	Target Water Quality Range
VIA	Visual Impact Assessment
WMA	Water Management Area
WMP	Water Management Plan
WQO	Water Quality Objective

1 INTRODUCTION

1.1 BACKGROUND

Consol Glass (Pty) Limited (Consol) was the holder of a prospecting right over portions of Olifantsfontein 196 IR and Rietkol 237 IR. Consol commenced with an internal restructuring process of its mining interests in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002) in 2013. The restructure included the establishment of Apex Silica Mining (Pty) Ltd (Apex Silica) and Nhlabathi Minerals (Pty) Ltd (Nhlabathi). Following the restructuring process, Consol gave consent to Nhlabathi to apply for a Mining Right over the area to which it held the prospecting right, for the Rietkol Mining Operation (referred to as the **Rietkol Project**).

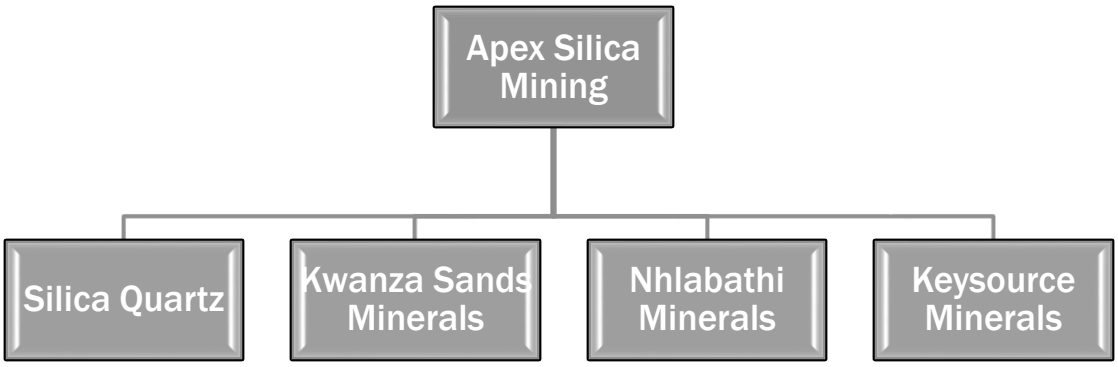


Figure 1: Company Structure

Nhlabathi applied for a Mining Right to mine silica in February 2018 and commenced with the Environmental Impact Assessment (EIA) process as contemplated in the National Environmental Management Act 107 of 1998 (NEMA) and Government Notice (GN) No. R. 982-986 of 4 December 2014: NEMA: EIA Regulations, as amended, for the Rietkol Project.

Several specialist studies were conducted within the Mining Right Application (MRA) area in support of the EIA process, and a comprehensive Public Participation process was initiated. The final Scoping Report was submitted on 3 April 2018 and accepted by the Department of Mineral Resources and Energy (DMRE) on 26 April 2018. However, the MRA was rejected by the DMRE Mpumalanga Mine Economics Directorate on the basis that the MRA formed part of another right granted in terms of the MPRDA. This decision resulted in a delay in the EIA process, ultimately causing the application for Environmental Authorisation to lapse.

After research by DMRE officials and Nhlabathi employees, it was established that the prior right, on which basis the MRA was rejected, was the prospecting right registered over the properties held by Consol. To remedy the situation, Consol submitted a letter to the DMRE on 8 June 2018 granting Nhlabathi the consent to proceed with the MRA. As a result, the DMRE withdrew the refusal letter by issuing an acceptance letter on 12 September 2018. Nhlabathi could, therefore, continue with the EIA process.

However, on 31 August 2018, Mineral Resources and Energy Minister Gwede Mantashe closed the Mpumalanga DMRE Office until further notice, with the result that DMRE accepted no new applications for Environmental Authorisation. The DMRE Office was only re-opened for business on 5 August 2019.

Following the re-opening of the DMRE Office, Nhlabathi has re-initiated the MRA process and applied for a Mining Right over the same farm portions in early 2020. The MRA was accepted by the DMRE on 21 January 2021 and Nhlabathi has since re-initiated the EIA process with Jacana Environmentals cc (Jacana) appointed as the independent Environmental Assessment Practitioner (EAP).

Consol has appointed Jacana to apply for Integrated Environmental and Water Use Authorisation for the Rietkol Project in terms of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998), the 2014 Environment Impact Assessment (EIA) regulations, the National Environmental Management: Waste Act (NEMWA), 2008 (Act 59 of 2008) and the National Water Act (NWA), 1998 (Act 36 of 1998), as amended. The integrated application for Environmental Authorisation (EA) and the Waste Management Licence (WML) was submitted to the DMRE on 18 March 2021, the Competent Authority (CA) for any mining and related activities.

This document serves as 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), from **19 March to 26 April 2021**.

1.2 APPLICANT AND SPECIALIST DETAILS

1.2.1 Applicant

Project applicant	Nhlabathi Minerals (Pty) Ltd
Responsible person	Prince Fikile Holomisa
Physical address	Consol House, Osborn Road, Wadeville
Postal Address	PO Box 157, Delmas, 2210
Telephone	013 665 7900
Facsimile	013 665 7910
E-mail	fikile@silq.co.za

1.2.2 Environmental Assessment Practitioner (EAP)

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	Registered Environmental Assessment Practitioner at the Environmental Assessment Practitioners Association of South Africa (EAPASA) – Number 2020/1800 Registered as a Professional Environmental Scientist (Pr.Sci.Nat.) at the South African Council for Natural Scientific Professions – Registration No. 400090/02 Member of the Land Rehabilitation Society of Southern Africa (LaRSSA): Membership ID 30835
Abbreviated Curriculum Vitae	Marietjie Eksteen is the Managing Member of the consulting firm Jacana Enviromentals cc, an environmental consulting firm based in Polokwane. She is an environmental scientist with 30 years' experience, her main fields of expertise being water quality management, mine water management, environmental legal compliance, and project management. She obtained a Masters' degree in Exploration Geophysics (MSc) from the University of Pretoria in 1993. Since establishing Jacana Enviromentals in 2006, she has been involved in a variety of mine- and industry-related environmental projects serving clients such as MC Mining Limited, South32 SA Coal Holdings, Glencore Operations South Africa, Consol Glass and Silicon Smelters, amongst others. 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.
Curriculum Vitae	Refer to Appendix 9.

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, Hydropedology	SAS Environmental Holdings
Terrestrial / Aquatic Biodiversity	SAS Environmental Holdings
Groundwater	Groundwater Complete
Air Quality	EBS Advisory (Pty) Ltd
Ambient Noise	Enviro-Acoustic Research cc
Blasting & Vibration	Blast Management & Consulting
Traffic	AvzconS Civil Engineering Consultant
Heritage and Cultural Resources	R&R Cultural Resource Consultants
Palaeontology	ASG Geo Consultants (Pty) Ltd
Visual and Aesthetics	SAS Environmental Holdings
Social	Diphororo Development (Pty) Ltd
Hazard Identification and Risk Assessment (HIRA)	AirCheck Occupational Health, Environmental and Training Services
Land Trade-off & Macro-Economic Analysis	Mosaka Economic Consultants
Medical Research Study	EBS Advisory (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 Hydropedology	SAS Environmental Holdings	Tshiamo Setsipane	MSc (Soil Science)	Cand.Sci.Nat. – SACNASP Reg No. 114882.
		Braveman Mzila	BSc (Hons) Hydrology BSc (soil Science and Hydrology)	Member of the SA Soil Surveyors Organisation (SASSO), the Soil Science Society of SA (SSSSA), and the Land Rehabilitation Society of Southern Africa (LaRSSA).
		Stephen van Staden	BSc (Hons) Zoology MSc Environmental Management	Member of the SA Soil Surveyors Organisation (SASSO), the Soil Science Society of SA (SSSSA), and the Land Rehabilitation Society of Southern Africa (LaRSSA).
Terrestrial / Aquatic Biodiversity	SAS Environmental Holdings	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 undertaking faunal studies throughout South Africa.
		Christien Steyn	BSc Environmental Management and Botany BSc (Hons) Plant Science	Pr.Sci.Nat. - SACNASP Reg No. 127823/21 Extensive experience in undertaking floral studies throughout South Africa.
Groundwater	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 Medical Research Study	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, Lifetime 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, Lifetime Membership.
Ambient Noise	Enviro-Acoustic Research	Morné de Jager	B. Ing (Chemistry)	Acoustic Society of America South African Acoustic Institute
Blasting and Vibration	Blasting Management & Consulting	Danie Zeeman	1985 - 1987 Diploma: Explosives Technology, Technicon Pretoria	International Society of Explosives Engineers.

Aspect	Firm	Specialists	Qualification	Professional registrations and affiliations
			1990 - 1992 BA Degree, University of Pretoria 1994 National Higher Diploma: Explosives Technology, Technicon Pretoria 2000 Advanced Certificate in Blasting, Technicon SA	
Heritage and Cultural Resources	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	ASG Geo Consultants	Dr Gideon Groenewald	PhD Geology National Diploma in Nature Conservation	Pr.Sci.Nat. Earth Scientist, Reg no 401946/83. Accredited by the Palaeontological Society of Southern Africa (society member for 25 years).
Visual and Aesthetics	SAS Environmental Holdings	Sanja Erwee	Bsc Zoology	Extensive experience undertaken visual assessments throughout South Africa for numerous mining and infrastructure assessments.
		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.
Traffic	Avzcons (Pty) Ltd	Awie van Zyl	BSc Eng. Civil	ECSA Reg. No: 920506
Land trade-off and Macro-economic Analysis	Mosaka Economic Consultants	William Mullins	BSc – Trained as Mathematician and Statistician. 16 years' experience as macro- and micro-economist	Specialising in application of econometric models in analysing specific socio-economic impacts.
		Riekie Cloete	M. Com (Agricultural Economy)	Specialising in Cost-benefit Analyses and Macro-Economic Impact Modelling.
		Tefelo Majoro	M. Com (Economics)	Specialising in public economic and finance and SAM modelling.
Social	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	-
Hazard Identification and Risk Assessment (HIRA)	AirCheck	Piet Marais	MSc (Occupational Physiology)	Registered Occupational Hygienist (SAIOH).
		Lisa Roux	B Tech (Environmental Health)	Registered Occupational Hygienist (SAIOH).
		George Farmer	BSc (Hons) Biokinetics	Registered Occupational Hygiene Assistant (SAIOH).

2 PROJECT LOCALITY

The Rietkol Project is in Wards 8 and 9 of the Victor Khanye Local Municipality within the Nkangala District Municipality of Mpumalanga Province. Delmas/Botleng are approximately 6 km east and Eloff 4 km south of the MRA area. The Rietkol Project is located strategically close to major roads in the area, including the N12 (to the north-west), R50 (to the north-east) and R555 (to the south). The Springs/Durban Transnet Freight Rail (TFR) railway line is situated to the south, alongside the R555.

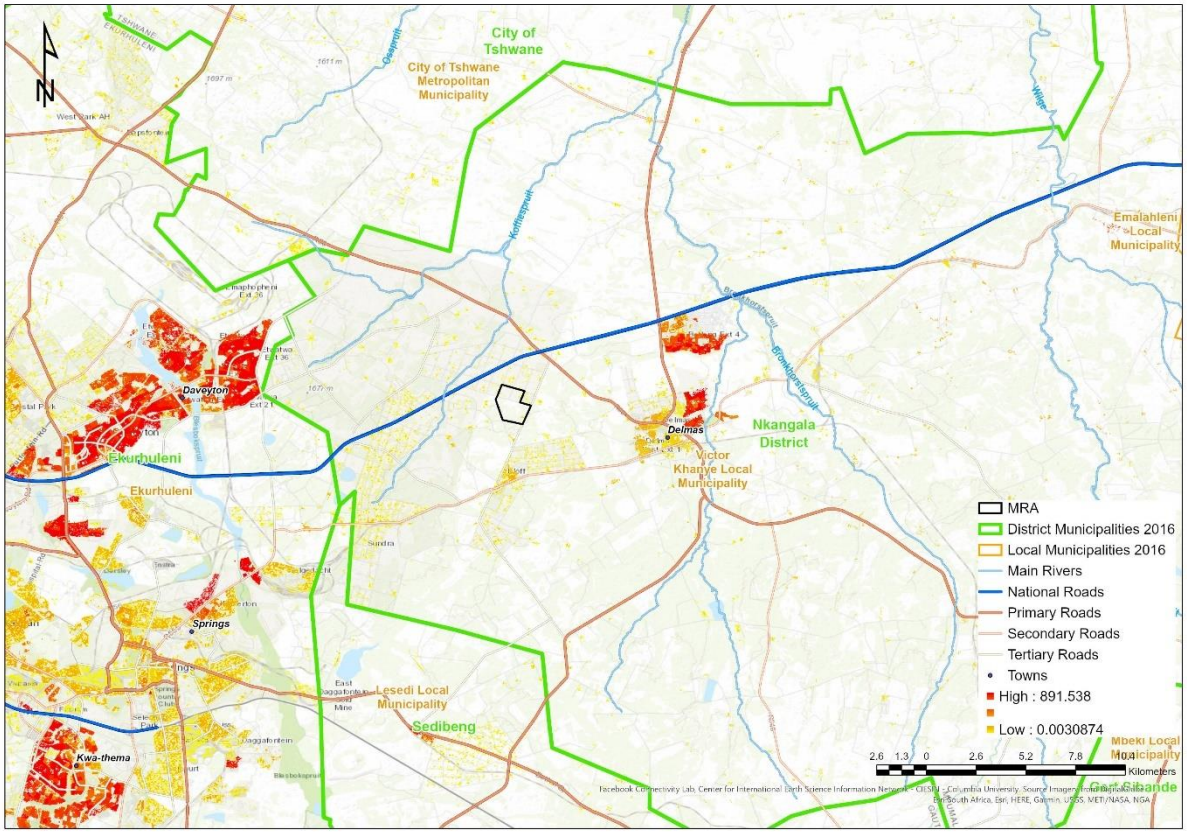


Figure 2: Project locality and institutional map

The Rietkol MRA covers an area of 221 ha consisting of:

- 16 Modder East Agricultural Holdings (AHs) on the farm Olifantsfontein 196 IR, each approximately 4.1 ha in extent;
- Portion 71 of the farm Rietkol 237 IR; and
- A portion of Remaining Extent (RE) of portion 31 of the farm Rietkol 237 IR.

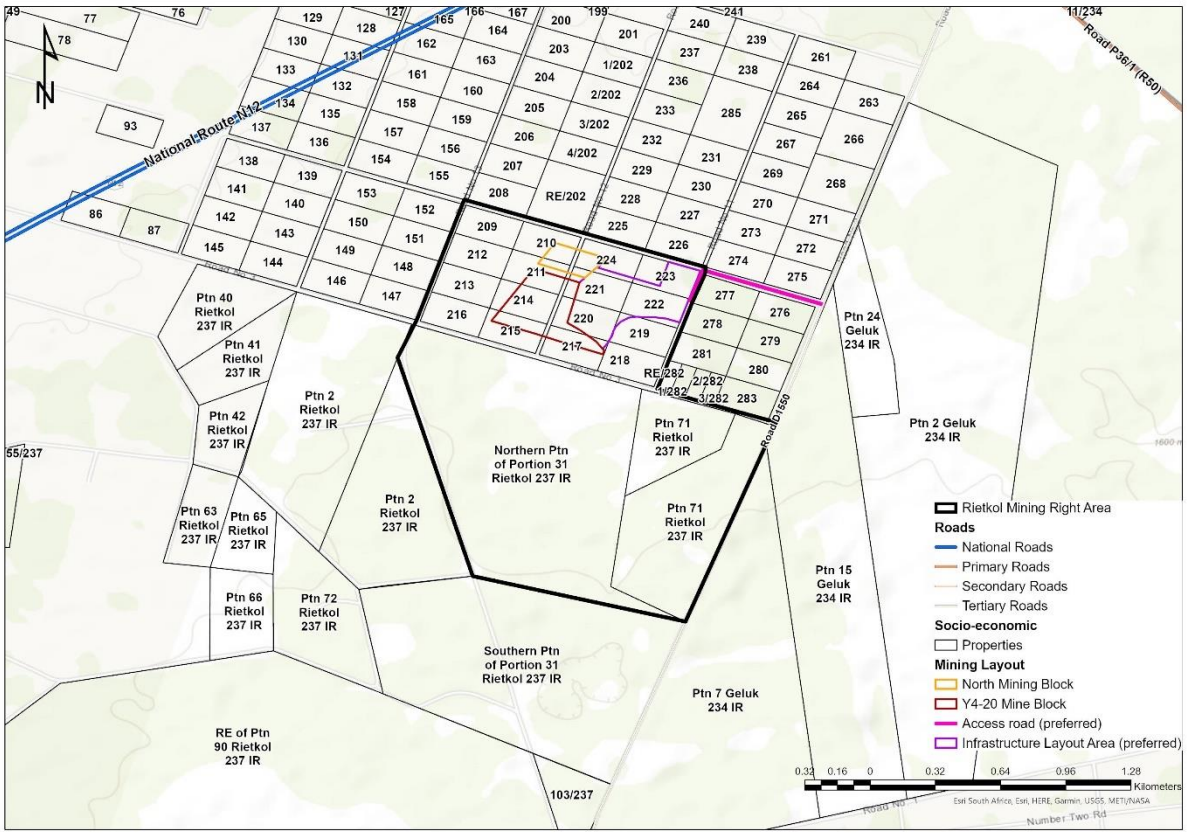


Figure 3: Property map of MRA area and surrounds

3 DESCRIPTION OF PROPERTY

The registered description of the properties involved is tabled below, as indicated in Figure 3.

Table 2: Registered landowners

Portion Number	Title Deed Number	SG Number	Owner
AH 209	T11927/2019	TOIR04410000020900000	Consol Glass (Pty) Ltd
AH 210	T8896/2019	TOIR04410000021000000	Consol Glass (Pty) Ltd
AH 211	T38311/1969	TOIR04410000021100000	Christo Smit
AH 212	T1558/2020	TOIR04410000021200000	Consol Glass (Pty) Ltd
AH 213	T171746/2005	TOIR04410000021300000	Johanna Elizabeth van der Walt
AH 214	T5414/2018	TOIR04410000021400000	Consol Glass (Pty) Ltd
AH 215	T2743/20003	TOIR04410000021500000	Veizaj Sokol
AH 216	T116099/2006	TOIR04410000021600000	Bheki Mthethwa Lorraine Mthethwa
AH 217	T2918/2019	TOIR04410000021700000	Consol Glass (Pty) Ltd
AH 218	T7171/2019	TOIR04410000021800000	Consol Glass (Pty) Ltd
AH 219	T7171/2019	TOIR04410000021900000	Consol Glass (Pty) Ltd
AH 220	T2918/2019	TOIR04410000022000000	Consol Glass (Pty) Ltd
AH 221	T2918/2019	TOIR04410000022100000	Consol Glass (Pty) Ltd
AH 222	T78652/2004	TOIR04410000022200000	Johanna Catharina Kotze Piet Kotze
AH 223	T2918/2019	TOIR04410000022300000	Consol Glass (Pty) Ltd
AH 224	T34277/1990	TOIR04410000022400000	Petrus Johannes Naude
RE of Ptn 31 of Rietkol 237 IR	T16617/1993	T0IR00000000023700031	Christiaan Le Cordeur Rossouw
Ptn 71 of Rietkol 237 IR	T1885/2018	T0IR00000000023700071	Rossouw Pluimvee-Eiers (Pty) Ltd

The Department of Rural Development and Land Reform (DRDLR) in Mpumalanga indicated the following regarding land claims within the MRA area:

Olifantsfontein 196 IR	According to the DRDLR database there are no land claims against the property.
Ptn 31 & 71 of Rietkol 237 IR	There is a land claim against the property, but so far only Ptn 91 has been affected and settled. Ptns 31 & 71 are not affected, but research is ongoing.

For further details, refer to the correspondence with the DRDLR included in Appendix 1-7.

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

The landownership associated with the MRA and surrounds (1 km radius) is provided in Figure 4.

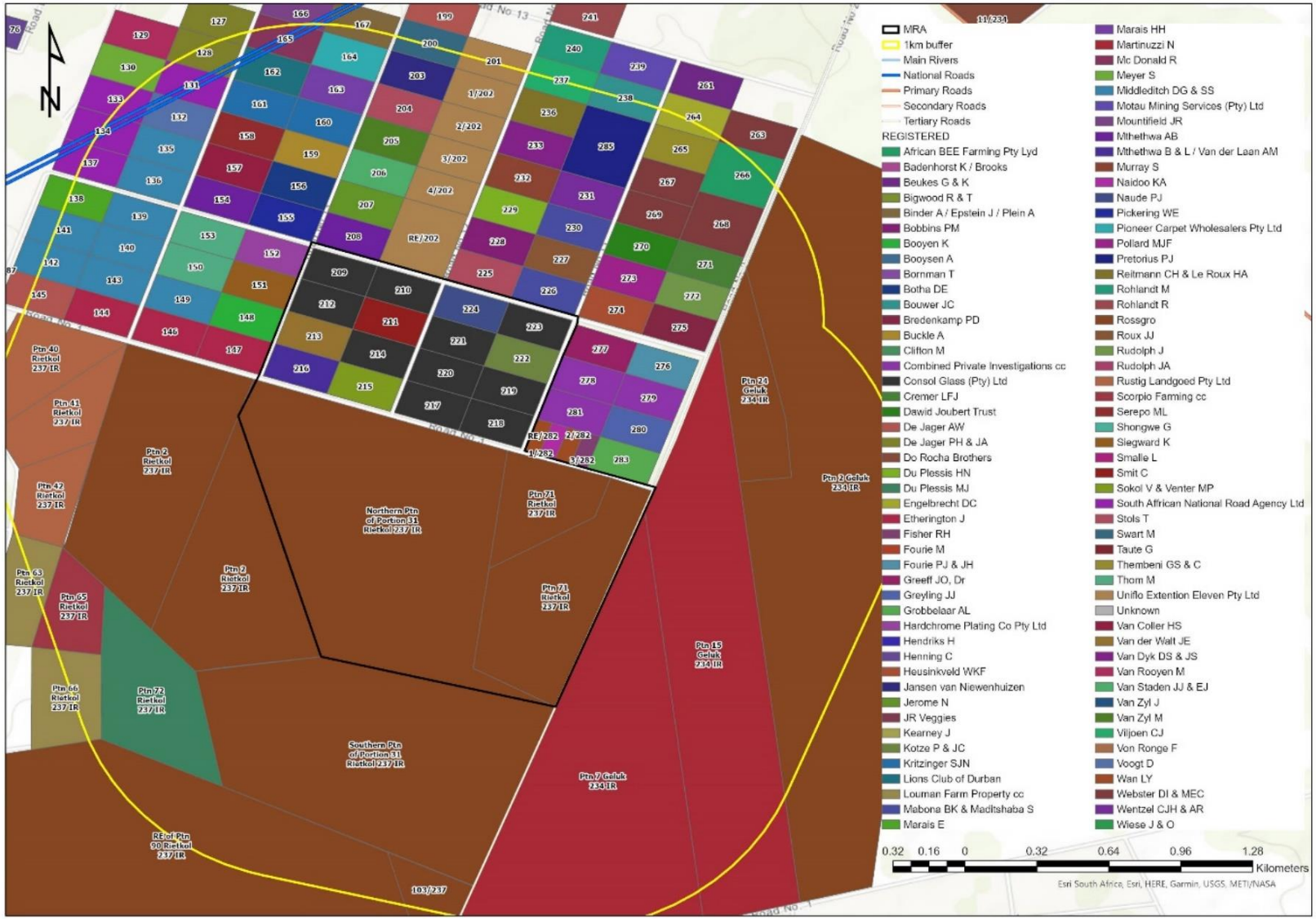


Figure 4: Landownership map within 1 km radius of the MRA boundary

4 DESCRIPTION OF THE PROPOSED OVERALL ACTIVITY

Silica is planned to be mined by means of conventional opencast methods to a depth of between 30 and 50 meters below surface (mbs). The estimated life of mine (LOM) for the proposed Rietkol Project is 20 years. Further exploration drilling will be conducted during the operational phase, which may increase the LOM and mining depth if the resource proofs viable. **It is important to note that this EA application deals with the first 20 years of mining only.**

The proposed project includes the following mining and related infrastructure:

- Opencast pits;
- Run of mine (RoM) stockpiles;
- Processing plant (crushing, screening, washing and drying operations);
- Product stockpiles;
- Administration office facilities (security building, administration and staff offices, reception area, ablution facilities);
- Production facilities (locker rooms, laboratory, workshops, stores, ablution facilities);
- Bagging facility and warehouse;
- Weighbridge;
- Access roads; and
- Clean and dirty water management infrastructure.

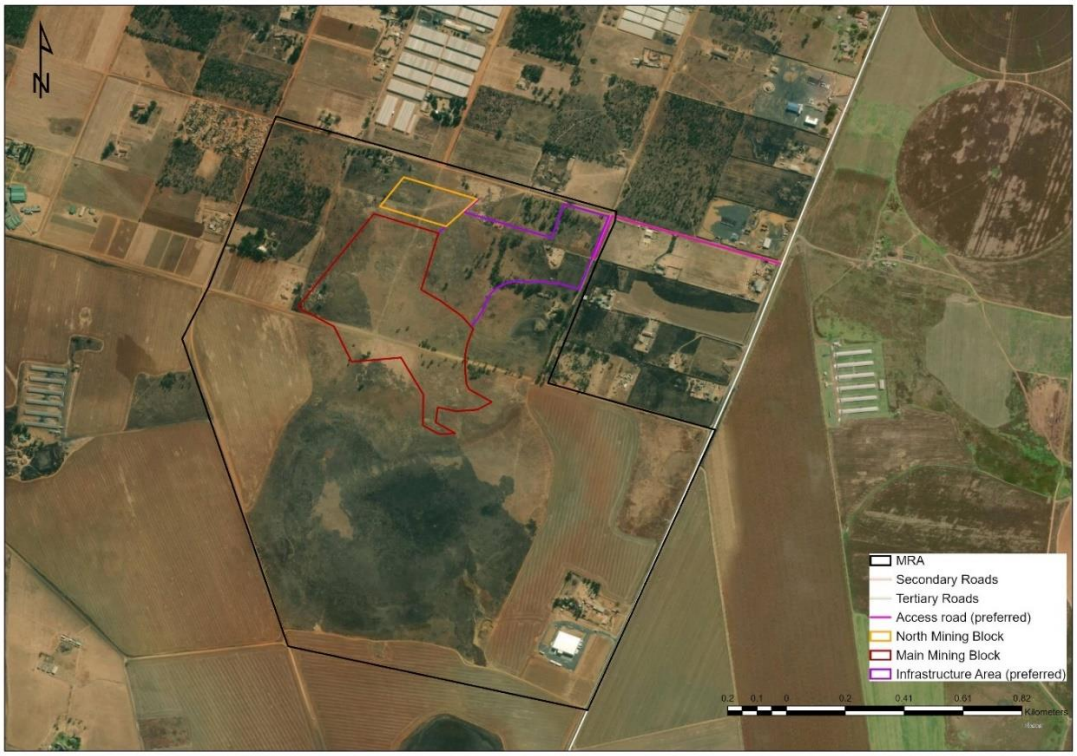


Figure 5: Rietkol Project Layout

4.1 GEOLOGY

All geological information provided in this document was interpreted from the 1:250 000 geological map of the Rietkol Project area provided in Figure 6 and obtained from the Rietkol Mining Work Programme (MWP, 2019) Report.

4.1.1 Local Geology

Stratigraphically, the MRA area and mine occur on the boundary between the Malmani Subgroup and the Pretoria Group of the Transvaal Supergroup. The Malmani Subgroup consists of several hundred meters of cherty, stromatolitic dolostone, about 2.6 billion years old that was deposited on an intra-cratonic marine basin under tidal conditions (MWP, 2019).

The Malmani Subgroup is unconformably overlain by a layer, informally known as the Giant Chert, of cryptically brecciated chert, grading into typical breccia, which is set in a black, silicified mudstone matrix. Its thickness varies along the strike from 0 to 20 m. The Giant Chert forms the base of the Pretoria Group and represents a palaeosol formed because of dissolution of the carbonate fraction of siliceous dolostone during a period of emersion and denudation. The cryptically brecciated chert formed because of small mechanical disturbances and where soil and alluvial movements were active; more typical breccia in silicified mudstone resulted. Sinkholes and cave systems, filled with residual material, which formed during this long period of denudation, have been described in detail outside the MRA area.

The Bevets Conglomorate Member directly overlies the Giant Chert and consists of irregularly rounded chert pebbles, grading upward into pure quartzite. Both the Giant Chert and the Bevets Member form the Rooihoogte Formation. Conglomerate and quartzite are impersistent along the strike and are not more than a few meters thick. This stratigraphic unit marks the appearance of allochthonous terrigenous material, such as quartz, although variable amounts of autochthonous chert and clay are admixed in places. The Bevets Member marks the transgression of a coastline and was followed by the deposition of shale, minor quartzite, and ironstone of the Timeball Hill Formation.

The Bevets conglomerate and quartzite as well as the Timeball Hill Formation are generally accepted as marine sediments. Nevertheless, a latchstring environment was recently proposed as an alternative, but without excluding the possibility of a marine environment. Its age is not accurately established but is probably 2.3 - 2.2 billion years old. The Malmani Subgroup and the Pretoria Groups are disconformably overlain by late Carboniferous – Permian diamictite, shale and sandstone of the

Karoo Supergroup. The Proterozoic and Permian strata are intruded by several generations of diabase and dolerite sills and dykes.

The Malmani Subgroup and the Pretoria Group underwent a mild static metamorphism, probably within the greenschist facies, which undurated the argillaceous rocks into slate and recrystallized the sandstone into quartzite. The Karoo strata are unmetamorphosed.

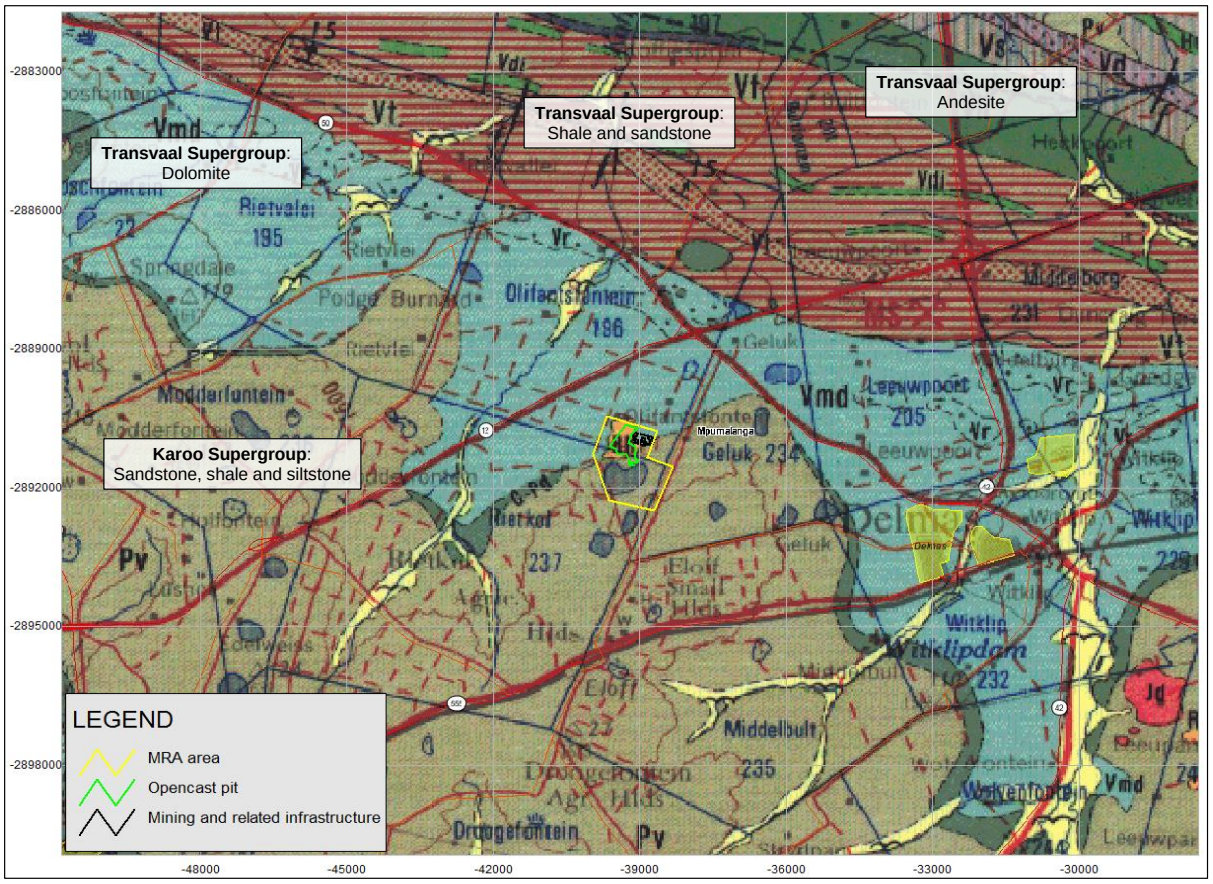


Figure 6: 1:250 000 geological map of the Rietkol Project area

4.1.2 Site Specific Geology – Results of Exploration Drilling

The Delmas silica deposit is referred to as a mega-sinkhole filled with beach sand during the Pretoria Group transgression. The deposit forms a kidney-shape of pure quartzite overlying agrillitic rock and chert breccia. The latter represents residual material left after dissolution of siliceous dolostone from the Malmani Subgroup of the Transvaal Supergroup during the pre-Pretoria Group karst event. The residual material and the quartzite are interpreted as the filling of a mega-sinkhole. From the sedimentological and structural relations between the residual material and the quartzite, it is suggested that the latter could be correlated with the basal, transgressive marine beds of the Pretoria Group. It is proposed that during this transgression, due to progressive subsidence, the mega-sinkhole

was filled with pure arenitic quartz beach sand that had been washed and sorted by tidal action. The sand was later transformed into quartzite by low-grade metamorphism.

A flat dipping dolerite sill of approximately 30 m thick cuts through the deposit and divides it into an Upper- and a Lower Quartzite band. Due to the thickness of the sill, mining will not cut through the sill and only the Upper Quartzite band will be mined to a maximum depth of approximately 30-50 meters.

The existence of a deposit of good quality quartzite on the Modder East Orchards AHs has been known for many years and therefore various studies have been done over the past decades to determine the quality and quantity of the silica deposits in the Delmas region. Pilkington has investigated the surface and found the quartzite is suitable for glass-making in the early 1980's. A geological survey of the Delmas area was carried out in 1983 and showed that the Eloff deposit was the only worthwhile deposit to investigate further.

From the earliest studies all indications were that the Eloff deposit is derived from the Daspoort Formation and was deposited or slumped into an uneven sinkhole in the dolomite of the Chuniespoort Group of the Transvaal Supergroup. The material was subsequently leached which resulted in a very pure quartzite. The sinkhole is lined with chert or chert breccia plus green and khaki shales.

From the drilling it appears as though the degree of surface weathering is much more restricted at Eloff than at Delmas, however the quartzite throughout the deposit appears to be exceptionally pure. Limited clay minerals are present on most joints and fractures, which means the clay should be released both in the mining and processing of the rock.

4.2 RESOURCE PARTICULARS

4.2.1 Type of Mineral

The borehole analytical results and the associated geological report correlates with the historic geological model. Inclusive of the additional borehole results, the total in-situ resource is estimated to be 29.75 million tonnes (Mt).

The predominant minerals to be mined are:

- Glass Sand (Silica) QG Type Q
- Silica sand (general) Q Type Q
- Sand (general) QY Type I

- Silica Sand QD Type Q

The mining may encounter the following minerals, which will be mined as part of the planned mining operations:

- Clay (CA) Type Cy
- Ball Clay (CL) Type Cy
- Concrete Sand (QO) Type Q
- Building Sand (QB) Type Q
- Clay (general) (Cy) Type Cy
- Crusher Sand (Silica) (QC) Type Q
- Foundry Sand (Silica) (QF) Type Q
- Filling Sand (Silica) (QL) Type Q
- Fuller's Earth (Clay) (CE) Type Cy
- Group (Clay) (Cl) Type Cy
- Metallurgical Silica (QM) Type Q
- Shale/Brick Clay (CS) Type Cy
- Silcrete (Silica) (QS) Type Q

4.2.2 Products and Markets

The main reason for this MRA is for the supply of silica sand to various markets including the glass, foundry and filtration industries in the Gauteng and Mpumalanga regions. In addition to this, many other local industries rely on various grades of silica sand to manufacture their products. The main products that are envisaged to be sold are River Sand, Amber Sand, Flint Sand, Chemical Sand and Filter Sand.

Roughly 95% of the products will be distributed within the region while the remaining 5% is destined for the remainder of South Africa and surrounding African countries. The main industries that make use of the products are as follow:

Product	Industry
River Sand	Construction and road works
Amber Sand	Container glass industry
Flint Glass	Flat glass industry
Chemical Sand	Sodium Silicate
Filter Sand	Water Purification

Based on the current market structure approximately 70% of the mined material would be supplied to the glass industry, and the remaining to other silica sand users, including:

- Silica Distributors
- Adhesive Manufacturers
- Metal Foundries
- Golf Course Maintenance
- Building Maintenance
- Coatings and Adhesives Producers

4.3 OPEN PIT MINING

Silica will be mined through an opencast bench mining method. The benches will be mined at a width of 30m and a height of 5m. Final mining depth will be between 30 and 50 mbs. Mining will commence in the northern portion of the MRA area and will progress in a south-easterly direction.

Drilling and blasting of the rock face will be conducted on a predetermined schedule in accordance with projected volumes of production and will be undertaken by blast professionals and with the required safety procedures applied.

The mining method will include:

- Vegetation and topsoil will be stripped ahead of mining. At least one cut (30m) should already be stripped and available for drilling between the active topsoil stripping operation and the open void;
- The topsoil will be loaded onto dump trucks by excavators and hauled to areas that require rehabilitation;
- Drilling operations will commence in the front of the advancing pit after the topsoil has been removed;
- The blasted RoM will be stockpiled with excavators; and
- Thereafter RoM will be transported to the crushing plant by means of haul trucks with a loading capacity of approximately 40 tons.

4.3.1 Mining Model and Schedule

Access ramps will be located along the eastern pit limit and are laid out within the orebody to minimise the mining of waste.

The North Block will be mined for the first 3 years of LOM in a northernly direction, commencing from Block S04. Block S04 is the deepest and the ore body floor slopes up to the outcrop in Block S01. The ore from Block S04 will be used as a strategic stockpile in readiness for plant start-up.

Once Block S04 has been mined out a void exists to dump the tailings from the washing plant from about YR2 onwards. Since it is the deepest portion of the block, the water will not negatively impact on the mining operation of S03, S02 and S01. The void created by mining the North Block is 309 197 bank cubic meters (BCM) and tailings can be dumped in the North Block for the first 16 years of mining.

Once the North block has been mined out, mining in the Main Mining Block will commence in YR4, in a southernly direction up to Block 14 in YR20. The barrier between North Block and the Main Mining Block is 30m. This constitutes a loss and can be optimized by means of further detailed geotechnical analysis.

Various machinery and vehicles will be used in the pit and to transport the RoM to the crushing plant. The equipment includes excavators, front-end loaders, and ADT's.

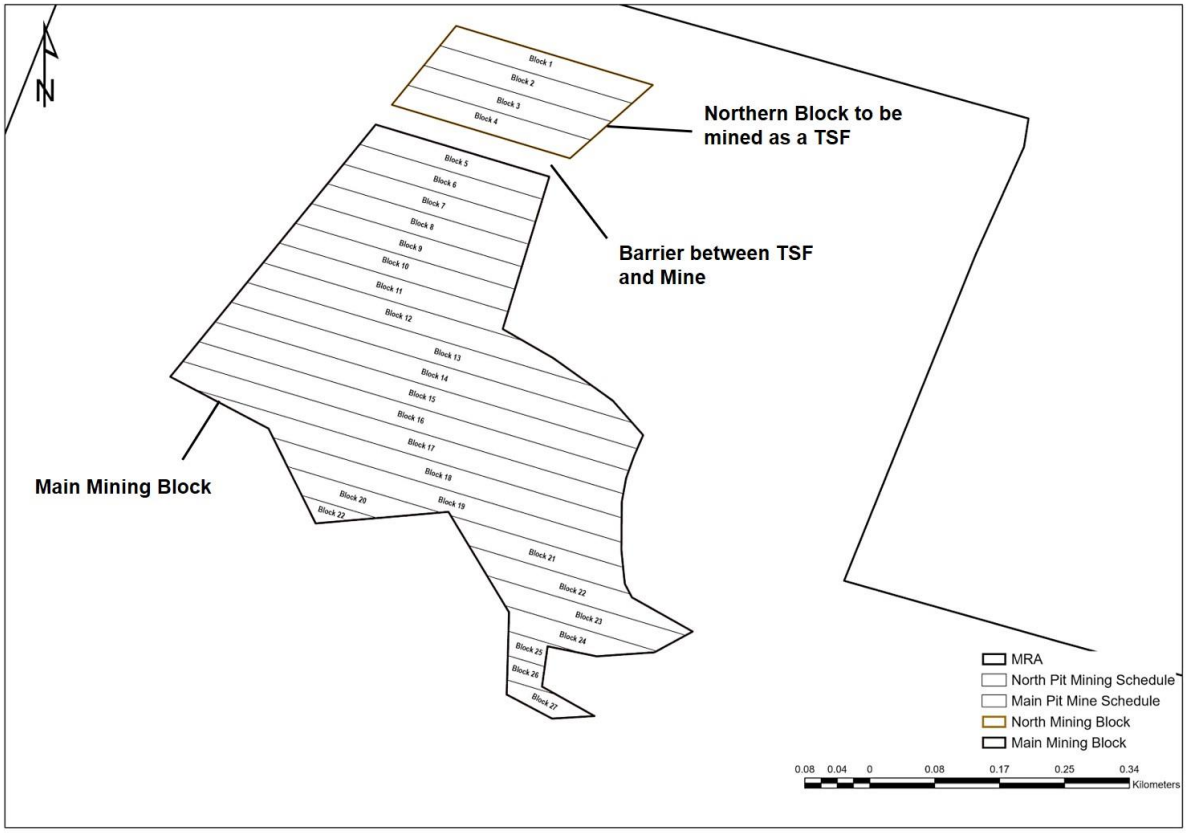


Figure 7: Plan view of the mining blocks

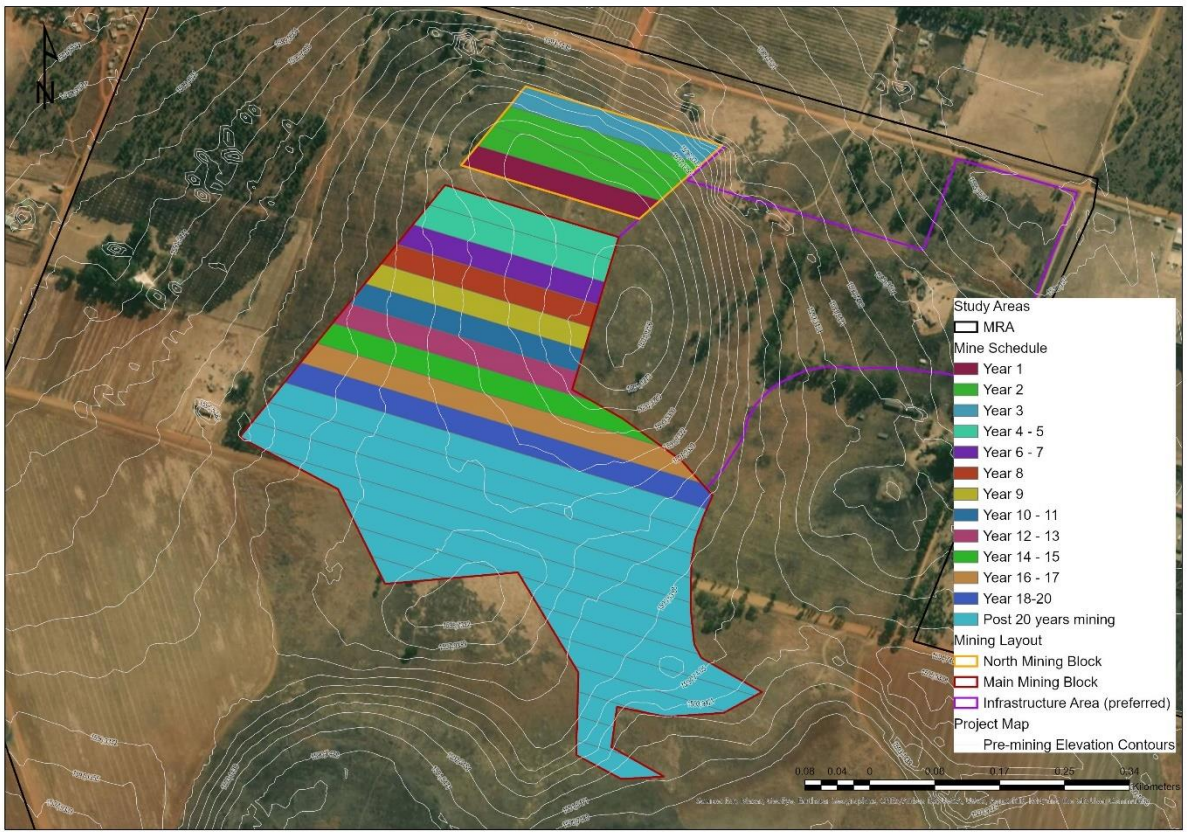


Figure 8: Mine schedule for first 20 years of mining

Figure 9 shows a cross-section of the North and Main Blocks in a north-south direction.

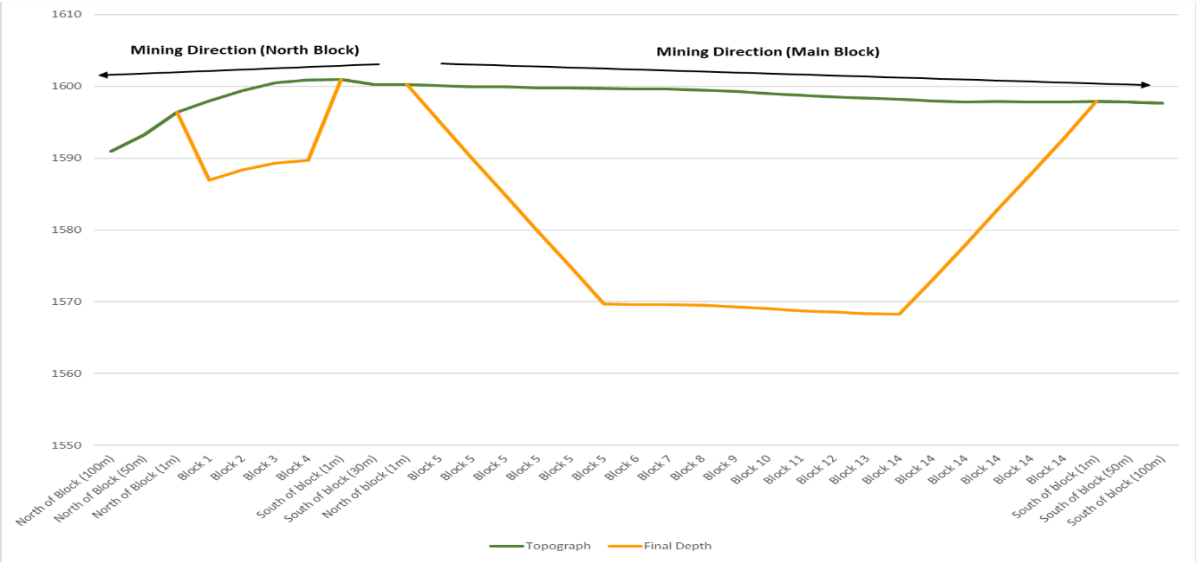
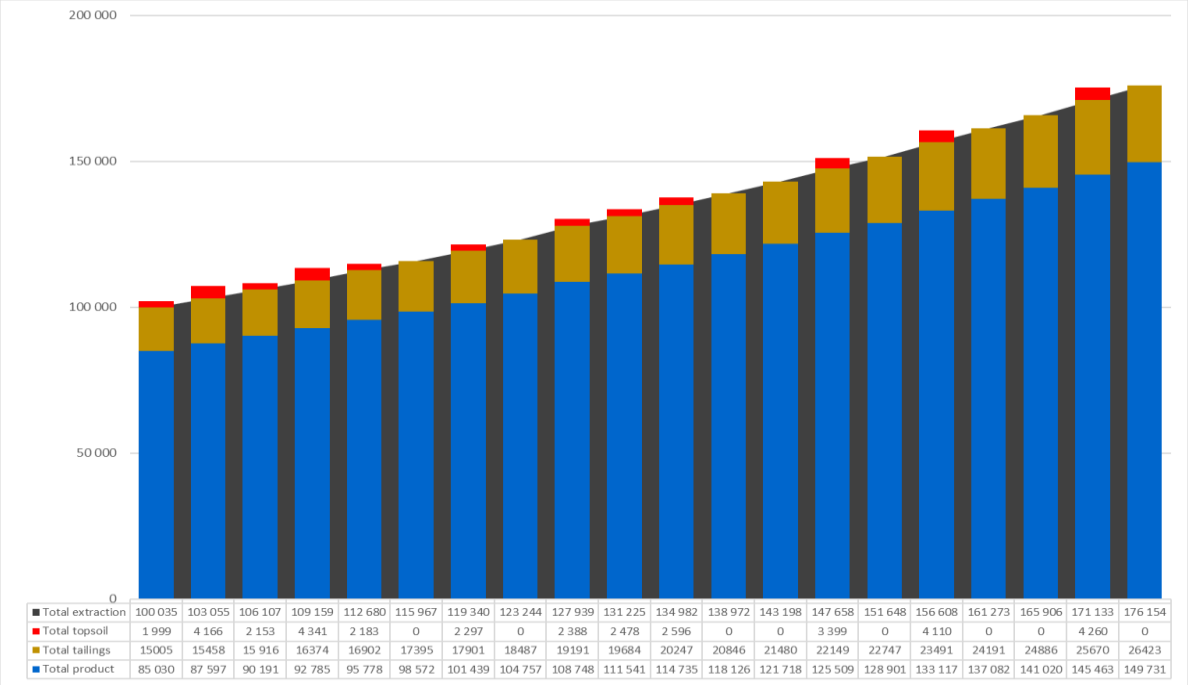


Figure 9: Cross-section through the Rietkol mining pits

The production schedule over the first 20 years of mining is indicated in Figure 10 below.



Total extraction	100 035	103 055	106 107	109 159	112 680	115 967	119 340	123 244	127 939	131 225	134 982	138 972	143 198	147 658	151 648	156 608	161 273	165 906	171 133	176 154
Total topsoil	1 999	4 166	2 153	4 341	2 183	0	2 297	0	2 388	2 478	2 596	0	0	3 399	0	4 110	0	0	4 260	0
Total tailings	15005	15458	15 916	16374	16902	17395	17901	18487	19191	19684	20247	20846	21480	22149	22747	23491	24191	24886	25670	26423
Total product	85 030	87 597	90 191	92 785	95 778	98 572	101 439	104 757	108 748	111 541	114 735	118 126	121 718	125 509	128 901	133 117	137 082	141 020	145 463	149 731

Figure 10: Rietkol Project production schedule

4.3.2 Rehabilitation and Closure Planning

Slimes will be pumped into the North Block and will form part of the rehabilitation process. As most of the material mined is processed and removed from site as product, backfilling of the Main Block to a free-draining state will not be possible. Therefore, the final rehabilitation plan allows for the backfilling of all the remaining material and building rubble into the pit area, sloping of the high-wall areas, and establishment of a recreational area within the Main Block final void area, as per the agreement with the stakeholders and authorities.

At the end of LOM, all infrastructure that has a beneficial post-mining use will be retained. The remaining infrastructure and buildings will be demolished and building rubble will be placed in the pit. The cleared areas will be ripped and levelled before topsoil is placed and the area is re-vegetated. Inert reject material will be placed in the open pit area and the sides of the pit will be sloped and re-vegetated.

A Rehabilitation, Decommissioning and Closure Plan Financial provision will be developed for the Rietkol Project during the EIA Phase, in line with the requirements of Government Notice No. R.1147 (GNR 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 GNR 1147.

4.4 DESCRIPTION OF THE PROCESSING PLANT

The processing plant comprises of crushing, screening, washing and drying operations. Amber and flint sand will not go through the dryer plant.

4.4.1 Crushing

RoM is fed to the crushing plant by tipping it into a feed chute feeding a grizzly screen which screens the RoM before the oversize material is crushed. The crushed RoM is fed via conveyor to a screen with the upper and lower decks consisting of larger and smaller screening panels, respectively. The oversize material from the upper deck is fed with a conveyor to a jaw crusher which crushes the material to the desired size. River sand product is stockpiled (undersize) while the oversize together with a recycle stream and the crushed product is discharged into a chute.

The final crushing plant screen consists of varying screening panels to yield different grades of material which are used as feed stocks for the various wash plant products. The -20mm particles are screened out in the front of the screen while the undersize is collected at the rear of the screen. The oversize material of is fed to a Gyro crusher with conveyor and the crushed product (100% passing 40mm) is recycled for washing. The material is drawn from underneath the -5mm stockpile by a tunnel conveyor that feeds the wash plant.

4.4.2 Wash Plant

Various products are produced in the wash plant using crusher feed stock. Depending on the category and quality requirement, additional crushing, screening, and hydro-sizing equipment is employed.

4.4.3 Screening Process

A vibratory feeder feeds the feedstock onto conveyor which discharges the material onto a grizzly screen which cuts at the desired size. The material from the grizzly screen is wet screened on the main screen. The oversize from the first screen is discharged onto the dewatering screen containing a mixture of screening panels (arranged in increasing aperture size in the direction of flow). The oversize material from the second screen is fed to a vertical shaft impactor from where the material crushed to -5mm which is recycled and recombined with the raw feed.

The slurries collected underneath the first screen and the front section of the dewatering screen gravitates into a pot in which slimes overflow to the thickener pot and the underflow is pumped,

dewatered, and stacked with a separator on the product stockpile. The overflow from the separator returns to the pot below the screens.

The material collected in the collection pan at the rear section of the dewatering screen gravitates into another pot in which slimes are removed in the overflow to the thickener pot and the underflow is pumped to a separator, dewatered, and stacked onto the Filter Product stockpile. Finally, the overflow from this separator returns to a pot.

All the overflows from the various pots in the screening and hydro-sizing plants combine into a pot from where it is pumped to the thickener.

4.4.4 Screening with Hydro-sizing Process

Feedstock is fed onto a conveyor with a vibratory feeder that combines with the recycled oversize material from screen the dewatering float glass screen onto a single conveyor. This feeds the vertical side impactor (VSI) that crushes the -40mm feed to 100% passing 5mm. The crushed material from the VSI is fed onto the main screen consisting of only 1mm screening panels and the oversize from the screen is discharged onto the dewatering screen which consists of 1mm panels in the front and 4 rows of panels with 5mm apertures at the rear section of the screen.

The material screened out in the main and dewatering screens is collected and discharged into a pot. From this pot it is pumped to a dewatering cyclone where the solids are dewatered in preparation of further washing. The cyclone overflow is returned to the pot under the main screen and the overflow from this pot is gravity fed to the pot that goes to the thickener.

The cyclone underflow comprises the feed to the primary classifier where the D50 cut size of 665µm is achieved by an upward flow of water. The underflow of the cyclone gravity feeds to a pot from where the underflow is dewatered with a separator and stacked as filter product. The overflow of the separator is returned to another pot and the overflow from this pot gravitates to the thickener pot.

The overflow from the first classifier gravitates into a secondary classifier of which the D50 cut size is 75µm. The underflow of this classifier is fed into a pot from where the underflow is pumped to and dewatered with a separator and stacked as the final product. The overflow of the separator is returned to a pot and the overflow from the pot gravitates to the thickener return pot. Finally, the overflow from the secondary classifier flows into a pot, the underflow of which is pumped to a dedicated separator, dewatered, and stacked onto the chemical sand product stockpile. The separators overflow is returned to the pot and the overflow from this pot feeds into the into the tailings facility (open pit).

4.4.5 Dryer Plant

After being dried in the respective stockpiles to a moisture content of 5%, amber and float glass filter products are fed with a tunnel conveyor into a silo from which it is fed to driers with vibratory feeders.

The energy required to dry the material to a desired moisture content of less than 1% is obtained by combusting a heavy hydrocarbon fuel blend. The combusted fuel (flue gas) heats the filter sand, thereby evaporating the moisture associated with the sand. Flue gas exits the drier and entrained dust is removed in a dust suppression system before the gas is discharged into the atmosphere. The dried filter product is discharged from the drier onto conveyors and is stockpiled in the dry sand shed before being sized in the screening plant according to product specifications.

Material that is not fed through the driers is placed on drying beds adjacent to the plant. Water run-off from the drying beds is collected in a sump and channelled to the process water dam located to the south-west of the plant for re-using in the plant.

The dried filter sand is fed by means of conveyor to the dry screening plant where it is sized into fractions by means of vibratory screens in accordance with product specifications.

4.5 PROJECT INFRASTRUCTURE

Currently little infrastructure exists to service the planned mining activities and most of the infrastructure requirements will be established as part of the planned mining operation. The infrastructure components and layout are presented in Figure 11.

4.5.1 Roads and Transport

4.5.1.1 Mine traffic

The vehicle traffic related to the mine includes (refer to Table 3):

- Transport of staff to and from work working on a three (3) shift rotation per day;
- Routine maintenance of equipment, site vehicles and production equipment;
- Transport of fuel and on-site refuelling;
- Management and visitor transport and supervision activities; and
- Transport of final product to the markets, estimated at approximately 36 trucks (one-way) per day, at highest production levels (worst-case scenario).

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

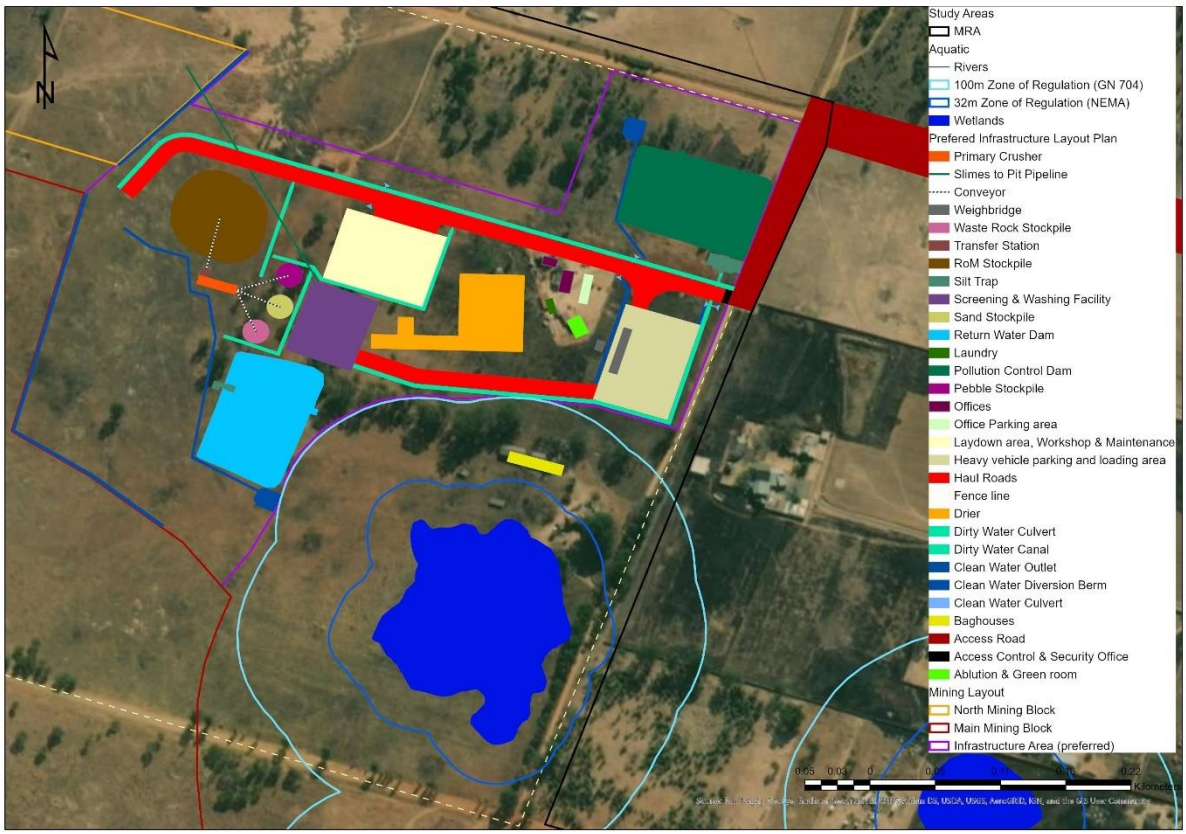


Figure 11: Infrastructure Layout Plan

Table 3: Transport at Rietkol (MWP, 2019)

Type of vehicle	**Estimated Vehicle Movements (round trips)**		
	Per day	Per month	Per annum
Light vehicle traffic	16	350	4200
Buses	12	360	4320
Deliveries	3 trips per week	12	120
Other (Customers etc.)	2	44	528
Product Transport			
Tippers (40 ton)	54	1620	19440
33-ton tipper and flatbed vehicles	4	120	1440
Flatbed trucks	10	300	3600
Bulk tankers	4	96	1152

4.5.1.2 Access and haul roads

Access to the site will be gained via the N12 and the R50. From the R50, access to site will be via Provincial Road D1550, a paved secondary provincial road. This road will be upgraded to handle the additional traffic associated with the proposed mining project. From the D1550 the mine will be

accessed via an existing gravel road turning off the D1550 just north of AH 276. Similarly, this gravel 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.

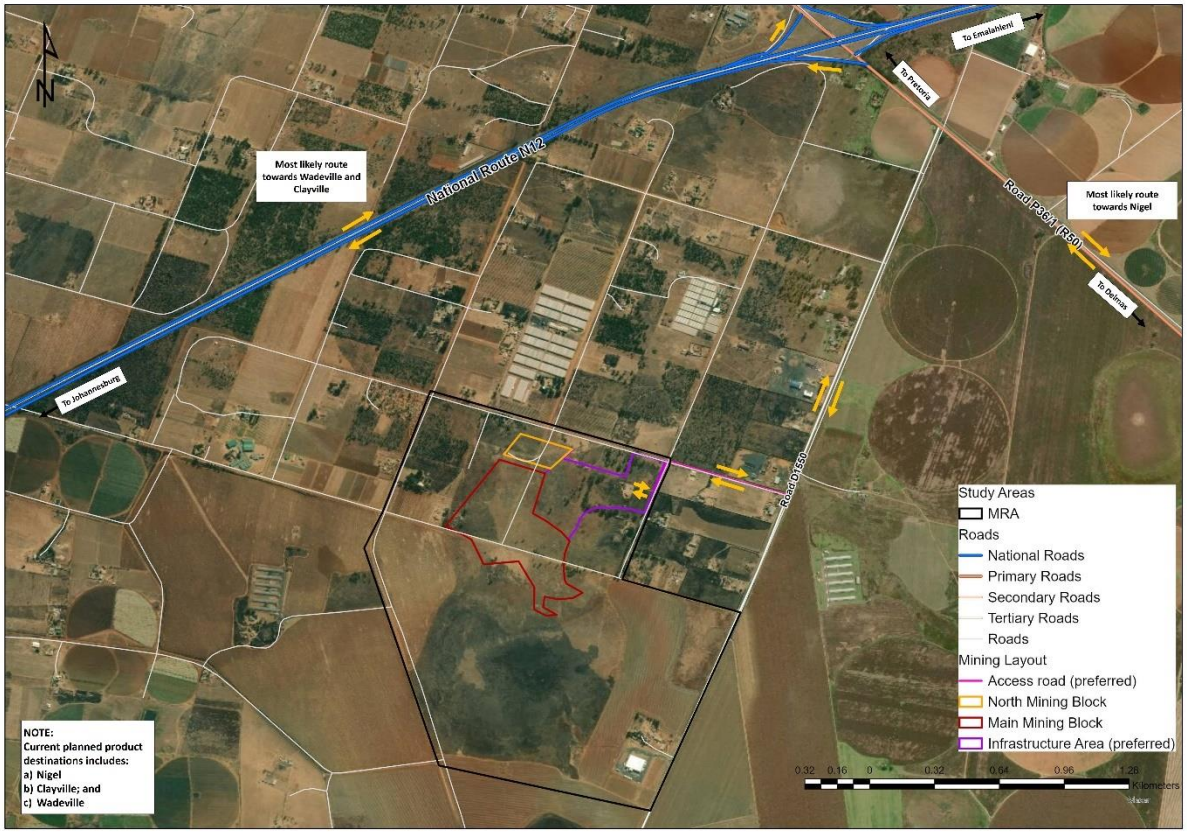


Figure 12: Site access and product transport routes

4.5.2 Bulk Electricity

An 11 kV electricity supply line is located on the northern boundary of the MRA area and discussions with Eskom is underway to connect to this supply line. Generators will be installed to supplement Eskom power where required.

Table 4: Anticipated Power Requirement (MWP, 2019)

Lighting, Workshops and Offices		
Energy	Kilo Watt Hour/month	14 040
Average Power	Kilo Watt	30
Peak Power	Kilo Watt	50
Plant Conveyors and screens		
Energy	Kilo Watt Hour/month	156 000
Average Power	Kilo Watt	250
Peak Power	Kilo Watt	400

Pumps		
Energy	Kilo Watt Hour/month	436 800
Average Power	Kilo Watt	700
Peak Power	Kilo Watt	950
Crushers		
Energy	Kilo Watt Hour/month	280 800
Average Power	Kilo Watt	450
Peak Power	Kilo Watt	790

4.5.3 Bulk Water

4.5.3.1 Potable water

Potable water will be used in the change houses and the offices. The potable water demand has been calculated at between 150 and 200 litres/person/day. At full production, a peak demand of 20 m^3/day of potable water will be required.

4.5.3.2 Process water

Limited water is consumed during processing and all processing water will be recycled. However, there will be a loss of approximately 20% through moisture in the product and evaporation.

Water for processing and dust suppression will be obtained from the open pit (groundwater influx) and the existing boreholes within the MRA area.

The estimated water requirements for the mining operation at full production is indicated in Table 5.

Table 5: On-site anticipated water requirement at full production (MWP, 2019)

Dust Suppression		
Minimum Demand	m^3/month	650
Maximum Demand	m^3/month	1 040
Average Demand	m^3/month	845
Maximum Demand	ℓ/s	0.4
Processing		
Minimum Demand	m^3/month	6 627
Maximum Demand	m^3/month	8 694
Average Demand	m^3/month	7 610
Maximum Demand	ℓ/s	3.4
Potable Water – washrooms and consumption		
Minimum Demand	m^3/month	450
Maximum Demand	m^3/month	600

Average Demand	m^3/month	525
Maximum Demand	ℓ/s	0.2
Total Water (excluding recycling)		
Average	m^3/month	8 980
	m^3/day	299
	ℓ/s	3.5
Maximum	m^3/month	10 334
	m^3/day	345
	ℓ/s	4.0

Note: The above volumes exclude any recycling. The overall water balance and make-up water requirements will be defined as part of the EIA process, and it is envisaged that this make-up requirement will be much lower than the stated water demand above.

4.5.3.3 Stormwater management

The overall objective of storm water management at the MRA area will be to isolate contaminated areas from clean runoff thereby minimising contaminated runoff and preventing pollution of water resources. Process water will be recycled for re-use in the process plant.

Except for limited chemicals used in the thickener plant, no further chemicals are added during the beneficiation process. The material mined is inert and poses a low water quality risk. Only the workshop area where maintenance of vehicles and machinery takes place has been identified as a dirty water area. Run-off from the site will be managed to limit siltation of the surrounding water sources.

The Storm Water Management Plan (SWMP) will be defined as part of the EIA process.

4.5.4 Hydrocarbon requirements

A total of 128 m^3 of hydrocarbon storage facilities will be required for the operational phase, as indicated in Table 6.

Table 6: Hydrocarbon requirements for the Rietkol Project

Total Volume	Location
82 000 litres	Bulk storage facility for diesel at the workshop area
23 000 litres	Bulk storage facilities for oils and lubricants at the workshop area
23 000 litres	Bulk storage facilities for used oils at the workshop area

4.6 WASTE MANAGEMENT

4.6.1 Mine Residue

Tailings will be backfilled into the open pits and no surface tailings facilities are planned. The tailings backfill schedule of North and Main Blocks are presented in Figure 13.

The void created by mining the North Block is 309 197 BCM and tailings can be dumped in the North Block for the first 16 years of mining. From YR17 onwards the tailings will be dumped in Block S05 – 07 of the Main Block. A berm of 2m will separate the tailings disposal area from the active mining operations to the south. Figure 14 shows the final pits and associated voids after backfilling (at decommissioning).

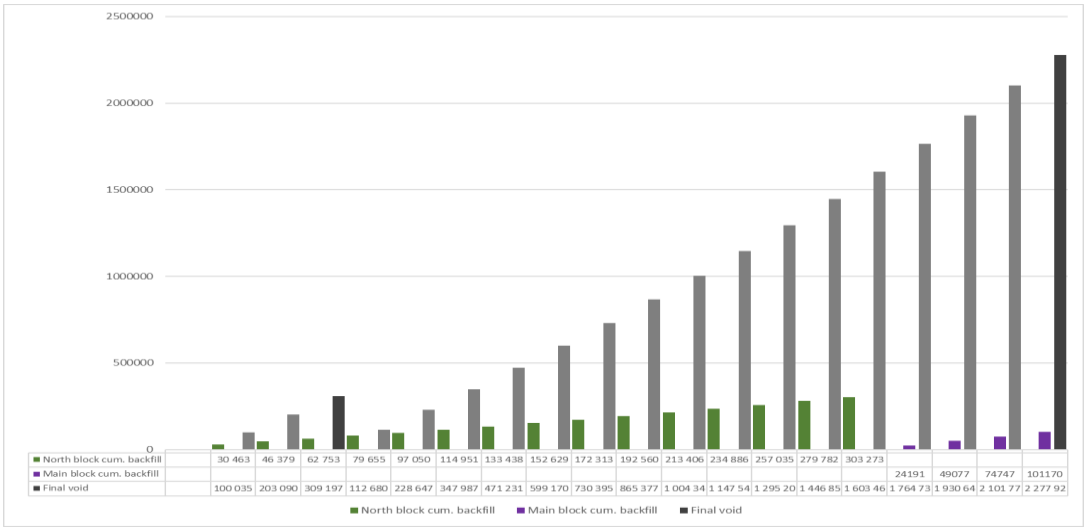


Figure 13: Tailings backfill schedule

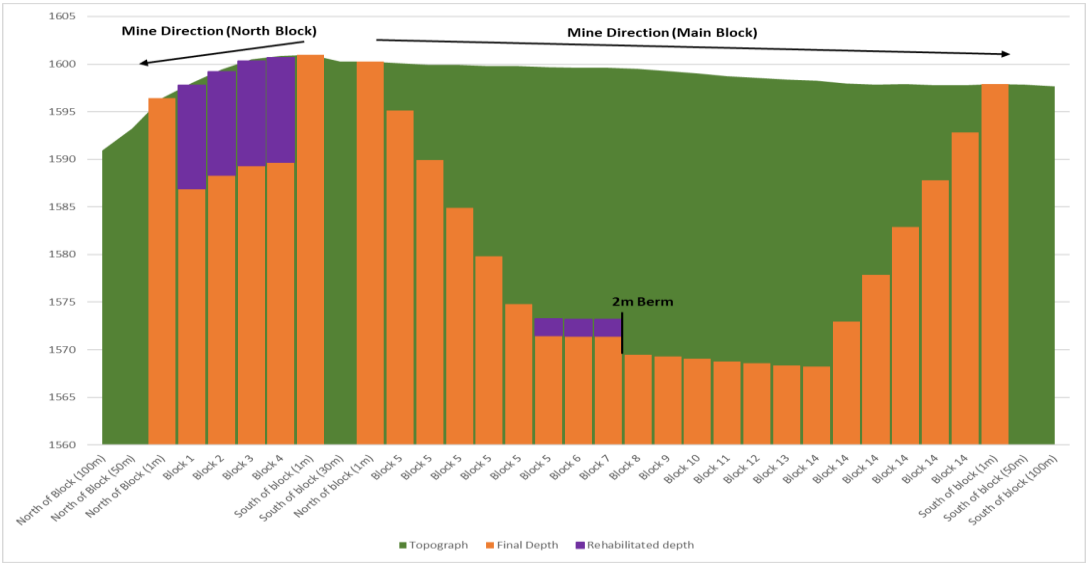


Figure 14: Cross-section through the Rietkol mining pits after backfilling

4.6.2 Non-Mining Waste

4.6.2.1 Sewage

The only sewage expected to be generated on the mine is from the ablution facilities and washrooms at the infrastructure area.

The wastewater and greywater originating from the change houses and laundry will drain into a modular calcamite septic tank system that will need to be emptied twice a week. The wastewater flows were calculated as follows:

- 150 people.
- The design flows were taken as 70ℓ/person/day as per SABS 1993 for workers per shift.
- The septic tank will be cleaned twice a week giving a maximum retention time of 4 days.

The septic tank will therefore need a capacity of 42 000 ℓ (150 people*70 ℓ*4 days). It is recommended to install a 44 500 ℓ modular calcamite tank to allow for some additional storage capacity.

4.6.2.2 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 Rietkol Project site.

4.7 ORGANIZATIONAL STRUCTURE OF THE MINE

It is envisaged that the Rietkol Project will employ 100 people at full production. 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 Government Certificated Engineer will be appointed.

Table 7: Employee numbers (MWP, 2019)

Year	YR01	YR02	YR03	YR04 onwards
Employees	96	100	100	100
Construction contractors	100	50	50	-
Total	196	150	150	100

4.8 LISTED ACTIVITIES

In terms of the 2014 EIA Regulations (as amended), several listed activities are triggered by the proposed Rietkol Project which require an EA. In addition, the disposal of tailings constitutes a waste management activity which requires a WML.

Table 8: Listed and waste management activities

Activity	Approximate Extent	Listed or Waste Management Activity	Applicable Notice
Open Pit Mining	North Block: 2.8 ha Main Block: 9.4 ha	X	GNR 984 – A15 GNR 984 – A17 GNR 983 – A28
Infrastructure area, including processing facility, workshops, and stockpiles	12.9 ha	X	GNR 984 – A6 GNR 984 – A15 GNR 983 – A28
Access / haul roads	35 433 m^2	X	GNR 983 – A24 GNR 983 – A56
Water management facilities (including dams)	PCD: 6 000 m^3 RWD: 5 000 m^3 Clean water canals: 215 m Dirty water canals: 1 300 m	X	GNR 983 – A9
Bulk hydrocarbon facilities	128 m^3	X	GNR 983 – A14
Waste management (incl. sewage)	45 m^3/day (septic tank)	N/A (below threshold)	-
Mine residue (tailings) disposal	404 443 m^3	X	GN No. 921 – Category B11
Blasting	N/A	N/A	-
Product transport	N/A	N/A	-

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 is done in parallel in terms of the One Environmental System – refer to Section 5.2 for more detail on the S&EIR process.

The listed and waste management activities are indicated in Figure 15.

In addition to the above, the construction and operation of a dryer will be undertaken as part of the processing at the Rietkol Project. Drying is listed as an activity which results in atmospheric emissions which have or may have a significant detrimental effect on the environment, including health, social, economic, and ecological conditions, or cultural heritage (GN 893 of 22 November 2013 published in terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)):

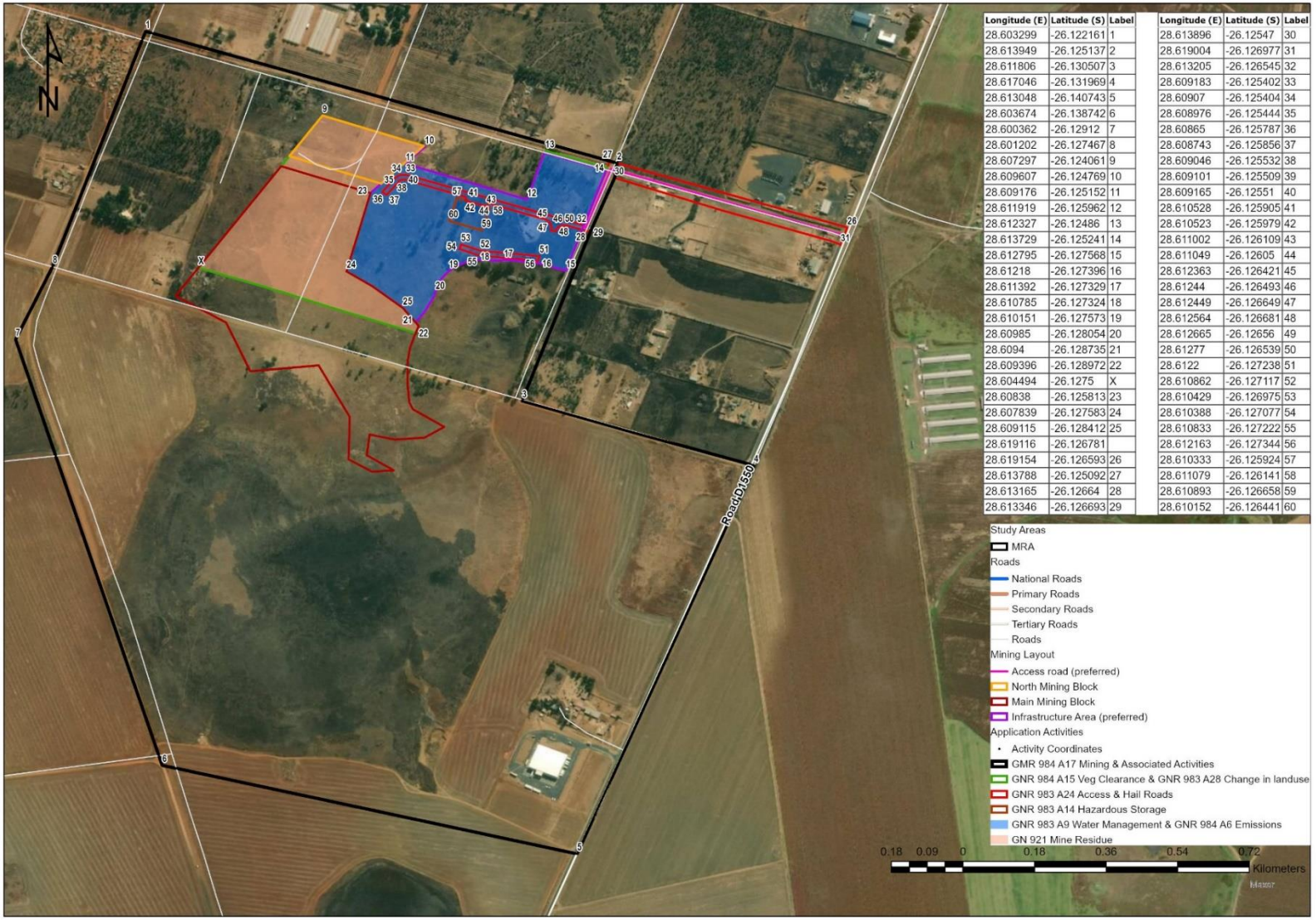
Category 5: Mineral Processing, Storage and Handling

Subcategory 5.2: Drying

Description: Drying of mineral solids including ore, using dedicated combustion installations

Application: Facilities with a capacity of more than 100 tons/month product

An Atmospheric Emissions Licence (AEL) will need to be acquired for the dryer installation prior to construction. Application for an AEL will be conducted on approval of the MRA.



Longitude (E)	Latitude (S)	Label
28.603299	-26.122161	1
28.613949	-26.125137	2
28.611806	-26.130507	3
28.617046	-26.131969	4
28.613048	-26.140743	5
28.603674	-26.138742	6
28.600362	-26.12912	7
28.601202	-26.127467	8
28.607297	-26.124061	9
28.609607	-26.124769	10
28.609176	-26.125152	11
28.611919	-26.125962	12
28.612327	-26.12486	13
28.613729	-26.125241	14
28.612795	-26.127568	15
28.61218	-26.127396	16
28.611392	-26.127329	17
28.610785	-26.127324	18
28.610151	-26.127573	19
28.60985	-26.128054	20
28.6094	-26.128735	21
28.609396	-26.128972	22
28.604494	-26.1275	X
28.60838	-26.125813	23
28.607839	-26.127583	24
28.609115	-26.128412	25
28.619116	-26.126781	
28.619154	-26.126593	26
28.613788	-26.125092	27
28.613165	-26.12664	28
28.613346	-26.126693	29

Longitude (E)	Latitude (S)	Label
28.613896	-26.12547	30
28.619004	-26.126977	31
28.613205	-26.126545	32
28.609183	-26.125402	33
28.60907	-26.125404	34
28.608976	-26.125444	35
28.60865	-26.125787	36
28.608743	-26.125856	37
28.609046	-26.125532	38
28.609101	-26.125509	39
28.609165	-26.12551	40
28.610528	-26.125905	41
28.610523	-26.125979	42
28.611002	-26.126109	43
28.611049	-26.12605	44
28.612363	-26.126421	45
28.61244	-26.126493	46
28.612449	-26.126649	47
28.612564	-26.126681	48
28.612665	-26.12656	49
28.61277	-26.126539	50
28.6122	-26.127238	51
28.610862	-26.127117	52
28.610429	-26.126975	53
28.610388	-26.127077	54
28.610833	-26.127222	55
28.612163	-26.127344	56
28.610333	-26.125924	57
28.611079	-26.126141	58
28.610893	-26.126658	59
28.610152	-26.126441	60

Figure 15: Listed and waste management activities associated with Rietkol Project

5 POLICY AND LEGISLATIVE CONTEXT

5.1 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 and Water Use 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. 59 of 2008: National Environmental Management: Waste Act (NEMWA), as amended

Other legislative frameworks applicable to the Rietkol Project include:

- Act No. 108 of 1996: The Constitution of South Africa
- Act 25 of 2014: National Environmental Management Laws Amendment Act (NEMLAA)
- Act No. 25 of 1999: National Heritage Resources Act (NHRA)
- Act No. 10 of 2004: National Environmental Management: 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. 101 of 1998: National Veld and Forest Fire Act
- Act No. 15 of 1973: Hazardous Substances Act
- Act No. 15 of 2019: Carbon Tax 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.267 of 24 March 2017: Water Use Licence Application and Appeals Regulation
- GN No. R. 982-985 of 4 December 2014: NEMA: EIA Regulations, as amended
- GN No. 960 of 5 July 2019: Notice of the requirement to submit a report generated by the National Web-based Environmental Screening Tool
- GN No. 320 of 20 March 2020: Procedures for the assessment and minimum criteria for reporting on identified environmental themes when applying for Environmental Authorisation

- GN No. R.993 of 8 December 2014: National Appeal Regulations, as amended
- 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. R632 of 24 July 2015: Regulations regarding the planning and management of residue stockpiles and residue deposits, as amended
- GN No. R.893 of 22 November 2013: Atmospheric Emissions Activities
- GN No. R.152 of 2007: NEMBA: Threatened or Protected Species (TOPS) Regulations
- GN No. R.598 of 2014: NEMBA: Alien and Invasive Species Regulations
- GN No. R.1147 of 20 November 2015: Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations
- GN No. R527 of 23 April 2004: Mineral and Petroleum Resources Development Regulations, as amended
- GN No. 1556 of 29 November 2019: Regulations on Carbon Offsets under section 19 of the Carbon Tax Act
- 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. 117 of 1998: Municipal Structures Act
- Act No. 32 of 2000: Municipal Systems Act
- Act No. 67 of 1995: Development Facilitation Act (DFA)
- 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. 22 of 1994: Restitution of Land Rights Act, as amended
- Act No. 112 of 1991: Amendment of the Upgrading of Land Tenure Rights Act

The following provincial legislation has bearing on the project:

- Mpumalanga Local Government Ordinance 17 of 1939 that deals with nuisance pollution
- Mpumalanga Land Administration Act No. 5 of 1998, which regulates land administration
- Mpumalanga Nature Conservation Act No. 10 of 1998 (MNCA), which regulates nature conservation

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
- Mpumalanga Biodiversity Sector Plan (2014)
- 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

Policies and planning documents include:

- Mpumalanga Provincial Growth and Economic Development Strategy
- Mpumalanga Tourism Growth Strategy / Master Plan
- Mpumalanga Spatial Development Framework
- Nkangala District and Victor Khanye Local Municipal Spatial Development Framework
- Nkangala District and Victor Khanye Local Municipal Integrated Development Plan
- Highveld Priority Area Air Quality Management Plan, 2012

- Environmental Management Framework (EMF) for the Olifants and Letaba Rivers Catchment Areas, 2009

5.2 APPROACH TO ENVIRONMENTAL AUTHORISATION AND STAKEHOLDER ENGAGEMENT

The enactment of the NEMLAA introduced the One Environmental System (OES) on 8 December 2014. In terms of the OES every applicant who applies for a mining right in terms of Section 22 of the MPRDA must conduct an EIA and submit an Environmental Impact Assessment Report (EIAR) and Management Programme Report (EMPr) in terms of the NEMA and its EIA regulations (2014, as amended).

Under the OES these reports are submitted to the DMRE who is the Competent Authority for any mining and related activities. The system requires all permitting applications to be conducted in parallel to facilitate integrated decision-making at Government level and the Environmental Authorisation application should therefore ideally include the requirements of the NEMA, the NEMWA and others, as applicable.

The proposed Rietkol Project triggers a S&EIR process, which entails the following (Figure 16):

- **Pre-Application and Application Phase:** Notification of IAPs prior to submission of the Application and conducting such consultation as may be required to commence with baseline investigations. Thereafter, the submission of the application form to the relevant Competent Authority, in this case the Mpumalanga DMRE.
- **Scoping Phase:** Compilation of a draft Scoping Report (DSR) and providing it for comment to all registered 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 (Plan of Study). 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 acceptance of the FSR and Plan of Study, 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. 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 Phase:** 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 timeframe for a "non-substantive" EIA process is legislated to take no more than 300 calendar days (excluding public holidays and the December break). This implies an EIA process where all issues could be satisfactorily resolved, and no substantive changes needed to be made or new and unexpected information needed to be added to the environmental report. 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 application for a Water Use Licence (WUL) will be conducted in parallel to the EIA process and the stakeholder engagement integrated as far as practically possible. The draft Integrated Water and Wastewater Management Plan (IWWMP) will be made available for comment at the same time as the draft EIAR and EMPr and combined public meetings and focus groups will be held.

The following diagram indicate the process and the steps to follow.

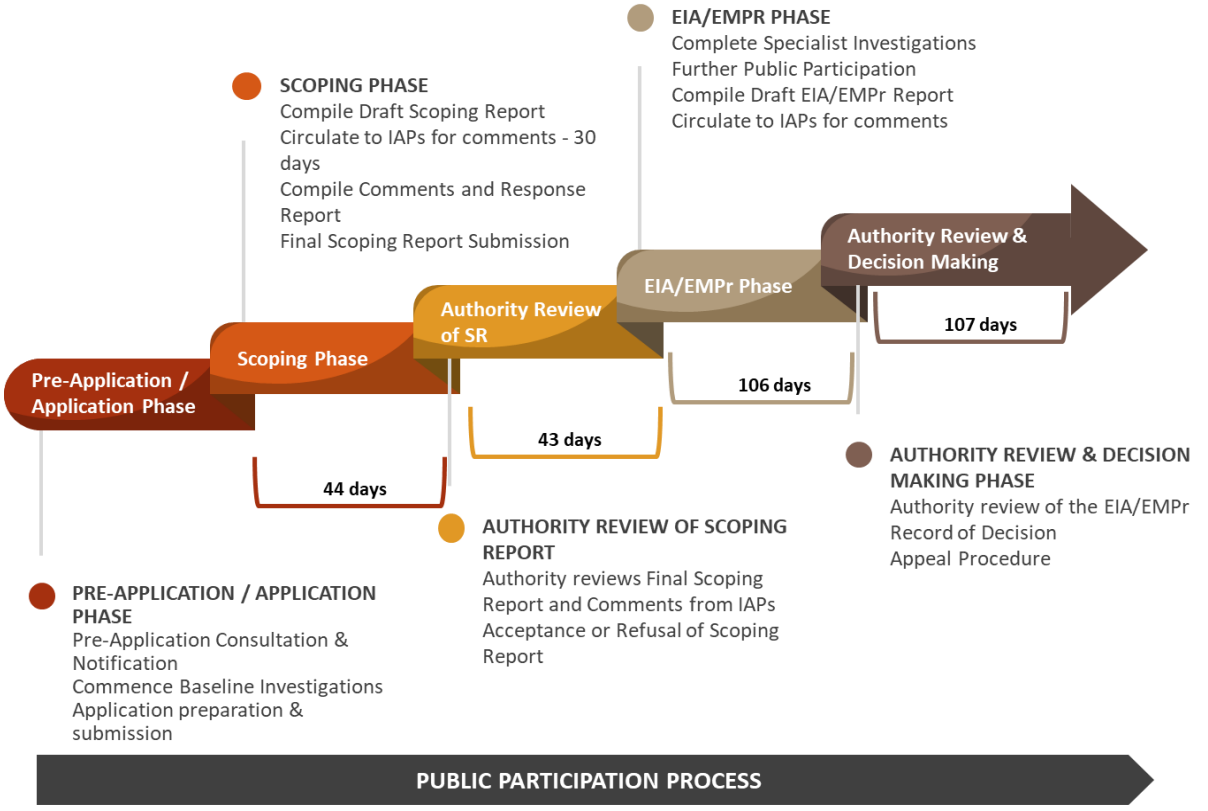


Figure 16: S&EIR process and timeframes

5.3 LICENSING REQUIREMENTS

The following licencing requirements have been identified:

Legislation	Requirement	Status
MPRDA **Nhlabathi Minerals (Pty) Ltd to apply for a mining right.**	Submission of MRA to Mpumalanga DMRE	MRA submitted on 21 January 2020, acceptance received 21 January 2021.
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 to Mpumalanga DMRE	EA application submitted on 18 March 2021. Final Scoping Report submitted to DMRE on 7 May 2021.
NEMWA, Waste Regulations (2013) **Mine residue is classified as a waste management activity**	Application for WML to Mpumalanga DMRE	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 Mpumalanga DWS	In progress.
NEM:BA, TOPS regulations **Permits required for the destruction and/or relocation of protected species**	Permit application to MTPA	To follow once mining right is granted, prior to construction activities.
NEM:AQA	Application for AEL to Nkangala District Municipality	To follow once mining right is granted, prior to construction of the dryer plant.
NHRA **Permits required for relocation of burial sites**	Permit application to SAHRA	To follow once mining right is granted, if mining or any other infrastructure is closer than 50m to the informal graveyard.
SPLUMA **Rezoning of property**	Application to municipality for required rezoning	To follow once mining right is granted.

6 NEED AND DESIRABILITY OF THE PROJECT

6.1 SPECIALIST MARKET ANALYSIS

Global consumption of industrial silica sand is expected to climb 4.4% annually through 2020 to 304 million metric tons valued at $12.8 billion. Growth in crude steel output, motor vehicle production, and specialty silica manufacturing activity will drive sales gains. While horizontal oil and gas drilling activity will be less robust than it has been over the past decade, hydraulic fracturing will remain a key component of demand into the near term (Freedonia group website).

A market research study conducted by the National Industrial Sands Association (NISA) in 2011 indicate demand for silica sand can be segmented into various major markets including glass, metal castings foundries, hydraulic fracturing, building products and chemicals as outlined below:

- Glassmaking: Silica sand is the primary component of all types of standard and specialty glass. It provides the essential SiO_2 component of glass formulation and its chemical purity is the primary determinant of colour, clarity, and strength. Industrial sand is used to produce flat glass for building and automotive use, container glass for foods and beverages, and tableware. In its pulverized form, ground silica is required for production of fiberglass insulation and reinforcing glass fibres. Specialty glass applications include test tubes and other scientific tools, incandescent and fluorescent lamps, television, and computer CRT monitors.
- Metal Casting: Industrial sand is an essential part of the ferrous and non-ferrous foundry industry. Metal parts ranging from engine blocks to sink faucets are cast in a sand and clay mold to produce the external shape, and a resin bonded core that creates the desired internal shape. Silica's high fusion point (1760°C) and low rate of thermal expansion produce stable cores and molds compatible with all pouring temperatures and alloy systems. Its chemical purity also helps prevent interaction with catalysts or curing rate of chemical binders. Following the casting process, core sand can be thermally or mechanically recycled to produce new cores or molds.
- Metal Production: Industrial sand plays a critical role in the production of a wide variety of ferrous and non-ferrous metals. In metal production, silica sand operates as a flux to lower the melting point and viscosity of the slags to make them more reactive and efficient. Lump silica is used either alone or in conjunction with lime to achieve the desired base/acid ratio required for purification. These base metals can be further refined and modified with other ingredients to achieve specific properties such as high strength, corrosion resistance or

electrical conductivity. Ferroalloys are essential to specialty steel production, and industrial sand is used by the steel and foundry industries for de-oxidation and grain refinement.

- Chemical Production: Silicon-based chemicals are the foundation of thousands of everyday applications ranging from food processing to soap and dye production. In this case, SiO_2 is reduced to silicon metal by coke in an arc furnace to produce the silica precursor of other chemical processes. Industrial sand is the main component in chemicals such as sodium silicate, silicon tetrachloride and silicon gels. These chemicals are used in products like household and industrial cleaners to manufacture fibre optics and to remove impurities from cooking oil and brewed beverages.
- Construction: Industrial sand is the primary structural component in a wide variety of building and construction products. Whole grain silica is used in flooring compounds, mortars, specialty cements, stucco, roofing shingles, skid resistant surfaces and asphalt mixtures to provide packing density and flexural strength without adversely affecting the chemical properties of the binding system. Ground silica performs as a functional extender to add durability and anti-corrosion and weathering properties in epoxy-based compounds, sealants, and caulks.
- Paint and Coatings: Paint formulators select micron-sized industrial sands to improve the appearance and durability of architectural and industrial paint and coatings. High purity silica contributes critical performance properties such as brightness and reflectance, colour consistency, and oil absorption. In architectural paints, silica fillers improve tint retention, durability, and resistance to dirt, mildew, cracking and weathering. Low oil absorption allows increased pigment loading for improved finish colour. In marine and maintenance coatings, the durability of silica imparts excellent abrasion and corrosion resistance.
- Ceramics and Refractories: Ground silica is an essential component of the glaze and body formulations of all types of ceramic products, including tableware, sanitary ware and floor and wall tile. In the ceramic body, silica is the skeletal structure upon which clays and flux components attach. The SiO_2 contribution is used to modify thermal expansion, regulate drying and shrinkage, and improve structural integrity and appearance. Silica products are also used as the primary aggregate in both shape and monolithic type refractories to provide high temperature resistance to acidic attack in industrial furnaces.
- Filtration and Water Production: Industrial sand is used in the filtration of drinking water, the processing of wastewater and the production of water from wells. Uniform grain shapes and grain size distributions produce efficient filtration bed operation in removal of contaminants in both potable water and wastewater. Chemically inert, silica will not degrade or react when it comes into contact with acids, contaminants, volatile organics or solvents. Silica gravel is

used as packing material in deep-water wells to increase yield from the aquifer by expanding the permeable zone around the well screen and preventing the infiltration of fine particles from the formation.

- Recreational Products: Industrial sand even finds its way into sports and recreation. Silica sand is used for golf course bunkers and greens as well as the construction of natural or synthetic athletic fields. In golf and sports turf applications silica sand is the structural component of an inert, uncontaminated, growing media. Silica sand is also used to repair greens and to facilitate everyday maintenance like root aeration and fertilization. The natural grain shape and controlled particle size distribution of silica provides the required permeability and compaction properties for drainage, healthy plant growth and stability.

Glass is the largest market accounting for 37% of global silica sand consumption (in volume terms). With 32% of overall sales, foundries represent the next largest market, followed by hydraulic fracturing, building products, and chemicals, with other applications (such as abrasives and recreation) accounting for the remainder of demand. The Global Industrial Silica Sand market is witnessing many growth drivers such as increased adoption of industrial silica sand for hydraulic fracturing.

International trade in silica sand is limited due to the high cost of transporting silica sand relative to its value. Thus, quarries and processing facilities are typically located near major centres of demand.

6.2 SOCIAL DEVELOPMENT

The Executive Summary of the National Development Plan (NDP, 2030) 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.

Consol and its subsidiary companies work closely with provincial government structures in support of the NPD, and is committed to the above actions in the form of:

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

6.3 ECONOMIC BENEFITS

The Rietkol Project will develop a sustainable, quality silica resource with a minimum LOM of 20 years, which has the potential to deliver huge economic benefits at the local, provincial, and national level in terms of multi-generational employment, power security, and the contribution to the GDP.

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.
- ***Downstream socio-economic benefits***: Most of the silica is earmarked for the domestic market including the glass-making industry. The glass-making industry is a major contributor to the national GDP and employment and provides further economic opportunities downstream of the mine and factories, including the bottling and container glass industries (wine, soda, and beer) as well as building and float glass industries.

6.4 JOB CREATION

The Rietkol Project will create a peak of approximately 100 temporary job opportunities at authorisation and commencement of construction. Within the first year of mining, there is an opportunity to create approximately 100 permanent positions once production reaches steady state. In addition, approximately 40 - 50 workers will be employed by support consultants.

Nhlabathi will employ people from the local community as a priority, provided sufficient skills are available within the surrounding communities.

Consol Glass is currently receiving quantities of glass sand from an existing mine in the Delmas area where the available product will be in short supply in the next decade. About 30% of the output of the three processing units in Gauteng at Wadeville, Clayville and Nigel, depend on glass sand. In practical terms a reasonable possibility exists that some employment opportunities can be lost if the Rietkol Project does not go ahead. It is estimated that about 550 people currently employed by the glass-making industry will probably have to be laid off if additional glass sand resources are not secured. Thus, in addition to the direct employment opportunities, the Rietkol Project can sustain approximately 550 existing employment opportunities within the glass-making industry.

6.5 WORKFORCE DEVELOPMENT

As part of the Social and Labour Plan (SLP), Nhlabathi 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.

6.6 COMMUNITY DEVELOPMENT

Nhlabathi is committed to optimise opportunities in the local communities through the implementation of the SLP. To further support local communities, Nhlabathi is proposing a Local Economic Development (LED) project and support small business development. Nhlabathi proposes the implementation of a school infrastructure and support project over the first 5 years of mining. 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, Nhlabathi is committed to support business initiatives through the provision of opportunities, assistance, and support to SMME's and new HDSA business ventures. Various 100% black-owned and operated SMME companies are earmarked for further development at the Rietkol Project through the Enterprise Development programme, including:

- Bophelo Baka Wellness Solutions – Wellness training
- Yanboy Trading Enterprises – Bus service
- Thulukhanye Laundry Services and Projects – Cleaning services
- Analungile Trading & Projects – Laundry services

7 DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PREFERRED ALTERNATIVE

7.1 DEVELOPMENT ALTERNATIVES CONSIDERED

7.1.1 Site Location Alternatives

No site location alternatives have been considered as mining can only be undertaken in areas where economically mineable resources occur. The Rietkol resource was established through extensive prospecting and geological modelling over many years.

7.1.2 Technology Alternatives

7.1.2.1 Mining methodology

Selection of a mining method is always dictated by the orebody or resource. The silica resource at the Rietkol Project is shallow, with various outcrops occurring on the proposed mining footprint. Mining will take place to a depth of 30 m with potential resource up to 50 mbs and opencast mining is therefore the only viable mining methodology.

7.1.2.2 Mine residue disposal methodology

The mine schedule allows for mining in North Block to be mined within a short period of time. Slimes (tailings) will be pumped into the mined-out void. The alternative is to construct surface tailings facilities within the infrastructure area.

The in-pit disposal of tailings material is more environmentally friendly for the following main reasons (Groundwater Complete (GC), 2018):

- The tailings material is effectively enclosed by mostly quartzite that is characterised by low hydraulic properties. This will greatly reduce the rate of contaminant migration (if present).
- The tailings material (or a portion thereof at least) will be deprived of oxygen in the event of the pit being flooded, which will reduce oxidation and the formation of poor quality leachate.

Thus, in-pit disposal of the mine residue (tailings) is deemed positive in terms of groundwater quality management, visual impact (no residual surface tailings dams) and the general biodiversity of the area. Backfilling of the North Block also allows for full rehabilitation of this area back to grazing capability.

Surface tailings facilities were therefore not considered further.

7.1.3 Design or Layout Alternatives

7.1.3.1 Surface infrastructure layout and placement

Infrastructure to support the Rietkol Project has been laid out and engineered to best suit the topography and mining pit layouts, as well as the relatively small footprint of the MRA area.

The initial infrastructure layout was informed by the following environmental and cultural attributes:

- Aquatic resources (wetlands): The infrastructure layout avoided the wetlands in the MRA area, with an appropriate buffer between the more sensitive southern depression wetland.
- Land use and capability: The infrastructure layout avoided the land currently used for cultivation (crops and feed production, orchards), as well as the timber plantation located in the north-western corner of the MRA area. These land uses within the MRA area can therefore continue despite mining.
- Heritage resources: The infrastructure layout avoided the heritage resources of significance (graves), as well as the old trigonometrical beacon. It must be noted that mining will take place near the graves from YR15 onwards, which may necessitate the relocation of the graves at that point in time.
- Existing infrastructure: Existing infrastructure within the infrastructure layout will be utilised as far as possible for offices, workshops, ablution facilities, etc. to reduce the impact footprint and associated vegetation clearance requirements.

The total area of disturbance of the initial layout amounts to approximately 26.6 hectares (ha), as follow (Figure 17):

	Extent	**Current Land Use**
North Block	2.77 ha	Grazing = 1.45 ha Wilderness = 1.32 ha
Main Block	9.36 ha	Grazing = 5.32 ha Wilderness = 4.04 ha
Infrastructure and stockpile area	14.51 ha	Grazing = 10.64 ha Wilderness = 2.8 ha Residential = 1.07 ha

A total area of approximately 17.4 ha currently used as grazing will be destroyed by this alternative. A total of approximately 8.2 ha is classified as wilderness (rocky outcrops).

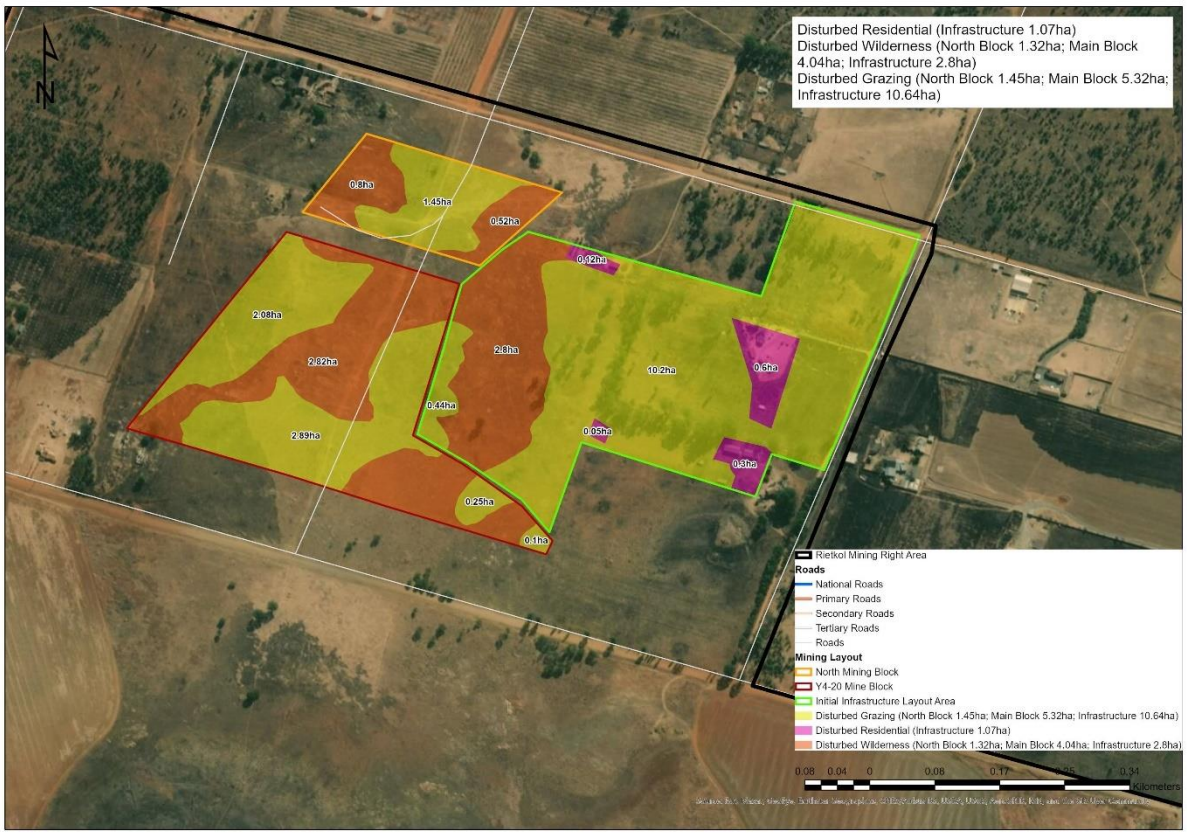


Figure 17: Pre-mining land use – initial infrastructure layout option

Following baseline studies, an alternative option for the infrastructure layout and placement was proposed to:

- Avoid placement of new infrastructure development within the 100m buffer of the hillslope seep wetland to the south; and
- Reduce the infrastructure footprint and associated dirty water management areas.

Figure 18 indicates the two infrastructure layout alternatives in relation to the hillslope seep wetland and associated 100m buffer. The initial layout (indicated in green) was positioned well within the 100m buffer zone of the wetland, almost encroaching on its edge. The alternative (indicated in purple) is outside of the 100m buffer zone and resulted in a reduction in footprint of approximately 1.6 ha.

The reduced infrastructure layout footprint was therefore chosen as the preferred alternative going forward and infrastructure was relocated to fit within the reduced footprint. This alternative is supported by the wetland specialist who recommended that a minimum buffer of 100m be maintained between the wetland systems and any new infrastructure and mining developments.

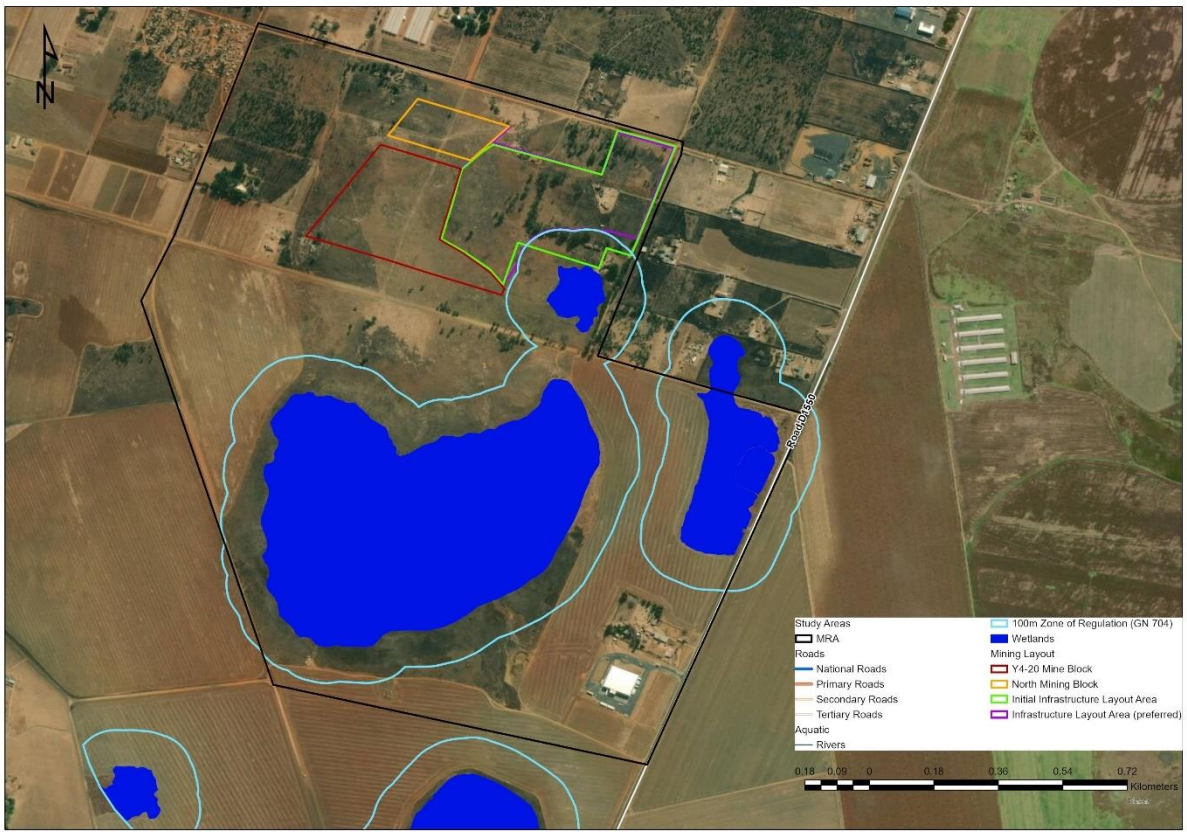


Figure 18: Infrastructure layout and placement alternatives

The total area of disturbance of the preferred layout alternative amounts to approximately 25 hectares (ha), as follow:

	Extent	**Current Land Use**
North Block	2.77 ha	Grazing = 1.45 ha Wilderness = 1.32 ha
Main Block	9.36 ha	Grazing = 5.32 ha Wilderness = 4.04 ha
Infrastructure and stockpile area	12.89 ha	Grazing = 9.34 ha Wilderness = 2.8 ha Residential = 0.75 ha

A total area of approximately 16 ha currently used as grazing will be destroyed. A total of approximately 8 ha is classified as wilderness (rocky outcrops).

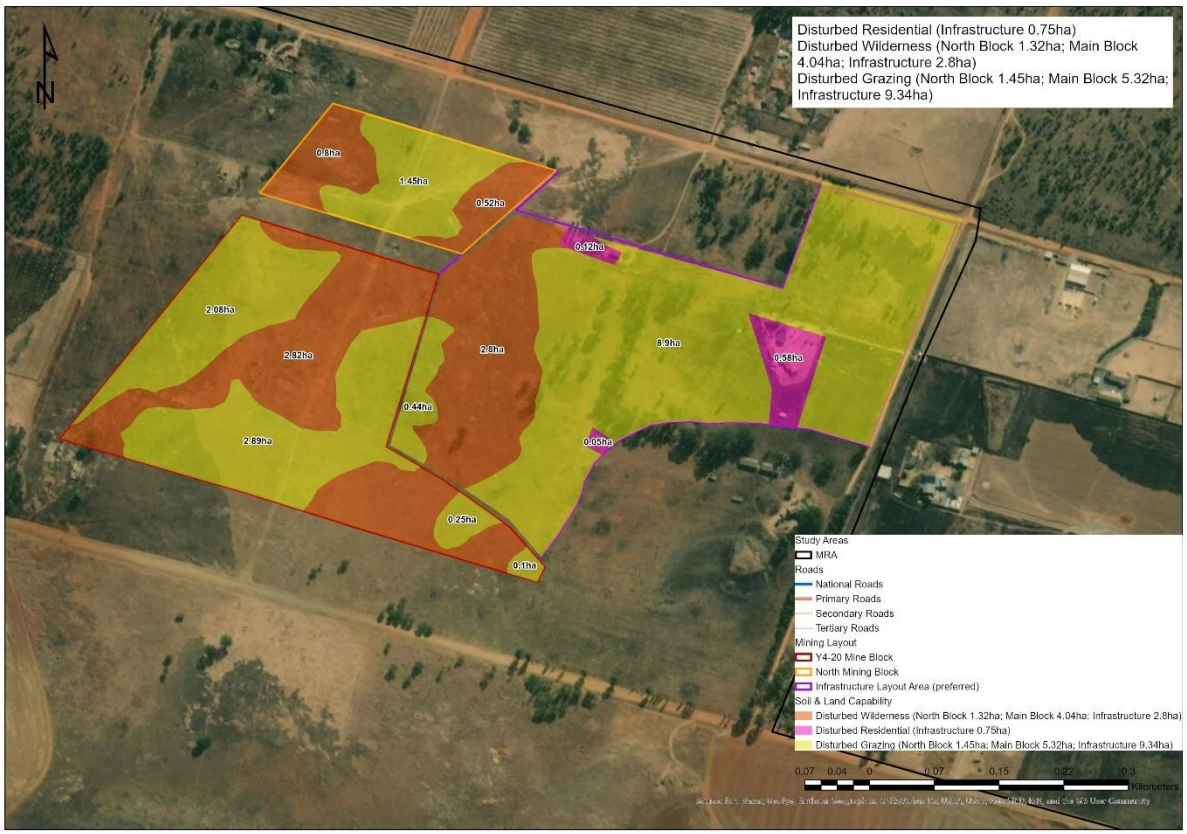


Figure 19: Pre-mining land use – preferred infrastructure layout option

7.1.3.2 Access road from D1550 to infrastructure area

Two alternative access routes are available from the D1550 to the mine infrastructure area, as indicated on Figure 20.

The southern access road is a wide gravel road which will require minimum upgrading and from an economic perspective is thus the more viable option. However, the southern access road passes through the hillslope wetlands to the east of the MRA area, as well as between the southern depression and the northern artificial hillslope seep situated to the south of the infrastructure area.

The ecological impact assessment (backed up by landowners' comments) indicated that it is highly likely that *Pyxicephalus adspersus* (Giant Bullfrog) will occur within and around the non-cultivated areas of the large wetland in the southern portion of the MRA area and the hillslope wetlands to the north and east of this depression wetland. The wetland further south of this (outside of the MRA area) is further likely to also provide suitable habitat to *Pyxicephalus adspersus*.

The proposed mining activities will result in increased traffic frequency, which will inevitably result in a higher risk of *Pyxicephalus adspersus* mortality rates associated with vehicles. Thus, where possible,

the roads between the large wetland systems should not be used for heavy traffic movement, particularly during peak breeding seasons or following events of high rainfall when bullfrogs emerge from aestivation (Scientific Aquatic Services (SAS), 2018).

Therefore, from a biodiversity perspective and the potential impact on the protected Giant Bullfrog, the southern access route is not considered viable, and the northern access route is thus put forward as the preferred option.

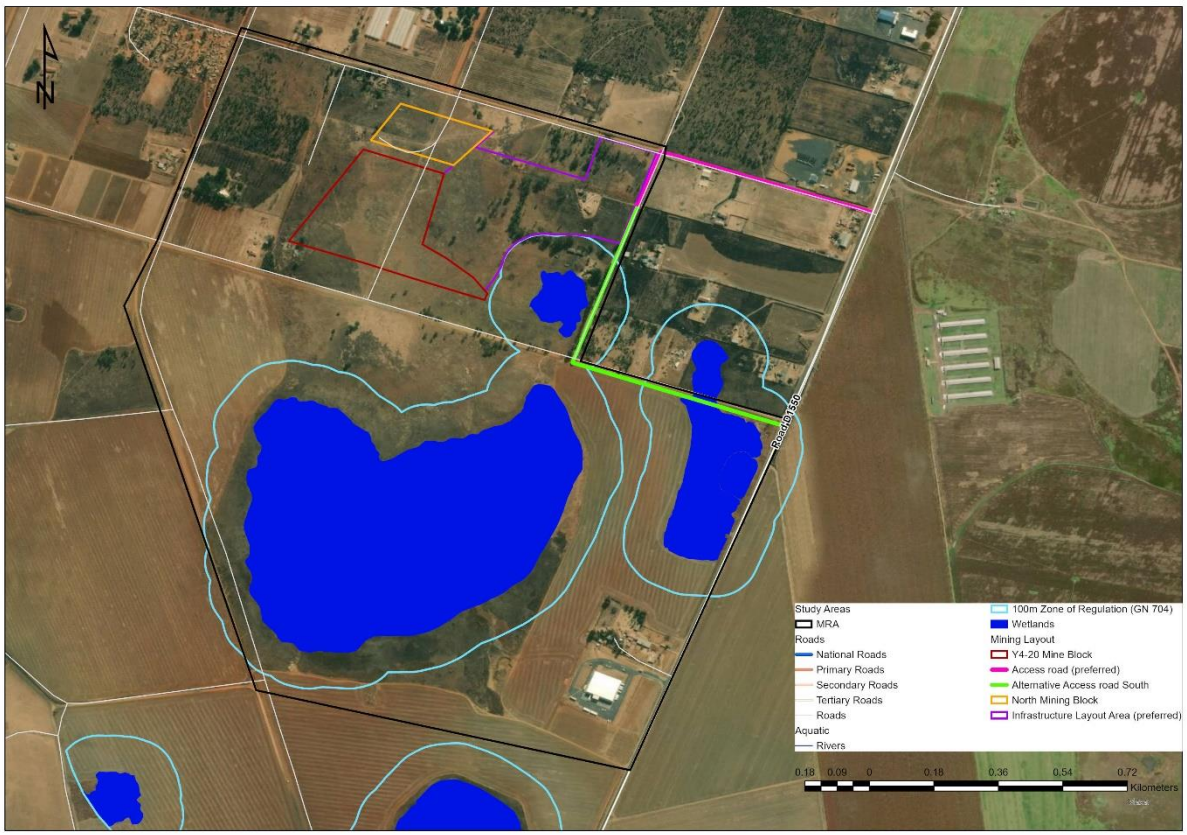


Figure 20: Alternative options for mine access

7.1.4 No-Go Option

The main consequence of the No-Go Option is the loss of opportunity to develop a high-quality mineral resource with an estimated LOM of 20 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 – refer to Section 6 of this report for more detail on the economic benefits and employment opportunities associated with the Rietkol Project.

Furthermore, most of the silica is earmarked for the domestic market including the glass-making industry. The glass-making industry is a major contributor to the national GDP and provides further

economic opportunities downstream of the mine and factories, including the bottling and container glass industries (wine, soda, and beer) as well as building and float glass industries.

Other socio-economic benefits that will be lost include the skills development opportunities, community development projects as proposed in the SLP and local procurement and SMME opportunities.

7.1.5 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. The relatively small size of the MRA area and occurrence of wetlands further limit the potential for alternative sites.

The only real alternative to the mine is the No-Go Option. Based on the macro-economic analysis of the baseline activities (Mosaka Economic Consultants, 2018), the total GDP generated by the existing land use activities within the MRA area is estimated at a total of R 1.13 million per annum and the direct at R 0.41 per annum (2017 prices). Only two direct permanent employment opportunities are sustained by the land use activities, with a total of 6 if the indirect and induced is added.

The main consequence of the No-Go Option is the loss of opportunity to develop a high-quality mineral resource with an estimated LOM of 20 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 projects / programmes and local procurement and SMME opportunities.

7.1.6 Motivation for Preferred Development Alternatives

Table 9: 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 Mpumalanga and Gauteng economies is an additional positive factor.
Mining methodology	Opencast mining	The silica resource is shallow, and mining will take place to a depth of 30 m with potential resource up to 50 mbs. Underground mining is not possible at these depths.
Mine residue disposal	In-pit disposal of tailings	In-pit disposal of tailings will allow full rehabilitation of the North Block, with a final land capability of grazing. No surface tailings facilities will be left on surface after mining is completed, which is positive in respect of visual, groundwater and post-mining land use.
Surface infrastructure placement and layout	Revised, preferred alternative indicated in Figure 18	Reduction in footprint of approximately 1.6 ha. A buffer of 100m is maintained between new infrastructure and the wetland systems. Only 16 ha currently used as grazing will be destroyed vs the 17.4 ha of the original layout alternative.
Access Road	Northern access road to the north of AHs 276 & 277	Keep possible migratory routes open between the wetlands identified in the area, thereby reducing the potential risk to *Pyxicephalus adspersus* (protected Giant Bullfrog) due to the increase in heavy vehicle traffic.

The preferred mining and layout infrastructure footprint are indicated in Figure 21.

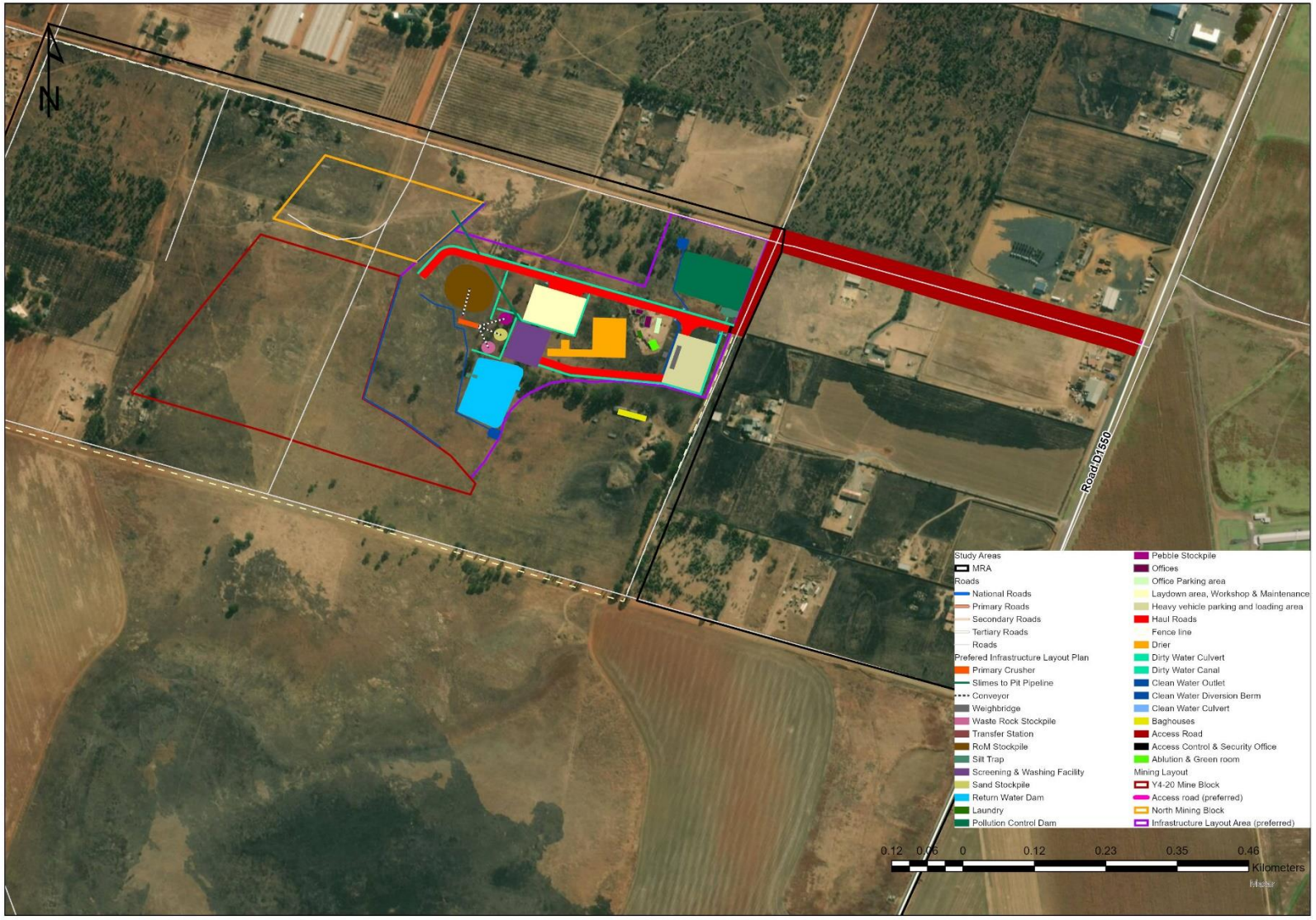


Figure 21: Preferred mining and layout infrastructure footprint (Masterplan)

7.2 DETAILS OF PUBLIC PARTICIPATION PROCESS FOLLOWED

The Public Participation Report is attached as Appendix 1 and reflects the Public Participation conducted as part of the Announcement and Scoping Phases. The process forms part of a re-application and therefore comments made in the previous application from 2016 – 2018 have been included to ensure all comments are taken into consideration.

An updated report will be provided with the draft EIAR/EMPr and the final Public Participation Report with the final EIAR/EMPr.

Below a summary of the Public Participation Process to date.

7.2.1 Register of Interested and Affected Parties

A list of potential IAPs were compiled at the onset of the Public Participation Process in January 2016 and updated in 2021. The register includes all relevant Government Departments and other agencies, landowners, neighbouring landowners and communities, and Environmental Interest Groups / NGO's. The following Government Departments are included due to their relevancy to the project:

- Mpumalanga Department of Mineral Resources and Energy (DMRE)
- Mpumalanga Department of Agriculture, Rural Development, Land Reform, Environmental Affairs (MDARDLEA)
- Mpumalanga Department of Water and Sanitation (DWS)
- Mpumalanga Department of Rural Development and Land Reform (DRDLR): Regional Land Claims Commissioner
- Mpumalanga Department of Agriculture, Forestry and Fisheries (DoA & DAFF)
- Department of Environment, Forestry and Fisheries (DEFF)
- Mpumalanga Department of Transport
- Nkangala District Municipality
- Victor Khanye Local Municipality

Additional Authorities and Agencies included in the IAP register are:

- South African Heritage Resource Agency (SAHRA)
- Mpumalanga Tourism and Parks Agency (MTPA)
- Environmental NGO's and Advocacy Groups

The IAP register is maintained and updated throughout the process as required by the NEMA and 2014 EIA Regulations. Refer to Appendix 1-1 for a copy of the IAP Register.

7.2.2 Project Notifications

Project Notifications are sent via:

- Email, where email addresses exist and are available,
- Fax, where a fax number exists
- Post, if neither an email nor a fax is available, but a postal address is available
- Sms, where a cell number is available

This ensures all parties are aware of the notification. The following notifications have been sent to potential IAPs:

- Project Announcement (notification of intended applications) and Background Information Document (BID) on 12 February 2021 (refer to Appendix 1-2 for the notification letter and Appendix 1-3 for a copy of the BID in English and isiZulu).
- Letter to the Mpumalanga Land Claims Commissioner sent on 20 January 2017 with follow-up emails and responses on 22 March 2018 (refer to Appendix 1-7).

The following table provides detail on stakeholder groups and method of notification:

Table 10: Notifications Table

Interested & Affected Party	Method of Notification	Date of Notification
AFFECTED PARTIES		
MRA Landowner		
Landowners within the MRA area	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed Response to specific comments	12 Feb 2021 12 Feb 2021 18 Mar 2021 April 2021
Traditional Leaders, Communities, Settlements		
Traditional Leader	*Not applicable*	
Lawful Occupier, Community / Settlement	*Not applicable*	
Land Claimants		
Land Claims Commissioner	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Notification of the availability of the DSR emailed	12 Feb 2021 18 Mar 2021
Land Claimant	*Not applicable*	
Municipalities		
District and Local Municipalities	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed	12 Feb 2021

Interested & Affected Party	Method of Notification	Date of Notification
	Notification of the availability of the DSR emailed	18 Mar 2021
Organs of State		
Relevant Authorities	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Notification of the availability of the DSR emailed	12 Feb 2021 18 Mar 2021
OTHER AFFECTED PARTIES		
Other landowners		
Direct neighbours	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed Response to specific comments	12 Feb 2021 12 Feb 2021 18 Mar 2021 May 2021
Landowners within a 1km radius	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed Response to specific comments	12 Feb 2021 12 Feb 2021 18 Mar 2021 May 2021
Neighbouring land occupants, settlements or communities		
Adjacent Traditional Leaders	*Not applicable*	
Neighbouring land occupants, settlements or communities	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed	12 Feb 2021 12 Feb 2021 18 Mar 2021
INTERESTED PARTIES		
Regional Landowners	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed	12 Feb 2021 12 Feb 2021 18 Mar 2021
Environmental NGO's / Conservation Organisations	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed	12 Feb 2021 12 Feb 2021 18 Mar 2021
Other, as registered	Nhlabathi's intent to resubmit the Environmental Authorisation application – Notification and BID emailed Advertisements & On-site Notices Notification of the availability of the DSR emailed	12 Feb 2021 12 Feb 2021 18 Mar 2021

7.2.3 Advertisements and On-Site Notifications

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

Table 11: Advertisement Table

Type of Media	Name of Media	Distribution	Date of Placement
Newspaper	Streek Nuus	Local Delmas area	12 Feb 2021

The following on-site notifications (Appendix 1-4) were placed to announce the project and application:

Table 12: On-Site Notices Table

Location of Notice	Name of Location	Coordinate of Placement	Date of Placement
Project Property Boundary	Main road to Eloff, entrance to Emafentsini	S26°07.609 E028°37.131	12 Feb 2021
Plot 152	Mafensini Tuck Shop	S26°07.521 E028°36.120	12 Feb 2021
Delmas	Victor Khanye Local Municipality	S26°08.979 E028°40.762	12 Feb 2021
Delmas	Willow Corner Center Shoprite	S26°09.058 E028°40.947	12 Feb 2021
Delmas	Pick and Pay Center	S26°08.405 E028°40.560	12 Feb 2021

7.2.4 Availability of Project Documentation

The following documents were made available throughout the process:

Table 13: Public Documents Table

Document	Timeframe	Date of Availability	Date of Comment Closure
Background Information Document (attached as Appendix 1-3)	Ongoing	12 February 2021	Not applicable
Draft Scoping Report	30 days (excl. public holidays)	18 Mar 2021	26 Apr 2021

7.2.5 Translation of Project Notices and Documents

The on-site notices, the BID and the Non-Technical Summary are translated into the predominant local language, which in this case is isiZulu, for distribution.

7.2.6 Engagement with IAPs

Engagements for the current process is planned as per the Public Participation Plan (Appendix 8); however, engagements held with landowners, land occupants and the municipality during the previous application are included to ensure all relevant issues raised in the previous process is retained and addressed in the re-application process.

Appendix 1-5 contains the minutes of meetings held in the previous process:

- Victor Khanye Local Municipality Meeting held on 9 March 2018
- Landowner / Occupant Meeting (English) held on 9 March 2018
- Land Occupant, labourers, and local communities Meeting (isiZulu) held on 10 March 2018

7.3 SUMMARY OF ISSUES RAISED BY IAPS

The comments and response report includes comments from both the current and previous processes to ensure any comments made in terms of potential impacts are included in the process.

Table 14: Comments and Response Summary

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
AFFECTED PARTIES					
MRA Landowners					
Landowners within the MRA area	X	Feb 2016 March 2016 Nov 2016 Feb 2021 Apr 2021	Impact on water, air quality (silica), health, noise, economic livelihoods and security. Cumulative impacts of other existing and planned mining operations.	The process will be conducted through two phases (the Scoping and EIA Phases) where opportunity will be provided to the public for participation, input and provision of information regarding the various specialist studies.	Not finalised
Landowners within the MRA area	X	Apr 2021	Inclusion of specific studies such as a Medical Research study and Poultry Impact Assessment to determine the impact on human health and on poultry production of the nearby broiler and packhouse businesses.	The health risks and medical conditions associated with silicosis have been well researched for many years, specifically WHO and US Occupational Safety and Health Administration who have set standards based on their research, 40 and 100 µg/m^3 respectively. The potential for silica dust-fallout will be addressed in the Air Quality Impact Assessment, which will provide an indication of the risk to not only employees, but also the general public adjacent to the proposed mine. In addition, Nhlabathi has committed to undertake a Medical Research Study. The specialist studies do address the potential impacts on mammals / poultry to the extent that data is available in this regard. Very limited data is however available.	Not finalised
Landowners within the MRA area	X	March 2018 Feb 2021 April 2021	Concerns raised regarding the impacts on: Groundwater – quality and quantity including the effect blasting & vibrations may have on groundwater. Air quality and its associated health risks, with specific reference to silicosis as well as the impact it would have on the agriculture businesses (crops, livestock, etc). Security and the increase in crime.	Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase through the various specialist studies being conducted. The potential impact on the economic activities of MRA landowners will be assessed as part of the macro-economic impact assessment.	Not finalised

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
			Noise and blasting impacts. Economic impact on businesses due to above impacts. Cumulative impacts considering the existing baseline and planned other developments.	Cumulative effects will be investigated as far as it is practical and relevant. The regional air quality will be taken into account to identify any cumulative effects.	
Landowners within the MRA area	X	Feb 2021	Relocation of packing stores will have a very serious financial and logistical impact on business.	The potential impact on the economic activities and business activities will be assessed as part of the macro-economic impact assessment, including impacts on GDP and employment.	Not finalised
		Apr 2021	Concerns of irreparable loss and damages that will be suffered as a result of the proposed mining.	The socio- and macro-economic specialists have secured several meetings with stakeholders that have raised concerns and objections, to discuss their concerns and include these in the impact assessment process.	Not finalised
Traditional Leaders, Communities, Settlements					
Traditional Leader			*Not applicable*		
Lawful Occupier, Community / Settlement			*Not applicable*		
Land Claimants					
Land Claims Commissioner	X	March 2018	No land claims registered on the MRA properties.		Consensus
Land Claimants			*Not applicable*		
Municipalities					
District Municipality			*No comments received to date*		
Local Municipality	X	Oct 2016 Nov 2016	The area is an eco-sensitive area with an underground lake that supplies the town with water. Also, the area is underlain by dolomitic geology. 800m buffer zone between the residential area and the proposed mine. The intended mine is within the urban edge of Delmas and falls within the residential component of the farms of Modder East Orchards. The area is agricultural zoned. The proposed mine is not in line with the SDF of Delmas.	Noted, further engagement with the municipality will be arranged as part of the EIA process. The information was forwarded to the groundwater specialist who made further enquiries in this regard. Full details will be provided in the groundwater impact assessment.	Not finalised
Local Municipality	X	March 2018	Impact on local roads – need for coordination with the municipality. Impact and monitoring of groundwater – quality & quantity.	Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase through the various specialist studies being conducted.	Not finalised

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
			Influx and management of informal settlements. Blasting impact on groundwater.	The municipality will be kept up to date as more information becomes available.	
Ward Councillors	X	March 2018	Management of influx and the impact on the informal settlement neighbouring the planned mining area.	Once all specialist studies are complete, a cumulative impact zone will be determined, and only at that time will we be able to determine if resettlement is required. At this stage, the first approach will be to avoid resettlement.	Not finalised
Organs of State					
DMRE			*No comments received to date*		
MDARDLEA			*No comments received to date*		
DoA	X	March 2018	Aspects to be considered during the EIA is current land use, grazing capacity, land capability and a detailed soil study.	These aspects will be addressed in the Soils, Land Use and Land Capability specialist assessment and in the EIAR.	Not finalised
DALRRD	X	Feb 2021	Soils and land use investigations Weeds and alien invader plant management plan	These aspects will be addressed in the Soils, Land Use and Land Capability specialist assessment and in the EIAR.	Not finalised
SAHRA	X	March 2018	Mitigation for the conservation of historical structures. MRA underlain Very High palaeontological sensitive rocks, as seen by the SAHRIS palaeomap. All reports and appendices to be uploaded to the SAHRIS system.	This section of the report will be rephrased and clarified. It is unlikely that the structures are older than 60 years and not regarded as significant. No mitigation measures are recommended. The area falls in the BLUE category of SAHRA's Palaeontological Sensitivity Map because of the underlying Vryheid formation. Blue is low in sensitivity and no palaeontological studies are required; however, a protocol for finds is required. A palaeontological study will be conducted, to the level proposed by the professional palaeontologist.	Not finalised
MTPA	X	March 2018	No objection. Aspects to be addressed in the EIA include terrestrial assessment, freshwater assessment, critically endangered terrestrial orchid. Recommendations include a detail flora study, wetland delineation, if orchid is found inform MTPA, plans for active water purification.	We take note of your comments, which will be addressed in the relevant specialist reports and EIAR/EMPr.	Not finalised
Roads and Transport	X	Feb 2021	Concerned how roads will be affected – access and building line	The potential impact on roads will be addressed in the Traffic Impact Assessment. Further consultation will be initiated with the Dept.	Not finalised

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
OTHER AFFECTED PARTIES					
Other landowners					
Direct Neighbours	X	March 2018 Feb 2021 April 2021	Concerns raised regarding the impacts on: Groundwater – quality and quantity including the effect blasting & vibrations may have on groundwater. Damage to property due to drilling & blasting. Heavy motor vehicles on the access road. Air quality and its associated health risks, with specific reference to silicosis as well as the impact it would have on the agriculture businesses (crops, livestock, etc). Biodiversity impacts, visual impacts and sense of place. Increased noise and traffic. Economic impact on businesses due to above impacts, including property value. Cumulative impacts taking into account the existing baseline and planned other developments. Monitoring programmes and feedback to landowners on the results.	Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase through the various specialist studies being conducted. The potential impact on the economic activities in the area will be assessed as part of the macro-economic impact assessment. Cumulative effects will be investigated as far as it is practical and relevant. The regional air quality will be taken into account to identify any cumulative effects. The specialist studies will recommend the type, method and frequency of monitoring required.	Not finalised
		Apr 2021	This cumulative impact from an economic, social and environmental perspective should be investigated and included as part of the specialized environmental studies.	Cumulative effects will be investigated as far as it is practical and relevant. It is noted that the closest operational mine to the proposed Rietkol Project is more than 8 km away (Kangala Coal). Once all specialist studies are complete, a cumulative impact zone will be determined based on the impact modelling by the specialists.	Not finalised
Landowners within a 1km radius	X	Feb 2016 March 2016 April 2016 March 2018 April 2021	Concerns raised regarding the impacts on: Groundwater – quality and quantity including the effect blasting & vibrations may have on the dolomitic aquifer and groundwater in general, formation of sinkholes. Air quality and its associated health risks, with specific reference to silicosis as well as the impact it would have on the agriculture businesses (crops, livestock, greenhouses etc). Biodiversity impacts (including specie movement). Visual impacts and sense of place. Increased noise and traffic.	Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase through the various specialist studies being conducted. The concerns raised will be forwarded to the specialists for consideration during their assessments. Impact of blasting on infrastructure and animals (horses) will be addressed as part of the blasting impact assessment. The structures and structure types will be identified as best possible and evaluation done accordingly.	Not finalised

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
			Blasting effects on structures and animals especially horses. Economic impact on businesses due to above impacts including property value and method/procedure to address damages and compensation to be paid. Cumulative impacts taking into account the existing baseline and planned other developments. Monitoring programmes and feedback to landowners on the results. Job creation and losses.	Cumulative effects will be investigated as far as it is practical and relevant. The regional air quality will be taken into account to identify any cumulative effects. The specialist studies will recommend the type, method and frequency of monitoring required. The potential impact on the existing economic activities and the benefits of the proposed mining activity will be assessed as part of the macro-economic impact assessment, including impacts/benefits on GDP and employment.	
Neighbouring land occupants, settlements or communities					
Adjacent Traditional Leaders			*Not applicable*		
Neighbouring land occupants, settlements or communities	X	March 2016 Feb 2021	Will the project require resettlement? In support as the mine as it will generate job opportunities and skills development. Impact on water, air quality and health.	Your comments will be considered during the social impact assessment that addresses both impacts and benefits to the community. Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase. A cumulative impact zone will be determined around the proposed mining activities to understand the need for resettlement.	Not finalised
Neighbouring land occupants, settlements or communities	X	March 2018 Feb 2021	Concerns raised regarding: Resettlement. Graves and ancestral beliefs. Limited employment opportunities.	The specialist studies (specifically Air Quality, Noise and Blasting), that will determine the likely impacts on the communities, are still underway. Once these studies are complete, we will be able, at the next meeting, to explain to you what those impacts will be, as well as what we propose the mine does to protect the community. The families (next of kin) of any grave sites affected will be consulted. With employment, for every person employed in a family, up to 5 dependents may be uplifted. At a mine there are skilled and unskilled opportunities, but those that are unskilled can be developed through skills development. If the skills required does not exist in the local area, this can be remedied	Not finalised

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
				over time with skills development programmes. Also, benefits are not only focussed on employment, there are procurement and enterprise development opportunities as well as bursaries, internships and learnerships. All these programmes must be described in the 5-year SLP, which forms part of the commitment the mining company makes.	
	X	Apr 2021	Corporate Social Investment Road Infrastructure Housing Health Care Services (Clinics/Hospital) Educational Infrastructure Water Infrastructure Creation of Job opportunities to alleviate poverty preferably to local stakeholders. Black economic empowerment businesses residing in the community. Environmental management	Noted, your comments will be considered during the social impact assessment that addresses both impacts and benefits to the community.	Not finalised
INTERESTED PARTIES					
Regional Landowners (outside 1km buffer)	X	Feb 2016 March 2016	Scope of work of specialist tests. Underground lake and cave on plot 183 Impact on air quality and health Benefits to be invested locally through job creation and procurement. Concerned about mining over aquifer Impacts on groundwater, increased subsidence and incidents of sinkholes, degradation of current poorly maintained local and provincial infrastructure, increase in noise and air pollution as well as blasting and tremors, increase in socio-economic problems due to a lack of housing, crime, etc and a decline in property value and sense of place.	As described in the BID, the process will go through two phases where opportunity will be provided for you to participate, provide inputs and receive information regarding all the various specialist studies being conducted for the project. The first report that will be made available will be the draft Scoping Report, which will describe the environmental baseline (what the current status is) and the Plan of Study of the further in-depth specialist studies, only thereafter will the full EIAR be compiled and made available. Your concerns have been forwarded to our specialists for further investigation. We will keep you up to date of any further information and engagements.	Not finalised
Regional Landowners (outside 1km buffer)	X	March 2018	Groundwater – quality and quantity including the effect blasting & vibrations may have on the dolomitic aquifer and groundwater in general, formation of sinkholes.	Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase through the various specialist studies being conducted. The	Not finalised

Interested and Affected Parties		Date Comments Received	Issues Raised	Response	Consultation Status (Consensus, Dispute, Not Finalised)
			Air quality and its associated health risks, with specific reference to silicosis. Economic impact including property value. Increase in crime and safety concerns. Blasting effects on animals especially horses. Monitoring and the reporting protocol when limits are exceeded.	concerns raised will be forwarded to the specialists for consideration during their assessments. Impact of blasting on infrastructure and animals (horses) will be addressed as part of the blasting impact assessment. The potential impact on the existing economic activities and the benefits of the proposed mining activity will be assessed as part of the macro-economic impact assessment, including impacts/benefits on GDP and employment.	
	X	Mar 2021	Concerns regarding dust and air quality for cattle. Negative effects on bull frogs, cranes and secretary birds. Negative effects on water levels.	Your concerns around environmental degradation are noted and will be considered during the EIA process and within the relevant specialist impact studies. Mitigation measures will be determined to deal with any of the concerns raised and impacts identified by the specialists for inclusion in the EMPr.	Not finalised
Interested Parties (Stefan Roets)	X	Feb 2018 Feb 2021	Impact on land use and zoning surrounding the mining area. Rezoning application process. Concerned about infrastructure, mainly roads.	The latest update of the SDF was supplied by Mr Steenekamp on 9 March 2018 and will be reviewed further by the EAP during the EIA Phase. Further engagement with the municipality will be conducted to discuss the land zonation as contemplated in the SDF. The rezoning process will be done after the EIA process is complete, as this application normally requires the specialist studies conducted during the EIA. They also normally require the Authorisations and Licenses. It will happen before we go on site. The potential impact on roads will be addressed in the Traffic Impact Assessment.	Not finalised
Other, as registered	X	Mar 2021	We are grateful about the report hoping for life changing opportunities.	Noted.	

A detailed Comment and Response Report (CRR) is attached as Appendix 1-6. Copies of written submissions during the current process are included in Appendix 1-7, previous written copies of comments as contained in the CCR is available on request.

8 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE SITE

The existing status as reflected in this section is based on the specialist studies (desk-top and fieldwork baseline studies) conducted during the 2018 EIA process. The specialist reports will be updated with additional fieldwork during March 2021 and further impact modelling as applicable. The Plan of Study (Section 10) defines the further work proposed in this regard. The complete specialist reports will be made available for public comment during the EIA Phase.

8.1 CONSERVATION CHARACTERISTICS

The Mpumalanga Biodiversity Sector Plan (MBSP, 2014) indicates that the MRA area is dominated by natural areas, with some occurrence of moderately and heavily modified areas, as presented in Figure 22. No protected areas are in close vicinity to the project.

According to the National Freshwater Ecosystem Priority Area (NFEPA, 2011) database several wetlands occur in the area, including a natural depression wetland situated within the southern portion of the MRA area, with a second natural depression situated ± 30m to the south. Both features are considered to be in a moderately modified (Class C) ecological condition. These wetlands have been included in the MBSP aquatic dataset as Ecological Support Area (ESA) wetlands.

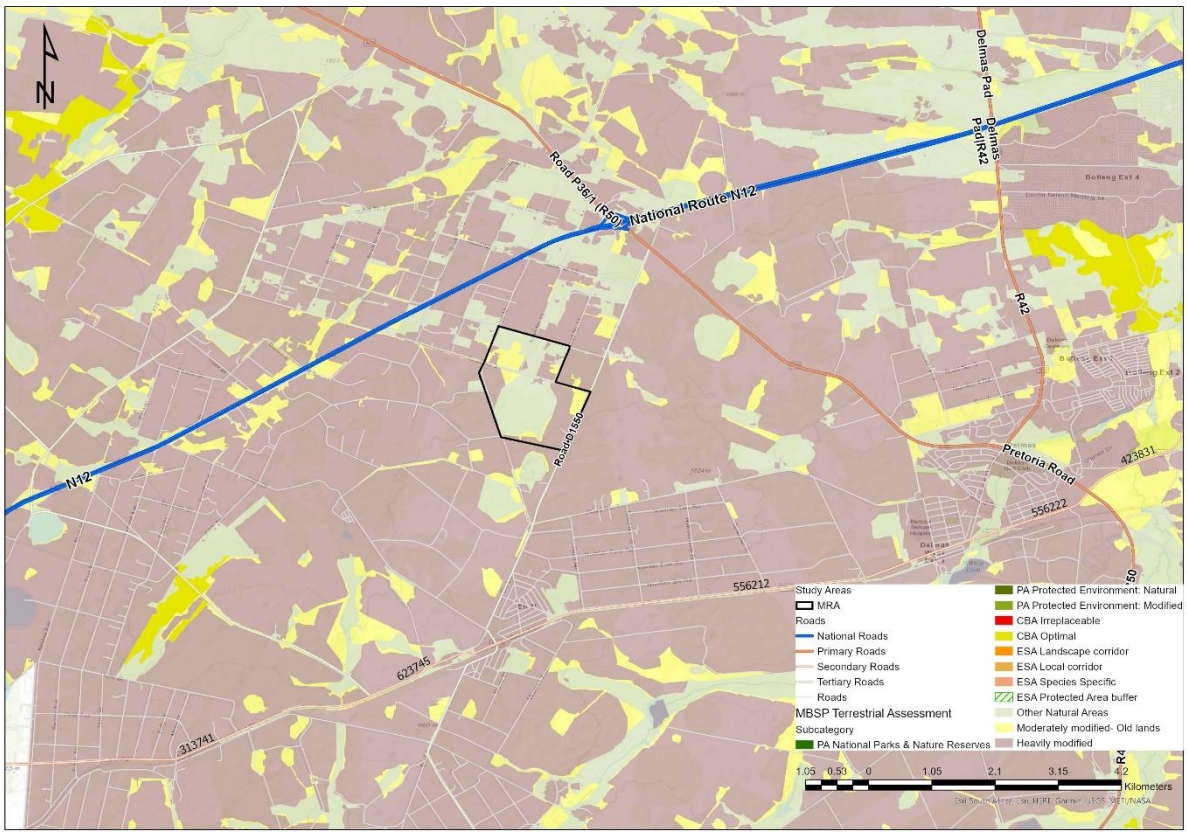


Figure 22: Mpumalanga Biodiversity Sector Plan classification

According to the Mining and Biodiversity Guidelines (2013) most of the central portion and various other smaller portions of the MRA area are of Moderate Biodiversity Importance. Only a small section within the south-western corner of the MRA area (associated with the depression wetland) is of Highest Biodiversity Importance.

The MRA area is not located within 10 km of an Important Bird Area (IBA). The Devon Grassland IBA is situated ± 11 km southwest of the MRA area.

8.2 BIOPHYSICAL ENVIRONMENT

8.2.1 Topography and Landscape Character

The topography of the larger area can be described as gently undulating with surface elevations varying from approximately 1 450 to 1 670 meters above mean sea level (mamsl). The highest surface elevations occur to the south and south-west and decrease towards the north-east in the flow direction of the Koffiespruit. The lower-lying Koffiespruit River is situated approximately 2.5 km north-west of the MRA area.

The topography associated with the MRA area is mostly level, with some undulations present. No prominent topographical features are present within the MRA area, although some low rocky outcrops are present towards the centre and various large pan wetlands are located to the south.

General views of the landscape associated with the MRA area and surrounds are indicated below.

Figure 23: General views of the MRA area and the surrounding region

The landscape associated with the MRA area and its immediate surroundings exhibit a common, discernible pattern, is considered to have broadly similar landforms, vegetation, and settlement configurations, and thus comprise a single landscape character type. This landscape character type can be described as rural, undulating open grasslands, intersperses with cultivated fields, alien tree stands and low-density development.

Figure 24: Landscape character of the MRA area, indicating grassland, alien tree clumps and low-density development

Due to the nature of the project and its location within an area currently unaffected by significant mining activity, the proposed project will lead to a moderate level of visual intrusion on the landscape and is expected to be clearly noticeable in relation to its surroundings. The undulating landscape, the overall limited height of the proposed surface infrastructure and the inherent Visual Absorption Capacity (VAC) of the MRA area, will however serve to somewhat limit such intrusion from certain receptor sites. In addition, the MRA area is somewhat screened by existing vegetation and infrastructure, and existing light industrial activities are present in the region.

The landscape character type is not unique to the MRA area and can also be found within the larger region. The sense of place associated with the MRA area is therefore not highly significant when compared to its surroundings.

8.2.2 Soils and Land Capability

The dominant soil types within the MRA area include Hutton/Clovelly (Hu)/(Cv), Rocky Outcrop, Westleigh/Avalon (We)/(Av) and Mispah/Glenrosa/Dresden (Ms/Gs/Dr). The remainder of the MRA area is occupied by Witbank (Wb) (Anthrosols), Pinedene (Pn), as well as residential properties.

Sandstone outcrops were observed where the bedrock is exposed on the ground surface around the crest (hilltop) landscape position. This is indicative of intense erosion likely attributed to historic land uses, particularly overgrazing. Abandoned buildings and other residual concrete structures from historic infrastructure were also observed within the MRA area. Such area and other existing buildings were classified as Witbank (anthrosols) (man-made soil deposit) and delineated as equivalent to the observed rocky outcrop areas. The table below summarises the total area for each soil form as well as their associated percentage areal extent.

Table 15: Soil forms identified within the MRA area

Soil Form	Total Area (Ha)	% Areal Extent
Hutton/Clovelly	92.5	41.8
Rocky Outcrop	31.2	14.1
Westleigh/Avalon	20.5	9.3
Mispah/Glenrosa/Dresden	15.1	6.8
Witbank (Anthrosols)	3.7	1.7
Pinedene	1.4	0.6
Wetland (Katspruit)	50.8	23
Residential Properties	6.0	2.7
Total Area	221.2	100

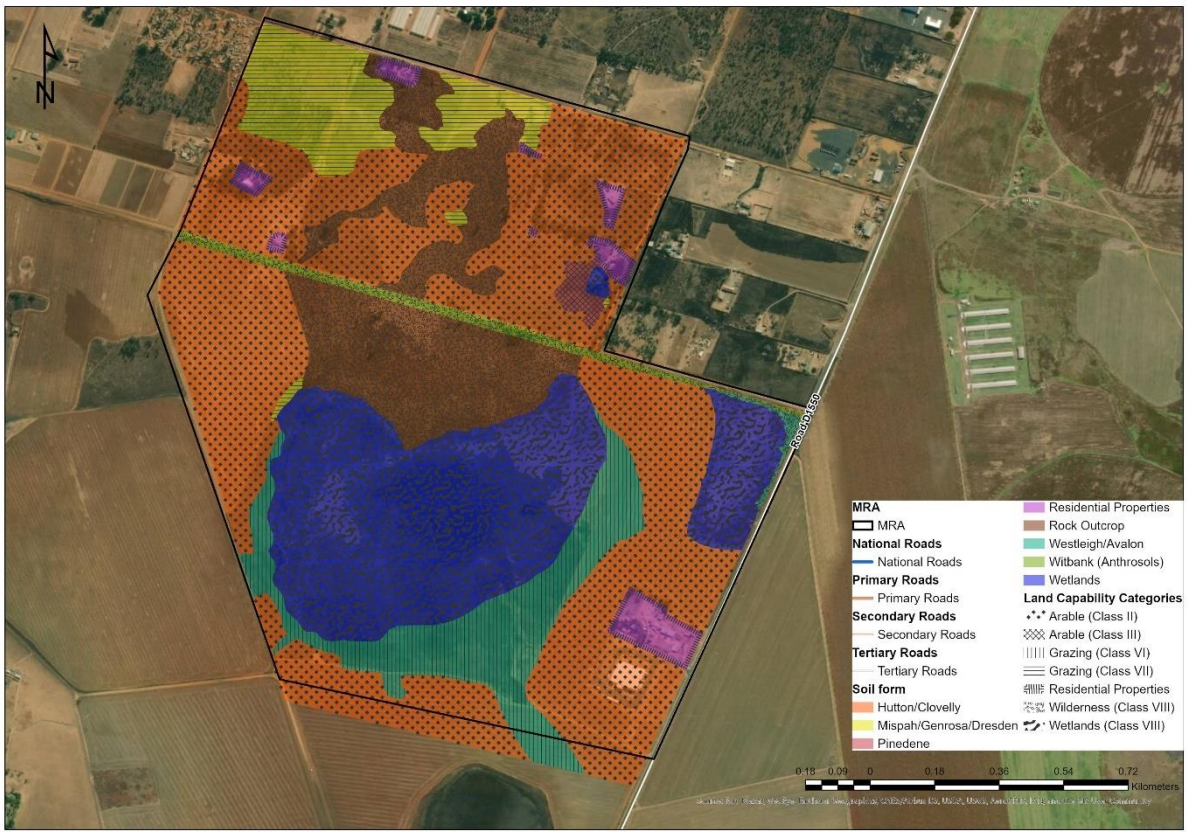


Figure 25: Soil form and land capability map

8.2.3 Historic and Current Land Use

Several dominant land uses have been identified in the vicinity of the MRA area, namely:

- Agricultural, in the form of cultivated lands;
- Grazing land and open veld;
- Livestock farming;
- Cultivated orchards;
- Flower and vegetable tunnels;
- Residential, which includes low-density residential dwellings associated with individual farms. Several smallholdings and agricultural holdings are located within a 10 km of the MRA area, including Eloff, Breswol, Botleng and the larger town of Delmas; and
- Urban residential areas located further from the MRA area, including Benoni, Brakpan, and Springs to the southwest, Bronkhorstpruit to the north and Ogies to the east.

Several main roads are present in the vicinity of the MRA area, including:

- The N12 highway located approximately 1 km to the north;
- The R50 roadway approximately 2 km to the northeast;

- The R555 roadway approximately 4 km to the south;
- The D1550 roadway to the east; and
- Numerous local gravel roads, one road forming the northern boundary and the other forming the southern border of the MRA area.

Current land use activities within the MRA area include livestock grazing and cultivated agriculture (maize and orchards) as indicated in Figure 26. Notably, the wetlands occupy a fairly large portion of the MRA area.

The MRA area in its present state has not been impacted by mining and industrial activities and therefore the proposed mining activities will lead to a noticeable change in land use of the area. Light industrial activities are however common in the immediate vicinity of the MRA area and several smaller mining operations are situated within 5 km of the MRA boundary.

Sandstone outcrops were observed where the bedrock is exposed on the ground surface around the crest (hilltop) landscape position. This is indicative of intense erosion likely attributed to historic land uses, particularly overgrazing. Abandoned buildings and other residual concrete structures from historic infrastructure were also observed within the MRA area. Such area and other existing buildings were classified as anthrosols (man-made soil deposit) and delineated as equivalent to the observed rocky outcrop areas.

Figure 26: Existing land use map

8.2.4 Biodiversity

8.2.4.1 Habitat units

The habitat associated with the MRA area is mostly of low to intermediate sensitivity, with only the wetland habitat unit being of a higher sensitivity rating. Much of the study area has been disturbed through agricultural activities because of crop farming and to a lesser extent grazing of cattle.

Four habitat units were identified. These habitat units are:

- Three wetland systems located within the MRA area;
- Rocky Grassland located predominantly in the central portion of the MRA area, running from north to south. This habitat unit is of a higher elevation than the surrounding areas;
- Disturbed areas associated with overgrazed pastures and old lands where ecological succession processes have commenced; and
- Agricultural areas where the vegetation has been completely transformed by current crop cultivation activities.

8.2.4.2 Vegetation cover

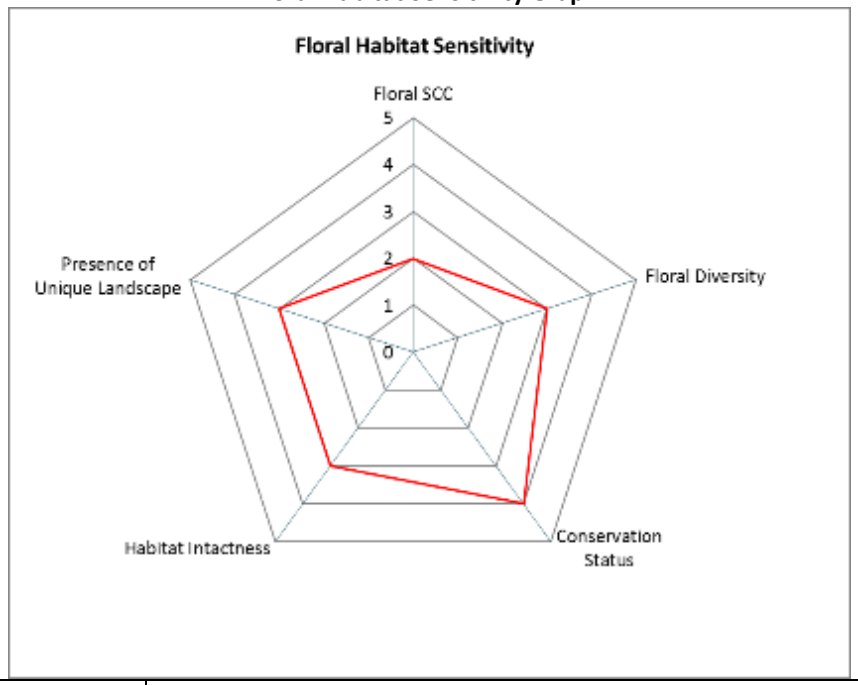
The MRA area falls within the Grassland Biome, the Mesic Highveld Grassland Bioregion and is situated within the Eastern Highveld Grassland vegetation type.

The Eastern Highveld Grassland vegetation types occurs on slightly to moderately undulating plains including some low hills and pan depressions. The vegetation is short dense grassland dominated by a typical Highveld grass composition (*Aristida* spp., *Digitaria* spp., *Eragrostis* spp., *Themeda* spp., and *Tristachya* spp.) including small, scattered rocky outcrops providing habitat for wiry, sour grasses and some woody species such as *Vachellia caffra, Celtis africana, Diospyros lyciodes* subsp. *lyciodes, Parinari capensis, Protea caffra, P. welwitschii* and *Rhus magalismontanum*.

Most of the vegetation associated with the MRA area has been transformed by agricultural activities, with remnant patches of natural, undisturbed grassland present, including rocky outcrop areas, which are also utilised as grazing for livestock. Stands of alien trees are mainly present in the vicinity of homesteads and vegetation of low height in the form of grassland dominates the vegetation. The occurrence of bare and exposed soils is limited.

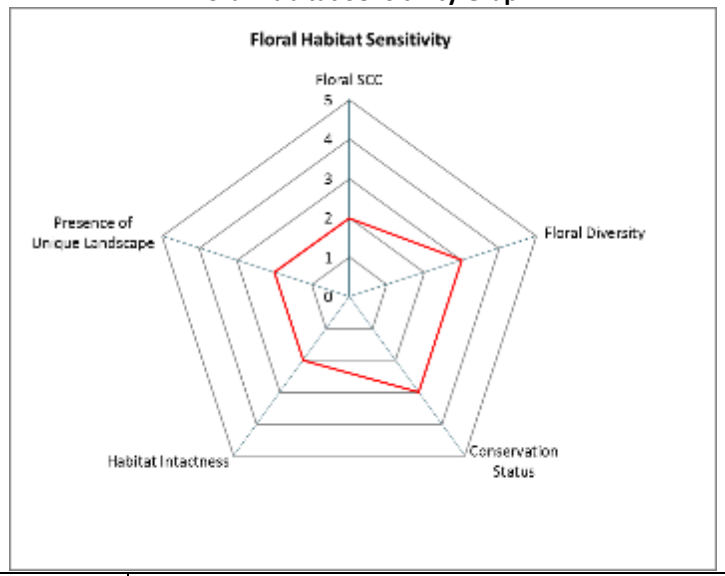
8.2.4.3 Floral environment

8.2.4.3.1 Habitat Unit 1: Rocky Grassland

<table>
<tr><td rowspan="2">Habitat Unit:
Rocky Grassland</td><td>Floral Habitat Sensitivity</td><td>Intermediate</td><td rowspan="3">  </td></tr>
<tr><td colspan="2">Notes on Photograph:
Typical view of the Rocky Grassland habitat unit</td></tr>
<tr><td colspan="3">Floral Habitat Sensitivity Graph:
 
</td></tr>
<tr><td>Floral Species of Conservation Concern (SCC)</td><td colspan="3">Four floral SCC which are listed as declining, namely Hypoxis hemerocallidea, Gladiolus vinosomaculatus, Gladiolus permeabilis and Crinum graminicola, which are protected under the Mpumalanga Nature Conservation Act (MNCA) of 1998 were encountered within this habitat unit. Only two other SCC are listed for the QDS, namely Crinum bulbispermum and Kniphofia typhoides, however neither were found</td></tr>
</table>

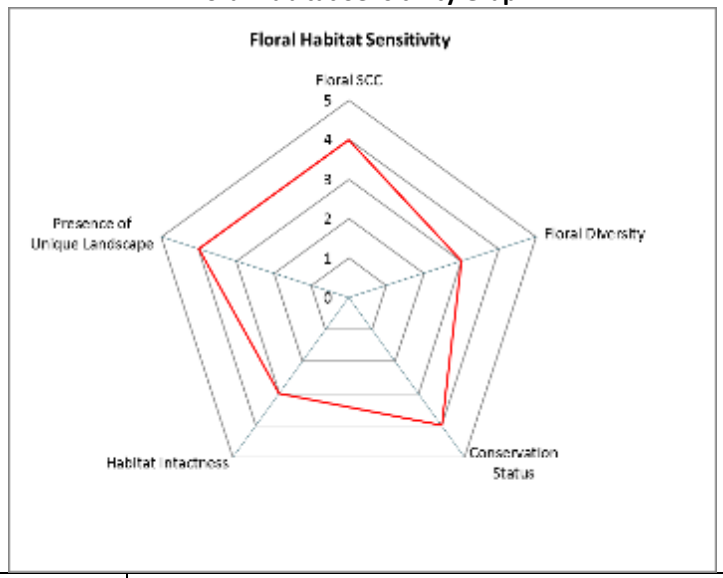
	within this habitat unit. Years of overgrazing combined with unsuitable habitat is likely to exclude both these species from this habitat unit.		
Floral Diversity	Floral diversity was intermediate with a number of species indicative of the vegetation type in which the habitat unit is situated recorded. However anthropogenic activities have had a marked impact on the overall floral diversity. Typical species found in this habitat unit include *Gladiolus vinosomaculatus, Gladiolus permeabilis, Aristida difusa, Heteropogon contortus* and *Eragrostis chloromelas*.	General comments: This habitat unit is associated with rocky outcrops and areas of higher elevation within the MRA area. Cattle grazing is the dominant land use, however grazing pressure is considered to be intermediate. There is a high presence of forbs within the habitat unit as well as common grassland flowers. The habitat unit is considered to be the most intact and least disturbed habitat unit within the MRA area.	Business Case, Conclusion and Mitigation Requirements: This habitat unit is of intermediate ecological sensitivity, with a loss of floral diversity and species being likely should development within this habitat unit occur. Mining activities within this habitat unit should be minimised where possible, ensuring that the mining footprint is kept to a minimum. It is advised that a rescue and relocation plan for floral SCC be implemented where the mining footprint will encroach on this habitat unit.
Conservation Status of Vegetation Type/Ecosystem	The vegetation type is listed as Endangered (Mucina & Rutherford 2006) however the species composition of the habitat unit is no longer representative of this vegetation type.		
Habitat Integrity/Alien and Invasive species	Overall intactness of the habitat unit is considered to be of an intermediate level. The grass species present within the habitat unit are non-climax species, further indicating levels of disturbance within the habitat unit. Although the habitat unit has undergone varying levels of disturbance, very few alien and invasive species were present within the habitat unit, partly attributable to the very shallow soils present.		
Presence of Unique Landscapes	The rocky nature and elevated position of the habitat unit in comparison to the surrounding areas creates niche habitat for floral species whilst providing an increased level of protection from veld fires. The rocky outcrops shelter many of the plants in the rocky grassland from the more sever heat and damaging effects of veld fires.		

8.2.4.3.2 Habitat Unit 2: Disturbed Grassland

<table>
<tr><td>Habitat Unit:
Disturbed Grassland</td><td>Floral Habitat Sensitivity</td><td>Moderately Low</td><td rowspan="2">  </td></tr>
<tr><td colspan="2">Notes on Photograph:
View of the disturbed grassland with stands of Eucalyptus grandis trees evident.</td></tr>
<tr><td colspan="3">Floral Habitat Sensitivity Graph:
 
</td></tr>
<tr><td>Floral Species of Conservation Concern (SCC)</td><td colspan="3">One floral SCC which is listed as declining, namely Crinum graminicola, which are protected under the Mpumalanga Nature Conservation Act (MNCA) of 1998were encountered within this habitat unit. Past agricultural and current grazing activities have led to the habitat being largely disturbed, lowering the probability of any other SCC being present.</td></tr>
<tr><td>Floral Diversity</td><td>Very few floral species that are indicative of the Eastern Highveld Grassland vegetation type were recorded. However, the majority of species within this habitat unit are pioneer species or species that are generally associated with disturbed habitat. Dominant</td><td colspan="2">General comments:
Overgrazing and trampling by livestock were evident within the unfenced sections of this habitat unit. Pioneer</td><td>Business Case, Conclusion and Mitigation Requirements:</td></tr>
</table>

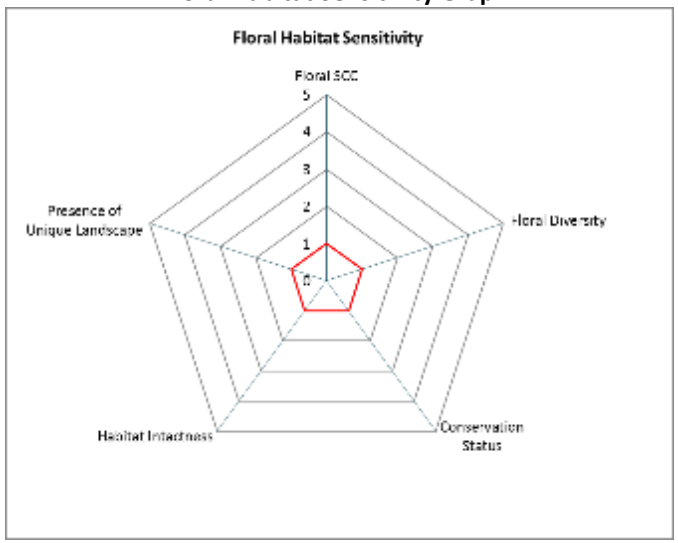
	species within this habitat unit include *Stoebe plumosum, Hyparrhenia hirta, Diheteropogon amplectens, Eragrostis chloromelas, Eucalyptus grandis* and *Eragrostis gummiflua*.	grass species, alien invasive trees as well as grass species commonly associated with disturbed habitats dominated this habitat unit. Fenced off areas are still used for grazing in a more controlled manner, however many of these areas were also previously utilised for crop cultivation.	This habitat unit is of moderately low ecological sensitivity. Although mining in this habitat unit is unlikely to have a significant impact on the receiving environment, it is advised that a rescue and relocation plan for floral SCC be implemented where the mining footprint will encroach on this habitat unit.
Conservation Status of Vegetation Type/Ecosystem	The vegetation type is listed as Endangered (Mucina & Rutherford 2006) however, the species composition is no longer representative of the vegetation type.		
Habitat Integrity/Alien and Invasive species	Habitat was largely modified due to livestock grazing, agricultural activities and presence of alien trees such as *Eucalyptus* spp. and forbs such as *Campuloclinium macrophalum* (Pompom weed).		
Presence of Unique Landscapes	The disturbed grassland habitat is located in the lower regions of the MRA area and surrounds the Rocky Grassland Habitat Unit. The landscape in which this habitat unit is situated is not considered to be particularly unique.		

8.2.4.3.3 Habitat Unit 3: Wetlands

<table>
<tr><td>Habitat Unit:
Wetlands</td><td>Floral Habitat Sensitivity</td><td>Moderately high</td><td colspan="3" rowspan="2">  </td></tr>
<tr><td colspan="2">Notes on Photograph:
Wetland feature with excavated dam within the MRA area</td></tr>
<tr><td colspan="3">Floral Habitat Sensitivity Graph:
 
</td><td colspan="3"></td></tr>
<tr><td>Floral Species of Conservation Concern (SCC)</td><td colspan="2">No floral SCC were encountered within this habitat unit, however there remains the possibility that Crinum bulbispermum and Kniphofia typhoides may occur within this habitat unit.</td><td colspan="3"></td></tr>
<tr><td>Floral Diversity</td><td colspan="2">Floral diversity was moderate with obligate and facultative wetland species being observed within this habitat unit. The diversity of the wetland habitat unit has been negatively affected as a result of the excavation of the dam.</td><td rowspan="2">General comments:
This habitat unit is associated with the lower lying south eastern area between the higher lying rocky grassland and the eastern boundary road. The wetland provides habitat for species generally associated with saturated soil conditions, and although the area was</td><td rowspan="2" colspan="2">Business Case, Conclusion and Mitigation Requirements:
This habitat unit is of moderately high ecological sensitivity and if any activities are to infringe upon this habitat unit t impact on floral habitat, diversity and floral SCC is likely to be significant.</td></tr>
<tr><td>Conservation Status of Vegetation Type/Ecosystem</td><td colspan="2">Wetlands by nature are considered important and are to be protected and conserved at all times. Further, the wetland habitat is located within an endangered vegetation type as listed by Mucina & Rutherford (2006).</td></tr>
</table>

Habitat Integrity/Alien and Invasive species	Wetland habitat has been transformed due to the excavation of the artificial dam structure. The unnatural drainage of the surrounding wetland areas, combined with grazing activities, has resulted in a degraded wetland environment. A small number of alien invasive forb species were observed within the wetland habitat.	notably disturbed, the overall habitat suitability for floral species is considered to be moderately high.	All possible steps must be taken to ensure that mining activities within the MRA area do not negatively affect the wetland areas and their associated integrity and function with specific mention of biodiversity support functions.
Presence of Unique Landscapes	The wetland habitat unit contributes to floral diversity of the MRA area through the creation of niche habitat for flora adapted to saturated soil conditions.		

8.2.4.3.4 Habitat Unit 4: Agricultural Fields

<table>
<tr><td>Habitat Unit:
Agricultural Fields</td><td>Floral Habitat Sensitivity</td><td>Low</td><td rowspan="2">  </td></tr>
<tr><td colspan="2">Notes on Photograph:
Typical view of current agricultural fields (Pecan nut plantation) within the MRA area</td></tr>
<tr><td colspan="3">Floral Habitat Sensitivity Graph:
 
</td></tr>
<tr><td>Floral Species of Conservation Concern (SCC)</td><td colspan="3">No floral SCC were encountered in this habitat unit and it is highly unlikely that any such species will occur</td></tr>
<tr><td>Floral Diversity</td><td colspan="2">Floral diversity was considered to be low with much of the areas having been cleared to make way for agricultural crops.</td><td rowspan="2">General comments:
This habitat unit is associated with current and historic crop fields which has completely transformed the ecological structure of the natural vegetation. Overall ecological function</td><td rowspan="2">Business Case, Conclusion and Mitigation Requirements:
This habitat unit is of low ecological sensitivity. Activities within this habitat unit will have an insignificant impact on the floral</td></tr>
<tr><td>Conservation Status of Vegetation Type/Ecosystem</td><td colspan="2">The vegetation type is listed as Endangered (Mucina & Rutherford 2006), however no representative vegetation remains.</td></tr>
</table>

Habitat Integrity/Alien and Invasive species	Habitat is severely transformed and dominated by pioneer grasses such as *Cynodon dactylon* in the newly planted orchards. The remaining agricultural areas are currently homogenously planted with *Zea mays* (Maize).	is low in the areas of the orchard and very low in the maize fields.	environment, however care must be taken to limit edge effects on the surrounding natural areas.
Presence of Unique Landscapes	No unique landscapes important to flora were present.		

8.2.4.3.5 Floral Species of Conservation Concern

An assessment considering the presence of any plant species of concern, as well as suitable habitat to support any such species was undertaken. The complete PRECIS Red Data Listed plants for the grid reference 2628BA was acquired from SANBI.

Threatened species are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) is a threatened species.

Species of Conservation Concern (SCC) are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, and Declining. Table 16 below represent those species that obtained a Probability of Occurrence (POC) score of 60% or more.

Table 16: Floral SCC listed for the QDS that obtained a POC score of 60% or more

Species	POC	Motivation
***Crinum bulbispermum* (Burm.f.) Milne-Redh. & Schweick.**	70%	Within distribution range with suitable habitat in the form of wetlands and damp depressions being present. Not recorded during assessment
Kniphofia typhoides Codd	45%	Within distribution range however suitable habitat is not present. Seasonally wet areas are present however, the MRA area is not in a climax state and has been largely disturbed. Not recorded during assessment

From the above assessment, it is evident that *Crinum bulbispernum* is likely to occur within the MRA area, although this species was not recorded during the site assessment. The above species, should they occur on site, are likely to be found within the Wetland habitat unit, which adds to the sensitivity of this habitat unit.

Additionally, four species protected by the MNCA (1998) were recorded during the assessment in the Rocky Grassland habitat and the Disturbed Grassland habitat units, namely *Gladiolus vinosomaculatus, Gladiolus permeabilis, Crinum graminicola* and *Hypoxis hemerocallidea*. If individuals or communities of these species will be disturbed by mining 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 Mpumalanga Tourism and Parks Agency (MTPA).

The MTPA has further indicated that *Brachycorythis conica* subsp. *transvaalensis* has been recorded on the farm Rietkol. Should this species be observed, mining activities in that area are to be halted and MTPA notified and consulted to determine the best way forward.

8.2.4.3.6 Alien and Invasive Plant Species

During the floral assessment, dominant alien and invasive floral species were identified and are listed below.

Table 17: Dominant alien vegetation species identified during the field assessment

Species	English name	Country of Origin	Category*
Trees/ shrubs			
Acacia dealbata	Silver wattle	Australia	2
Schinus molle	Peruvian pepper tree	S. America	N/L
Eucalyptus grandis	Blue Gum	Australia	1b
Robinia pseudoacacia	Black Locust	N. America	1b
Celtis australis	Nettle tree	Australia	3
Forbs			
Bidens pilosa	Common blackjack	S. America	N/L
Campuloclinium macrophalum	Pompom weed	S. America	N/L
Stoebe plumosum	Bankrupt bush	Indigenous	N/L
Solanum mauritianum	Bugweed	S. America	1b
Tagetes minuta	Tall khakiweed	S. America	N/L
Verbena bonariensis	Purple top	S. America	1b

*N/L = Not Listed and not categorised

National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, GN R598 of 2014:

- Category 1a – Invasive species that require compulsory control.
- Category 1b – Invasive species that require control by means of an invasive species management programme.
- Category 2 – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.
- Category 3 – Ornamentally used plants that may no longer be planted. Existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread.

A relatively low diversity of alien species occurs within the MRA area. The presence of *Campuloclinium macrophalum* is of great concern, as this species is known to spread rapidly and is hard to control once it is formally established. Alien species located in the MRA area need to be removed on a regular basis as part of maintenance activities according to the NEMBA Alien and Invasive Species Regulations, 2014.

8.2.4.3.7 Medicinal Plant Species

Medicinal plant species are not necessarily indigenous species, with many of them regarded as alien invasive weeds. The table below presents a list of dominant plant species with traditional medicinal value, plant parts traditionally used and their main applications, which were identified during the field assessment. These medicinal species are all commonly occurring species and are not confined to the MRA area.

Table 18: Dominant traditional medicinal floral species identified during the field assessment

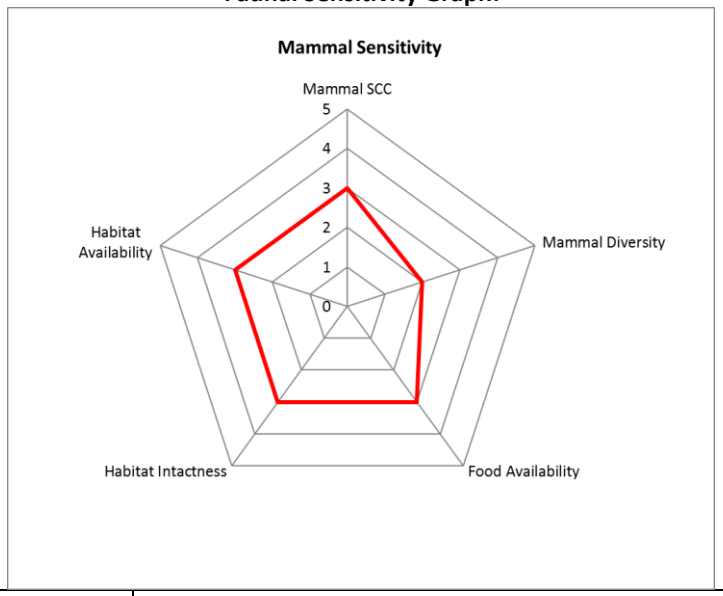
Species	Name	Plant parts used	Medicinal uses
Hypoxis hemerocallidea	Star flower	Bulb	Infusions of the corm are used as emetics to treat dizziness bladder disorders and insanity. Decoctions have been given to weak children as a tonic and the juice is reported to be applied to burns. The stems and leaves are mixed with other ingredients to treat prostate problems. Traditional uses are also said to include testicular tumours, prostate hypertrophy, and urinary infections. In recent years, the plant has become an important commercial source of extracts used in prostate preparations and in various tonics and so-called immune boosting preparations.
Tagetes minuta	Tall khaki bush	Leaves	Highly aromatic leaves have repellent properties of essential oils used by gardeners to keep plants disease free. Oil used in perfumery and as flavouring in foods, beverages, and tobacco.
Pelargonium luridum	Wild geranium	Fleshy root stock	Water or milk decoctions of the tubers are used to treat diarrhoea and dysentery.
Scabiosa columbaria	Wild scabious	Leaves or fleshy roots	The plant is a remedy for colic and heartburn. Dried roasted roots are made into a wound-healing ointment, and the powdered roots are also used as a pleasant-smelling baby powder.

A moderately low diversity of medicinal species is present, most of which are common and widespread and thus the proposed activities are not likely to pose a significant threat to medicinal species locally and regionally. If individuals of *Hypoxis hemerocallidea* or communities thereof are disturbed by mining 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 MTPA.

8.2.4.4 Faunal Environment

The overall habitat availability of the MRA area is considered to be moderately low to intermediate. This is largely because of anthropogenic activities, hunting and snaring by local communities, loss and disturbance of habitat as well as limited habitat connectivity with surrounding areas. The wetland habitat unit is considered to be of highest importance for faunal species, with the grassland areas surrounding the wetland forming a suitable periphery habitat for a number of small mammal species. Historical evidence of mammal activity (burrows) was observed within both the Disturbed Grassland and the edges of the Rocky Grassland habitat units, however active hunting by the local communities as well as anthropogenic activities has resulted in a large loss of these species.

8.2.4.4.1 Mammals

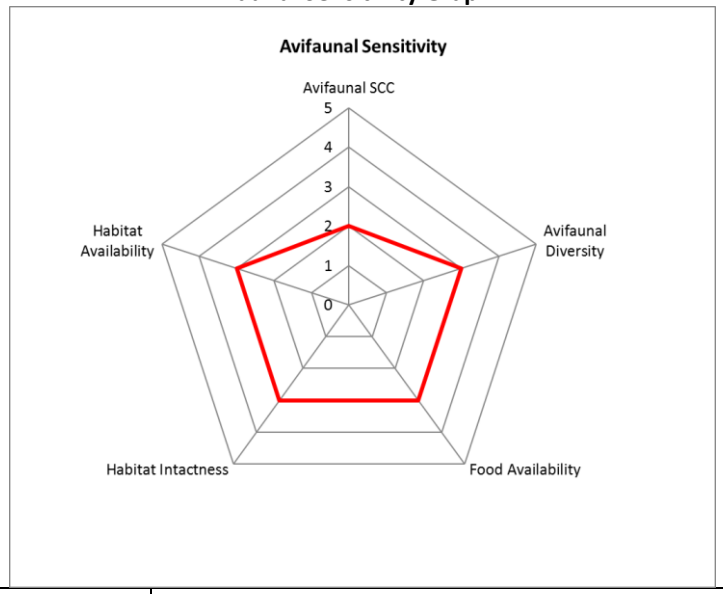
<table>
<tr><td>Faunal Class:
Mammals</td><td>Faunal Habitat Sensitivity</td><td>Intermediate</td><td rowspan="2">Photograph:
  </td></tr>
<tr><td colspan="2">Notes on Photograph: Top: Aethomys chrysophilus (Red Vlei Rat) captured in a Sherman Trap within the MRA area. Below: Skeletal remains of Hystrix africaeaustralis (African Porcupine) found near an old abandoned excavated burrow.</td></tr>
<tr><td colspan="3">Faunal Sensitivity Graph:
 
</td></tr>
<tr><td>Faunal SCC/Endemics/TOPS</td><td colspan="3">No mammal SCC were encountered during the site assessment. The onsite habitat potential of the MRA area in terms of SCC is considered to be low, with anthropogenic activities such as farming and localised subsistence hunting further limiting the probability of occurrence of SCC within the MRA area.</td></tr>
<tr><td>Faunal Diversity</td><td>The overall mammal diversity of the MRA area is considered to be moderately low. Information from local farmers as well as historic burrows and species remains (bones) indicate that the MRA area historically would have had an intermediate to moderately high mammal diversity, however impacts from</td><td colspan="2">General comments (dominant faunal species/noteworthy records etc.):
Mammal species predominated within the wetland habitat units as well as the disturbed grassland that surrounds the

Business Case, Conclusion and Mitigation Requirements:
The mammal habitat sensitivity is of an intermediate ecological sensitivity, notably within the</td></tr>
</table>

	farming activities and the local communities has resulted in a significant decrease in diversity.	wetland habitat unit. The rocky grassland by nature is categorised as sourveld and as such very few mammal species will utilise this habitat unit. The rocky grassland habitat unit however does provide a connectivity corridor between the eastern and western portions of the MRA area, where mammal resource availability is higher. Although local farmers made mention of several mammal species that used to occur within the MRA area, all evidence indicated that localized anthropogenic impacts as well as hunting activities by the local communities has resulted in a significant loss of mammal species within the MRA area and surrounds.	wetland habitat. Any encroachment on these areas may have a negative impact on mammals within the MRA area. Further, mining of the rocky grassland is likely to result in a loss of connectivity within the MRA area.
Food Availability	Food availability is restricted primarily to granivorous species and species that are able to utilise herbaceous material as a food source. Food availability was highest in the wetland areas. The remaining grasslands of the MRA area were noted to have an intermediate level of food availability for mammal species.		
Habitat Integrity	Habitat integrity is considered to be of an intermediate level. Historic farming activities as well as habitat modification has resulted in a significant loss of habitat integrity, however the overall ecological connectivity of the MRA area is still relatively intact.		
Habitat Availability	Primary mammal habitat is provided by the wetlands whilst the rocky grassland and disturbed grassland areas are considered to be secondary habitat. Mammal species were most abundant around the wetlands and immediate surroundings where food and water availability were also highest.		

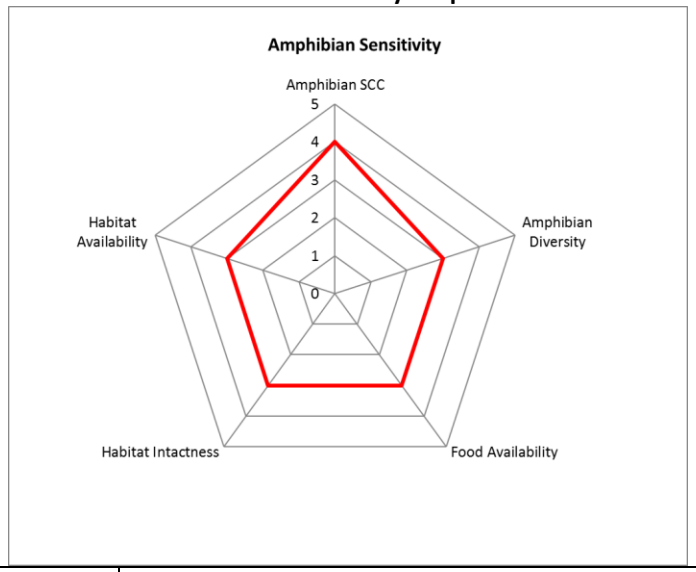
8.2.4.4.2 Avifauna

Faunal Class: **Avifauna**	**Faunal Habitat Sensitivity**	**Intermediate**	**Photograph:**
	Notes on Photograph: Top: *Euplectes afer* (Golden Bishop) observed in the wetland habitat unit. Bottom: *Mirafra Africana* (Rufous-naped Lark) observed within the rocky grassland		
Faunal Sensitivity Graph:			
Faunal SCC/Endemics/TOPS	No avifaunal SCC were observed within the MRA area. Although the habitat within the MRA area have undergone disturbances, the short grass areas created by overgrazing may prove suitable to *Geronticus calvus* (Bald Ibis), as this species exhibits preference to short grassland habitat.		



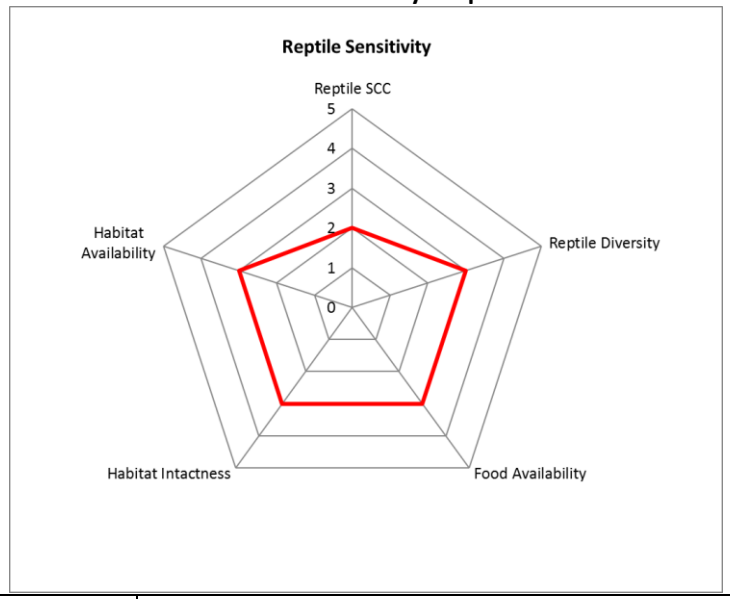
Faunal Diversity	Avifaunal diversity within the MRA area is considered to be intermediate, with a large majority of the species observed considered common and widespread.	General comments (dominant faunal species/noteworthy records etc.): The MRA area's avifaunal diversity was locally congregated around the wetland areas and the housing infrastructure. This is mainly attributable to the increase of food and water resources in these areas as well as roosting and nesting sites.	Business Case, Conclusion and Mitigation Requirements: The avifaunal habitat sensitivity for the MRA area is considered to be intermediate. Past farming activities, current grazing pressures and veld mismanagement has resulted in decreased habitat suitability of avifaunal species as well as SCC. The wetland habitat unit however is still considered important for avifaunal species and as such mining activities should not encroach upon this habitat unit.
Food Availability	The food provision capability of the MRA area is considered to be intermediate. The wetland and disturbed grassland habitat units are considered to be the most important habitats for avifaunal food resources.		
Habitat Integrity	Habitat integrity is considered to be intermediate. Anthropogenic and farming activities have lowered the overall habitat integrity of the MRA area.		
Habitat Availability	The wetlands and to a degree the surrounding disturbed grassland provided the most suitable habitat for avifaunal species within the MRA area. The rocky grassland is utilised to an extent as a foraging area as well as the remaining areas of the MRA area. Some of the dense tree stands (alien trees) surrounding the farmhouses within the MRA area are used for nesting by species such as *Bostrychia hagedash* (Hadeda Ibis) and *Streptopelia capicola* (Cape Turtle Dove).		

8.2.4.4.3 Amphibians

Faunal Class: **Amphibians**	**Faunal Habitat Sensitivity**	**Intermediate**	**Photograph:**
	Notes on Photograph: Representative images of the applicable amphibian habitat within the MRA area.		
Faunal Sensitivity Graph:  			
Faunal SCC/Endemics/TOPS	Only one amphibian SCC is expected to occur within the MRA area, namely *Pyxicephalus adspersus* (Giant Bullfrog, Vulnerable). Populations of this species are likely to occur around the wetland boundaries.		

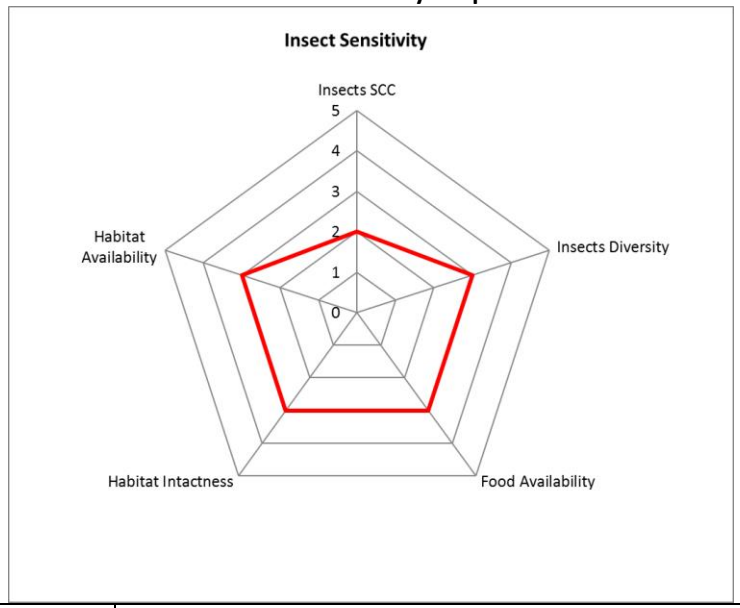
Faunal Diversity	No amphibian species were observed during the time of the assessment due to the very thick vegetation cover within the wetland habitat unit as well as the cryptic nature of many amphibian species. The wetland habitat unit and immediate surrounding grassland area is considered to be ideal habitat for amphibian species, and as such the MRA area is considered to have an intermediate diversity of amphibian species.	General comments (dominant faunal species/noteworthy records etc.): Amphibian populations are expected to be localised within the wetland and lower lying grassland areas surrounding the wetland habitat unit, where the soil moisture content was observed to be higher, and where food resources were more accessible and abundant. Species that can be expected to occur within the MRA area include but are not limited to *Xenopus laevis, Amietophrynus gutturalis, Cacosternum boettgeri, Amietia angolensis*.	Business Case, Conclusion and Mitigation Requirements: The amphibian sensitivity for the MRA area is considered to be intermediate. The wetlands and immediately surrounding grasslands are ideal amphibian habitat, and as such edge effects need to be effectively managed to limit disturbances to these habitats.
Food Availability	The wetland and surrounding grasslands are capable of supporting suitable food resources in the form of invertebrates.		
Habitat Integrity	Amphibian habitat integrity is considered to be intermediate. The northern wetland and surrounding grassland are relatively isolated in terms of amphibian movement and separated from the southern depression not only by topography but also by old agricultural lands and a dirt road.		
Habitat Availability	The wetland provides suitable habitat for amphibian species that are more water dependant, whilst the grassland areas are suitable for amphibian species that are less water dependant. The south section of the MRA area where the wetland habitat unit is located is expected to be a key location within the MRA area in terms of habitat provision.		

8.2.4.4.4 Reptiles

<table>
<tr><td>Faunal Class:
Reptiles</td><td>Faunal Habitat Sensitivity</td><td>Intermediate</td><td rowspan="2">Photograph:
  </td></tr>
<tr><td colspan="2">Notes on Photograph: Old farm buildings provide ideal habitat for a wide range of reptile species</td></tr>
<tr><td colspan="3">Faunal Sensitivity Graph:
 
</td><td></td></tr>
<tr><td>Faunal SCC/Endemics/TOPS</td><td colspan="3">No SCC were observed during the site assessment, nor are any expected to occur within the MRA area.</td></tr>
<tr><td>Faunal Diversity</td><td>A low reptile diversity was observed during the site assessment; however this is likely attributable to the secretive nature of many reptile species and the unseasonally dry conditions currently being experienced in the region. It is likely that the MRA area will have an intermediate level of reptile diversity. A dead specimen of a Naja mossambica (Mozambique Spitting Cobra) was found near one of the houses in the south eastern portion of the MRA area. With the exception of the cobra only</td><td>General comments (dominant faunal species/noteworthy records etc.):
Reptile species observed within the MRA area predominated around the existing infrastructure of farmhouses and outbuildings. Reptiles are expected to concentrate around these areas as well as the wetland habitat unit as many of</td><td>Business Case, Conclusion and Mitigation Requirements:
The reptile habitat sensitivity for the MRA area is intermediate. Reptile species are expected to be relatively localised around the wetland areas, as well as current housing and farm infrastructures. The wetland habitat</td></tr>
</table>

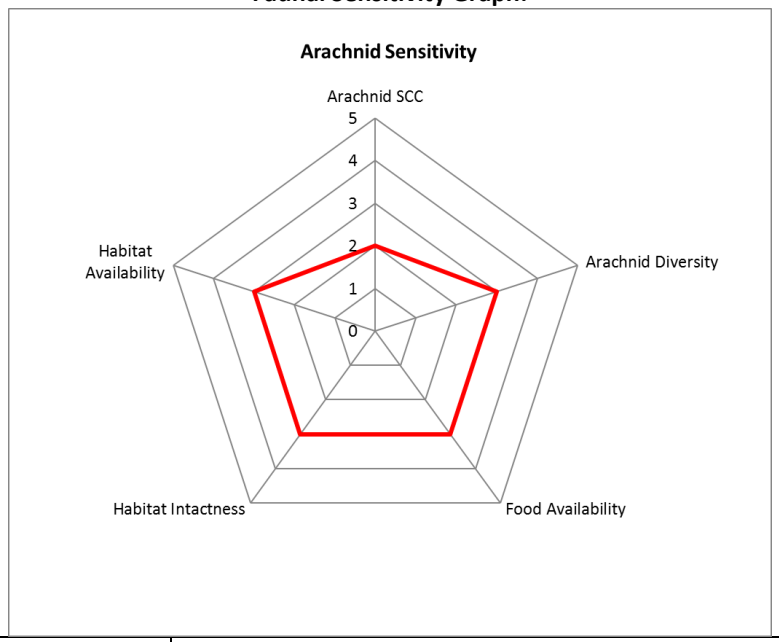
	common skinks were observed around the MRA area, namely *Trachylepis punctatissima*.	the food and water resources needed are found at these locations.	unit is expected to be a primary source of viable resources for many reptile species, and as such the wetland habitat unit should be exempt from all mining activities. Further, it must be ensured that this habitat unit is not affected by edge effects because of mining activities within the MRA area.
Food Availability	Small mammals and amphibians found within the MRA area will provide a suitable food resources for any predatory snakes within the MRA area, whilst small invertebrates are a suitable food resource for smaller reptiles.		
Habitat Integrity	Overall, the habitat integrity of the MRA area was considered to be intermediate. Although there has been large scale habitat disturbance and transformation in areas, the overall ecological connectivity of the MRA area has not been severely affected, notably for reptile species.		
Habitat Availability	Much of the MRA area that would have been classified as natural reptile habitat has been disturbed and transformed, either through farming practices or the construction of houses and workshops. However, many reptiles are adept at adapting to new environments, notably snakes. Furthermore, outbuildings and sheds provide new suitable habitat areas for reptiles.		

8.2.4.4.5 Insects

<table>
<tr><td>Faunal Class:
Insects</td><td>Faunal Habitat Sensitivity</td><td>Intermediate</td><td rowspan="2">Photograph:
  </td></tr>
<tr><td colspan="2">Notes on Photograph: From top left to bottom right: Maransis rufolineatus (Grass Stick Insect); Palpares caffer (Mottled Veld Antlion); Spilostethus pandurus (Milkweed Bug); Myrmeleon spp (Pit-building Antlions).</td></tr>
<tr><td colspan="3">Faunal Sensitivity Graph:
 
</td></tr>
<tr><td>Faunal SCC/Endemics/ TOPS</td><td colspan="3">No SCC were observed within the MRA area, nor are any insect SCC expected to occur within the MRA area due to habitat disturbance and the lack of suitable niche habitats needed by insect SCC.</td></tr>
<tr><td>Faunal Diversity</td><td>Overall insect diversity of the MRA area is considered to be intermediate. The MRA area appeared to be inhabited by a fairly large number of insects, however the diversity of species was not considered to be high. This may be attributed to the lower than normal rainfall, as well as later seasonal shifts. Species observed included Belenois aurota (Brown-veined</td><td colspan="2">General comments (dominant faunal species/noteworthy records etc.):
The wetlands and to a lesser extent the disturbed grassland are considered important in terms of ongoing insect survival within the MRA area. A healthy</td><td>Business Case, Conclusion and Mitigation Requirements:
The insect habitat sensitivity is considered to be intermediate. The varying floral characteristics of the disturbed grasslands and wetlands provide a range of varying</td></tr>
</table>

	White), *Junonia hierta* (Yellow Pansy), *Danaus chrysippus* (African Monarch) and *Pantala flavescens* (Pantala flavescens).	and strong insect population is necessary to ensure a suitable and ongoing food resource for several other species, as well as the insects playing a vital role in terms of pollinating plant species.	habitats for a variety of insect species. These species in turn are utilised as a food source by numerous other faunal species. As such, mining activities should not encroach upon the wetlands, and as far as possible impacts upon the disturbed grasslands should be minimised.
Food Availability	The grassland and wetland habitat units proved suitable habitat in terms of food provision for a number of insect species. The overall food availability for insects within the MRA area is considered to be intermediate.		
Habitat Integrity	Overall habitat integrity is considered to be intermediate, with much of the habitat units within the MRA area exhibiting a degree of connectivity.		
Habitat Availability	Both the wetlands and the disturbed grasslands provide suitable habitat to a number of insect species. The areas of decreased herbaceous layer, notably in the central areas of the rocky grassland had a decreased level of habitat provision for insect species.		

8.2.4.4.6 Arachnids

<table>
<tr><td>Faunal Class:
Arachnids</td><td>Faunal Habitat Sensitivity</td><td>Intermediate</td><td rowspan="2">Photograph:
  </td></tr>
<tr><td colspan="2">Notes on Photograph: Tibellus hollidayi (Running Spiders) observed within the MRA area</td></tr>
<tr><td colspan="3">Faunal Sensitivity Graph:
 
</td><td></td></tr>
<tr><td>Faunal SCC/Endemics/TOPS</td><td colspan="3">No arachnid SCC were observed within the MRA area, nor are any expected to occur within the MRA area due to anthropogenic activities.</td></tr>
<tr><td>Faunal Diversity</td><td>A small number of arachnid species were observed that are known to be commonly occurring in grassland areas. A combination of habitat disturbance, general secretive nature and small size often betrays the true diversity of arachnid species as they are not easily observed. The habitat and suitable insect population allows for the inference that the MRA area is likely to have a healthy although probably not highly diverse arachnid population.</td><td>General comments (dominant faunal species/noteworthy records etc.):
Anthropogenic activities and past farming, specifically ploughing activities has resulted in an altered arachnid species composition of within the MRA area. However, there still appears to be several arachnid species present within the MRA</td><td>Business Case, Conclusion and Mitigation Requirements:
Arachnid habitat sensitivity is considered to be intermediate. The rocky areas within the grasslands and grassland surrounding the wetlands are of importance as these areas are considered to have an</td></tr>
</table>

Food Availability	The relatively high number of insects within the MRA area provide a suitable food source for many of the arachnid species.	area, which is to be expected due to suitable food resources for arachnid species being present within the MRA area. Although no scorpions were observed within the MRA area during the time of the assessment, it is likely that commonly occurring species, notably those that are known to occur around human habitation and disturbed habitats, will occur within the MRA area. Such scorpion species expected to occur within the various habitat include *Pseudolychas pegleri* (Plain Pygmy-thicktail) and *Uroplectes triangulifer* (Highveld Lesser-thicktail).	increased potential for the occurrence of arachnid species. Mining of the wetland areas should be avoided, whilst the overall footprint of the mine should be kept as small as possible to minimise the impacts on arachnid species as far as possible.
Habitat Integrity	Habitat integrity is considered to be intermediate as a result of habitat disturbance within the MRA area. There was very little variation in species observed throughout the MRA area, with all the habitat units appearing to be inhabited by similar species.		
Habitat Availability	The MRA area is considered to have an intermediate level of habitat availability for arachnid species. The MRA area provides habitat for different arachnid species, both web building and ground hunting spiders, as well as terrestrial based scorpions.		

8.2.4.4.7 Faunal Species of Conservational Concern Assessment

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

Scientific Name	Common Name	POC %
Geronticus calvus	Bald Ibis	60
Pyxicephalus adspersus	Giant Bullfrog	60

From the above list of species, it is evident that the MRA area has the potential to provide habitat to a small number of faunal SCC. *Pyxicephalus adspersus* (Giant Bullfrog) is under threat because of habitat loss, namely wetlands and moist grassland. Further, in some areas of distribution *P. adspersus* is utilised as a food source, however this utilisation is not sustainable. *Geronticus calvus* (Bald Ibis) is being faced with similar threats of natural habitat loss, however grazing activities that create short grasslands have proven to be favourable to this species.

The Disturbed Grasslands and Wetland are the most likely habitats in which these species may be found, and as such increased importance needs to be placed on limiting, and where applicable mitigating impacts that occur within these habitats.

8.2.4.5 Ecological Sensitivity Mapping

Figure 27 conceptually illustrates the areas considered to be of increased ecological sensitivity. The areas are depicted according to their sensitivity in terms of the presence or potential for floral and faunal SCC, habitat intactness and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity. Table 19 presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development.

Table 19: A summary of sensitivity of each habitat unit and implications for development

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Rocky Grassland	Intermediate	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	Mining activities in this area are unlikely to have a significant impact on the receiving environment, faunal species will be impacted upon due to loss of foraging area. Floral SCC rescue and relocation programmes will

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
			have to be implemented prior to any activity within this habitat unit.
Disturbed Grassland	Intermediate (Fauna) to Moderately Low (Flora)	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	Mining activities in this area are unlikely to have a significant impact on the receiving environment, faunal species will be impacted upon due to loss of foraging area. Floral SCC rescue and relocation programmes will have to be implemented prior to any activity within this habitat unit.
Wetlands	Moderately High	Preserve and enhance the biodiversity of the habitat unit, Limit development and disturbance, no-go alternative must be considered.	Any disturbance of this habitat unit is discouraged and may lead to denied environmental authorisation by authorities.
Agricultural Fields	Low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	Although mining development in this area is unlikely to have a significant impact on the receiving environment, care must be taken to limit edge effects on the surrounding natural areas.

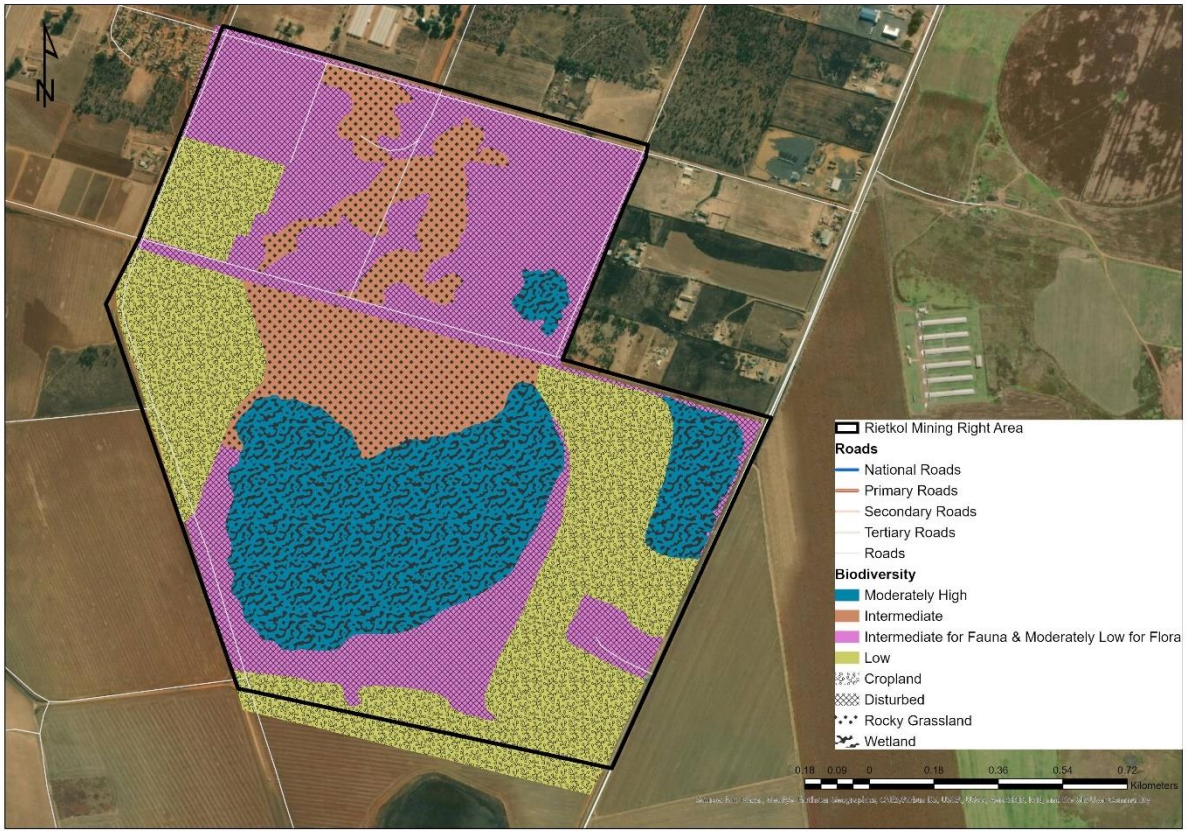


Figure 27: Ecological sensitivity map

8.2.5 Surface Water

The MRA area is located within the B20B quaternary catchment, which covers an area of approximately 323 km^2. A prominent watercourse, namely the Koffiespruit, is located ± 2.5 km west of the Rietkol MRA area and within the same catchment. The Bronkhorstspruit is located approximately 9 km east of the MRA area, but in a neighbouring catchment (B20A). No streams or watercourses transect the MRA area.

Surface elevations and watercourses for the Rietkol Project area are indicated in Figure 28.

The NFEPA database (2011) and Present Ecological State/Ecological Importance and Sensitivity (PES/EIS) database, developed by the DWS, were utilised to obtain additional background information on the Rietkol Project area. The information therein is summarised in Table 20.

Table 20: Summary of desktop information pertaining to the proposed Rietkol Project

Ecoregion	**Highveld**
Catchment	Olifants North
Water Management Area (WMA)	Olifants
SubWMA	Upper Olifants
Quaternary Catchment	B20B
Most proximal sub-quaternary reach	B20B-01285
Proximity	2.5 km north-west of Rietkol MRA area
Sub-quaternary reach name	Koffiespruit
Expert PES assessment	Y
PES category median	D (Largely Modified)
Mean Ecological Importance Class	Moderate
Mean Ecological Sensitivity Class	Moderate
Stream Order	1
Default Ecological Class	C (Moderately Modified)

Additionally, the NFEPA database identified the following in respect of the proposed Rietkol MRA area:

- Not an important FEPA;
- Not important in terms of cranes, frogs or water birds;
- The NFEPA database identified the natural depression to the south as a natural feature that is in a moderately modified condition; and
- The Koffiespruit was identified as an NFEPA River, however it is located 2.5 km north-west of the proposed Rietkol MRA area.

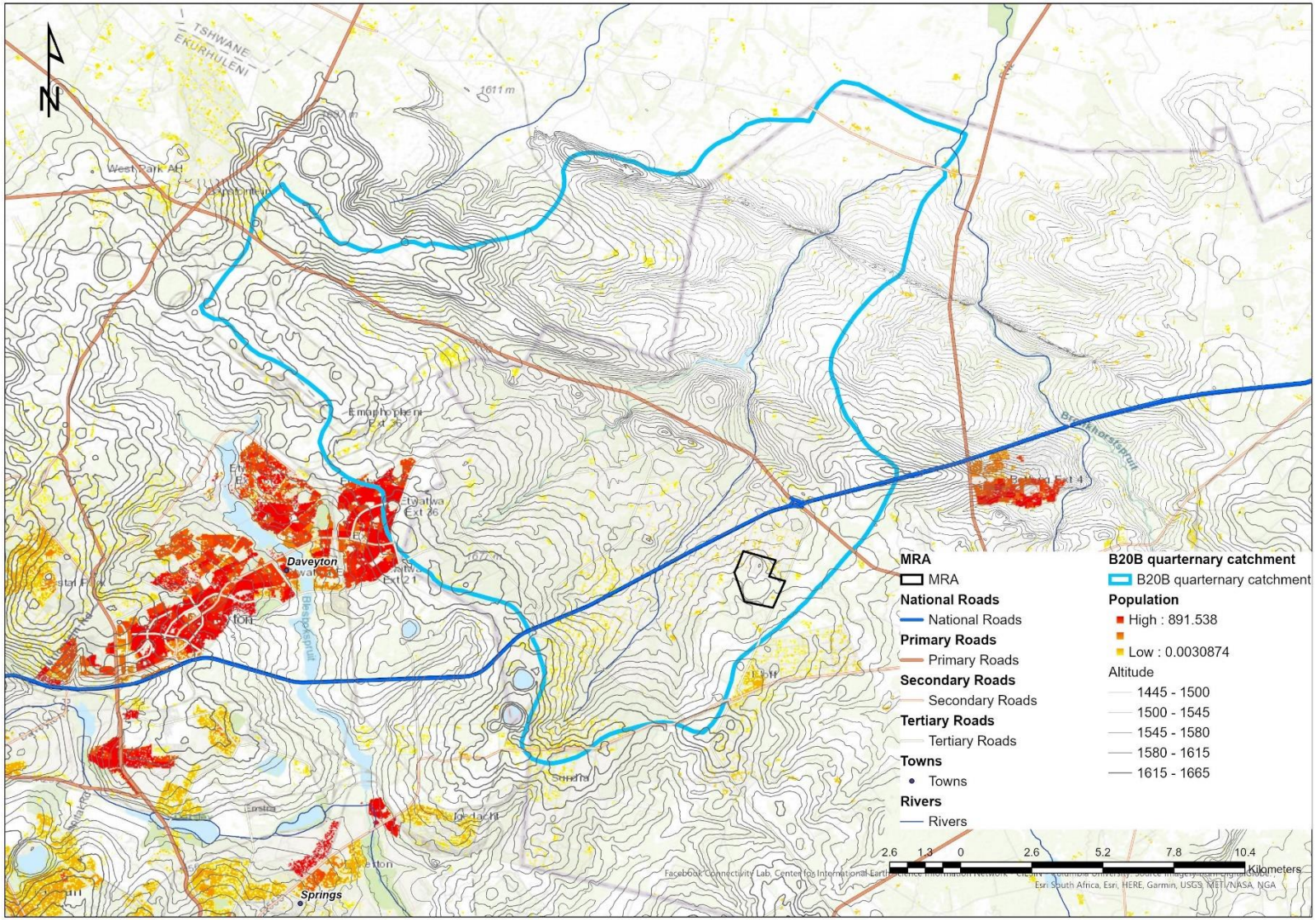


Figure 28: Watercourses associated with quaternary catchment B20B

The Koffiespruit is regarded as a perennial river; however, in its upper reaches and directly west of the Rietkol MRA area this is not the case, and it is therefore not believed to receive any significant baseflow. The Koffiespruit is thus not considered to be an important receptor of contamination that may potentially originate from the MRA area. Furthermore, the mineral to be mined is silica, a chemically inert mineral, that is hosted within a very clean (inert) quartzite. Both the resource mineral and host rock are inert, meaning that any seepage that may potentially originate from the MRA area is expected to be of good quality.

8.2.5.1 Wetlands

Two hydrogeomorphic (HGM) units were identified within the proposed MRA area, classified as depression (pan) and hillslope seep wetlands. These wetlands have been considerably modified by anthropogenic activities and have an intermediate level of ecoservice provision with relatively good water quality.

The identified wetlands were classified as Inland systems falling within the Highveld Ecoregion and within the Mesic Highveld Grassland Group 4 wetland vegetation group.

Table 21: SANBI wetland classification of the identified wetlands in the vicinity of the MRA area

Level 1: System	Level 2: Regional setting	Level 3: Landscape unit	Level 4: HGM unit
Inland: **An ecosystem that has no existing connection to the ocean, but which is inundated or saturated with water, either permanently or periodically.**	Ecoregion: Highveld Ecoregion NFEPA WetVeg Group: Mesic Highveld Grassland Group 4	Plain: An extensive area of low relief, characterised by relatively level, gently undulating, or uniformly sloping; with a very gentle (typically ≤ 1%) slope gradient.	Hillslope Seeps: A wetland area located on gently to steep sloping land and dominated by colluvial uni-directional movement of water and material downslope.
		Valley Floor: The typically gently sloping, lowest surface of a valley.	Depression: A wetland system with closed or near-closed elevation contours.

The delineated wetlands and the associated buffer zones are presented in Figure 29.

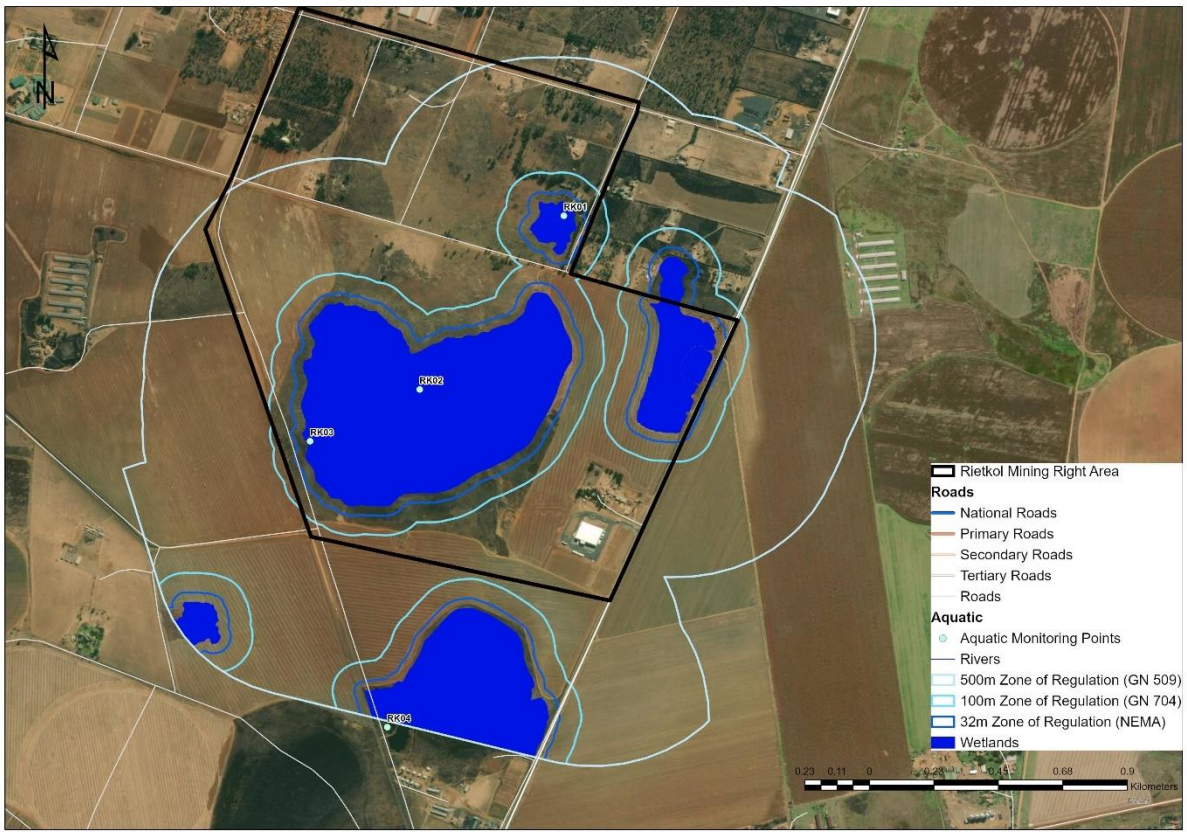


Figure 29: Wetland delineation and buffer zones

The hillslope seep wetlands are hydrologically isolated and not connected to other surface water resources, as inferred from the local micro-topography. The hillslope seeps within the MRA area are recharged by surface water from seasonal rainfall as well as via the interflow soils (SAS, 2018). The soils are not driven significantly by groundwater. Surface water was observed at the time of assessment, and the hydrological regime seems to be significantly enhanced by the impoundment features within the wetlands. The ecological integrity of the wetlands is largely modified with marginal EIS, as it is associated with artificial impoundments due to historic excavation. As such, it is recommended that these wetlands be managed as a class D (largely modified) Recommended Ecological Class (REC) to avoid further deterioration of these wetlands from its PES.

The depression (pan) is hydrologically isolated from other surface water resources, as inferred from the local micro-topography in its vicinity. This pan is recharged by surface water from seasonal rainfall as well as subsurface flow (SAS, 2018). Groundwater is not anticipated to have a direct significant interaction with the surface and shallow sub-surface hydrogeological processes which drive this pan (SAS, 2018). The surrounding agricultural activities is up to the edge of this pan and have already reduced the catchment yield that enters the pan. Nevertheless, the pan is sustained by hydropedological interflow (subsurface water within the vadose zone of the pan). The ecological

integrity of this wetland is moderately modified due to surrounding agricultural activities. The Category C REC management class is recommended to enhance the PES and avoid further degradation.

Table 22: Summary of the results of the assessments applied to the wetlands

Wetland System	PES	Ecological function and service provision	EIS	REC
Hillslope seeps	D (Largely modified)	Intermediate	D (Largely modified)	D (Largely modified)
Pan	C (Moderately modified)	Moderately low/ Intermediate	C (Moderately modified)	C (Moderately modified)

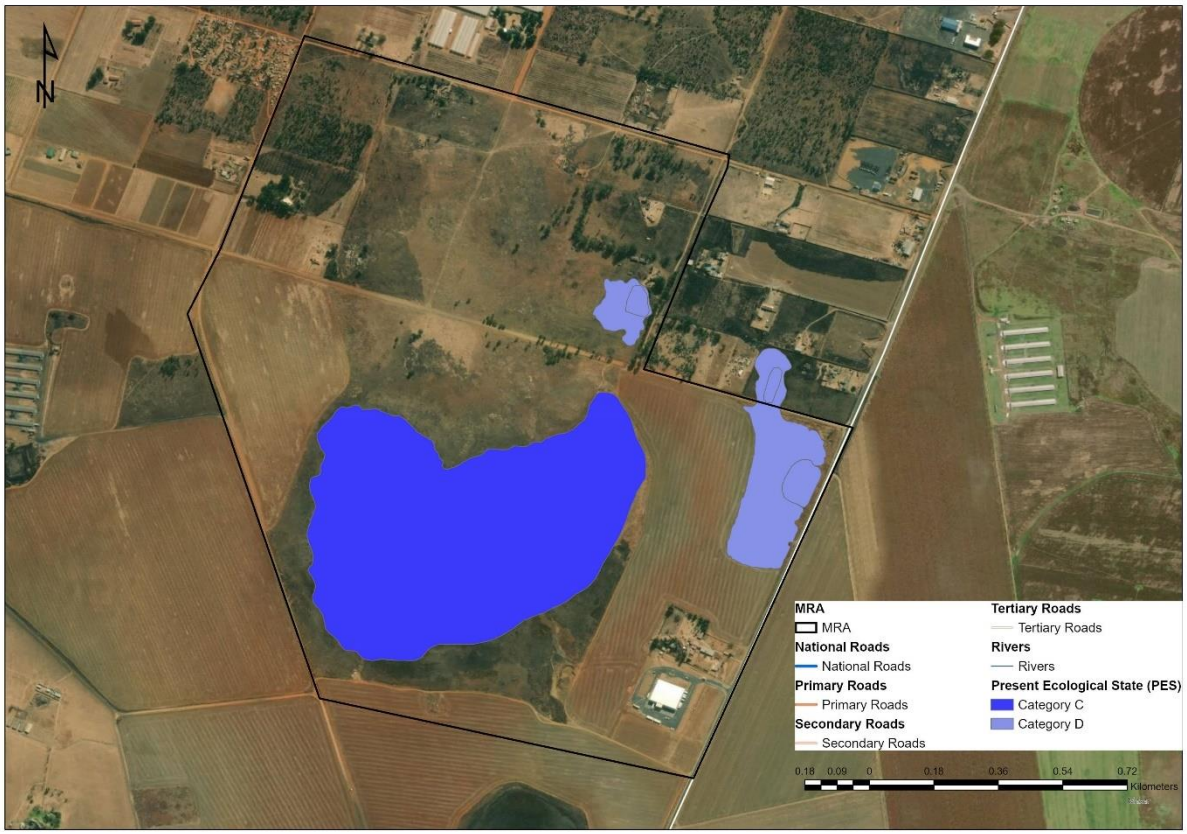


Figure 30: PES of wetlands in the MRA area

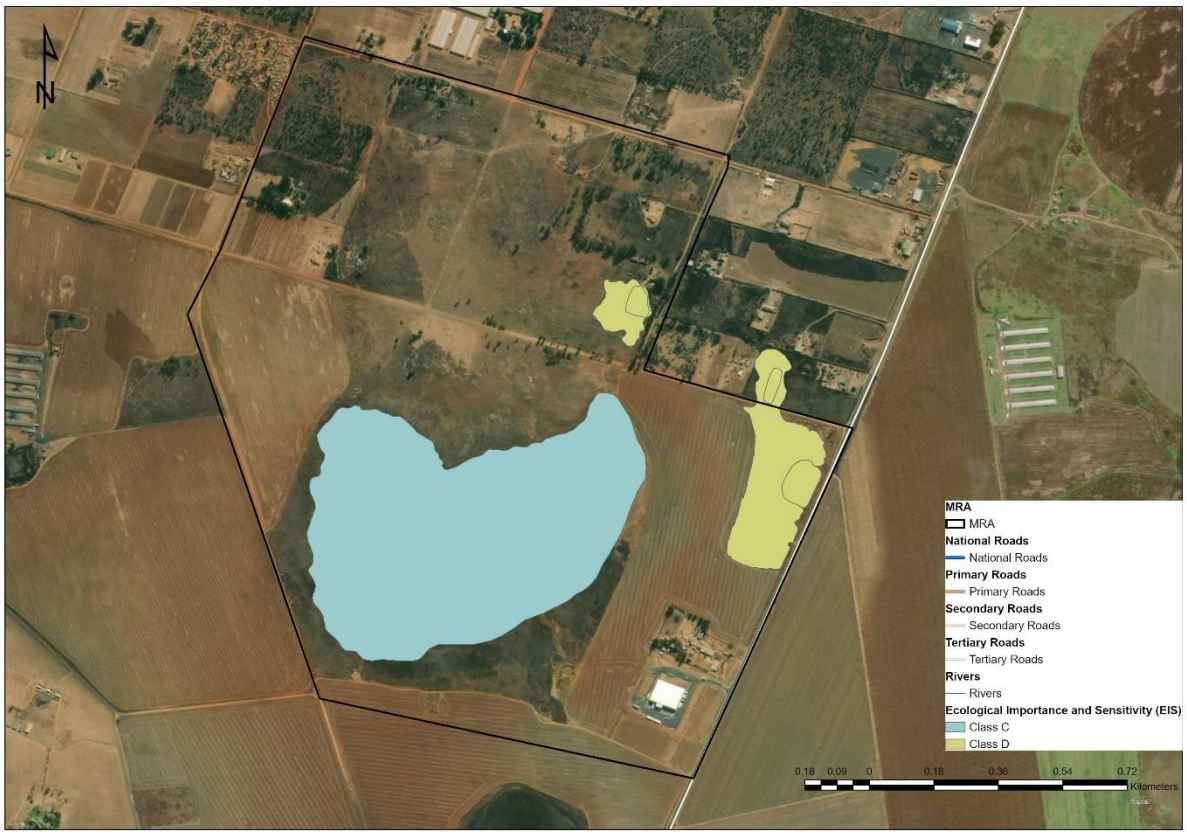
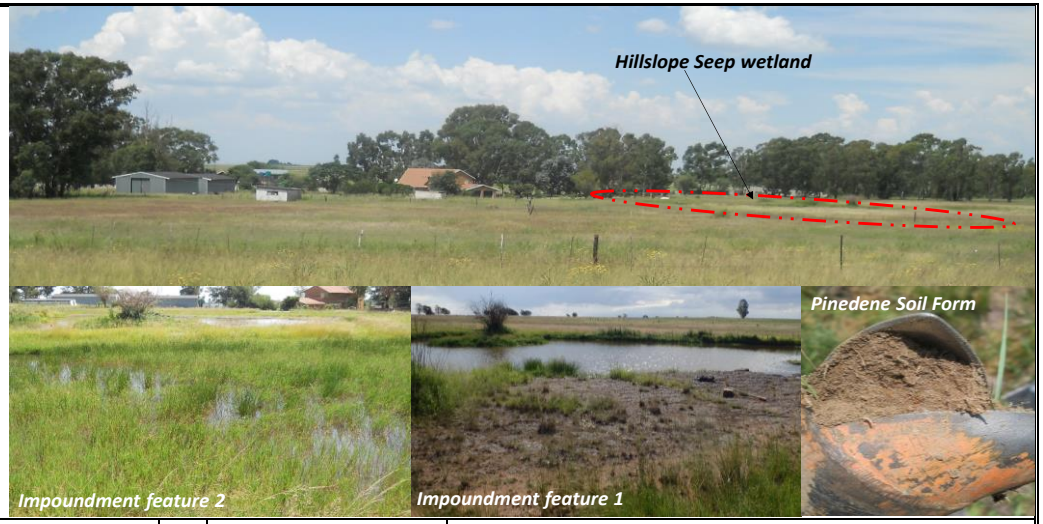
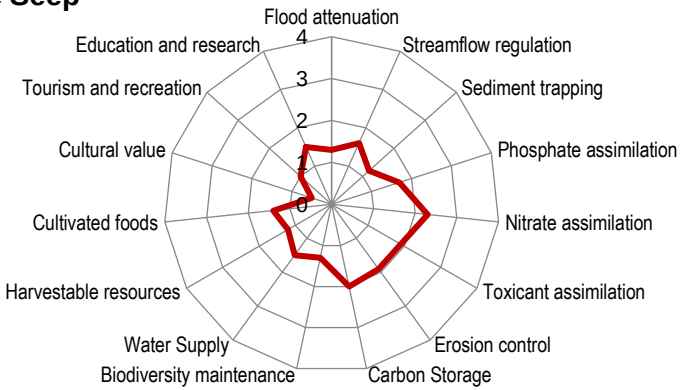


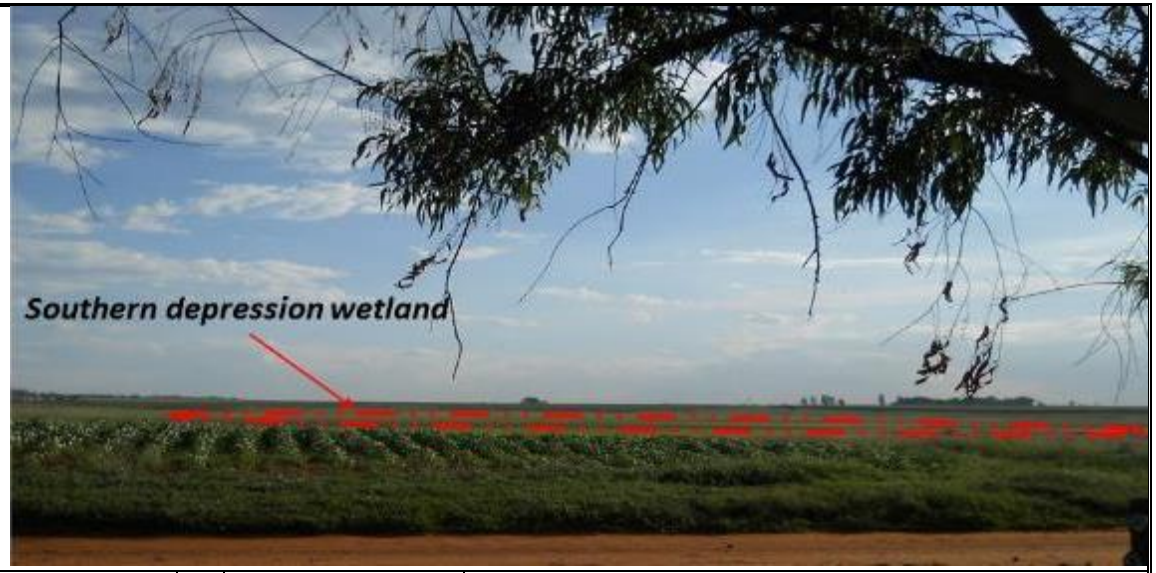
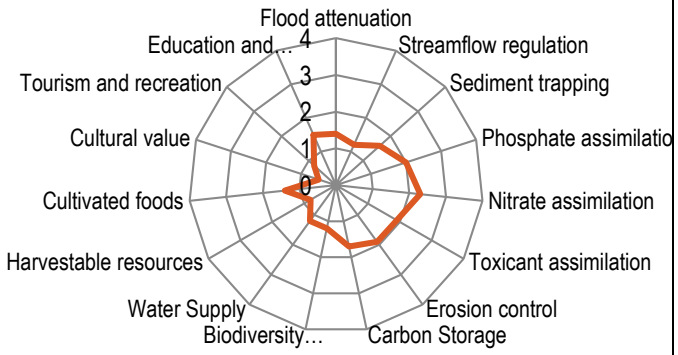
Figure 31: EIS of wetlands in the MRA area

Table 23: Summary of results of the assessment of the hillslope seep wetland

<table>
<tr><td colspan="3">Wetland Resource: Hillslope seep within MRA</td><td colspan="4" rowspan="2"> 
</td></tr>
<tr><td colspan="3">Ecological & socio-cultural service provision graph:
Hillslope Seep
 
</td></tr>
<tr><td>HGM Unit</td><td>Hillslope seep</td><td>Fatal Flaw?</td><td>N</td><td>Photograph notes</td><td>View of the artificial impoundments within the hillslope seep wetland</td></tr>
<tr><td>Ecoservices</td><td colspan="2">Intermediate: Considered important for nitrates and toxicants assimilation as well as erosion control services.</td><td colspan="4">Watercourse characteristics:
Hydraulic regime
This depression is hydrologically isolated and not connected to other surface water resources, as inferred from the local micro-topography. Surface water was observed at the time of assessment, and the hydrological regime seems to be significantly enhanced by the impoundment features within the wetland, as the base of the artificial impoundment feature within this wetland likely intersects the groundwater.</td></tr>
<tr><td>PES</td><td colspan="2">PES Category: Largely Modified (D)
Extensive modifications were observed within the wetland, including the artificial impounding to enhance water collection for livestock and/or aesthetic purposes.
Hydrology = 4.1 (D); Geomorphology = 4.0 (D) Vegetation = 3.5 (C)</td><td colspan="4">Water quality
Water quality is considerably good with a pH of 6.6; 6 mS/m electrical conductivity, and 7.99 mg/L dissolved oxygen; measured in-situ at 26.3 °C water temperature.</td></tr>
<tr><td>EIS and REC</td><td colspan="2">EIS REC Category: Marginal (D)
The ecological integrity of this wetland is considered to be largely modified with marginal EIS, as it is associated with</td><td colspan="4">Geomorphology and sediment balance
The intrusive excavation activities during the impounding of this wetland have extensively altered the natural geomorphic features of this depression. In addition, the gentle concave-</td></tr>
</table>

	an artificial impoundment due to historic excavation. As such, it is recommended that this depression can be managed as a class D (largely modified) REC to avoid further deterioration of this wetland unit from its PES.	shaped slope of the topographical wetland location and man-made berms may result in increased sedimentation from diffuse flows into the wetland.
		Habitat and biota This wetland exhibits a fairly intact vegetation cover and is considered to be an important breeding site for endangered crane species, according to the NFEPA database, despite the observed anthropogenic modifications.

Table 24: Summary of results of the assessment of the southern depression wetland

<table>
<tr><td colspan="2">Wetland Resource: Southern Depression</td><td colspan="4" rowspan="2"> 
</td></tr>
<tr><td colspan="2">Ecological & socio-cultural service provision graph:
<u>Southern Depression</u>
 
</td></tr>
<tr><td>HGM Unit</td><td>Depression (Pan)</td><td>Fatal Flaw?</td><td>N</td><td>Photograph notes</td><td>View of the southern depression</td></tr>
<tr><td>Ecoservices</td><td colspan="2">Intermediate:
Considered important for nitrate assimilation, toxicant assimilation, erosion control and carbon storage. This feature has limited importance with regards to harvestable resources, tourism, and recreation or for tourism and recreational activities.</td><td colspan="4">Watercourse characteristics:
Hydraulic regime
This depression is considered to be hydrologically isolated from other surface water resources, as inferred from the local micro-topography in its vicinity. However, this depression may be geohydrologically connected to the surrounding areas, for instance through an aquifer fracture and/or some other geological conduit.</td></tr>
</table>

PES	Overall PES Category: Moderately Modified (C) Hydrology = 3.5 (C); Geomorphology = 0.4 (A); and Vegetation = 4.0 (D)	Water quality Water quality is considerably good with a pH of 6.31, 14 mS/m electrical conductivity, and 3.45 mg/L dissolved oxygen; measured in-situ at 35.1 °C water temperature.
EIS and REC	EIS and REC Category: Moderate (C) The ecological integrity of this wetland is considered to be moderately modified due to surrounding agricultural activities. The category C REC management class is recommended to enhance the PES and avoid further degradation whilst of this HGM unit.	Geomorphology and sediment balance The gentle slope of the wetland and livestock trampling may result in increased sedimentation from diffuse flows into the wetland.
		Habitat and biota This wetland habitat appears to be moderately modified by agricultural activities and livestock grazing, however, a predominantly intact vegetation cover was observed to persist throughout this HGM unit.

8.2.5.2 Surface water quality

Four surface water (aquatic) resources were assessed in respect of water quality, namely:

- An artificial impoundment associated within the western hillslope seep wetland (RK01);
- A natural depression wetland (RK02) and associated artificial impoundment (RK03) within the MRA area; and
- A depression wetland situated to the south of the MRA area which has an open water body associated with it (RK04) and is dammed because of road crossings.

Refer to Figure 29 for an indication of the position of the aquatic monitoring points.

Although the MRA area encompasses RK01, RK02 and RK03, the planned opencast pit and infrastructure area are located 100m outside of the freshwater resources and will not intersect the freshwater features.

8.2.5.2.1 Visual assessment

A photographic record of each site was made to provide visual record of the characteristics of each monitoring point, as observed during the field assessment. Table 25 and Table 26 summarise the observations for the various criteria made during the visual assessment undertaken on the site over time.

8.2.5.2.2 Analyses and comparison of water quality with established guidelines

Water quality data were garnered from RK01 – RK03 during three sampling runs spanning different seasons, and RK04 was sampled during a single sampling run. The data on selected water quality variables were assessed and compared to the following guidelines:

- South African Water Quality Guidelines for aquatic ecosystems, recreation, agricultural use and drinking water (DWAF, 1996);
- General and Special Limits for the discharge of wastewater into a watercourse (DWAF, 1999); and
- Resource quality objectives for the Upper Olifants River catchment (General Notice 466 of 2016) (OREWA). Please note that as none of the aquatic resources assessed have riverine characteristics, OREWA was only considered as a tentative guideline for management of resources within the greater catchment.

Table 25: Location of the water quality monitoring points with co-ordinates thereof

Description	Photograph (02.04.2016)	Photograph (13.06.2016)	Photograph (06.12.2016)
Site: RK01 Description: Artificial impoundment associated with a hillslope seep wetland within the proposed Rietkol silica mine, and within the MRA area. GPS: 26° 7'43.47"S 28°36'41.88"E			
Site: RK02 Description: Natural depression located directly to the south of the proposed Rietkol silica mine, and within the MRA area. GPS 26° 8'1.33"S 28°36'22.95"E			

Description	Photograph (02.04.2016)	Photograph (13.06.2016)	Photograph (06.12.2016)
Site: RK03 Description: Artificial impoundment associated with the natural depression located directly south of the proposed Rietkol silica mine, and within the MRA area. GPS 26° 8'9.42"S 28°36'13.45"E			
Site: RK04 Description: Natural depression located 560m to the south of the MRA area boundary. GPS 26° 8'40.96"S 28°36'21.83"E	N/A - A revision of the proposed MRA area was published following the first two site visits, and a further natural depression wetland was identified as a monitoring point (RK04). Thus RK04 was only sampled once.		

Table 26: Description of the location of the aquatic monitoring points

Monitoring point	RK01	RK02	RK03	RK04
Hydrological linkages	This system is linked to a hillslope seepage wetland. The property owner indicated that the artificial feature was excavated from the wetland in 2006, and drainage from the wetland was directed into and accrued within the impoundment associated with RK01 for agricultural irrigation.	RK02 is a monitoring point within a natural depression and is inherently linked to an artificial impoundment that is located within the depression.	RK03 is a monitoring point within an artificial impoundment. The impoundment is associated with a natural depression. The water quality in the natural depression is being monitored by RK02.	RK04 is a depression wetland, which has an open water body associated with it because of road crossings. This system is not driven by groundwater nor is it hydrologically connected to the wetland systems to the north.
Anthropogenic applications	Crop irrigation by the neighboring farmstead	None	The artificial nature of the feature implies that the water might have been used for an anthropogenic purpose, but present uses are unknown.	Rossgro is also located directly next to the wetland and has large agricultural fields surrounding the wetland. Additionally, evidence of water being extracted from and discharged into the wetland was observed.
Algal presence	Only evident during the June inspection – indigenous *Marsilea* sp. observed at a moderately high cover.	Not evident.	Not evident.	Not evident.
Visual indication of an impact on aquatic fauna	Not evident.	Not evident.	Trampling by cows was observed during both the June and December assessments. Overgrazing was also observed in June.	Not evident.
Water clarity	Clear to moderately turbid.	Clear to moderately turbid.	Slightly to highly turbid with a low amount of suspended organic matter.	Slightly turbid.
Depth characteristics	The low gradient of the bed appeared to be largely moderate and uniform.	The low gradient of the bed appeared to be largely moderate and uniform.	The low gradient of the bed appeared to be largely moderate and uniform.	Moderate depth characteristics, but mostly uniform gradients across the feature.
Flow condition	The resource had limited flow diversity and consisted of a pool with very slow flow characteristics driven by the wind.	The flow condition was still and stagnant.	The resource had limited flow diversity and consisted of a pool with very slow flow characteristics driven by the wind.	The resource had limited flow diversity and consisted of a pool with very slow flow characteristics driven by the wind.
Water odor	Not evident.	Not evident.	Strong anoxic smell evident during the June and December site visits.	Strong smell of fertilizer.
Erosion potential	Unlikely – no erosion was evident.	Very low.	A high degree of erosion was observed on the edge of the feature during the June assessment.	High potential – steep banks with little vegetation. However, whilst potential was high, little erosion was observed.

Monitoring point	RK01	RK02	RK03	RK04
Aquatic Biota	The biota associated with this feature are common tolerant species known to occur in still water environments. Species with an affinity for vegetation biotopes are dominant.	Limited surface water present. Only more tolerant taxa present, including tadpoles (observed in December).	The biota associated with this feature are common tolerant species known to occur in still water environments. Species with an affinity for vegetation biotopes are dominant.	The biota associated with this feature are common tolerant species known to occur in still water environments. Species with an affinity for vegetation biotopes are dominant.

Table 27 to Table 30 present the compliance of each monitoring point with the guidelines listed above in a tabular format. A discussion on the suitability of the water at each of the monitoring points to the applicable water uses assessed is presented below.

RK02 and RK04 both represent a natural depression and should therefore be considered as the monitoring point in the most natural condition. However, the nature of each of the monitoring points is highly variable such that it is challenging to compare the water quality of the monitoring points to each other – for instance RK04 has likely been influenced by a road crossing through it, whereas RK02 has no such crossing. Thus, any comparisons made were done so with caution.

It is also important to note that standards were not presented in the guideline documents for thirty-nine parameters, and therefore only the baseline result is presented. This may be due to the rarity of the parameters in the environment, and in South Africa, or else a reflection of the significance (or un-importance thereof) of each element. Subsequent assessments will allow for these parameters to be assessed relative to the reference state to determine changes over time that might be associated with the proposed Rietkol Project.

Thirty-six of the parameters quantified had a recommended standard or guideline for at least one water use. The suitability of water at each of the monitoring points was calculated based upon the degree of compliant vs. non-compliant parameters with each of the standards stipulated for the water application. The results of this assessment are presented in Figure 32.

The compliance of several of the quantified parameters with the various applicable guidelines could not be determined as the stipulated standard was below the detection limit. For example, the ammonia concentration at RK01 was <0.1 mg/l, and the DWAF 1996 guideline for the concentration in aquatic ecosystems is <0.0007 mg/l. It was considered best practice to approach this issue by applying the precautionary principle and assuming that the parameter was non-compliant with the standard. Therefore, the water at each of the monitoring points might be more suitable for each of the water uses. In cases where less than three data values were above the detection limit at a site, the values above the detection limit were utilised alone to determine compliance (i.e. the value below the detection limit was excluded from the statistical analysis).

It is noted that no value is shown pertaining to the compliance of RK02 with the DWAF (1996) Target Water Quality Range (TWQR) for recreation as a 0% compliance value was achieved.

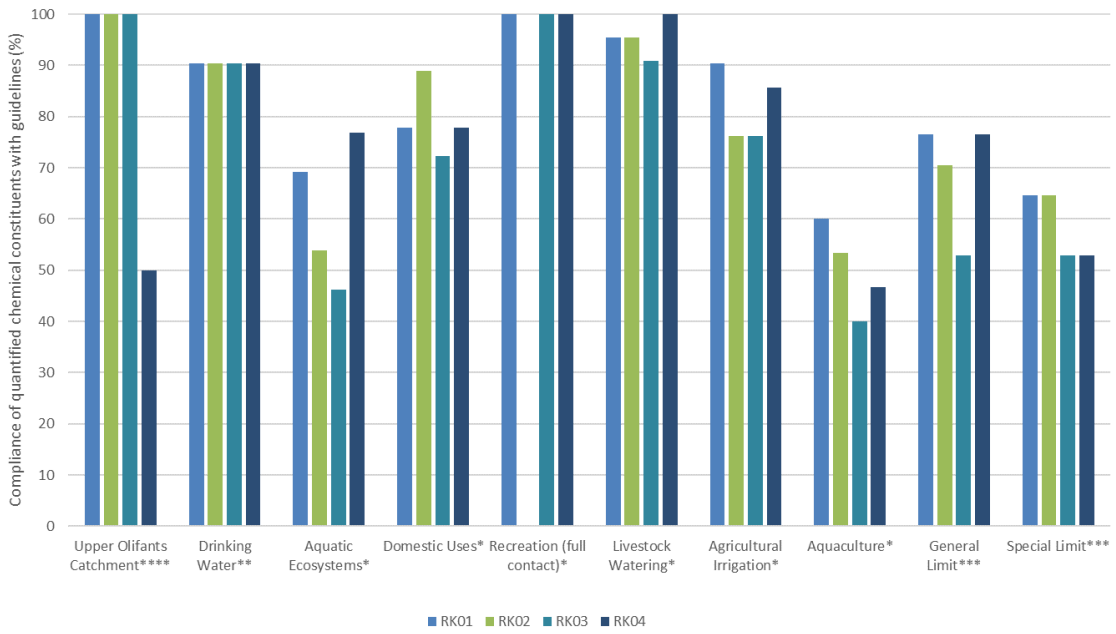


Figure 32: Compliance of the quantified parameters for each monitoring point with the stipulated guidelines

{* DWAF (1996); ** SANS 241 (2015); *** DWAF (1999); **** DWAF (2016)}

8.2.5.2.2.1 Baseline water quality with reference to aquatic ecosystem integrity

Figure 32 indicates that the water quality at RK01-03 is in line with the water quality standards recommended for the Upper Olifants Catchment. The TDS at RK04 exceeded this guideline by 1.1X. However, the water quality standards for the Upper Olifants Catchment only encompass basic water quality parameters, whereas the DWAF 1996 guidelines for aquatic ecosystems is more comprehensive. The water at the monitoring points complied with between 46% (RK03) and 77% (RK04) of the TWQR for aquatic ecosystems which define the acceptable percentage variance from the reference condition for a particular resource. The parameters which exceeded the TWQR are identified below, with the maximum level of exceedance presented as well:

- At all monitoring points the average concentration of ammonia (819X), copper (566X), lead (1 100X) and zinc (100X) exceeded the TWQR. (It is noted that the detection limit was not above the guideline in these instances). This indicates significant heavy metal contamination as well as contamination from nitrogen rich substances prior to any mining activity taking place;
- The concentration of arsenic exceeded the TWQR at RK01, 03, and 04, by a maximum of 2.4X;
- The concentration of manganese exceeded the TWQR at RK02, 03, and 04 by a maximum of 12.5X;

- The concentration of dissolved oxygen exceeded the TWQR at RK02 by a maximum of 1.08X; and
- The concentration of selenium and TDS exceeded the TWQR at RK04, respectively by a maximum of 1.5X and 1.1X.

Therefore, it is shown that the environmental state of the system prior to the development of the proposed Rietkol Project cannot be considered as pristine.

The recommended standards for the non-compliant constituents within aquatic ecosystems are all significantly low relative to other constituents, i.e. trace metals versus non-metals. This is due to the high toxicological risk each of the non-compliant constituent poses to the receiving environment.

The toxicity of ammonia is related to its potential to transform into ammonium. The occurrence and concentration of ammonium in aquatic ecosystems significantly increases the probability of eutrophication, which can result in an anoxic environment and severely reduce the biodiversity of the ecosystem. The transformation of ammonia into ammonium is triggered by changes in the pH, whereby an increase in the pH results in a concomitant increase in ammonium. Thus, by extension, the concentrations of ammonia can be toxic to aquatic biota.

Furthermore, the bioavailability and toxicity of chromium, lead, zinc, and copper are inversely related to changes in pH and water hardness. Manganese, lead, zinc, and copper are only soluble in high concentrations at low pH levels (less than 6.5). These metals are not inherently toxic (some of them are considered essential metals for metabolic health). However, the metals become toxic at high concentrations by disrupting protein synthesis through diluting other constituents in the cells and binding to the protein themselves (thus resulting in malformations which can result in cellular malfunctions). Thus, decreases in pH increase the metals' solubility, bioavailability, and toxicological potential, and vice versa for ammonia. Therefore, the risk posed by these potential toxicants to the receiving environment is highly sensitive to any alterations in the pH.

The average pH range at RK01-4 lies between 6.4 pH at RK02 and 7.7 pH at RK04. The pH continuum reflected at RK01-04 means that only a relatively small degree of buffering from influxes of hydrogen ions (or hydroxide ions) is present. Therefore, the system can be considered to be moderately sensitive to changes in pH.

The TDS and selenium were only quantified as exceeding the TWQR at RK04, however this may have been a result of existing water uses – where water is abstracted from and discharged into RK04 to

support the agricultural activities by Rossgro. Therefore, the system should not be considered naturally turbid or high in selenium.

The average EC across all the monitoring points ranged from 5.37 mS/m, 11 mS/m, 23 mS/m and 33 mS/m respectively at RK01 – 4. Indicating that all the features can be described as having a relatively medium salinity in this environment, and that the salinity across the features is highly variable. These data indicate that the features can be considered to have a low sensitivity to changes in salinity, as the features currently had moderate levels of salinity with high variability, as described above.

Clear separation of clean and dirty water associated with the proposed Rietkol silica mine is thus deemed essential as is strict planning in line with the requirements of Regulation GN704 to minimise any potential changes in pH, and other water quality variables as well

8.2.5.2.2.2 Baseline water quality with reference to identified and potential water applications

Figure 32 indicates that the only water application for which RK01, 03 and 04 were suited for is full contact recreational use. Full contact recreational use includes fully submersive activities such as swimming. However, no monitoring point was considered 100% suitable for any other use.

- The water at all the monitoring points complied with 90% of the SANS 241 (2015) drinking water standards. This was due to the concentration of iron and manganese which were above the recommended guideline at all monitoring points, and respectively by a maximum of 64X and 23X. At these concentrations, the metals can be considered potentially toxic to humans and thus the water should not be utilised for consumption without treatment. High concentrations of manganese are toxic and can cause the disruption of metabolic pathways in the central nervous system in particular (DWAF 1996). The effects of toxic doses of iron include depression, rapid and shallow respiration, coma, convulsions, respiratory failure and cardiac arrest (WHO 1996);
- The water at the monitoring points complied with between 72% (RK03) and 89% (RK02) of the DWAF (1996) TWQR for domestic uses. Similar to the above, the concentration of iron and manganese exceeded the TWQR, and also the concentration of mercury at all monitoring points. However, it is noted that the quantified concentration of mercury was below the detection limit of the laboratory test equipment. Thus, compliance could not be determined and was assumed. The concentration of lead and ammonia exceeded the TWQR for domestic use at RK03, and the concentration of selenium exceeded the TWQR at RK04. As discussed above, these constituents have significant potential toxicological risk at these concentrations, and this water is not deemed fit for domestic uses or full contact recreational use;

- The water at the monitoring points complied with between 91% (RK03) and 100% (RK04) of the TWQR for livestock watering. Specifically, the concentration of molybdenum at RK01 and RK02 exceeded the TWQR by 13X and 3X. The concentration of iron and boron at RK03 were respectively above the TWQR by 2X each. Molybdenum is considered highly toxic to organisms and may potentially also have bioaccumulation implications for humans. On this basis, and in comparison with the DWAF (1996) TWQR, RK01, 02, and 03 resources should not be utilised for livestock watering. RK04 may be utilised on the basis that the DWAF (1996) guidelines determine it to be suitable for such use; and
- The water at the monitoring points complied with between 76% (RK02 and RK03) and 90% (RK01) of the TWQR for irrigation. The concentration of manganese was above the TWQR at all the monitoring points, and by a maximum of 113X at RK03. The concentration of boron, and cobalt at RK03 exceeded the TWQR by 18X and 1.2X. The concentration of molybdenum exceeded the TWQR at RK01 and RK02 by 3X and 13X. Additionally, the concentration of suspended solids exceeded the TWQR of 50 mg/l at RK02-04, and by a maximum of 128X at RK03. The TSS concentration is not considered to be of a high concern for irrigation, however due to potential bioaccumulation the concentration of boron, cobalt, manganese, and molybdenum are. Water from these resources should not be considered fit for irrigation unless cautious monitoring is undertaken.

The visual assessment identified that RK01 and RK04 are likely being utilised for irrigation, and RK04 is likely also being utilised for informal domestic use. The water quality at these resources is not considered suitable for these uses. The continuation of irrigation may be justifiable if cautious monitoring of crops is undertaken to determine bioaccumulation. Additionally, these constituents may accumulate in irrigated soils over time increasing the toxicological risk and this aspect should also be monitored if use continues.

8.2.5.2.2.3 Baseline water quality with reference to potential anthropogenic pollutant fluxes

It should be noted that the baseline water quality at RK01-04 was not fully compliant with the General or Special Limit for the discharge of wastewater into a watercourse. This included the concentrations of copper, iron, lead, manganese, mercury, TSS and zinc at all the monitoring points. Therefore, it is shown that the environmental state of the system prior to the development of the proposed Rietkol silica mine is impacted. Thus, it is recommended that all possible pollution prevention measures be implemented within the mining operations of the proposed Rietkol Project to minimise cumulative impacts on the water sources.

Table 27: Quantified water quality at RK01, and compliance with the DWS (2016), SANS 241 (2015), DWAF (1996) and DWAF (1999) water quality guidelines

Parameter	RK01	RK01	RK01	RK01	DWS 2016	SANS 241 (2015)	DWAF 1996						DWAF 1999	
	04.02.2016	12.06.2016	06.12.2016	Mean	Upper Olifants Catchment	Drinking Water	Aquatic Ecosystems	Domestic Uses	Recreation (Full Contact)	Livestock Watering	Agricultural Irrigation	Aqua-culture	General Limit	Special Limit
Aluminium (ug/l)	0.317	< 0.100	1.07	0.70		≤ 300								
Ammonia as N (mg/l)	<0.1	0.30	0.20	0.25			≤ 0.007	≤ 1				≤ 0.025	≤ 3	≤ 2
Ammonium as N (mg/l)	<0.1	0.30	0.20	0.25										
Antimony (ug/l)	<0.010	< 0.010	< 0.010	< 0.010		≤ 20								
Arsenic, total (mg/l)	0.0182389	< 0.010	< 0.010	0.02		≤ 10	≤ 0.01	≤ 0.01		≤ 1	≤ 0.1	≤ 0.05	≤ 0.02	≤ 0.01
Barium (ug/l)	66.158328	0.07	0.07	22.10		≤ 700								
Beryllium (mg/l)	<0.010	< 0.010	< 0.010	< 0.010							≤ 0.1			
Boron (mg/l)	0.0496791	0.01	0.01	0.02		≤ 2 400				≤ 5	≤ 0.5		≤ 1	≤ 0.5
Cadmium (ug/l)	<10	< 0.010	< 0.010	< 0.010		≤ 3	≤ 5			≤ 10	≤ 10	≤ 0.2	≤ 5	≤ 1
Calcium (mg/l)	4.24	4.30	4.34	4.29			≤ 32			≤ 1000				
Chromium (mg/l)	<0.010	< 0.010	< 0.010	< 0.010			≤ 0.007	≤ 0.05		≤ 1	≤ 0.1	≤ 0.002	≤ 0.05	≤ 0.02
Cobalt (mg/l)	<0.010	< 0.010	< 0.010	< 0.010						≤ 1	≤ 0.05			
Copper (mg/l)	0.1654812	< 0.010	< 0.010	0.17		≤ 2	≤ 0.0003	≤ 1		≤ 0.5	≤ 0.2	≤ 0.005	≤ 0.01	≤ 0.002
DO (%)	98.8	110.80	113.40	107.67			> 80%							
EC (mS/m)	6	6.00	4.10	5.37		≤ 170		≤ 69		≤ 1000	≤ 40			
Iron (mg/l)	3.335	0.30	1.65	1.76		≤ 0.3		≤ 0.3		≤ 10	≤ 5	≤ 0.01	≤ 0.3	≤ 0.3
Lead (mg/l)	<0.010	< 0.010	< 0.010	< 0.010			≤ 0.0002	≤ 0.01		≤ 0.1	≤ 0.2	≤ 0.01	≤ 0.01	≤ 0.006
Lithium (mg/l)	0.0325081	< 0.010	< 0.010	0.03							≤ 2.5			
Magnesium (mg/l)	1.276	1.10	0.91	1.10				≤ 30		≤ 500				
Manganese (mg/l)	0.294	0.06	0.17	0.18		≤ 0.1	≤ 0.18	≤ 0.05		≤ 10	≤ 0.02	≤0.1	≤0.1	≤0.1

Parameter	RK01	RK01	RK01	RK01	DWS 2016	SANS 241 (2015)	DWAF 1996						DWAF 1999	
Mercury (mg/l)	<0.010	< 0.010	< 0.010	< 0.010			≤0.04	0.00		≤1		≤0.001	≤0.005	≤0.001
Molybdenum (mg/l)	0.1322897	< 0.010	< 0.010	0.13						≤0.01	≤0.01			
Nickel (ug/l)	27	< 0.010	< 0.010	27.00		≤ 70				≤1000	≤200			
Nitrate as N (mg/l)	<0.1	0.20	0.10	0.15		≤ 11		≤6		≤100		≤0.05	≤15	≤1.5
Nitrite as N (mg/l)	<0.05	<0.05	<0.05	<0.05		≤ 0.9		≤6		≤10			≤15	≤1.5
Orthophosphate as P (mg/l)	<0.1	<0.1	0.10	0.10								≤0.1	≤10	≤2.5
pH	6.61	7.90	6.50	7.00		≥ 5 to ≤ 9.7		6-9	6.5-8.5		6.5-8.4	6.5-9	5.5-9.5	5.5-7.5
Potassium (mg/l)	3.667	4.61	2.70	3.66			≤50							
Selenium (mg/l)	<0.010	< 0.010	0.02	0.02		≤ 40	≤0.02	≤0.02		≤50	≤0.02	≤0.3	≤0.02	≤0.02
Sodium (mg/l)	0.567	0.64	< 1	0.60		≤ 200		≤100		≤2000	≤70			
Sulphate (mg/l)	5	12.00	9.00	8.67		≤ 250		≤200		≤1000				
Suspended solids (mg/l)	27	13.30	22.00	20.77							≤50	≤50	≤25	≤10
Total Inorganic Nitrogen (mg/l)					<1.0									
Total Dissolved Solids (mg/l)	39	39.00	26.65	34.88	≤195	≤ 1 200								
Uranium (mg/l)	<0.010	< 0.010	< 0.010	< 0.010		≤0.015					≤0.01			
Vanadium (mg/l)	<0.010	< 0.010	< 0.010	< 0.010		≤0.2		≤0.1		≤1	≤0.1			
Zinc (mg/l)	0.1264323	< 0.010	0.27	0.20		≤ 5	≤0.002	≤3		≤20	≤1	≤0.03	≤0.1	≤0.04

*Mean was calculated based on numbers that were above the detection limit.

*Average value exceeded the specified guideline.

*Detection limit was below guideline, therefore compliance could not be determined. The precautionary principle was utilised, and it was assumed that the value exceeded the guideline.

*Data were below the detection limit, thus calculation of the parameter was not possible.

Table 28: Quantified water quality at RK02, and compliance with the DWS (2016), SANS 241 (2015), DWAF (1996) and DWAF (1999) water quality guidelines

Parameter	RK02	RK02	RK02	RK02	DWS 2016	SANS 241 (2015)	DWAF 1996						DWAF 1999	
	04.02.2016	12.06.2016	06.12.2016	Mean	Upper Olifants Catchment	Drinking Water	Aquatic Ecosystems	Domestic Uses	Recreation (Full Contact)	Livestock Watering	Agricultural Irrigation	Aqua-culture	General Limit	Special Limit
Aluminium (ug/l)	4.11	No Sample	1.91	3.01		≤ 300								
Ammonia as N (mg/l)	1.00		0.50	0.75			≤ 0.007	≤ 1				≤ 0.025	≤ 3	≤ 2
Ammonium as N (mg/l)	1.00		0.50	0.75										
Antimony (ug/l)	<0.010		< 0.010	< 0.010		≤ 20								
Arsenic, total (mg/l)	<0.010		< 0.010	< 0.010		≤ 10	≤ 0.01	≤ 0.01		≤ 1	≤ 0.1	≤ 0.05	≤ 0.02	≤ 0.01
Barium (ug/l)	39.00		0.14	19.57		≤ 700								
Beryllium (mg/l)	<0.010		< 0.010	< 0.010							≤ 0.1			
Boron (mg/l)	0.05		0.05	0.05		≤ 2 400				≤ 5	≤ 0.5		≤ 1	≤ 0.5
Cadmium (ug/l)	<0.010		< 0.010	< 0.010		≤ 3	≤ 5			≤ 10	≤ 10	≤ 0.2	≤ 5	≤ 1
Calcium (mg/l)	2.44		3.68	3.06			≤ 32			≤ 1000				
Chromium (mg/l)	<0.010		< 0.010	< 0.010			≤ 0.007	≤ 0.05		≤ 1	≤ 0.1	≤ 0.002	≤ 0.05	≤ 0.02
Cobalt (mg/l)	<0.010		< 0.010	< 0.010						≤ 1	≤ 0.05			
Copper (mg/l)	0.05		< 0.010	0.05		≤ 2	≤ 0.0003	≤ 1		≤ 0.5	≤ 0.2	≤ 0.005	≤ 0.01	≤ 0.002
DO (%)	49.80		98.30	74.05			> 80%							
EC (mS/m)	14.00		8.30	11.15		≤ 170		≤ 69		≤ 1000	≤ 40			
Iron (mg/l)	4.33		5.84	5.08		≤ 0.3		≤ 0.3		≤ 10	≤ 5	≤ 0.01	≤ 0.3	≤ 0.3
Lead (mg/l)	<0.010		< 0.010	< 0.010			≤ 0.0002	≤ 0.01		≤ 0.1	≤ 0.2	≤ 0.01	≤ 0.01	≤ 0.006
Lithium (mg/l)	0.01		0.01	0.01							≤ 2.5			
Magnesium (mg/l)	2.29		2.43	2.36				≤ 30		≤ 500				
Manganese (mg/l)	0.52		3.44	1.98		≤ 0.1	≤ 0.18	≤ 0.05		≤ 10	≤ 0.02	≤0.1	≤0.1	≤0.1

Parameter	RK02	RK02	RK02	RK02	DWS 2016	SANS 241 (2015)	DWAF 1996						DWAF 1999	
Mercury (mg/l)	<0.010		< 0.010	< 0.010			≤0.04	0.00		≤1		≤0.001	≤0.005	≤0.001
Molybdenum (mg/l)	0.03		< 0.010	0.03						≤0.01	≤0.01			
Nickel (ug/l)	26.00		< 0.010	26.00		≤ 70				≤1000	≤200			
Nitrate as N (mg/l)	<0.1		<0.1	<0.1		≤ 11		≤6		≤100		≤0.05	≤15	≤1.5
Nitrite as N (mg/l)	<0.05		<0.05	<0.05		≤ 0.9		≤6		≤10			≤15	≤1.5
Orthophosphate as P (mg/l)	0.10		<0.1	0.10								≤0.1	≤10	≤2.5
pH	6.31		6.50	6.41		≥ 5 to ≤ 9.7		6-9	6.5-8.5		6.5-8.4	6.5-9	5.5-9.5	5.5-7.5
Potassium (mg/l)	7.19		4.12	5.66			≤50							
Selenium (mg/l)	<0.010		0.02	0.02		≤ 40	≤0.02	≤0.02		≤50	≤0.02	≤0.3	≤0.02	≤0.02
Sodium (mg/l)	13.51		13.62	13.57		≤ 200		≤100		≤2000	≤70			
Sulphate (mg/l)	4.00		<2	4.00		≤ 250		≤200		≤1000				
Suspended solids (mg/l)	107.00		284.00	195.50							≤50	≤50	≤25	≤10
Total Inorganic Nitrogen (mg/l)					<1.0									
Total Dissolved Solids (mg/l)	91.00		53.95	72.48	≤195	≤ 1 200								
Uranium (mg/l)	<0.010		< 0.010	< 0.010		≤0.015					≤0.01			
Vanadium (mg/l)	0.01		0.01	0.01		≤0.2		≤0.1		≤1	≤0.1			
Zinc (mg/l)	0.08		0.40	0.24		≤ 5	≤0.002	≤3		≤20	≤1	≤0.03	≤0.1	≤0.04

*Mean was calculated based on numbers that were above the detection limit.

*Average value exceeded the specified guideline.

*Detection limit was below guideline, therefore compliance could not be determined. The precautionary principle was utilised, and it was assumed that the value exceeded the guideline.

*Data were below the detection limit, thus calculation of the parameter was not possible.

Table 29: Quantified water quality at RK03, and compliance with the DWS (2016), SANS 241 (2015), DWAF (1996) and DWAF (1999) water quality guidelines

Parameter	RK03	RK03	RK03	RK03	DWS 2016	SANS 241 (2015)	DWAF 1996						DWAF 1999	
	04.02.2016	12.06.2016	06.12.2016	Mean	Upper Olifants Catchment	Drinking Water	Aquatic Ecosystems	Domestic Uses	Recreation (Full Contact)	Livestock Watering	Agricultural Irrigation	Aqua-culture	General Limit	Special Limit
Aluminium (ug/l)	1.59	7.69	3.70	4.327		≤ 300								
Ammonia as N (mg/l)	0.1	17	0.1	5.733			≤ 0.007	≤ 1				≤ 0.025	≤ 3	≤ 2
Ammonium as N (mg/l)	0.1	17	0.1	5.733										
Antimony (ug/l)	<0.010	< 0.010	< 0.010	< 0.010		≤ 20								
Arsenic, total (mg/l)	<0.010	0.024	< 0.010	0.024		≤ 10	≤ 0.01	≤ 0.01		≤ 1	≤ 0.1	≤ 0.05	≤ 0.02	≤ 0.01
Barium (ug/l)	0.058	0.448	0.073	0.193		≤ 700								
Beryllium (mg/l)	<0.010	< 0.010	< 0.010	< 0.010							≤ 0.1			
Boron (mg/l)	27.000	0.022	0.039	9.020		≤ 2 400				≤ 5	≤ 0.5		≤ 1	≤ 0.5
Cadmium (ug/l)	<0.010	< 0.010	< 0.010	< 0.010		≤ 3	≤ 5			≤ 10	≤ 10	≤ 0.2	≤ 5	≤ 1
Calcium (mg/l)	5	20	5	10.047			≤ 32			≤ 1000				
Chromium (mg/l)	<0.010	0.016	< 0.010	0.016			≤ 0.007	≤ 0.05		≤ 1	≤ 0.1	≤ 0.002	≤ 0.05	≤ 0.02
Cobalt (mg/l)	<0.010	0.060	< 0.010	0.060						≤ 1	≤ 0.05			
Copper (mg/l)	0.014	0.017	< 0.010	0.016		≤ 2	≤ 0.0003	≤ 1		≤ 0.5	≤ 0.2	≤ 0.005	≤ 0.01	≤ 0.002
DO (%)	127.8	44.5	103.7	92.000			> 80%							
EC (mS/m)	9.000	52.000	8.100	23.033		≤ 170		≤ 69		≤ 1000	≤ 40			
Iron (mg/l)	8.78	37.23	11.36	19.124		≤ 0.3		≤ 0.3		≤ 10	≤ 5	≤ 0.01	≤ 0.3	≤ 0.3
Lead (mg/l)	<0.010	0.022	< 0.010	0.022			≤ 0.0002	≤ 0.01		≤ 0.1	≤ 0.2	≤ 0.01	≤ 0.01	≤ 0.006
Lithium (mg/l)	<0.010	< 0.010	< 0.010	< 0.010							≤ 2.5			
Magnesium (mg/l)	3	8	2	4.429				≤ 30		≤ 500				
Manganese (mg/l)	0.070	6.456	0.235	2.254		≤ 0.1	≤ 0.18	≤ 0.05		≤ 10	≤ 0.02	≤0.1	≤0.1	≤0.1
Mercury (mg/l)	<0.010	< 0.010	< 0.010	< 0.010			≤0.04	0.00		≤1		≤0.001	≤0.005	≤0.001

Parameter	RK03	RK03	RK03	RK03	DWS 2016	SANS 241 (2015)	DWAF 1996						DWAF 1999	
Molybdenum (mg/l)	<0.010	< 0.010	< 0.010	< 0.010						≤0.01	≤0.01			
Nickel (ug/l)	53.000	0.202	< 0.010	26.601		≤ 70				≤1000	≤200			
Nitrate as N (mg/l)	<0.1	0.1	0.1	0.100		≤ 11		≤6		≤100		≤0.05	≤15	≤1.5
Nitrite as N (mg/l)	<0.05	<0.05	<0.05	<0.05		≤ 0.9		≤6		≤10			≤15	≤1.5
Orthophosphate as P (mg/l)	<0.1	<0.1	<0.1	<0.1								≤0.1	≤10	≤2.5
pH	7.42	6.8	6.5	6.907		≥ 5 to ≤ 9.7		6-9	6.5-8.5		6.5-8.4	6.5-9	5.5-9.5	5.5-7.5
Potassium (mg/l)	7.3	45.4	9.3	20.670			≤50							
Selenium (mg/l)	<0.010	0.015	0.023	0.019		≤ 40	≤0.02	≤0.02		≤50	≤0.02	≤0.3	≤0.02	≤0.02
Sodium (mg/l)	1	19	2	7.363		≤ 200		≤100		≤2000	≤70			
Sulphate (mg/l)	3	104	7	38.000		≤ 250		≤200		≤1000				
Suspended solids (mg/l)	8	19117	67	6397.333							≤50	≤50	≤25	≤10
Total Inorganic Nitrogen (mg/l)					<1.0									
Total Dissolved Solids (mg/l)	58.5	338	52.65	149.717	≤195	≤ 1 200								
Uranium (mg/l)	<0.010	< 0.010	< 0.010	< 0.010		≤0.015					≤0.01			
Vanadium (mg/l)	<0.010	0.046	0.015	0.030		≤0.2		≤0.1		≤1	≤0.1			
Zinc (mg/l)	0.028	0.065	0.067	0.054		≤ 5	≤0.002	≤3		≤20	≤1	≤0.03	≤0.1	≤0.04

*Mean was calculated based on numbers that were above the detection limit.

*Average value exceeded the specified guideline.

*Detection limit was below guideline, therefore compliance could not be determined. The precautionary principle was utilised, and it was assumed that the value exceeded the guideline.

*Data were below the detection limit, thus calculation of the parameter was not possible.

Table 30: Quantified water quality at RK04, and compliance with the DWS (2016), SANS 241 (2015), DWAF (1996) and DWAF (1999) water quality guidelines

Parameter	Site	DWS 2016	SANS 241 (2015)	DWAF 1996						DWAF 1999	
	RK04	Upper Olifants Catchment	Drinking Water	Aquatic Ecosystems	Domestic Uses	Recreation (Full Contact)	Livestock Watering	Agricultural Irrigation	Aqua-culture	General Limit	Special Limit
Aluminium (ug/l)	0.28		≤ 300								
Ammonia as N (mg/l)	<0.1			≤ 0.007	≤ 1				≤ 0.025	≤ 3	≤ 2
Ammonium as N (mg/l)	<0.1										
Antimony (ug/l)	< 0.010		≤ 20								
Arsenic, total (mg/l)	0.02		≤ 10	≤ 0.01	≤ 0.01		≤ 1	≤ 0.1	≤ 0.05	≤ 0.02	≤ 0.01
Barium (ug/l)	0.09		≤ 700								
Beryllium (mg/l)	< 0.010							≤ 0.1			
Boron (mg/l)	0.04		≤ 2 400				≤ 5	≤ 0.5		≤ 1	≤ 0.5
Cadmium (ug/l)	< 0.010		≤ 3	≤ 5			≤ 10	≤ 10	≤ 0.2	≤ 5	≤ 1
Calcium (mg/l)	31.49			≤ 32			≤ 1000				
Chromium (mg/l)	< 0.010			≤ 0.007	≤ 0.05		≤ 1	≤ 0.1	≤ 0.002	≤ 0.05	≤ 0.02
Cobalt (mg/l)	< 0.010						≤ 1	≤ 0.05			
Copper (mg/l)	< 0.010		≤ 2	≤ 0.0003	≤ 1		≤ 0.5	≤ 0.2	≤ 0.005	≤ 0.01	≤ 0.002
DO (%)	101.19			> 80%							
EC (mS/m)	33.30		≤ 170		≤ 69		≤ 1000	≤ 40			
Iron (mg/l)	2.44		≤ 0.3		≤ 0.3		≤ 10	≤ 5	≤ 0.01	≤ 0.3	≤ 0.3
Lead (mg/l)	< 0.010			≤ 0.0002	≤ 0.01		≤ 0.1	≤ 0.2	≤ 0.01	≤ 0.01	≤ 0.006
Lithium (mg/l)	< 0.010							≤ 2.5			
Magnesium (mg/l)	21.45				≤ 30		≤ 500				
Manganese (mg/l)	0.23		≤ 0.1	≤ 0.18	≤ 0.05		≤ 10	≤ 0.02	≤0.1	≤0.1	≤0.1
Mercury (mg/l)	< 0.010			≤0.04	0.00		≤1		≤0.001	≤0.005	≤0.001

Parameter	Site	DWS 2016	SANS 241 (2015)	DWAF 1996						DWAF 1999	
Molybdenum (mg/l)	< 0.010						≤0.01	≤0.01			
Nickel (ug/l)	< 0.010		≤ 70				≤1000	≤200			
Nitrate as N (mg/l)	0.10		≤ 11		≤6		≤100		≤0.05	≤15	≤1.5
Nitrite as N (mg/l)	<0.05		≤ 0.9		≤6		≤10			≤15	≤1.5
Orthophosphate as P (mg/l)	<0.1								≤0.1	≤10	≤2.5
pH	7.70		≥ 5 to ≤ 9.7		6-9	6.5-8.5		6.5-8.4	6.5-9	5.5-9.5	5.5-7.5
Potassium (mg/l)	1.29			≤50							
Selenium (mg/l)	0.03		≤ 40	≤0.02	≤0.02		≤50	≤0.02	≤0.3	≤0.02	≤0.02
Sodium (mg/l)	10.79		≤ 200		≤100		≤2000	≤70			
Sulphate (mg/l)	11.00		≤ 250		≤200		≤1000				
Suspended solids (mg/l)	52.00							≤50	≤50	≤25	≤10
Total Inorganic Nitrogen (mg/l)		<1.0									
Total Dissolved Solids (mg/l)	216.45	≤195	≤ 1 200								
Uranium (mg/l)	< 0.010		≤0.015					≤0.01			
Vanadium (mg/l)	< 0.010		≤0.2		≤0.1		≤1	≤0.1			
Zinc (mg/l)	0.06		≤ 5	≤0.002	≤3		≤20	≤1	≤0.03	≤0.1	≤0.04

*Average value exceeded the specified guideline.

*Detection limit was below guideline, therefore compliance could not be determined. The precautionary principle was utilised, and it was assumed that the value exceeded the guideline.

*Data were below the detection limit, thus calculation of the parameter was not possible.

8.2.6 Groundwater

8.2.6.1 Hydrocensus

A hydrocensus/groundwater user survey was conducted in April 2016 by Aquatico Scientific within the MRA area and the immediate surrounding properties. The main aims and objectives of the hydrocensus field survey were as follow:

- To locate all IAPs with respect to groundwater – thus groundwater users;
- To collect all relevant information from the IAPs (i.e. name, telephone number, address, etc.);
- Accurately log representative boreholes on the IAPs properties; and
- To collect all relevant information regarding the logged boreholes (i.e. yield, age, depth, water level etc.) but especially the use of groundwater from the borehole.

An extended hydrocensus was conducted by Aquatico Scientific in January 2017, with a further follow-up in March 2018 to include additional boreholes not surveyed during the first two rounds.

A total of 86 boreholes, four dams and one cave were located, and their positions are indicated in Figure 33. The main finding of the hydrocensus/user survey is that groundwater is used extensively throughout the project area, especially for irrigation and domestic purposes (66% of all boreholes) – refer to Figure 34. The 2018 hydrocensus report is attached as Appendix 2.

An important feature from a groundwater perspective that occurs in the area is an underground cave partly filled with groundwater. The cave opening/entrance occurs on AH 138, approximately 2.5 km north of the Rietkol MRA boundary. Apart from its presence and its rest water level, very little concrete information on the cave structure and dimensions could be obtained.

The cave is recognized as an important feature in terms of environmental sensitivity as well as for heritage purposes. Although information on the cave is limited, the risk of negative impact because of the proposed Rietkol Project on the cave is very low to negligible due to:

- The cave's relative distance from the proposed project.
- The mineable reserve being slightly metamorphosed sandstone (silica) on top of an intrusive dolerite sill and not penetrating the dolomite.
- The limited impact (depth and radius) that the mining will have on the groundwater level drawdown (availability) and quality.

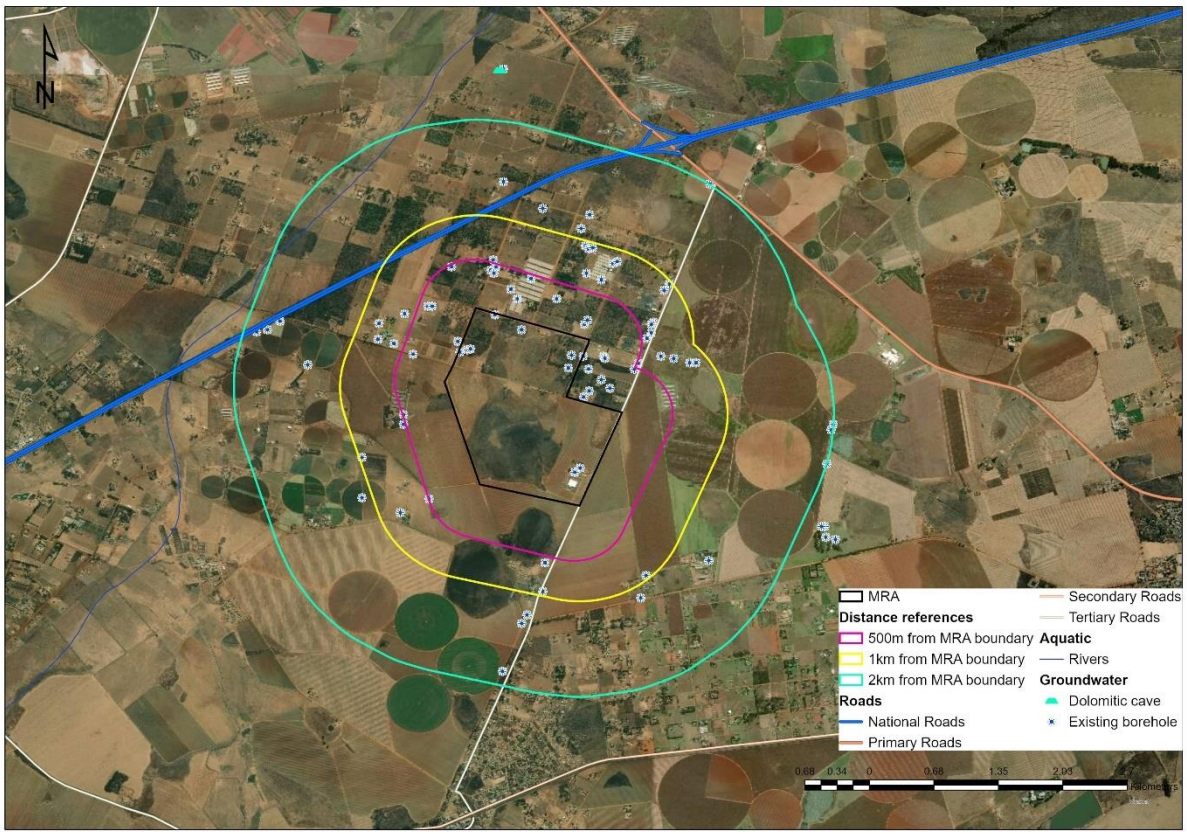


Figure 33: Position of hydrocensus recordings

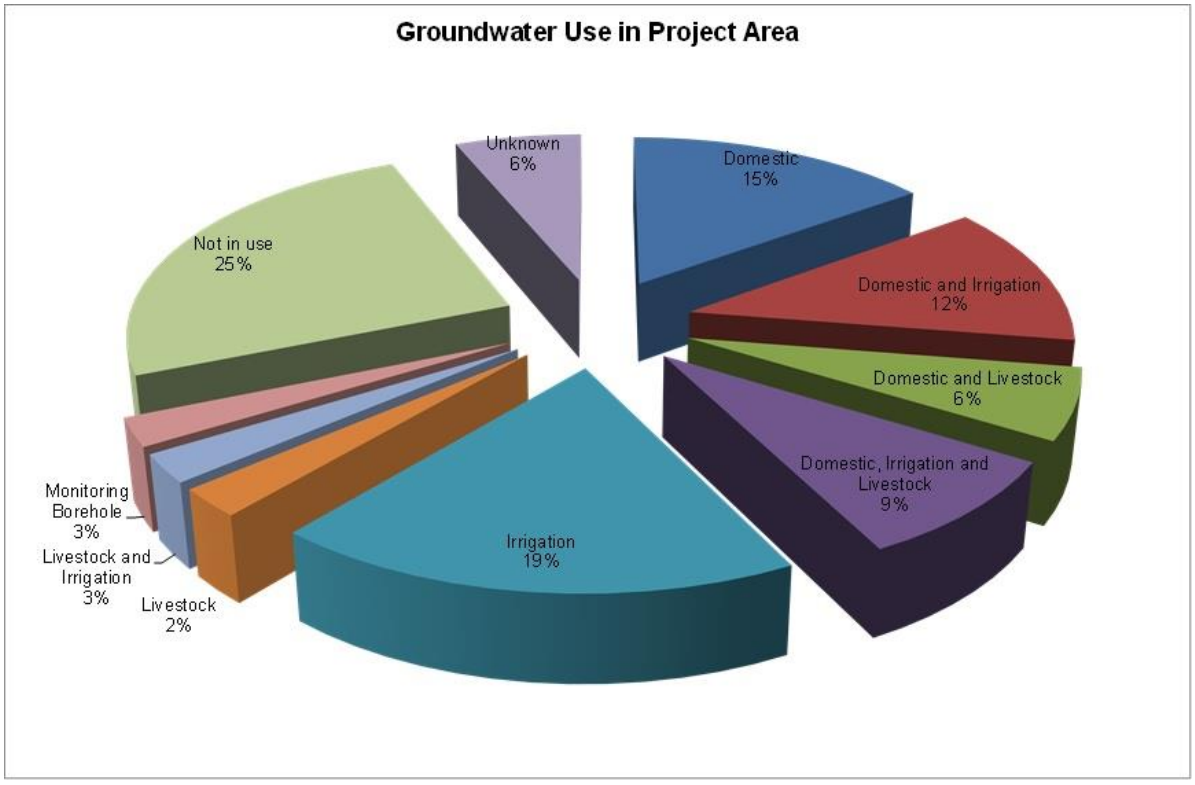


Figure 34: Groundwater use in the MRA area and surrounds

8.2.6.2 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 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.
- 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 MRA area as indicated in Figure 35. The Koffiespruit forms the western boundary, while the same topographic highs that form the eastern boundary of the B20B quaternary catchment also define the eastern aquifer boundary. The aquifer was estimated to cover an area of approximately 74 km^2.

It is important to note that the no-flow boundaries based on topographical highs are not cast in the proverbial stone. This is especially true in the Rietkol Project area where the topography is only slightly undulating (slopes are not steep). Furthermore, the overall high transmissivity of the dolomite host rock and the groundwater abstraction at high rate for irrigation can certainly affect the groundwater level to such an extent that it will flow across a surface topographical high. Groundwater abstraction for irrigation to the south-east of the MRA area has resulted in groundwater flowing east/south-eastwards (Figure 38) across the topographical divide.

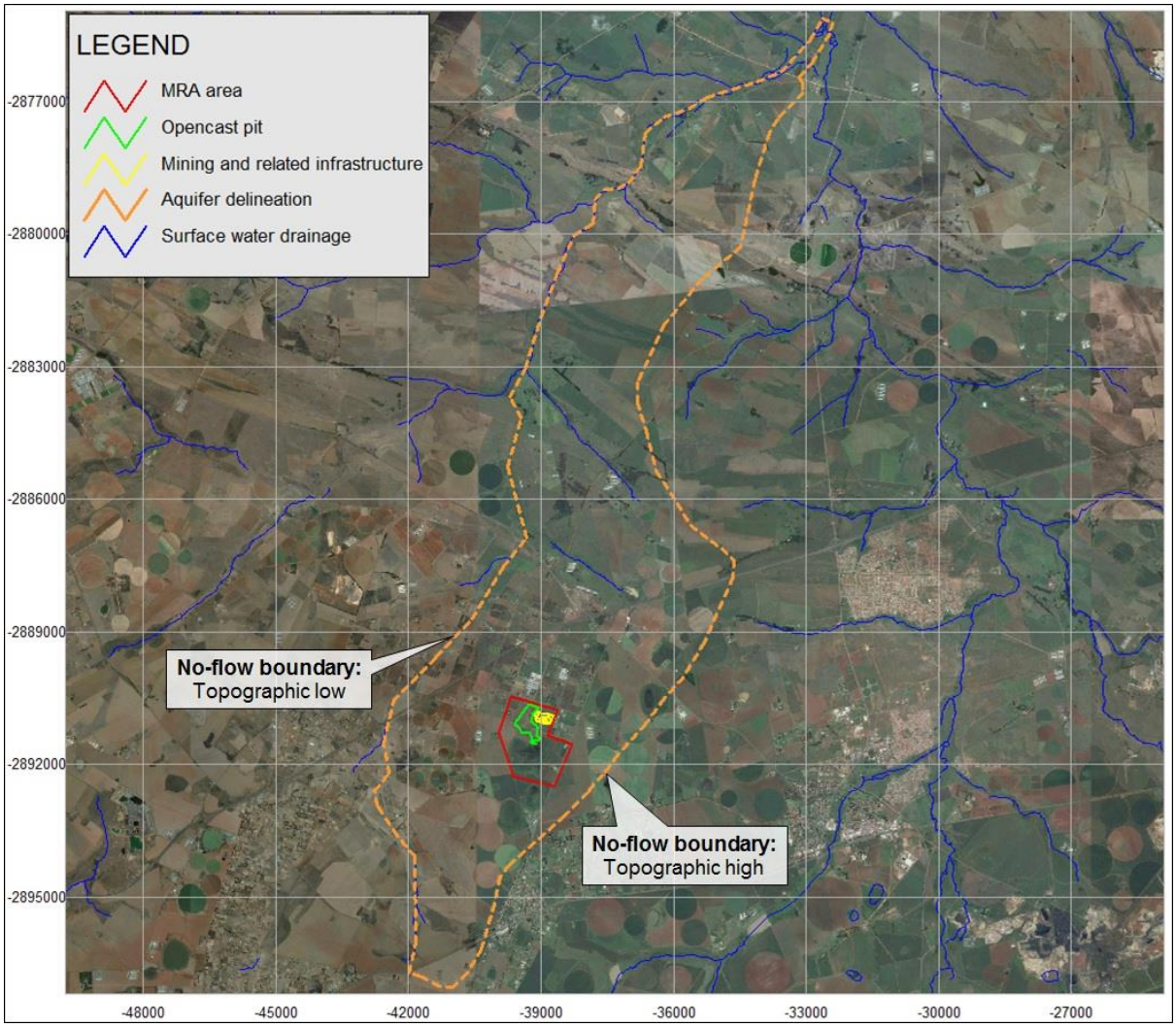


Figure 35: Aquifer delineation for MRA area

8.2.6.3 Groundwater level depth

Groundwater level information was collected during the hydrocensus/user surveys that were conducted within the MRA area and the surrounding properties. A thematic groundwater level map of the entire MRA area is provided in Figure 36. This information was also used to generate a contour map of the groundwater levels, which is provided in Figure 37.

Groundwater levels around the MRA area generally vary between ± 9 and 100 mbs, with the average being ± 42 mbs. Under ambient conditions, the deeper groundwater levels would generally be associated with the dolomite aquifer, while water levels in the Karoo aquifer/s generally do not exceed 10 mbs. Approximately 66% of all boreholes are in use (mainly for domestic and/or irrigation purposes), meaning that most groundwater levels are affected by the abstraction of groundwater. Not all groundwater levels are therefore representative of ambient/unaffected conditions, making it

difficult to distinguish between the dolomite aquifer and Karoo aquifer solely based on differing groundwater levels. The groundwater level contour map provided in Figure 37 clearly shows the groundwater depression cones resulting from the groundwater abstraction.

In conclusion, groundwater abstraction for domestic purposes and/or farming related activities has already caused a lowering of the local groundwater levels and is also believed to have affected the natural groundwater flow patterns and velocities.

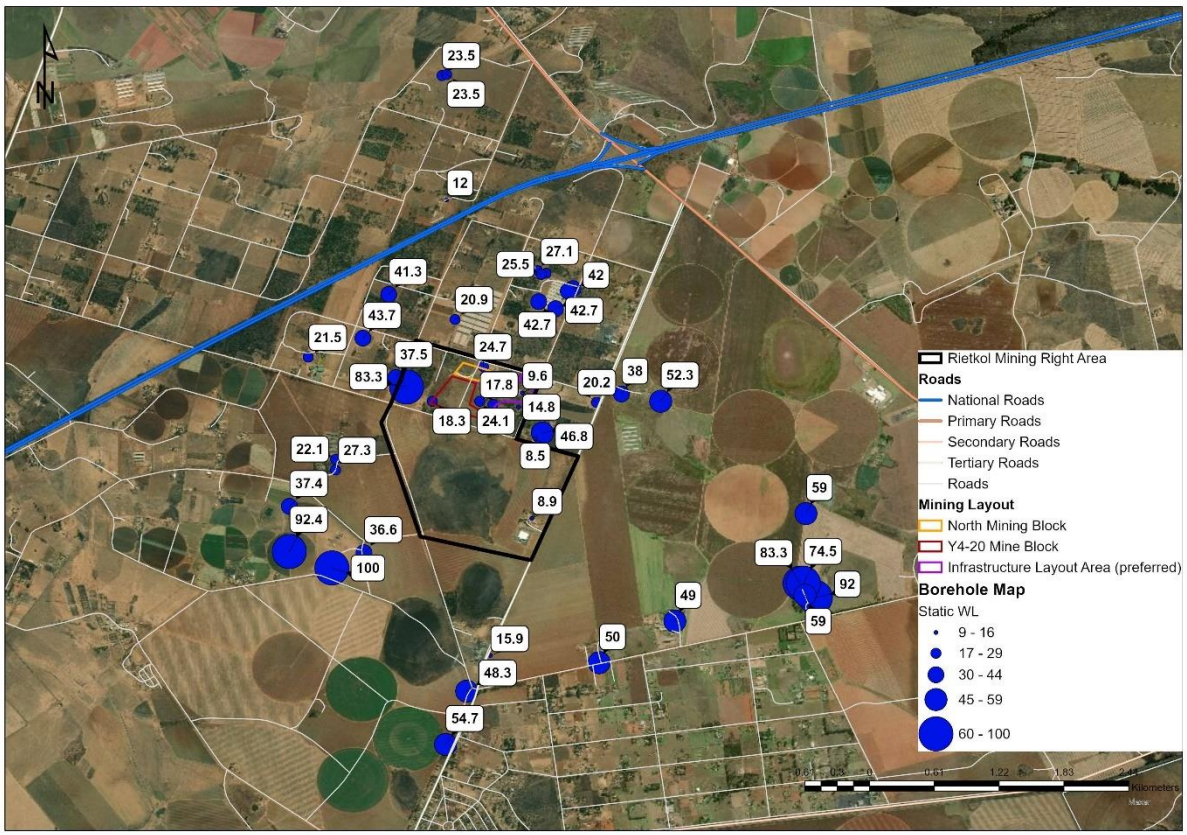


Figure 36: Thematic map of groundwater level depths (mbs)

- The numbers in the above figure indicate the groundwater level depth below surface in meters.
- The blue circles represent the positions of the user boreholes.
- The size of the blue circles is directly proportional to the groundwater level depth; hence the largest circle represents the deepest water level.

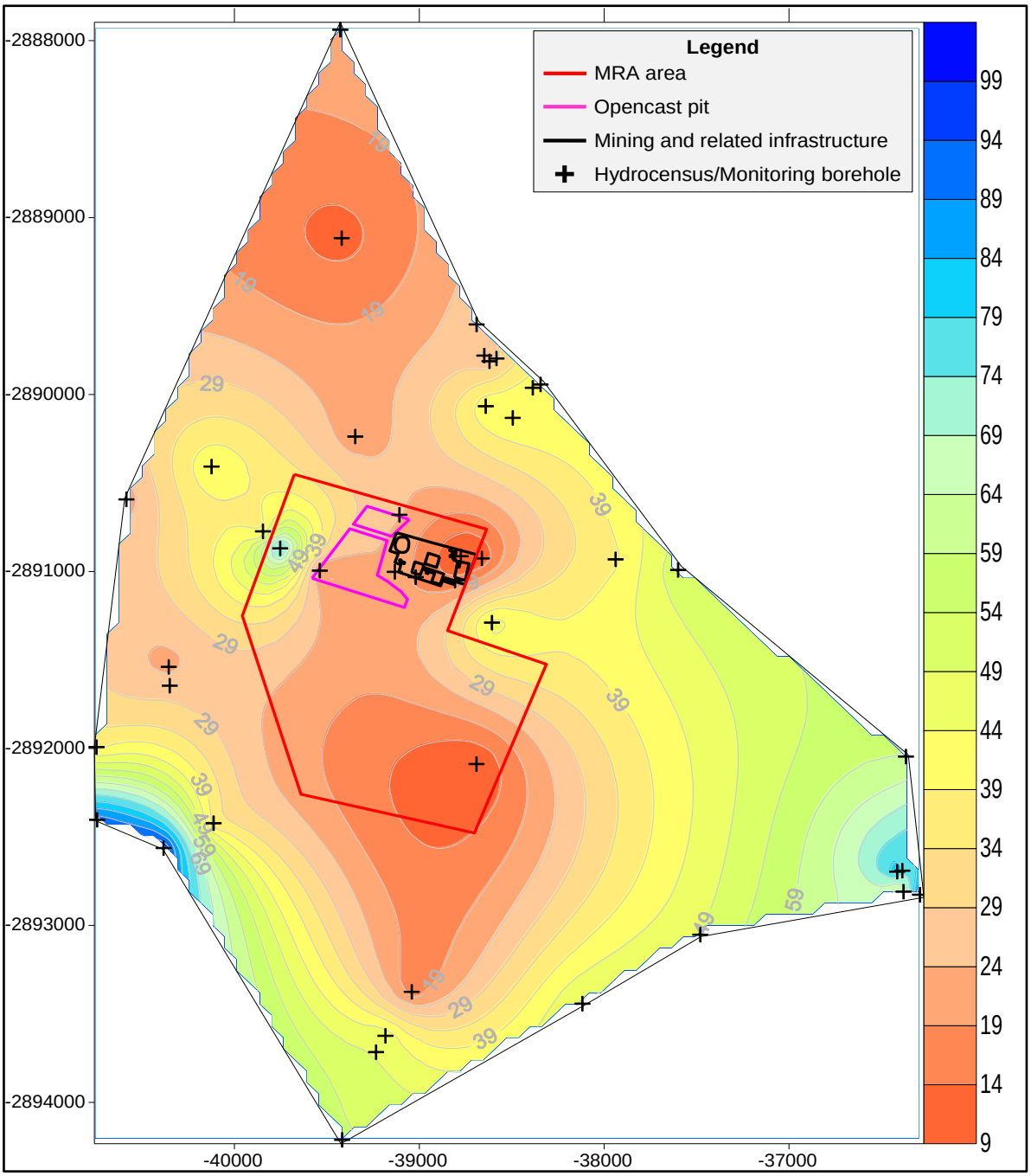


Figure 37: Contour map of groundwater level depths (mbs)

8.2.6.4 Groundwater flow evaluation

The groundwater level information collected during the hydrocensus was used to generate a contour map of the groundwater elevations in the MRA area, which is provided in Figure 38. This information was used to determine the direction of groundwater flow, which because of gravity is from higher to lower hydraulic elevations. It was also used to calculate the groundwater gradient within the MRA area.

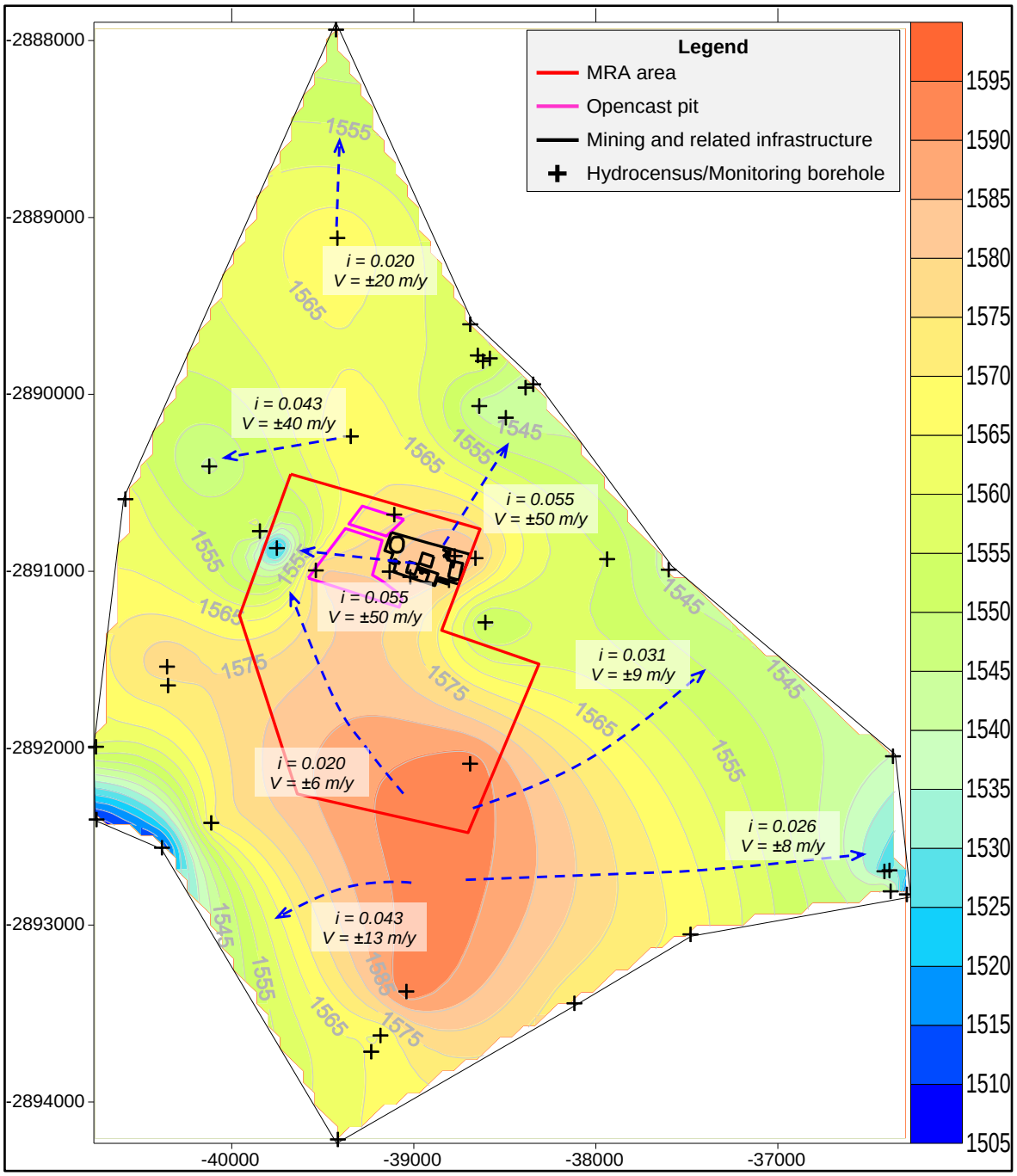


Figure 38: Contour map of groundwater level elevations (mamsl)

8.2.6.5 Aquifer types

Information from geological maps, drilling results and experience gained from numerous studies conducted in similar geohydrological environments suggest that three different types of aquifers may be present in the project area.

The first aquifer is a shallow, semi-confined, or unconfined aquifer that occurs in the transitional soil and weathered bedrock zone or sub-outcrop horizon. 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. The shallow weathered zone aquifer plays the most important role in mass transport simulations from process and mine induced contamination sources because the lateral seepage component in the shallow weathered 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.

Due to the mainly lateral flow and sometimes phreatic nature of the weathered zone aquifer, it is usually only affected by opencast mining, high extraction, or shallow underground mining where subsidence occurs and the entire roof strata above the mined area is destroyed.

The second aquifer system is the deeper secondary fractured rock aquifer that is hosted within the sedimentary rocks of the Karoo Supergroup, which underlies the southern half of the MRA area. 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 in some cases where groundwater is the only source of domestic water.

The third, and major aquifer system, is associated with the Malmani Subgroup (Transvaal Supergroup) dolomite that underlies the northern half of the MRA area. Dolomite is generally considered to be an excellent host rock for aquifers due to the formation of solution cavities and their ability to store vast volumes of groundwater. However, water needs to penetrate the rock for any dissolution to occur, meaning that the dolomite must have undergone some significant fracturing for any significant cavities to have formed over the years. According to the Parsons Classification System, this aquifer could be regarded as a major aquifer system, but also a sole aquifer system in some cases where groundwater is the only source of domestic water.

Notes:

- Mining will technically only intersect the shallow weathered zone aquifer to gain access to the underlying Rietkol quartzite that was deposited in an ancient sinkhole structure – leaving the Karoo- and Transvaal Supergroup (i.e. Malmani dolomite) aquifers intact. The quartzite

deposit may be regarded as a fourth aquifer; however, its crystalline structure and small size are characteristic of a minor, or even a non-aquifer system.

- The underlying dolomite aquifer will be separated from the overlying opencast pit by a dolerite sill of approximately 30m thick and many more meters of quartzite (i.e. Lower Quartzite band). The quartzite deposit in its entirety is expected to act as a buffer between the proposed mining activities and the surrounding and underlying dolomite.

8.2.6.6 Aquifer transmissivity and storativity

Constant rate pumping tests were performed on four user boreholes and four purpose-drilled monitoring boreholes. The positions of these eight boreholes are indicated in Figure 39.

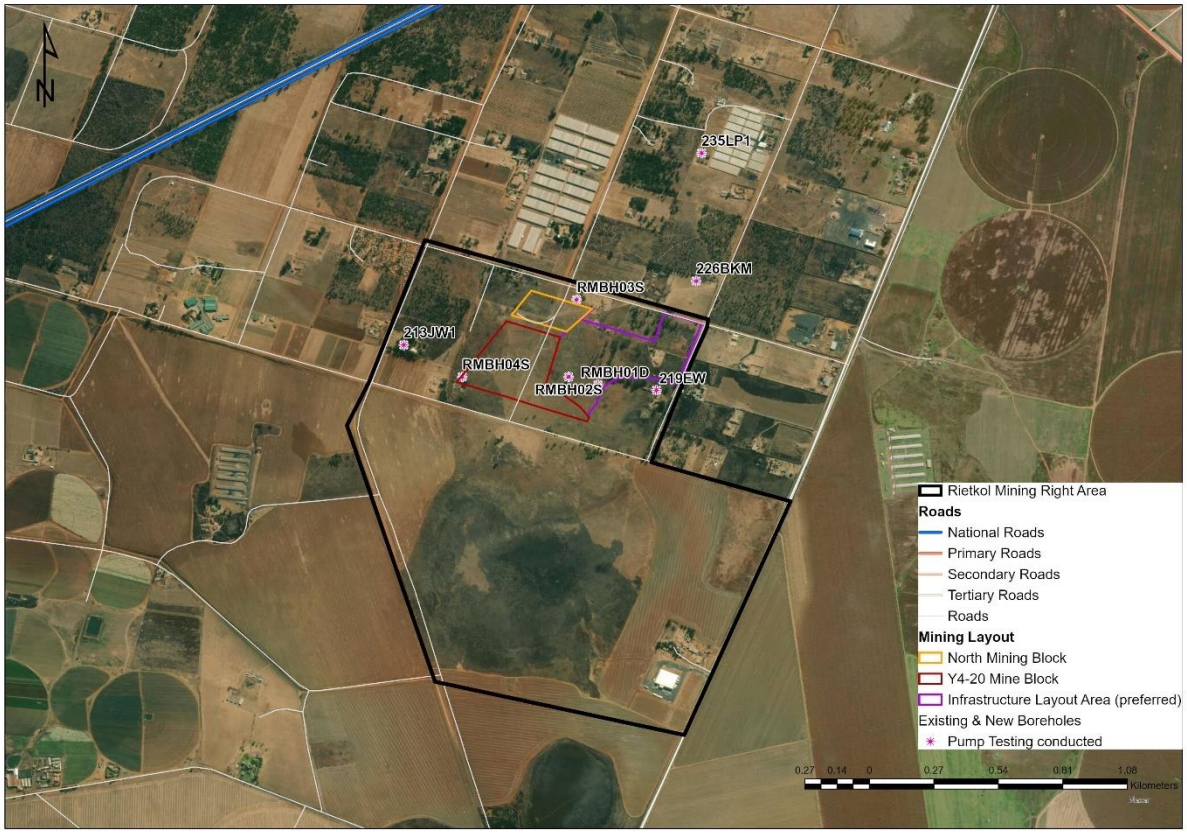


Figure 39: Positions of user boreholes on which pumping tests were performed

Based on the 1:250 000 scale geological map of the project area, boreholes 213JW1, 226BKM and 235LP1 are believed to be located within the Malmani dolomite. It follows that the average transmissivity of this dolomite aquifer is in the region of 22 m^2/d. On the other hand, borehole 219EW displayed a much lower transmissivity of nearly 6.5 m^2/d, which is believed to be representative of the fractured Karoo Supergroup aquifer. The four monitoring boreholes were drilled into the Rietkol

quartzite deposit and its associated contact zones and displayed an even lower average transmissivity of approximately 0.9 m^2/d.

The potential abstraction rates from the boreholes are provided in Table 31 and are indicated as liters per second for a 24-hour pump cycle. Although the borehole yields provided were calculated with tested and proven techniques, uncertainties still exist (especially with regards to the available drawdown) and are therefore first order approximations only.

Table 31: Potential borehole yields

Borehole	Potential Groundwater Yield (l/s)				
	No boundary	1 Boundary	2 Boundaries	Closed	Average
213JW1	5.5	2.7	1.8	1.4	2.8
219EW	1.3	0.6	0.4	0.3	0.7
226BKM	Test inconclusive				
235LP1	9.4	4.7	3.1	2.3	4.9
RMBH01D	0.9	0.5	0.3	0.2	0.5
RMBH02S	0.04	0.02	0.01	0.01	0.02
RMBH03S	Test inconclusive				
RMBH04S	0.04	0.02	0.01	0.01	0.02

The maximum on-site water requirement at full production is expected to be 4 l/s (i.e. 0.4 l/s dust suppression, 0.2 l/s potable water and 3.4 l/s plant). Table 31 shows that the combined sustainable yield of the on-site tested boreholes is around 4 l/s. The existing on-site boreholes would therefore be sufficient to supply the Rietkol Project, not considering groundwater influx and direct rainfall.

8.2.6.7 Aquifer recharge

The mean annual recharge to the aquifer underlying the project area should be in the order of 65 mm, which based on an average rainfall of approximately 690 mm/a, calculates to a recharge of ± 9%.

Where outcrop occurs, the effective recharge percentage can be slightly higher while in low-lying topographies where discharge generally occurs and thicker sediment deposition, the effective recharge will be lower or even zero. Based on this estimate, the mean annual recharge to the aquifer regime as defined in Figure 35 should be in the order of 5.6 Mm^3.

8.2.6.8 Groundwater quality conditions

Groundwater quality data is available for 22 user boreholes and four dedicated source monitoring boreholes. Their positions are indicated in Figure 40 and Figure 41 respectively. The data was evaluated with the aid of diagnostic chemical diagrams and by comparing the inorganic concentrations

to the South African National Standards for drinking water (SANS 241:2015). The once-off sampling data does not allow for any statistical analyses or trend identification.

8.2.6.8.1 Regional user boreholes

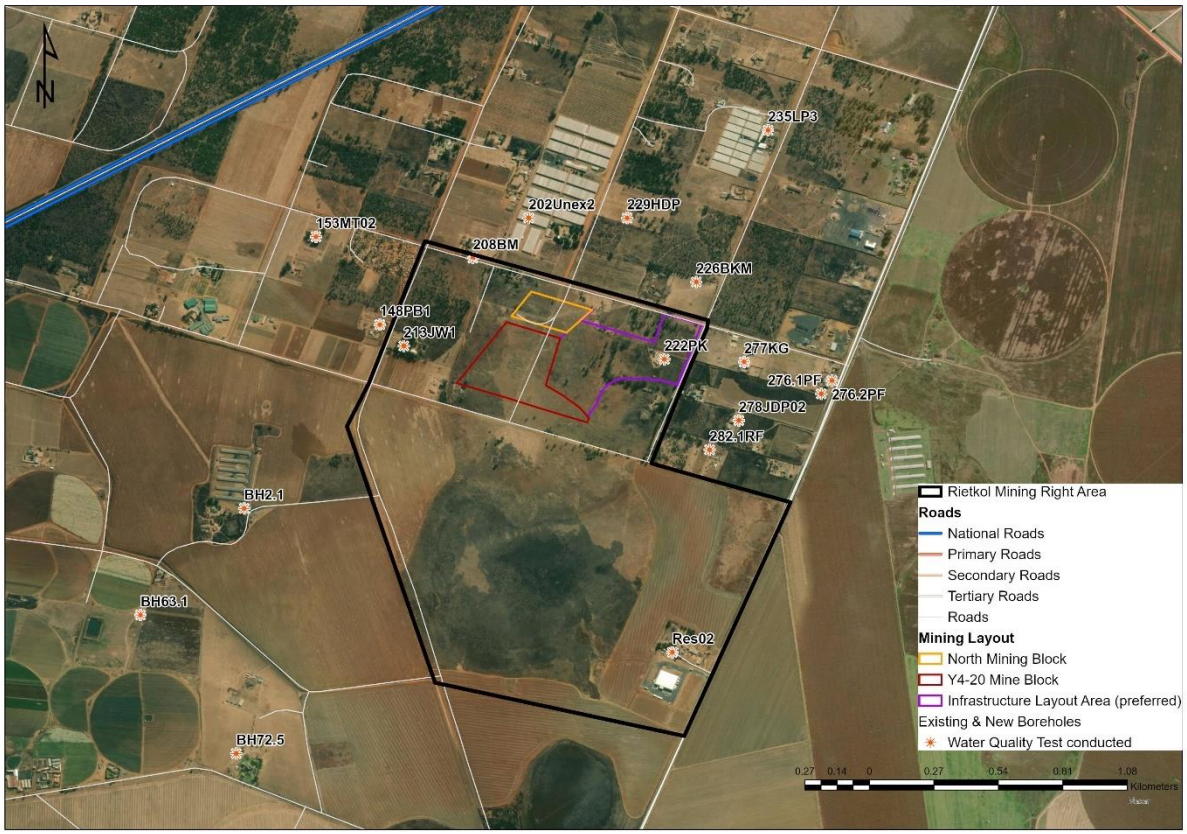


Figure 40: Distribution of regional groundwater quality data

The total dissolved solids (TDS) content of groundwater is a good indicator of the overall quality of the water, as it provides a measurement of the total amount/weight of salts that are present in solution. An increase in TDS will therefore also indicate an increase in the total inorganic content of the groundwater. Groundwater TDS concentrations of user boreholes vary between 120 mg/l and 416 mg/l, which are well below the maximum permissible SANS value of 1 200 mg/l.

The sulphate content of groundwater is low and vary from below the detection limit of 0.452 mg/l to nearly 45 mg/l, which are well below the maximum permissible SANS value of 500 mg/l.

In a farming environment, nitrate contamination is generally associated with seepage from pit latrines and animal feedlots/kraals or fertilisers, while where mining occurs the usage of nitrate-based explosives is mainly responsible for high levels of nitrate contamination. Health effects associated with high nitrate intake are impaired concentration, lack of energy and the formation of

methahemoglobin in blood cells. Groundwater nitrate concentrations measured in most user boreholes are well below the maximum permissible SANS value of 11 mg/l. Exceptions do however occur and a concentration of approximately 12 mg/l was measured in both boreholes 148PB1 and 202Unex2. The once-off analyses do not allow for accurate source identification, however the nitrate contamination affecting the abovementioned two boreholes is likely to originate from pit latrines and/or feedlots.

The groundwater pH conditions are neutral with values varying between 7.0 and 8.8. The neutral pH conditions restrict the mobilisation of metals, which are also sensitive to groundwater redox conditions.

User boreholes display groundwater chloride concentrations of between 2 mg/l and 85 mg/l, which are well below the maximum permissible SANS value of 300 mg/l.

Most user boreholes are dominated by fresh, clean, relatively young groundwater that has started to undergo mineralization, i.e. magnesium ion exchange. The groundwater is therefore dominated by magnesium cations, while bicarbonate alkalinity dominates the anion content. This is typical of a dolomite aquifer, which is mainly composed of calcium and magnesium carbonates.

Summary:

- Groundwater from most user boreholes is considered to be of good quality and is suitable for human consumption with regards to SANS 241:2015.
- Exceptions do however occur as the groundwater nitrate content measured in user boreholes 148PB1 and 202Unex2 exceeds the maximum permissible SANS value of 11 mg/l.
- The nitrate contamination is likely to originate from pit latrines or feedlots.
- The groundwater is mainly dominated by magnesium cations and bicarbonate alkalinity, which is typical of an unpolluted dolomite aquifer.

Table 32: Results of chemical and physical analyses for regional user boreholes

BH	pH	TDS mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO_4 mg/l
148PB1	7.4	264.0	48.7	27.6	9.5	2.8	14.9	7.0
202Unex2	7.3	120.0	17.6	10.7	4.6	0.7	7.5	3.9
208BM	8.0	216.0	35.8	31.5	6.7	0.9	6.3	12.0
153MT02	7.5	211.0	42.0	28.4	5.4	0.9	2.3	4.7
213JW1	7.9	173.0	35.0	21.5	2.7	0.9	1.8	14.7
229HDP	8.8	127.0	11.6	7.8	25.8	0.6	1.9	5.6
222PK	7.0	209.0	36.3	22.5	13.7	2.0	20.8	5.1

BH	pH	TDS mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO_4 mg/l
226BKM	8.1	167.0	35.2	15.8	10.5	1.0	7.7	5.4
235LP3	8.2	133.0	18.9	18.0	8.6	1.3	4.2	7.7
276.1PF	8.2	200.0	29.6	25.0	7.6	2.1	5.4	23.0
276.2PF	7.1	177.0	30.8	18.2	5.9	1.5	6.4	6.9
277KG	8.1	202.0	33.0	21.4	8.9	1.9	9.2	9.8
278JDP02	8.6	196.0	29.1	22.4	18.8	2.0	13.0	10.9
282.1RF	7.7	416.0	44.5	29.5	74.4	4.6	85.0	33.7
Res02	7.9	265.0	46.2	22.1	18.3	2.4	17.0	19.9
BH15.2	7.7	182.0	29.4	16.9	12.8	3.5	3.9	<0.452
BH2.1	8.3	182.0	30.7	18.6	3.4	1.4	7.4	<0.452
BH24.13	7.9	219.0	36.2	21.4	12.7	4.1	10.0	1.3
BH24.5	7.9	246.0	42.8	20.3	16.6	3.7	10.1	20.0
BH63.1	8.5	261.0	32.2	25.8	21.4	2.1	20.6	44.5
BH71.4	8.3	205.0	28.7	24.3	11.9	1.4	9.1	18.5
BH72.5	8.3	209.0	25.9	23.0	17.0	1.5	14.0	22.2

BH	NO_3 mg/l	F mg/l	Al mg/l	Fe mg/l	Mn mg/l	NH_3 mg/l	THardness mg/l	PO_4 mg/l
148PB1	**11.7**	<0.466	<0.005	<0.009	<0.001	<0.005	235.0	0.06
202Unex2	**12.1**	0.18	<0.005	<0.009	<0.001	<0.005	88.0	<0.002
208BM	2.6	0.20	<0.005	<0.009	<0.001	<0.005	219.0	<0.002
153MT02	0.7	0.23	<0.005	<0.009	<0.001	<0.005	222.0	<0.002
213JW1	0.3	0.17	<0.005	<0.009	<0.001	<0.005	176.0	<0.002
229HDP	3.0	<0.142	<0.005	<0.009	<0.001	<0.005	61.0	<0.002
222PK	1.3	0.49	<0.005	<0.009	<0.001	<0.005	183.0	<0.002
226BKM	0.6	0.18	<0.005	<0.009	<0.001	<0.005	153.0	<0.002
235LP3	1.1	0.20	<0.005	<0.009	<0.001	<0.005	121.0	<0.002
276.1PF	0.9	<0.263	0.01	<0.004	<0.001	0.19	177.0	<0.005
276.2PF	7.6	<0.263	<0.002	<0.004	0.04	0.19	152.0	<0.005
277KG	5.2	<0.263	<0.002	<0.004	<0.001	0.04	171.0	<0.005
278JDP02	0.6	0.22	<0.005	<0.009	<0.001	<0.005	165.0	<0.002
282.1RF	0.3	0.3	<0.002	<0.004	0.19	0.14	232.0	<0.005
Res02	0.8	<0.466	<0.005	<0.009	<0.001	0.10	206.0	0.05
BH15.2	0.5	<0.466	<0.005	<0.009	<0.001	0.08	143.0	0.04
BH2.1	7.7	<0.466	<0.005	<0.009	<0.001	0.05	153.0	0.04
BH24.13	0.6	<0.466	<0.005	<0.009	<0.001	0.05	179.0	0.11
BH24.5	<0.459	<0.466	<0.005	<0.009	<0.001	0.05	191.0	0.07
BH63.1	0.7	<0.466	<0.005	<0.009	<0.001	0.10	187.0	0.04
BH71.4	<0.459	<0.466	<0.005	<0.009	<0.001	0.05	172.0	0.05
BH72.5	0.5	<0.466	<0.005	<0.009	<0.001	0.06	159.0	0.04

Note: ***Red*** *- Value exceeds the maximum permissible SANS concentration allowed in drinking water.*

8.2.6.8.2 Site-specific monitoring boreholes

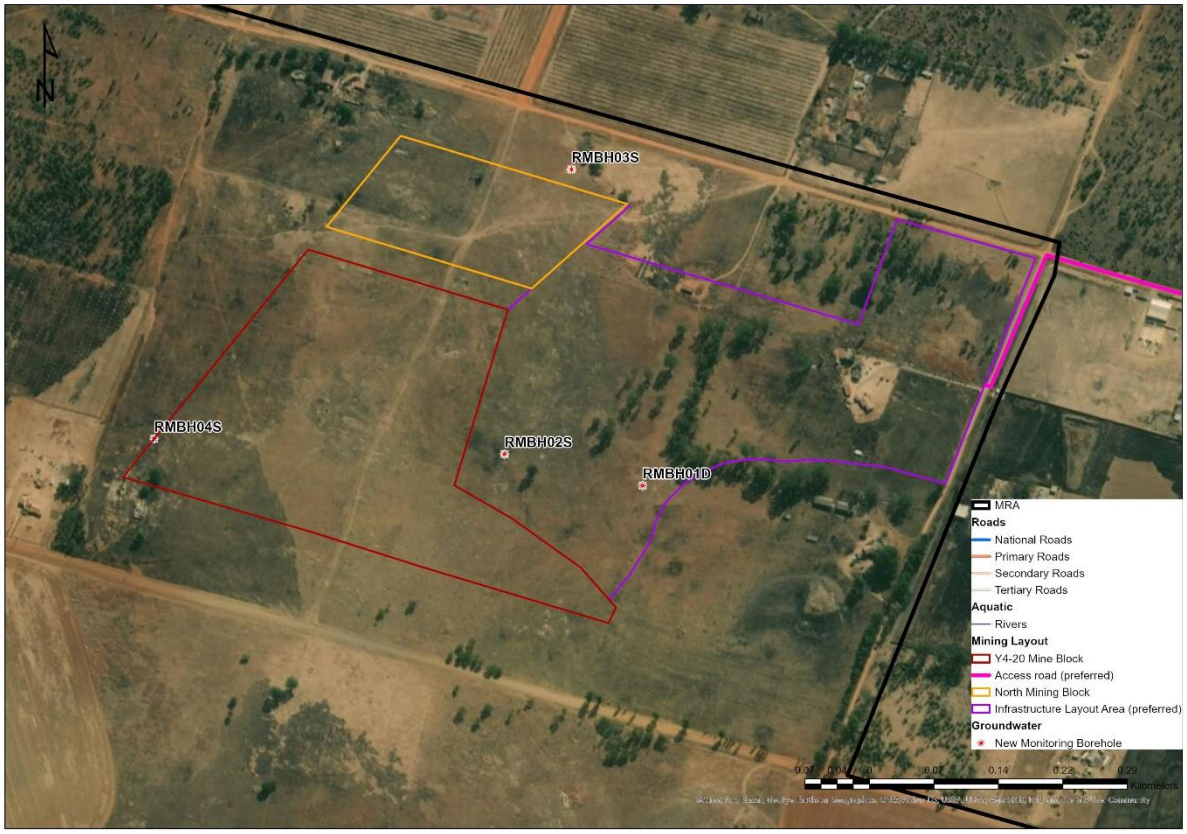


Figure 41: Distribution of site-specific groundwater quality data

Groundwater within the MRA area is of good quality according to SANS 241:2015 and representative of the ambient or unaffected environment. The TDS content of groundwater is a highly effective indicator of inorganic type contamination. Groundwater TDS concentrations vary between 20 mg/l and 84 mg/l, which are very low and perfectly suitable for human consumption.

The manganese content in borehole RMBH01D did however exceed the maximum permissible SANS value of 0.4 mg/l. The only explanation for the elevated manganese content is the fact that the borehole was drilled into the dolomite aquifer and the weathering in the borehole was very deep. The chemical weathering in dolomite terrains in South Africa often leaves a black to coffee-brown residue which is very light and is named manganese earth or wad. Since RMBH01 is the only site borehole drilled into the weathered dolomite and sampled shortly thereafter the elevated manganese in the groundwater is likely to originate from the manganese earth. It is unlikely to be the result of any nearby farming or human related activities.

Summary:

- Groundwater from the four monitoring boreholes is of good quality and is suitable for human consumption with regards to SANS 241:2015.
- The groundwater manganese content in borehole RMBH01D did however exceed the maximum permissible SANS value of 0.4 mg/l. The elevated manganese content is expected to originate from wad formed due to weathered dolomite/chert.

Table 33: Results of chemical and physical analyses for site specific monitoring boreholes

Parameter	Unit	RMBH01D	RMBH02S	RMBH03S	RMBH04S
pH	*pH units*	8.0	6.9	6.1	6.1
EC	*mS/m*	6.9	13.9	3.6	5.8
TDS	*mg/l*	40.0	84.0	20.0	36.0
Alkalinity	*mg $CaCO_3$/l*	30.3	34.8	10.6	11.3
Cl	*mg/l*	3.6	13.5	1.7	5.4
SO_4	*mg/l*	2.4	4.2	1.6	1.1
NO_3	*mg/l*	0.3	3.5	0.8	2.5
NH_4	*mg/l*	1.2	0.1	<0.008	<0.008
PO_4	*mg/l*	<0.005	<0.005	<0.005	<0.005
F	*mg/l*	<0.263	<0.263	<0.263	<0.263
Ca	*mg/l*	4.4	17.4	3.8	5.3
Mg	*mg/l*	2.7	2.7	1.2	1.5
Na	*mg/l*	2.5	4.7	1.5	4.2
K	*mg/l*	2.7	4.8	0.6	0.9
Al	*mg/l*	<0.002	<0.002	<0.002	<0.002
Fe	*mg/l*	<0.004	0.1	<0.004	<0.004
Mn	*mg/l*	**2.04**	0.36	0.02	0.08
Cr	*mg/l*	<0.003	<0.003	<0.003	<0.003
Cu	*mg/l*	<0.002	<0.002	<0.002	<0.002
Ni	*mg/l*	<0.002	<0.002	<0.002	<0.002
Total hardness	*mg $CaCO_3$/l*	22.0	55.0	14.0	19.0

***Note:** **Red** - Value exceeds the maximum permissible SANS concentration allowed in drinking water.*

8.2.7 Air Quality

8.2.7.1 Existing sources of pollution

Although the air quality in the region can be viewed as natural (rural), local airborne pollutant sources were identified during the various site visits. These are important to consider in terms of assessing the cumulative impact potential on air quality in the region:

- Agricultural activities;

- Vehicle emissions;
- Veld and agricultural fires;
- Industrial emissions;
- Power generation;
- Mining activities; and
- Home fires.

A qualitative discussion on each of these source types is provided in the subsections which follow.

8.2.7.1.1 Agriculture

Large scale agriculture to the south and east, along with small-scale type of agriculture (small holdings) which supply a family and relatives of food within the community are common in the area, except for the high intensity flowers grown in greenhouses. The airborne pollutant associated with the farming is Particulate Matter (TSP, PM_{10}, $PM_{2.5}$, etc.) generated by animal husbandry, wind erosion of open tilled fields and planting.

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 focus internationally with respect to emissions generated due to agricultural activity is related to animal husbandry, with special reference to malodours generated because of the feeding and cleaning of animal. The types of livestock assessed included pigs, sheep, goats, and chickens (within proximity to the project). Emissions assessed include ammonia and hydrogen sulphide.

Little information is available with respect to the emissions generated due to the growing of crops. The activities responsible for the release of particulates and gasses to atmosphere 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 tilling and harvesting operations;
- Vehicle entrained dust on paved and unpaved road surfaces;
- Gaseous and particulate emissions due to fertilizer treatment; and
- Gaseous emissions due to the application of herbicides and pesticides.

8.2.7.1.2 Vehicles

The force of the wheels of vehicles travelling on unpaved roadways causes the pulverisation of 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. Due to the nature of both mining and agricultural activity, road networks can often be of a temporary nature, and are thus unpaved. An unpaved road network exists in the area. Due to the volume of heavy vehicles using the roads near the site, the expected volumes of entrained dust are likely to be considerable.

Due to the proximity of the site to the N12 Highway, exhaust tailpipe emissions from vehicles are a significant source of particulate emissions. Exhaust fumes contain nitrogen, oxygen, carbon monoxide, water vapour, sulphur dioxide, nitrogen oxide, volatile hydrocarbons and polyaromatic hydrocarbons (PAHs) and their derivatives, acetylaldehyde, benzene and formaldehyde, carbon particles, sulphates, aldehydes, alkanes, and alkenes.

8.2.7.1.3 Veld and agricultural burning

A veld fire or controlled agricultural burn is a large-scale natural combustion process that consumes various ages, sizes, and types of flora growing outdoors in a geographical area. Consequently, 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 fires depend 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).

The major pollutants from burning are particulate matter, carbon monoxide and volatile organics. Nitrogen oxides are emitted at rates of from 1 to 4 g/kg burned, depending on combustion temperatures. Emissions of sulphur oxides are negligible. A study of biomass burning in the African savannah 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.

8.2.7.1.4 Brick kiln emissions

Clay brick manufacturing face poor uptake of tunnel kiln technology, and lack of abatement on clamp kilns, particularly of PM and CO emissions. Tunnel kiln technology is promoted in new, regulated operations.

8.2.7.1.5 Power generation

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.

8.2.7.1.6 Mining activities

Opencast mining should control the generation of particulate matter on mine haul roads. Water spraying is a cheap and effective means of control and should be consistently applied across mines in the Highveld Priority Area (HPA). Other studies have indicated that chemicals and re-surfacing techniques are effective. Potential sources of fugitive dust emissions (PM_{10} and dust) are released from these sources: material handling operations, vehicle entrainment by haul vehicles, windblown dust from tailings dams and oxides of nitrogen (NO_X) and carbon monoxide (CO) which are produced during mining operations. Fugitive dust emissions released during mining operations are generally only of concern within 3 - 5 km of the mine boundary.

8.2.7.1.7 Home fires

Domestic fuel burning continues partly due to poor uptake of technology, and high pace of settlement growth. Awareness and technology promotion activities are increasing, although local and provincial authorities have lacked capacity and means to ensure awareness and conversion. In the region of the mine, the housing associated with low-income housing with minimal electricity usage for heating during the colder winter months and for cooking. The open fires are made from any combustible material (usually wood or coal) and is often used to cook and to heat up the house. The associated emissions from these cooking fires differentiate from the type of material used for energy and the most common airborne pollutants are Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2), Carbon monoxide (CO), Carbon dioxide (CO_2) and Particulate matter (TSP, PM_{10}, $PM_{2.5}$, etc.). During the winters cold day's inversions form over the surface of the land and cause the airborne pollutants from domestic fuel burning to be entrapped. The air movement cannot disperse the air pollutant from the region and causes the concentrations to build up. The inversion layer and domestic fuel burning takes place at the same time, which increases the severity of the situation at some locations. As the day heats up (midday) the inversion layer breaks up and the pollutants can disperse.

8.2.7.2 Baseline air quality monitoring

8.2.7.2.1 Highveld Priority Area

The Highveld Priority Area (HPA) was declared in late 2007. The Department of Environment, Forestry and Fisheries (DEFF) developed and manages the implementation of the Highveld Priority Area Air Quality Management Plan, 2012.

Air emissions of fine particulate matter (PM_{10}) in the HPA over a year, is estimated at 279 630 tons, including:

- 89% PM_{10} from general industrial sources
- 50% PM_{10} from opencast mine haul roads dust
- 17% PM_{10} from primary metallurgical industries
- 12 % PM_{10} from coal power generation

NO_x air emission total 978 781 tons per year in the HPA, including:

- 90% NO_x from industrial sources
- 73% NO_x from coal power generation

SO_2 air emissions in the HPA total 1 622 233 tons per year, including:

- 99% SO_2 from industrial sources
- 82% SO_2 from coal power generation

8.2.7.2.2 Regional ambient air quality

Ambient air quality monitoring has been undertaken by Eskom at the Chicken Farm Site, situated approximately 30 km north-east of the Rietkol MRA area. The South African Air Quality Information System (SAAQIA) provided the following information from 1 January 2017 to 31 December 2017.

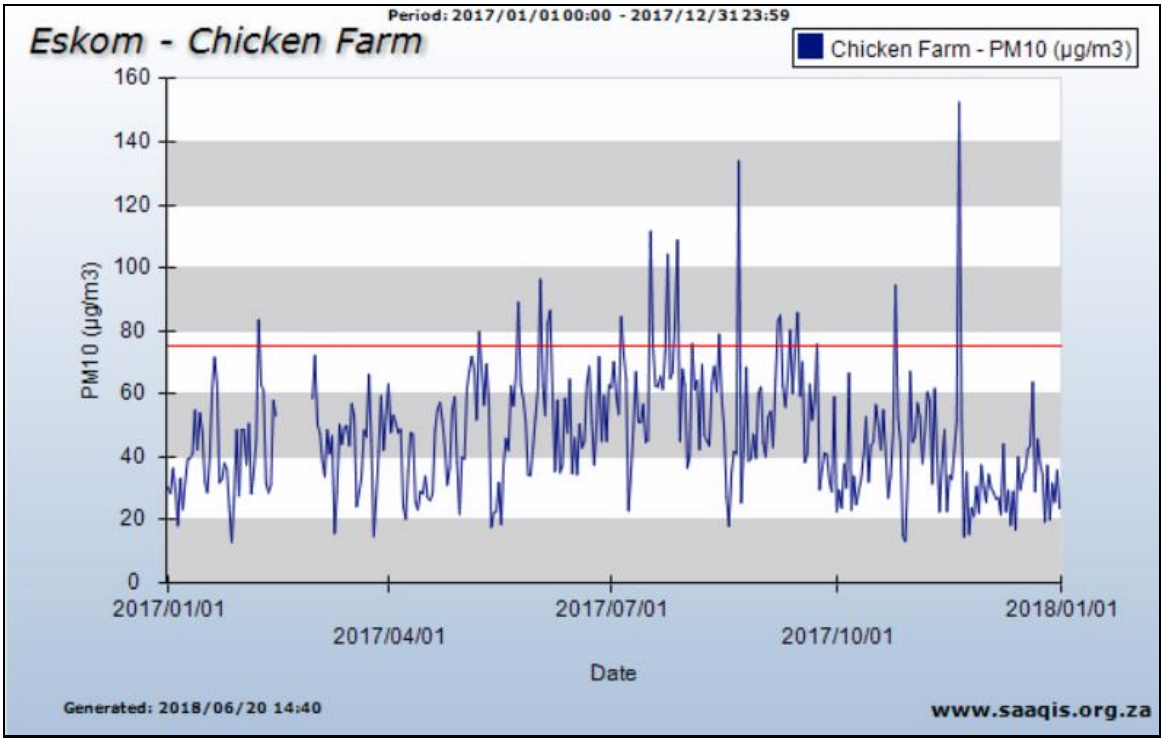


Figure 42: PM_{10} monitoring results at the Eskom Chicken Farm site (daily standard: 75 µg/m³)

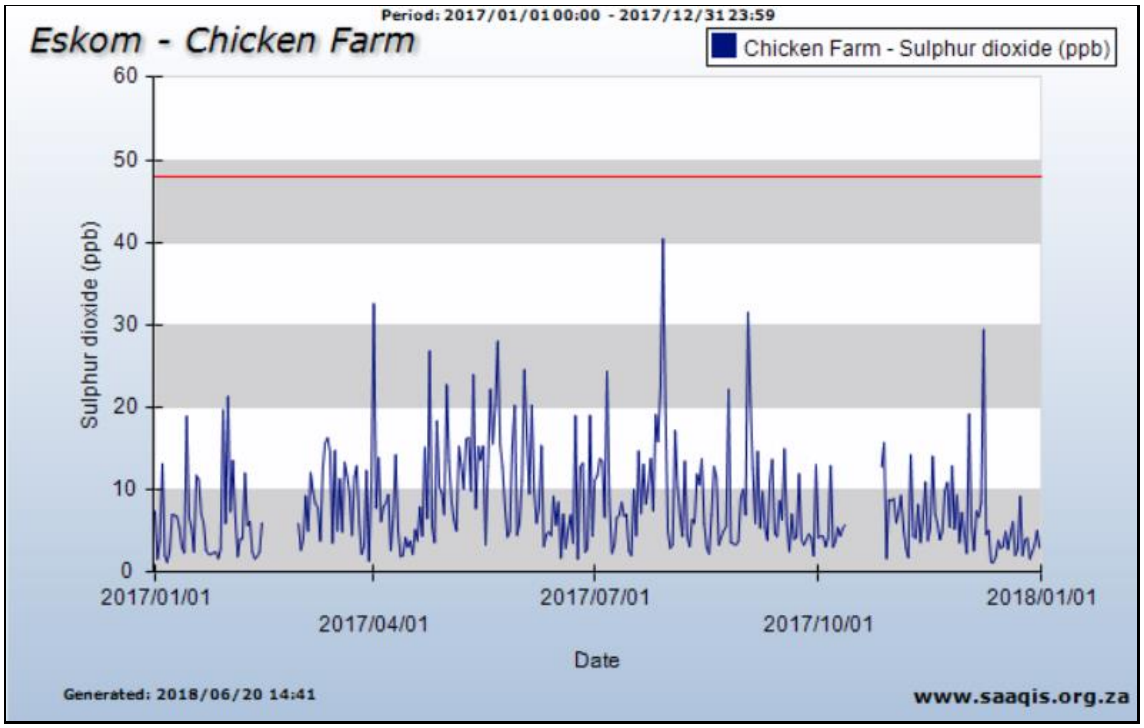


Figure 43: Sulphur Dioxide monitoring results at Eskom Chicken Farm site (daily standard: 48 ppb)

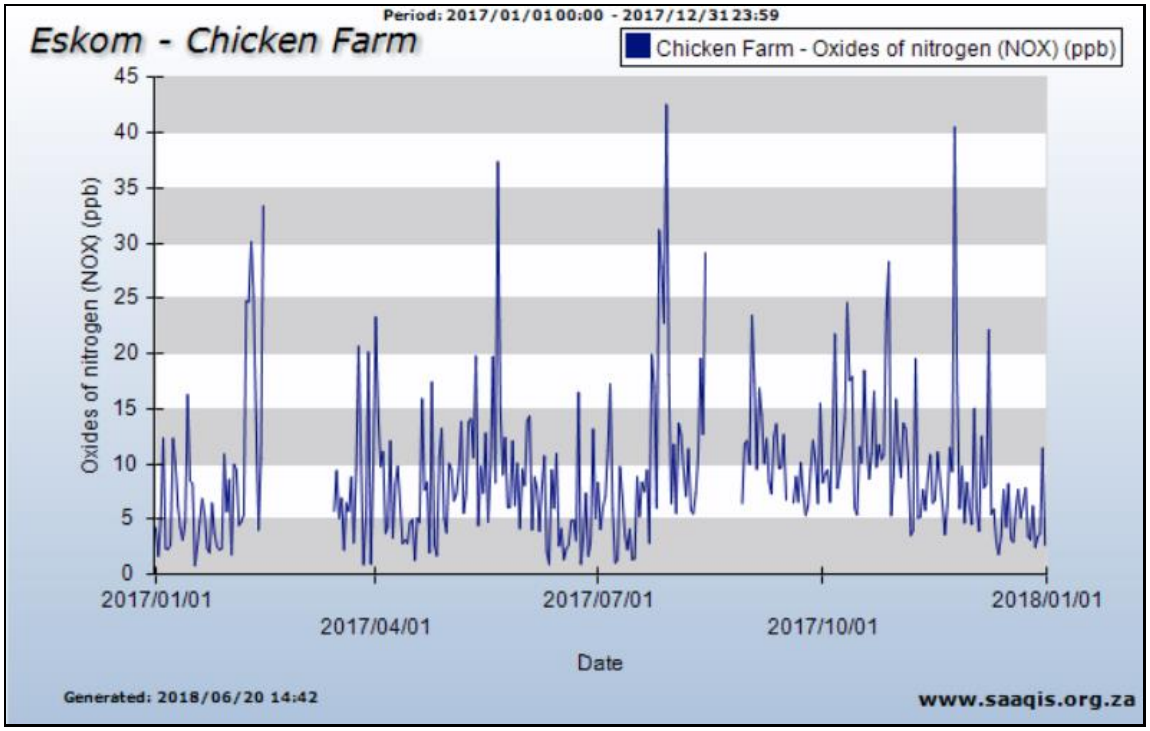


Figure 44: Oxides of Nitrogen monitoring results at Eskom Chicken Farm site (no daily standard prescribed)

8.2.7.2.3 Local ambient air quality

Ambient monitoring was undertaken as part of the baseline assessment of the air quality impact assessment. Baseline PM_{10} monitoring was conducted at eight positions, as indicated in Figure 45. The results are presented in Figure 46.

Table 34: Local PM_{10} monitoring results

Monitoring point	Ambient particulate matter (µg/m³)		
	Oct 16	Nov 16	Apr 18
Wocke	10.6	11.6	15.6
Burger	18.2	19.0	23.8
Van der Walt	22.7	21.9	24.1
Die Plaas	10.3	11.0	14.9
ST-PM1 (Blomme)			16.3
ST-PM2 (N12)			32.8
ST-PM3 (Rossgro)			12.5
ST-PM4 (Geluk)			17.1

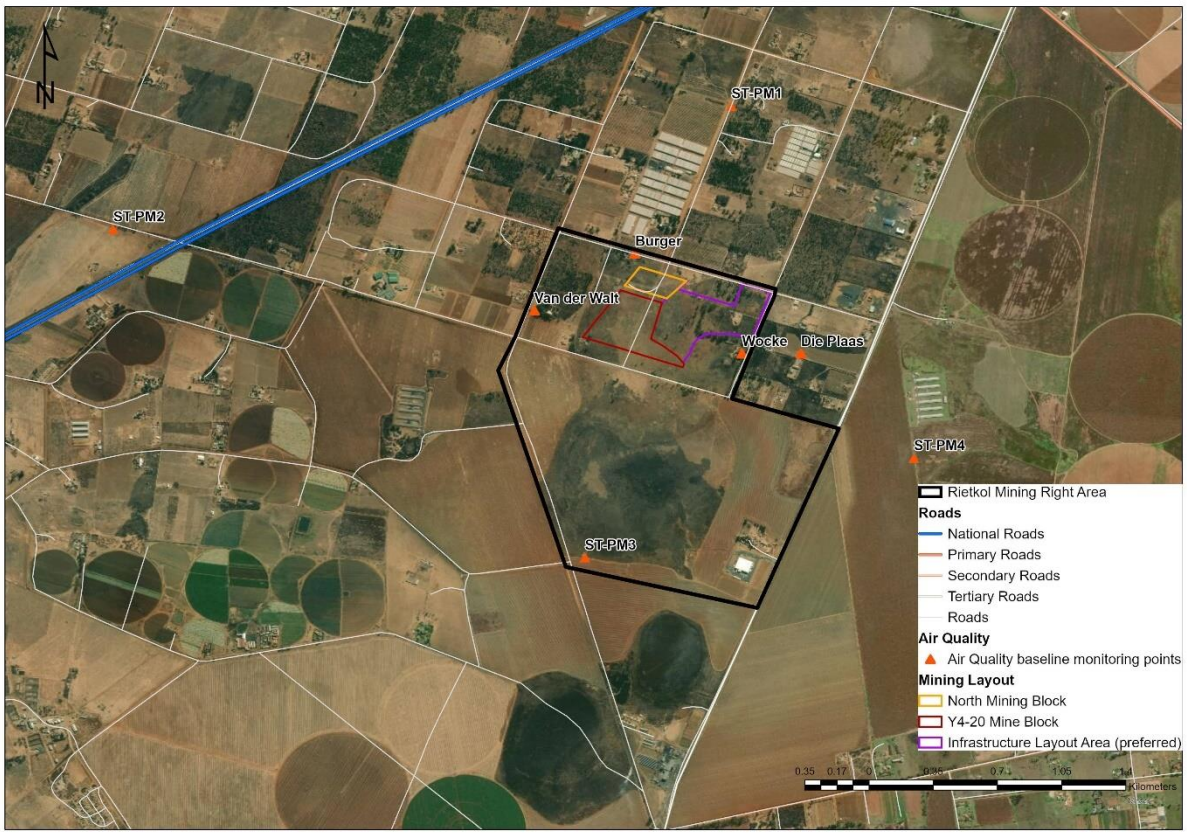


Figure 45: Baseline air quality monitoring points

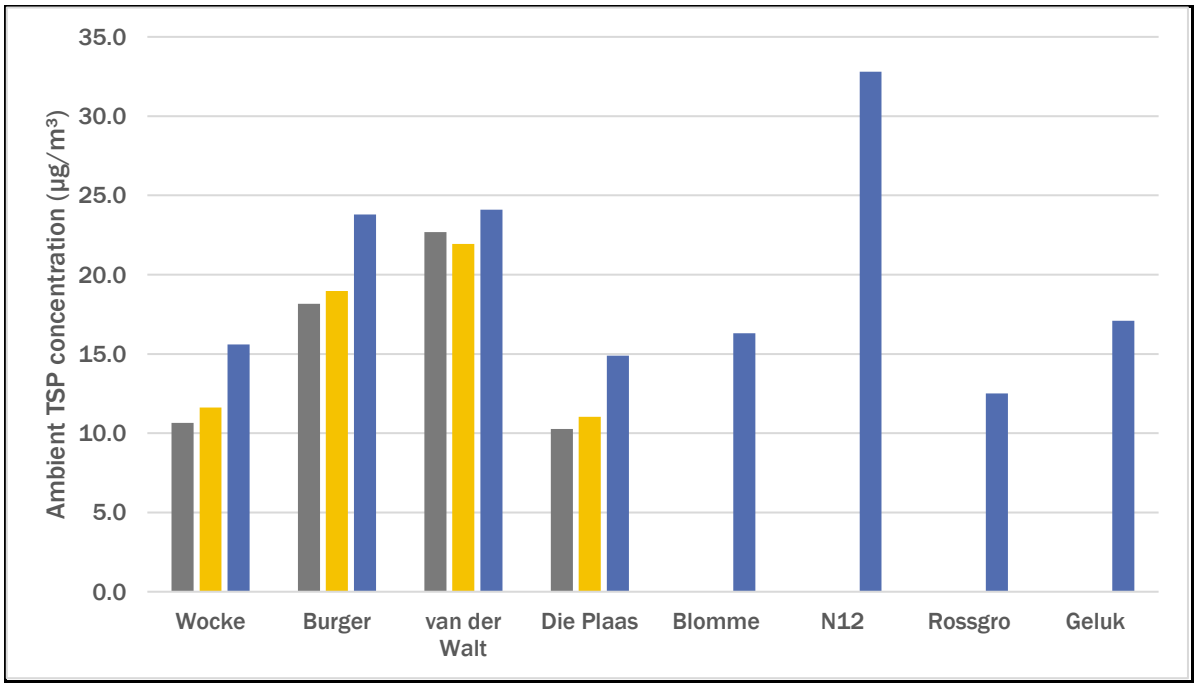


Figure 46: Local ambient PM_{10} monitoring results

The results indicate an ambient particulate load on the lower side of the ambient conditions for the HPA, and well below the National Standard PM_{10} daily average guideline of 75 µg/m^3.

8.2.8 Ambient Noise

8.2.8.1 Identified noise sources

The area is exposed to low frequency noises generated by the local road traffic (especially from the N12) and some tonal characteristics from the greenhouses that can be detected in the sound spectrum. The greenhouse fan noise is continuous in nature and is more detectable during the night hours at further distances from the source.

Identified noise sources in the region include:

- National Highway (N12) travelling from Johannesburg to Witbank (eMalahleni);
- Road 50 (R50) travelling from the N12 to Delmas;
- Main tarred road travelling from the R50 south towards Eloff;
- Groupings of greenhouses (especially fans of greenhouses) north of MRA area;
- Gravel road leading from main tarred road on the southern boundary of the MRA area; and
- General gravel road network of the region.

The study area can further be described in terms of environmental components that may contribute or change the sound character in the area, as follow:

- ***Topography***: The topography in the area can be described as *"Plains and Pans"* and there are little natural features that could act as noise barriers considering practical distances at which sound propagates.
- ***Surrounding land use***: The land use near the proposed development is agricultural and residential. Activities include crop cultivation, chicken coops and flower production with scattered dwellings featuring the bulk of the land use. The fans at the Unex Roses and chicken coops operate 24/7. The fans are quite audible and a significant source of noise at night.
- ***Roads***: The most important road (in terms of calculable acoustics near a receptor's dwelling) is the N12. Based on the 2003 data, the Average Annualized Daily Traffic (AADT) volume were approximately 6,500 vehicles. With a 6.5% growth, this would equate to an AADT for approximately 16,700 vehicles per day in 2018, or 955 vehicles during the day and 335 vehicles at night. Traffic on tarred road D1550 (leading from the R50 to Eloff) is quite audible during passing, with around 140 vehicles per hour (traffic count Tuesday, 17 April 2018). Assuming an AADT of around 5,000 vehicles per day (RAMS), traffic volumes would be ± 300 and 100 vehicles during the day and night-time periods. Traffic on the R50 is relatively high, but it is located further than 1,000 m from the project site, yet it may cumulatively contribute to noise

levels in the area. Traffic volumes similar to that of the D1550 were assumed. Other roads in the area do not carry sufficient traffic to warrant considering their contribution to the ambient soundscape (even though these roads do contribute to single events / during passing). The projected noise levels due to the main roads in the area are illustrated in Figure 47 and Figure 48, with the noise contours illustrated from 35 dBA upwards.

- ***Residential areas***: While there are several residential dwellings close to the proposed infrastructure, there are no formal residential/urban development closer than 2 000m from the proposed mine infrastructure.
- ***Other industrial and commercial processes***: There are several commercial and light industrial activities taking place on the AHs near the proposed development. A number of these activities are located close to the tar road, although based on the audible impression, the noise generating activities would be limited to daytime activities. While impulsive noises were audible, it was not considered significant.
- ***Ground conditions and vegetation***: The area falls within the Grassland biome, with the vegetation type being moist cool Highveld grassland. The natural veldt has been impacted significantly due to anthropogenic activities, with significant trees planted close the dwellings in the area. Most of the surface area is well vegetated with grasses, shrubs, sedges, and trees. Taking into consideration available information it is concluded that the ground surface is sufficiently covered to assume 50% hard ground conditions for modelling purposes. It should be noted that this factor is only relevant for air-borne waves being reflected from the ground surface, with certain frequencies slightly absorbed by the vegetation.

Figure 47: Projected conceptual ambient daytime noise levels due to roads

Figure 48: Projected conceptual ambient night-time noise levels due to roads

8.2.8.2 Existing ambient sound levels

Ambient sound measurements were conducted by Jansen (2016). Additional on-site measurements were collected 16-20 April 2018 by Enviro-Acoustic Research (EAR). The monitoring points are indicated Figure 49.

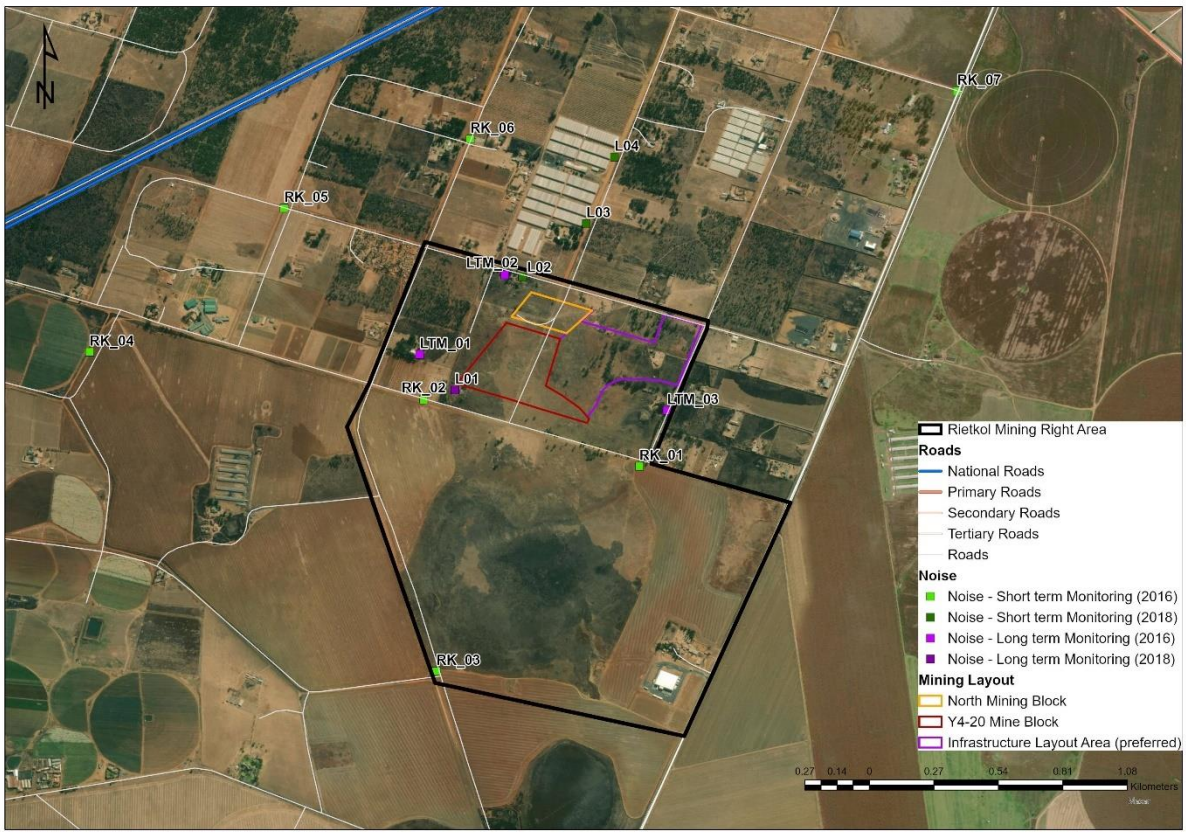


Figure 49: Baseline noise monitoring points

8.2.8.2.1 Results 2016 survey

The short-term noise measured results in 2016 are presented in Table 35. The survey identified some noise sources in the region (N12, local gravel road network and natural noises) which impact on the typical expected noise levels for the region. The region is classified as a rural area; however, with the proximity of the N12 and the busy tarred roads in the region, it is possible to classify the region as sub-urban with a major road in close proximity.

Table 35: Short-term noise monitoring results (2016)

ID	Name	Time	Duration (min)	L_{Aeq}	L_{ceq}	L_{A10}	L_{A90}	L_{AMIN}	L_{AMAX}
RK_01	SE corner of Site	10:48	60	50.5	64.0	51.7	36.7	32.3	82.4
RK_02	Bheki House	11:55	15	50.6	65.2	49.5	38.0	32.7	73.9
RK_03	Across the pan	12:17	15	39.7	63.4	42.9	33.0	28.6	61.4
RK_04	Highway monitoring point	12:40	15	46.3	68.5	47.4	44.5	40.7	63.6
RK_05	Highway monitoring point	13:06	15	46.8	66.1	49.7	43.8	37.8	55.1
RK_06	Agricultural Area	13:26	15	48.3	64.4	48.2	45.2	40.2	69.6
RK_07	UNEX Roses Road Side	13:50	15	68.1	76	70.3	50.2	35.2	85.2

The long-term noise measured are presented in Table 36. Jansen (2016) concluded that the area can be classified as "Urban – with major road" according to the SANS 10103:2008 type of districts, as the site is not rural in the pure aspect of a rural area.

Table 36: Long-term noise monitoring results (2016)

ID	Name	^{L}Req,daynight (dBA)	^{L}Req,day (dBA)	^{L}Req,night (dBA)
LTM_01	Van der Walt Home	57.21	54.53	50.04
LTM_02	Burger Home	55.17	52.11	48.20
LTM_03	Wocke Home	53.32	54.43	39.56
Average continuous rating levels calculating from LTM's		55.5	53.8	47.7
SANS 10103:2008 District D – Urban with Main roads		60.0	60.0	50.0

8.2.8.2.2 Results 2018 survey

Additional unattended long-term ambient (background) sound levels were measured over a four-night period from 16 - 20 April 2018 at monitoring point LO1 (Figure 49).

Table 37: Sound levels considering various sound level descriptors for LO1

	$L_{Amax,i}$ (dBA)	$L_{Aeq,i}$ (dBA)	$L_{Aeq,f}$ (dBA)	$L_{A90,f}$ (dBA90)	$L_{Amin,f}$ (dBA)	Comments
Day arithmetic average	-	53	49	41	-	-
Night arithmetic average	-	44	41	34	-	-
Day minimum	-	33	30	-	22	-
Day maximum	117	97	84	-	-	-
Night minimum	-	30	28	-	24	-
Night maximum	78	64	59	-	-	-

	$L_{Amax,i}$ (dBA)	$L_{Aeq,i}$ (dBA)	$L_{Aeq,f}$ (dBA)	$L_{A90,f}$ (dBA90)	$L_{Amin,f}$ (dBA)	Comments
Day 1 equivalent	-	56	49	-	-	Late afternoon and evening
Night 1 Equivalent	-	51	47	-	-	8-hour night equivalent average
Day 2 equivalent	-	62	55	-	-	16-hour day equivalent average
Night 2 Equivalent	-	50	45	-	-	8-hour night equivalent average
Day 3 equivalent	-	57	53	-	-	16-hour day equivalent average
Night 3 Equivalent	-	54	49	-	-	8-hour night equivalent average
Day 4 equivalent	-	59	54	-	-	16-hour day equivalent average
Night 4 Equivalent	-	50	45	-	-	8-hour night equivalent average
Day 5 equivalent	-	82	69	-	-	Morning and afternoon

The statistical data ($L_{A90,f}$) indicates a location with substantial elevated noise levels both day and night, even though L_{Amin} data indicates a location with a potential to become quiet. L_{Amax} levels frequently exceeded 65 dBA at night (more than 10 times each night) with the source unknown. When sound events occur at night (where the noise level exceeds 65 dBA) this may disturb the sleep of people. It should be noted that equivalent data shows a location where ambient sound levels are higher than the level desired for residential use at night (higher than 45 dBA).

In additional to the long-term measurement, a few single measurements were collected to gauge the noise levels from the fans located at the greenhouses (levels and spectral character). The data is presented in Table 38.

Table 38: Summary of singular noise measurements (2018)

Monitoring point	$L_{Aeq,i}$ level (dBA)	$L_{Aeq,f}$ level (dBA)	L_{A90} level (dBA90)	Comments
L02	50.6	49.5	47.0	Fans from the nursery significant and dominant sound. Birds and chickens audible at times, with some wind-induced noises. Agricultural equipment active in the area and clearly audible. Sounds of grinding and other workshop related activities audible at times.
L03	50.9	48.6	46.7	Fans from the greenhouses significant and dominant sound. Wind-induced noises due to plastic sheeting (from tunnels) occasionally flapping in the wind. Workers travelling up and down the gravel road on foot, via bicycle, tractor and a LDV. Voices audible at times. Nearby workshop related activities are taking place including grinding, use of hammers and drills etc. Wind-induced noises due to the presence of trees.

Monitoring point	$L_{Aeq,i}$ level (dBA)	$L_{Aeq,f}$ level (dBA)	L_{A90} level (dBA90)	Comments
L04	50.3	48.0	45.5	Fans from the greenhouses significant and dominant sound. Wind-induced noises due to plastic sheeting (from tunnels) occasionally flapping in the wind. Workers travelling up and down the gravel road on foot, via bicycle, tractor and in LDV. Voices audible at times. Nearby workshop related activities are taking place including grinding, use of hammers and drills etc. Wind-induced noises due to the presence of trees. Road traffic noise in distance, possibly the N12 traffic.

EAR (2018) concluded that, while measured ambient sound levels were higher, considering the developmental character of the area, the acceptable zone rating level would be typical of an urban area (45 dBA at night and 55 dBA during the day) as defined in SANS 10103:2008, acceptable for residential use. Mining activities (calculated noise levels) should not change these proposed acceptable rating levels with more than 7 dBA (disturbing noise) and ideally with no more than 3 dBA.

8.3 CULTURAL AND HERITAGE RESOURCES

R&R Cultural Resource Consultants conducted a Phase 1 Heritage Impact Assessment (HIA) of the MRA area during December 2016 and January 2017. The full report is attached as Appendix 3.

In addition, on the request of SAHRA, a desk-top Palaeontological Impact Assessment (PIA) was conducted by Dr Gideon Groenewald in April 2018. This report is attached as Appendix 4.

The findings of the two reports are briefly discussed below and should be read in conjunction with the specialist reports.

8.3.1 Palaeontology

The Rietkol Project area is dominated by large areas underlain by dolomitic rocks of the Hospital Hill Formation (Witwatersrand Supergroup), the Malmani Subgroup of the Chuniespoort Group (Transvaal Supergroup) as well as a cover of Permian aged Vryheid Formation of the Ecca Group (Karoo Supergroup).

The areas underlain by Vaalian aged rocks of the Hospital Hill Formation will have a Low palaeontological significance and underlies the entire central part of the development. The overlying

Malmani Subgroup is Very Highly sensitive for palaeontological heritage. It is important to note that the Malmani Subgroup contains significant karst formations and caves over its entire outcrop area, hence the high classification.

Geologically, the proposed development lies on the edge of the Vryheid Formation of the Ecca Group, which may contain plant fossils, especially in the shales above or below the coal. Bearing in mind that the terrain consists of quartzite outcrops where the sandstones have been metamorphosed, it is highly unlikely that fossils will be present in the rock. The objective of the mining is to extract sand and therefore there is no reason to penetrate the shale or coal layers.

The palaeontological sensitivity of the MRA area is indicated in Figure 50. The mining blocks are of Low sensitivity, whilst the infrastructure area is partly of Very High sensitivity and partly of Low sensitivity.

The desk-top PIA concluded that no mitigation for palaeontological heritage is recommended for this project before excavations reach a depth of 1.5m. A suitably qualified palaeontologist must visit the area indicated as Very High sensitivity during the first week of excavations. If excavations expose fossils, a Phase 1 PIA must be conducted, and a Chance Find Protocol (CFP) developed. The CFP must be included as part of the EMPr of the project, to record all unexpected fossils associated with the geological formations on site.

8.3.2 Stone Age

Quartz is hard and was frequently used for stone tool making. Isolated Middle Stone Age flakes were noted on the outcrop just north of the pan, but no intact primary site or stone knapping site was found, and no formal tools were observed. The terrain is not suitable for Rock Art as there are no large lose-standing boulders or rock overhangs which would facilitate rock art.

8.3.3 Iron Age

No Iron Age sites, or cultural material was observed.

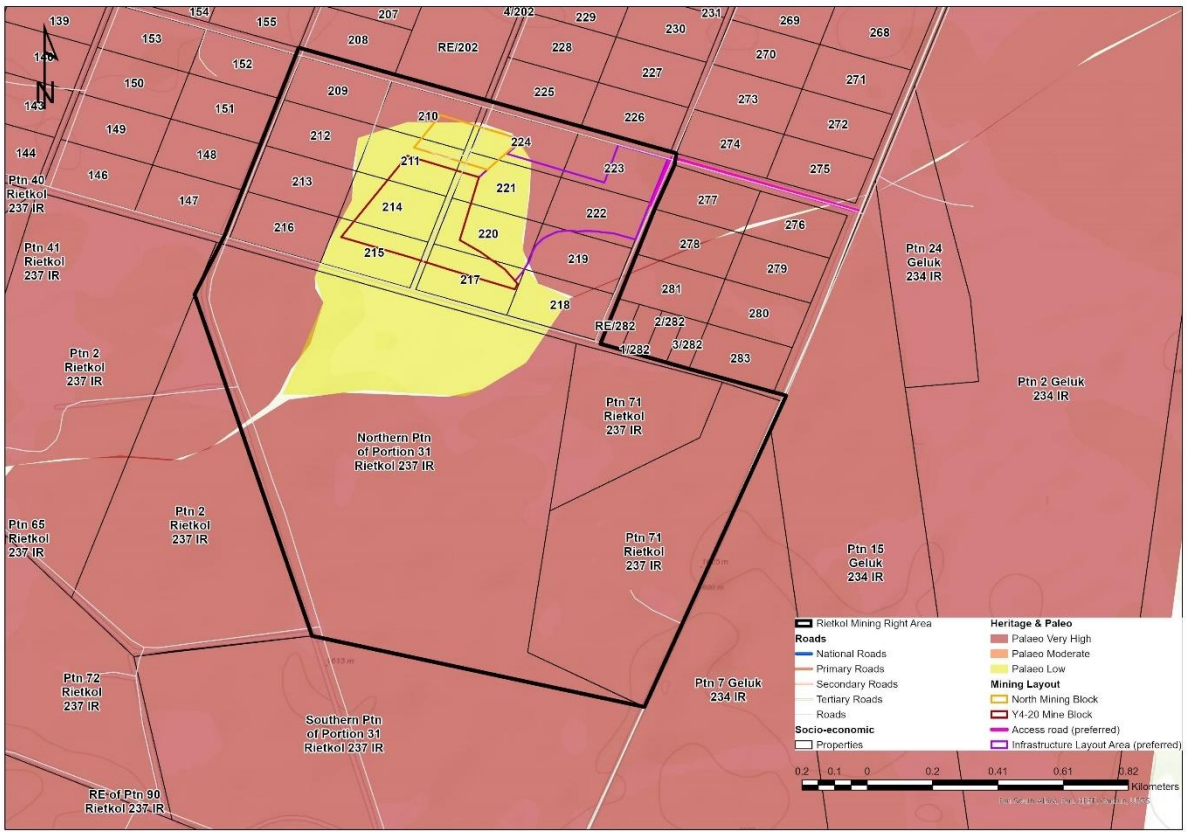


Figure 50: Palaeontological sensitivity of the area affected by the Rietkol Project

8.3.4 Graves and Burial Sites

An informal graveyard consisting of about 20 graves was recorded at coordinates S26°07'41.5" E28°36'32.2". Some of these graves are delineated by brick-and-mortar walls, whereas others are stone stacked. The graves are not maintained, are overgrown and some have been damaged by burrowing porcupines, while others have collapsed. Graves of both adults and children are present. None of the graves have headstones and no names could be discerned. The exact size of the graveyard and number of graves could not be determined accurately. The graves fall just outside of the mining pit area. The proposed mining will be undertaken in this area by YR15 according to the mining schedule, at which point the activity may impact on the graves.

8.3.5 The Built Environment

Several ruins exist of the properties, numbered 1 – 6 on Figure 51. Two of the ruins were homesteads (1 & 6), while the others relate to livestock and farming activities.

1. Ruins of a house and outbuilding constructed with a combination of fired clay bricks and cement blocks. The architectural design (shape and large windows) and building materials makes it highly unlikely that the structures are older than 60 years. Significance: Low. Coordinates: S26°07'40" E28°36'37"
2. Stacked large stones in two groups, the one resembling the letter J. Probably cleared from the adjacent ploughed field. Significance: None. Coordinates: S26°07'39.4" E28°36'22.8"
3. A structure that probably was a fowl-house. Contains modern prefab material. Connected to recording 1. Significance: None. Coordinates: S26°07'37" E28°36'23.4"
4. A pigsty constructed with cement blocks. Connected to recording 1. Significance: None. Coordinates: S26°07'35" E28°36'25.5"
5. Water trough and livestock pen. Connected to recording 6. Significance: None. Coordinates: S26°07'31.8" E28°36'25.2"
6. Ruins of a house and outbuilding. The house was constructed with fired clay bricks and mortar and the outbuilding of stone. Aspects such as the architectural design, ventilation ports and building material makes it highly unlikely that the structure is older than 60 years. A water tank stand constructed of brick and mortar stands near the house. Significance: Low. Coordinates: S26°07'29.8" E28°36'22.4"

All other buildings on the properties are modern.

Recording 7 is an old trigonometrical beacon (No. 626). Coordinates: S26°07'35.6" E28°36'30.3". The network of trigonometrical beacons on top of mountains and tall structures and buildings is known as a passive network since the beacon merely represents the position of the co-ordinate assigned to it and plays no role in updating or monitoring its position.

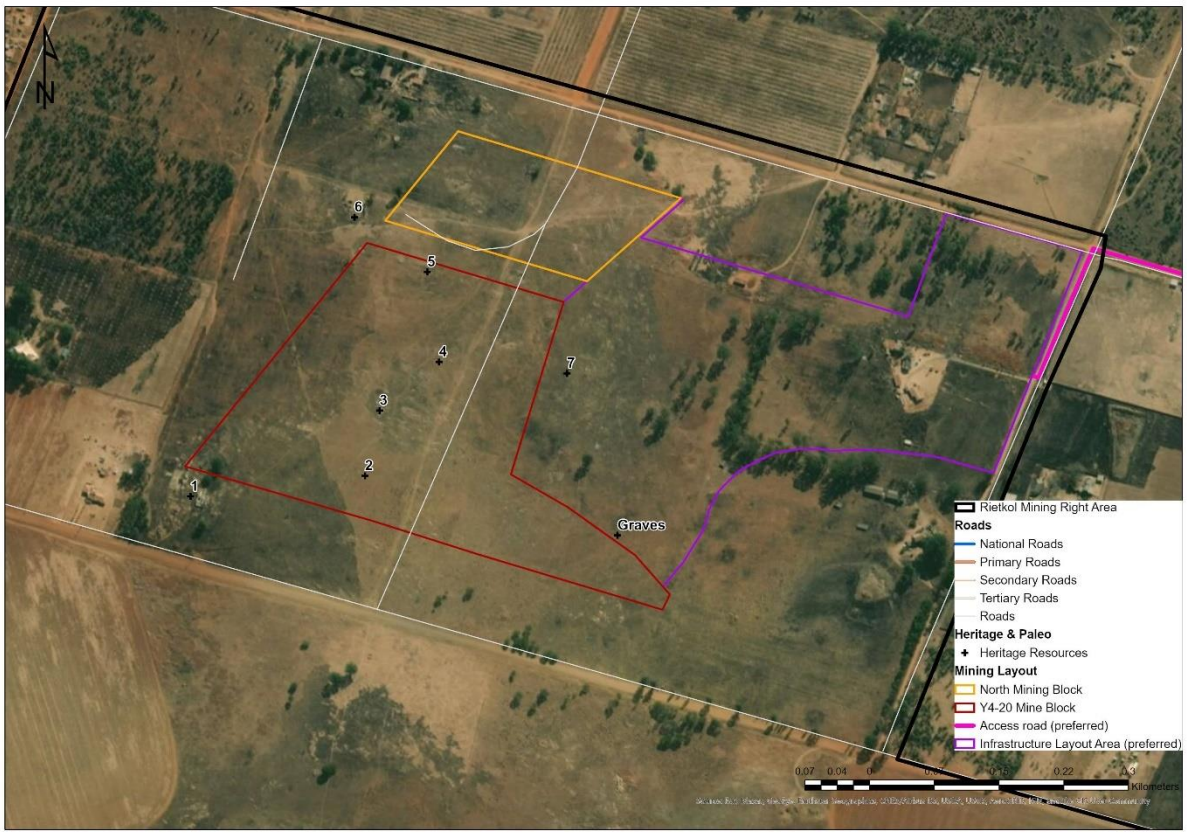


Figure 51: Heritage resources

8.4 SOCIO-ECONOMIC CHARACTER

8.4.1 Policy and Planning

8.4.1.1 South African Mining Charter

Focus on sustainable transformation of the mining industry. Mining Charter seeks to achieve the following objectives:

- To promote equitable access to the nation's mineral resources to all the people of South Africa;
- To substantially and meaningfully expand opportunities for HDSA to enter the mining and minerals industry and to benefit from the exploitation of the nation's mineral resources;
- To utilise and expand the existing skills base for the empowerment of HDSA and to serve the community;
- To promote employment and advance the social and economic welfare of mine communities and major labour sending areas;

- To promote beneficiation of South Africa's mineral commodities; and
- Promote sustainable development and growth of the mining industry.

Social management and mitigation measures, to be developed as part of the Social Impact Assessment (SIA), will be aligned to the Mining Charter.

8.4.1.2 National Strategy for Sustainable Development and Action Plan (2011)

The Strategy for Sustainable Development and Action Plan (NSSD1) is a proactive strategy that regards sustainable development as a long-term commitment, which combines environmental protection, social equity and economic efficiency with the vision and values of the country. It is a milestone in an ongoing process of developing support, and initiating and up-scaling actions to achieve sustainable development in South Africa (DEA, 2011) and has outlined the following strategic objectives:

- enhance systems for integrated planning and implementation;
- sustain ecosystems and use natural resources efficiently;
- move towards a green economy;
- build sustainable communities; and
- respond effectively to climate change.

8.4.1.3 National Spatial Development Perspective (NSDP)

The 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.

The Rietkol Project should take municipal-level spatial planning into account where possible.

8.4.1.4 National Development Plan 2030 (2010)

The national Development Plan 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 core elements of a decent standard of living identified in the plan are:

- housing, water, electricity and sanitation;
- safe and reliable public transport;
- quality education and skills development;
- safety and security;
- quality health care;
- social protection;
- employment;
- recreation and leisure;
- clean environment; and
- adequate nutrition.

8.4.1.5 Mpumalanga Provincial Economic Growth Path

The Mpumalanga Economic Growth and Development Path (MEGDP) is closely aligned to the National Strategy, but it however takes into consideration Mpumalanga's province-specific comparative and competitive advantages and the linkages to key provincial strategic objectives. The primary objective of the MEGDP is to foster economic growth that creates jobs, reduce poverty and inequality in the Province. The growth path is anchored on several parameters including sector development, inclusive & shared growth, spatial distribution, regional integration, sustainable human development and environmental sustainability with clearly defined strategic targets over the medium to long term.

In terms of the MEGDP, the mining industry remains one of the important economic sectors in the Province for economic growth and job creation. Recent studies conducted by the Province show that opportunities in the mining industry will come from these key commodities comprising of coal, chrome, gold, and dimension stones, now of recent is platinum. The mining industry also comes with secondary benefits including procurements, corporate social investments, beneficiation, retreatment of sub-economic deposits and dumps. According to the MEGDP, the industry is not without its challenges that causes barriers in the improved economic development and growth, namely a) upgrading and maintenance of the coal haulage network; b) increase the level of higher skilled graduates; c) Expand the water network and increase reliance on water transfer schemes; d) Increase

South Africa's base load and improve alternate energy supply; e) Establishment of a mining supplier park to enhance enterprise development in the province; f) Resolve land claims to release land for development; and g) Comprehensive support to small-scale mining enterprises.

The contribution of the agricultural sector to the GDP by Mpumalanga has been declining in the past ten years or so and consequently shedding jobs in the process. Analysis shows that, despite this declining trend in production and job absorption over time, this sector is still not performing to its optimal level yet. There is potential for growth and generation of more jobs. As part of the MEGDP, the province is targeting to create approximately 27 000 jobs in this sector in the next ten years. However, there are certain bottlenecks that will need to be resolved, including inadequate water for irrigation, outstanding land claims, access to land and competition between mining and arable land.

Tourism and cultural industries are also an important sector in terms of the MEGDP that can support economic growth. The wealth of natural and cultural resources that Mpumalanga possesses provides it with a base upon which to develop a sustainable industry. Refer to the Mpumalanga Tourism Growth Strategy below.

The MEGDP has set the following principles to provide guidance on mechanisms that will contribute to achieve their goals:

- Broad Based Black Economic Empowerment (BBBEE)
- Strategic Procurement
- Labour and Skills Development
- Inclusive and Shared Growth of the Economy
- Cooperatives
- Small Micro Enterprises (SME's)
- Finance and Funding

The key interventions that were emphasised for the province to focus on to give effect to the Growth Path include the following:

- Land Claims
- Water Allocation
- Transport and Logistics
- Electricity
- Policy & Regulations
- Communication

Mpumalanga Province has set ambitious targets to grow the economy and improve the lives of people in the Province. These targets are:

Table 39: Changes in socio-economic indicators

Changes in socio-economic indicators between 2011 and 2020		
Socio-Economic Indicator	2011	2020
Unemployment	28%	15%
Employment	890 000	1 609 656
Literacy levels	40 000 p.a.	63 000 p. a.
Life expectancy	51 years	62 years
Gini-coefficient	0.65	0.5

8.4.1.6 Mpumalanga Spatial Development Framework

The Mpumalanga SDF (2012) has identified the following strategic focus areas:

- The concentration of development within development and activity nodes with a regional and sub-regional function viz. Mbombela (Nelspruit), eMalahaleni (Witbank), Steve Tshwete (Middelburg), Govan Mbeki (Secunda) and Msukaligwa (Ermelo). Restructure these development and activity nodes to accommodate growth.
- The large population concentrations (supported by activity nodes) of Dr JS Moroka (Siyabuswa), Thembisile Hani (KwaMhlangwa), Bushbuck Ridge (Acornhoek, Bushbuckridge), Nkomazi, Nsikazi within Mbombela and Chief Albert Luthuli should:
    - Link with nearby nodes of economic potential by providing efficient transportation and roads infrastructure providing for high mobility of movement.
    - Integrate economic activities to provide local employment.
- The secondary activity nodes of Delmas, Standerton, Bethal, Belfast, Mashishing, Barberton, Komatipoort and Mkhondo should:
    - Balance the population with economic activities.
    - Provide social, economic, and engineering infrastructure in support of the existing population.
- The small settlements of Dr Pixley ka Isaka Seme (Volksrust), Dipaleseng (Balfour) and other smaller towns need to act as service centres for the surrounding population.
- The clustering of villages to allow for the provision of sustainable social and economic infrastructure should be encouraged.

- The housing of mining and power station personnel should take place in existing nearby towns (add to existing urban footprints).

The Mpumalanga SDF furthermore stipulates that infrastructure investment needs to promote the role and function of rural communities and focus on the development of communities to manage and develop their local economies, become self-sufficient, create livelihoods, add to the economy, and reduce their dependency on social grants. Rural development thus needs to provide for rural population clusters that can support sustainable economic, social, and engineering infrastructure, but also be accessible to higher order economic and social services within nearby urban nodes. Road and transportation linkages to urban areas need to be provided and maintained.

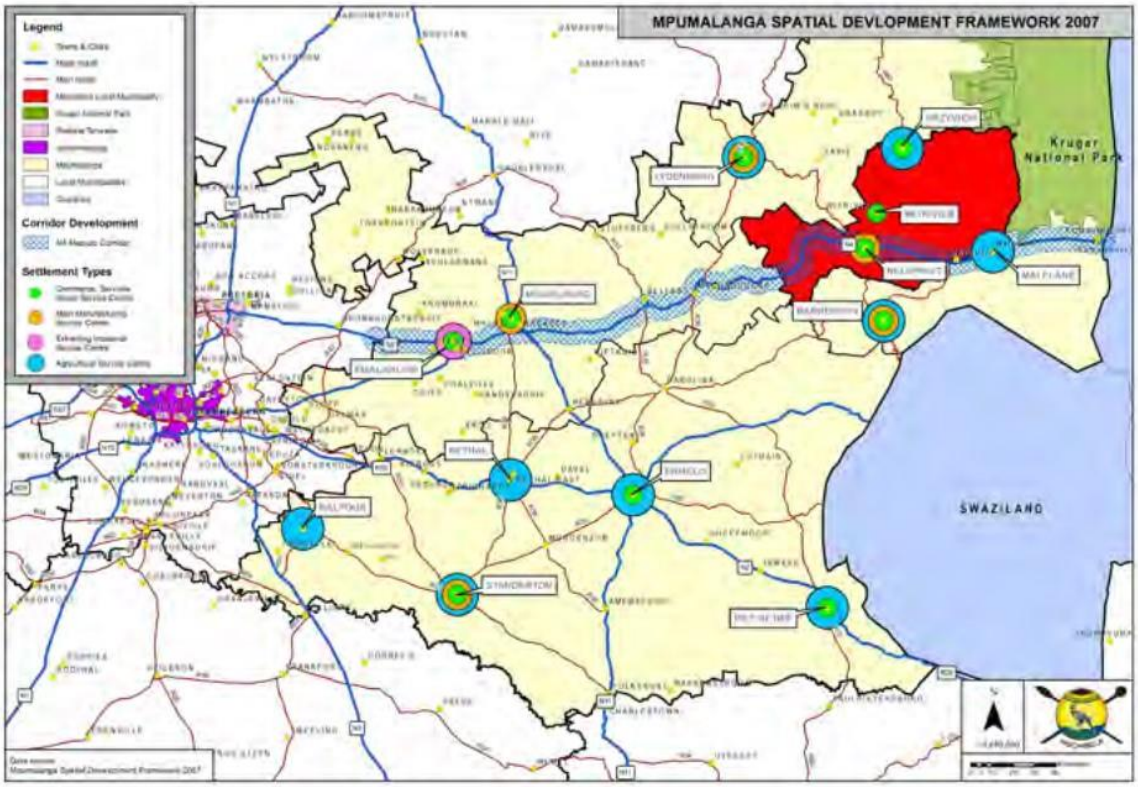


Figure 52: Mpumalanga Spatial Development Framework

8.4.1.7 Nkangala District Spatial Development Framework

The reviewed NDM Spatial Development Framework (SDF, 2014) is based on the following key principles:

- Principle 1: To achieve a sustainable equilibrium between urbanisation, biodiversity conservation, mining, industry, agriculture, forestry, and tourism related activities within the District, by way of effective environmental and land use management.

- Principle 2: To establish a functional hierarchy of urban and rural nodes (service centres/agri-villages) in the Nkangala District area; and to ensure equitable and equal access of all communities to social infrastructure and the promotion of local economic development by way of strategically located Thusong Centres (Multi-Purpose Community Centres) (MPCCs) in these nodes.
- Principle 3: To functionally link all nodal points (towns and settlements) in the District to one another, and to the surrounding regions, through the establishment and maintenance of a strategic transport network comprising internal and external linkages and focusing on the establishment of Development Corridors.
- Principle 4: To incorporate the existing natural environmental, cultural historic and man-made resources within the Municipality in the development of Tourism Precincts, with specific focus on the Tourism Gateway in the north-eastern parts of the District (Emakhazeni), as well as the northern and north-western mountainous parts of the District.
- Principle 5: To promote a wide spectrum of extensive commercial farming activities throughout the District, and to establish local fresh produce markets at the main nodal points identified.
- Principle 6: To optimally utilise the mining potential in the District without compromising the long-term sustainability of the natural environment.
- Principle 7: To concentrate industrial and agro-processing activities at the higher order nodes like Emalahleni and Steve Tshwete in the District where industrial infrastructure is available.
- Principle 8: To enhance business activities (formal and informal) at each of the identified nodal points in the Nkangala District by incorporating these activities with the Thusong Centres and modal transfer facilities.
- Principle 9: To consolidate the urban structure of the District around the nodal points by way of infill development and densification in identified Strategic Development Areas (SDAs) and Upgrading Priority Areas.
- Principle 10: To ensure that all communities (urban and rural) have access to at least the minimum levels of service as enshrined in the Constitution.

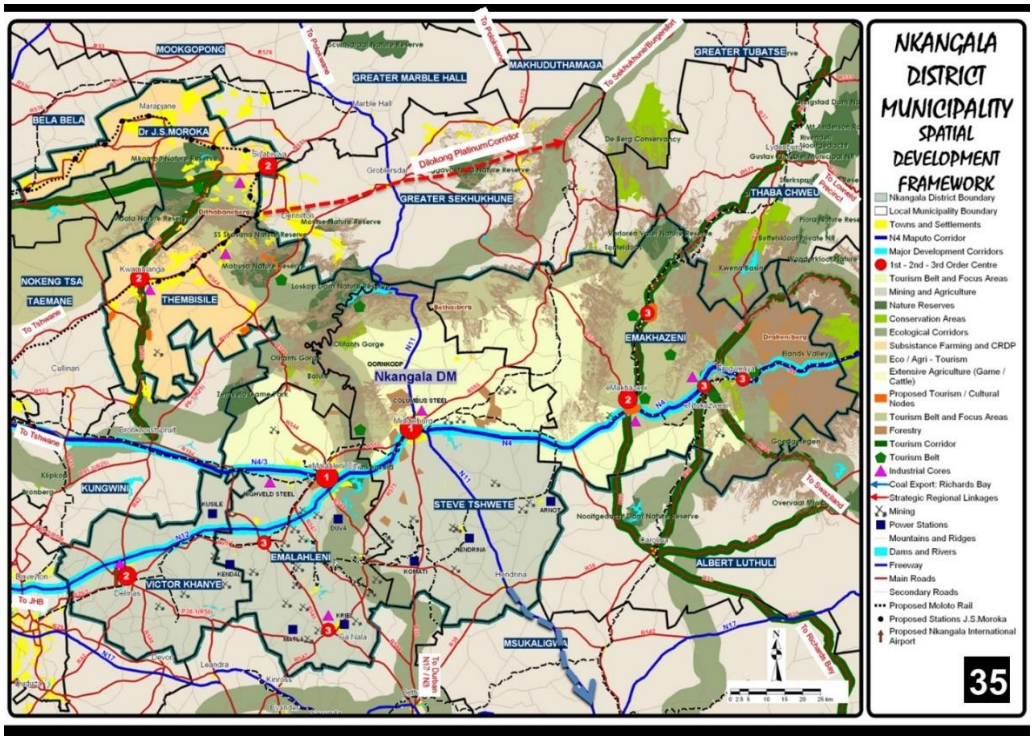


Figure 53: Nkangala SDF

8.4.1.8 Nkangala District Integrated Development Plan

The District's latest Integrated Development Plan (IDP) states that "it is the principal strategic planning instrument, which guides and informs all planning and development, and all decisions regarding planning, management and development, in the municipality. It is the key instrument to achieve developmental local governance for decentralised, strategic, participatory, implementation orientated, coordinated and integrated development." The compilation of the IDP must consider the current social environment to come up with Key Performance Areas (KPA) that would be formulated so as to address the various issued identified during that financial year.

8.4.1.9 Victor Khanye Local Municipal Integrated Development Plan

The Victor Khanye IDP has the following focus areas:

- Upgrading and refurbishment of Infrastructure.
- Land Development and Human Settlement needs.
- Local Economic Development.
- Institutional Development and Transformation.
- Financial position to be improved.
- Institutional capacity to deliver services in an efficient way to be enhanced.

- Governance and community involvement to be expanded.
- Infrastructure base to provide services and enable economic development, to be rehabilitated and expanded.
- Human settlement development to be expanded.

8.4.2 Summary of the Regional Policies

The table summarises the relevance and impact of the Regional Policies on the Rietkol Project:

Table 40: Regional Policy/Plan Summary

AREA	RELEVANCE TO THE RIETKOL PROJECT	
	SDF	**PGDP / IDP**
Mpumalanga	Focus on economic development Project is outside the Maputo Development Corridor as well as any Conservation / Biodiversity Corridors	Mining industry remains one of the important economic sectors in the Province for economic growth and job creation Challenges for mining development a) upgrading and maintenance of the coal haulage network; b) increase the level of higher skilled graduates; c) Expand the water network and increase reliance on water transfer schemes; d) Increase South Africa's base load and improve alternate energy supply; e) Establishment of a mining supplier park to enhance enterprise development in the province; f) Resolve land claims to release land for development; and g) Comprehensive support to small-scale mining enterprises.
Nkangala DM & Victor Khanye LM	Focussed on supporting Agricultural Development Outside Conservation and Tourism Nodes or Corridors Mining and Agriculture Victor Khanye LM: Within a Spatial Zone of Pre-dominantly mining	To ensure increased job creation and economic growth.

8.4.3 Institutional Location of the MRA area

The Nkangala District Municipality is one of the three (3) District Municipalities in Mpumalanga Province. The headquarters of Nkangala District Municipality are in Middelburg (Steve Tshwete Local Municipality). The Nkangala District consist of 6 Local Municipalities, i.e. Emalahleni, Dr J S Moroka, Victor Khanye, Thembisile, Emakhazeni, and Steve Tshwete. The area of the District covers a total area of approximately 16 892 square kilometres.

The municipality is situated in the western parts of the Nkangala District, and the north-central parts of Mpumalanga Province, with its headquarters in eMalahleni. The Emalahleni Municipal area, which means the “place of coal”, consists inter alia of the towns of eMalahleni, Kwa-Guqa, Ga-Nala and Ogies.

8.4.4 Regional Analysis

8.4.4.1 Towns and Settlements

The broader project area is located amongst existing towns and settlements. The closest formal towns are (refer to Figure 54):

Table 41: Nearest towns

No	Town	Direction	Distance
1	Delmas / Botleng	East	5 km
2	Daveyton / Etwatwa	West	15 km
3	Eloff	South	3.5 km

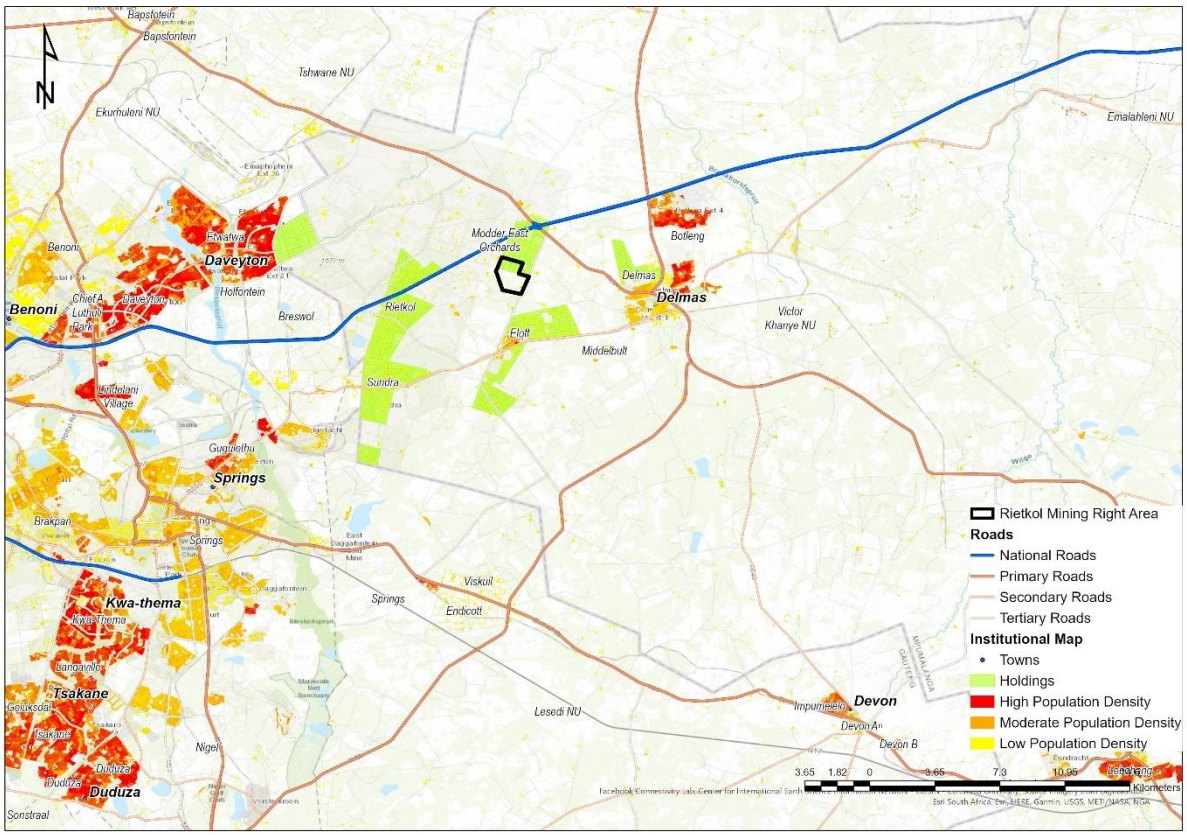


Figure 54: Towns and settlements

Some settlements and informal housing have been observed on the periphery of the formal towns. These are relevant as a risk of uncontrolled expansion in these areas due to the potential influx of jobseekers.

8.4.4.2 Demographic Analysis

Table 42: Demographic Indicators (2011)

Demographic	2001	2011	2016
Total population	56 335	75 452	84 151
Number of households	13 428	20 548	24 270
Population density (people per km^2)	36	48	54
Growth rate	1.14%	2.92%	2.48%
Average household size	4	3.6	3.5
Female headed households	28.2%	30.2%	30.9%
Young (0-14)	31.9%	28.2%	27.5%
Mid (15 – 64)	67.1%	67.1%	68.7%
Elderly (65+)	4.2%	4.7%	3.9%
Dependency Ratio	56.6%	49.1%	45.6%

The household dynamics within the region is a key determinant of the demand for services and employment. The average household size is indicative of the quality of life in an area. This connection is based on the following principle: In areas where average household size is higher the number of dependants is also expected to be greater and thus income per person will be lower.

The age and gender composition of a population can have a considerable impact on socio-economic development in an area. It is indicative of the size of the labour force, worker migration and the demands for health care and other social services.

8.4.4.3 Literacy rates and education

Table 43: Education Indicators

Education Indicators	2001	2011	2016
Population 20+ with no schooling (%)	26%	11.8%	10.7%
Population 20+ with matric (%)	14%	26.7%	26.0%
Population 20+ with higher education (%)	4.8%	7.7%	5.4%
Functional literacy rate (%)	56.0%	76.9%	Not known yet

Educational attainment is a key indicator of development in a population. To evaluate long term provision of education, it is important to disaggregate educational attainment for persons older than 20 years. This is an ideal group since they would have completed attending educational institutions indicating that the level of education they have is the final one. Statistics SA generated a measure of

educational attainment for persons over age 20. This group is expected to have completed educational enrolment and therefore giving a good measure for completed level of education.

8.4.4.4 Language

The most spoken language in this municipal area is isiZulu followed by isiNdebele.

8.4.4.5 General health and welfare

Table 44: Health Indicators

Health Indicators	2009	2010	2011
Mpumalanga			
HIV prevalence rate	35.5%	34.7%	35.1%
Nkangala District Municipal Area			
HIV prevalence rate	31.8%	32.6%	27.2%
Victor Khanye Local Municipal Area			
HIV prevalence rate - survey (pregnant women attending antenatal clinic 15-49 years old)	30.0%	25%	56.1%
HIV prevalence rate – DHIS (excluding pregnant women)	44.2%	34.4%	23%
TB cases		485	499

HIV/AIDS in South Africa has increased rapidly over the past decade. The social and economic consequences of the disease are far reaching and affect every facet of life in South Africa. Despite South Africa creating a progressive and far-sighted policy and legislative environment for dealing with HIV/AIDS, the prevalence of HIV/AIDS continues to increase. This indicates that policies and laws have not been adequately implemented and have not impacted significantly on the ground.

8.4.4.6 Basic Services and Housing

8.4.4.6.1 Housing

Table 45: Basic Infrastructure Indicators

Basic Service Infrastructure Indicators	2001	2011	2016
% of households in informal dwellings	37.9%	20.7%	16.8%
% of formal dwellings	62.1%	79.3%	83.2%
Housing owned / paying-off	51.4%	53.7%	61.4%

If there is a high backlog in formal housing availability, this must be taken into consideration by mining companies' housing provision strategies for their employees. Certain considerations and planning are also required to anticipate the impact of influx of work seekers into the local area.

The current housing status is important to determine the local area's capacity to respond to change.

With an established town and townships within the municipal area, sprawling informal settlements are found adjacent to the nodes, especially where there are mining and other economic activities. The existence of the informal settlements within the municipal area extends the service delivery backlogs in the municipality.

8.4.4.6.2 Water and Sanitation

Table 46: Water and Sanitation Indicators

Basic Service Infrastructure Indicators	2001	2011	2016
Is the municipality responsible to provide water?	Yes	Yes	Yes
Households to which water is provided (% of households)	72%	73%	75%
Households with piped connection inside dwelling (% of households)	28.2%	48.4%	54.4%
Households to which sanitation is provided (% of households)	72%	72%	71%
Households with flush toilet connected to sewerage	63.3%	70.6%	76.7%
% of households with no toilets or with bucket system	8%	5.7%	0.2%

Water and sanitation have generally improved in the municipal area due to service delivery increases.

With recent unrests regarding service delivery, it is important to ensure mining development does not place additional pressures on service delivery infrastructure and the capacity of municipalities to deliver the necessary services in the local area.

8.4.4.6.3 Electricity

Table 47: Electricity Indicators

Electricity Infrastructure Indicators	2001	2011	2016
% of households with electricity for lighting	65%	84.9%	91.0%

Electricity supply in the municipal area has increased dramatically since 2001.

8.4.4.6.4 Refuse Removal

Table 48: Refuse Removal Indicators

Refuse Removal Infrastructure Indicators	2001	2011	2016
% of households with weekly municipal refuse removal	62.3%	73.7%	69.1%

Weekly refuse removal improved between 2001 – 2011 but has decreased since with almost 5%.

8.4.4.7 Socio-Economic Profile

8.4.4.7.1 Development and Poverty Indicators

The Human Development Index (HDI) is a composite statistic of life expectancy, education, and income per capita indicators, which are used to rank countries into four tiers of human development. The index for any one country has a numerical range between 1 and 0. Countries with an HDI below 0.5 are considered to have a low level of human development, a score of 0.5 to 0.79 a medium level of development, and those with values of 0.8 and above are nations considered to have a high level of human development. South Africa has a HDI of 0.684, Mpumalanga 0.694 and Nkangala 0.62 in 2013. Provinces with an HDI below the national average deserve special attention as far as human development is concerned. Victor Khanye Municipality is ranked 10th in the province. The average household income in 2011 was R 80 239/annum or R 6 690/month/household, ranking as 9th in the province.

Table 49: Human Development Index

Development and Poverty Indicators	2001	2009	2013
Human Development Index (HDI)	0.48	0.54	0.61
Share of population below lower-bound poverty line	54.9%	44.3%	30.6%
Number of people below lower-bound poverty line	33 139	31 547	24 638
Bottom/poorest 40% share of income	7.7%	7.8%	8.0%
Gini-coefficient (0 best to 1 worst)	0.62	0.61	0.59
Palma ratio	6.64	6.20	5.74
Dependency ratio	56.6%	49.1%	45.6%

30.6% of the population are below the lower-bound poverty line in 2013, although it has improved and is still lower than provincial average it is higher than district average and ranked 5th lowest among local municipalities in the province. The proportion of income earned by the bottom/poorest 40% of households in the municipal area was 8.0% in 2013, which is less than National Development Plan/Vision 2030 target of 10% by 2030.

Gini-coefficient of 0.59 was recorded in 2013 which shows slight improvement between 2001 and 2013 & slightly lower (better) than the district and province.

The Palma ratio in South Africa increased (deteriorated) from 6.14 in 1996 to 7.90 in 2013. Therefore, for every R1 that the bottom 40 per cent of households earned, the top 10 per cent of households earned R7.90 in 2013. Similarly, the Palma ratio in Mpumalanga deteriorated from 5.34 in 1996 to 6.46 in 2014. In Nkangala in Palma ratio was 6.59 in 2013. In Victor Khanye there has been an

improvement, and for every R1 earned by the bottom 40% of households, R 5.74 was earned by the top 10% of households.

8.4.4.7.2 Household Income

Table 50: Household Income

Household Income	2001	2011
No income	21.07%	14.86%
R1 - R4,800	7.67%	3.75%
R4,801 - R9,600	20.93%	6.30%
R9,601 - R19,600	21.18%	17.54%
R19,601 - R38,200	14.54%	21.43%
R38,201 - R76,4000	7.04%	16.30%
R76,401 - R153,800	4.09%	9.46%
R153,801 - R307,600	2.35%	5.72%
R307,601 - R614,400	0.67%	3.21%
R614,001 - R1,228,800	0.17%	0.85%
R1,228,801 - R2,457,600	0.15%	0.32%
R2,457,601+	0.13%	0.26%

8.4.4.7.3 Employment Status

Table 51: Labour Indicators

Labour Indicators	2001	2011
Unemployment rate (%)	42.2%	28.2%
Youth Unemployment rate (15 – 34 years)	52%	35.8%
Working Group	36 207	50 605
Economically Active Population/Labour Force	24 491	34 975
Number of employed	13 266	21 843
Number of unemployed	9 809	8 573
Discouraged Workseeker	0	2 477

Unemployment rate in Victor Khanye has decreased dramatically since 2001 from 42.2% to 28.2%.

Table 52: Employment per Sector

Employment per sector	2011
Agriculture, hunting, forestry and fishing	18.2%
Mining and quarrying	12.7%
Manufacturing	7.8%
Utilities	0.5%
Construction	5.9%
Trade	18.7%
Transport	5.2%
Finance	4.9%
Community Services	14.3%
Private households	11.9%

The leading industry in terms of employment is trade with 18.7%, followed by agriculture 18.2% and mining 12.7%.

8.4.4.7.4 Economic Sectors

Table 53: Economic Indicators

Economic Indicators	Trend 1996 -2013		Forecast 2013 - 2018
GDP growth (%)	2.6%		2.7%
Contribution to Mpumalanga GVA (%)	Trend 2001	Trend 2007	Latest Figure 2011
	18%	18%	17.9%

Source: Statistics South Africa, Census 2011

It is expected that the municipality would have a GDP growth of 2.7% per annum by 2018, which would be higher than the Nkangala district and province. Community services, mining, trade, and transport should contribute the most to Victor Khanye's economic growth in the period 2013-2018. GVA at 2013 constant prices was R 4.7 billion.

Table 54: Sector's Share of Regional Total (%)

Industry	2001	2013	Industry Average Annual Growth, 2009-2013	Future Growth
Agriculture	11.0%	11.2%	0.2%	Low
Mining	29.3%	23.2%	-6.1%	Low
Manufacturing	3.5%	3.7%	0.2%	Medium
Utilities	0.9%	0.8%	-0.1%	Low
Construction	1.7%	3.0%	1.3%	Medium
Trade	14.8%	17.1%	2.3%	Medium
Transport	9.5%	12.4%	2.9%	Medium
Finance	12.0%	10.1%	-1.9%	Low
Community Service	17.3%	18.7%	1.4%	Low

Source: Municipal IDP's

The Economy of the municipality is driven by the mining sector which contributed 29.3% in 2001 to the local economy. Over the 12-year period, mining has had a steady decreased contribution to the economy of Victor Khanye, which will coincide with a reduction in jobs from this sector.

8.4.4.8 Difficulties facing the Local Municipal Area

From the socio-economic analysis, it is evident that Victor Khanye faces several challenges that should be addressed by growing certain sectors of the economy that can generate employment opportunities, reduce poverty as well as the poverty gap in line with the terms of the New Growth Path.

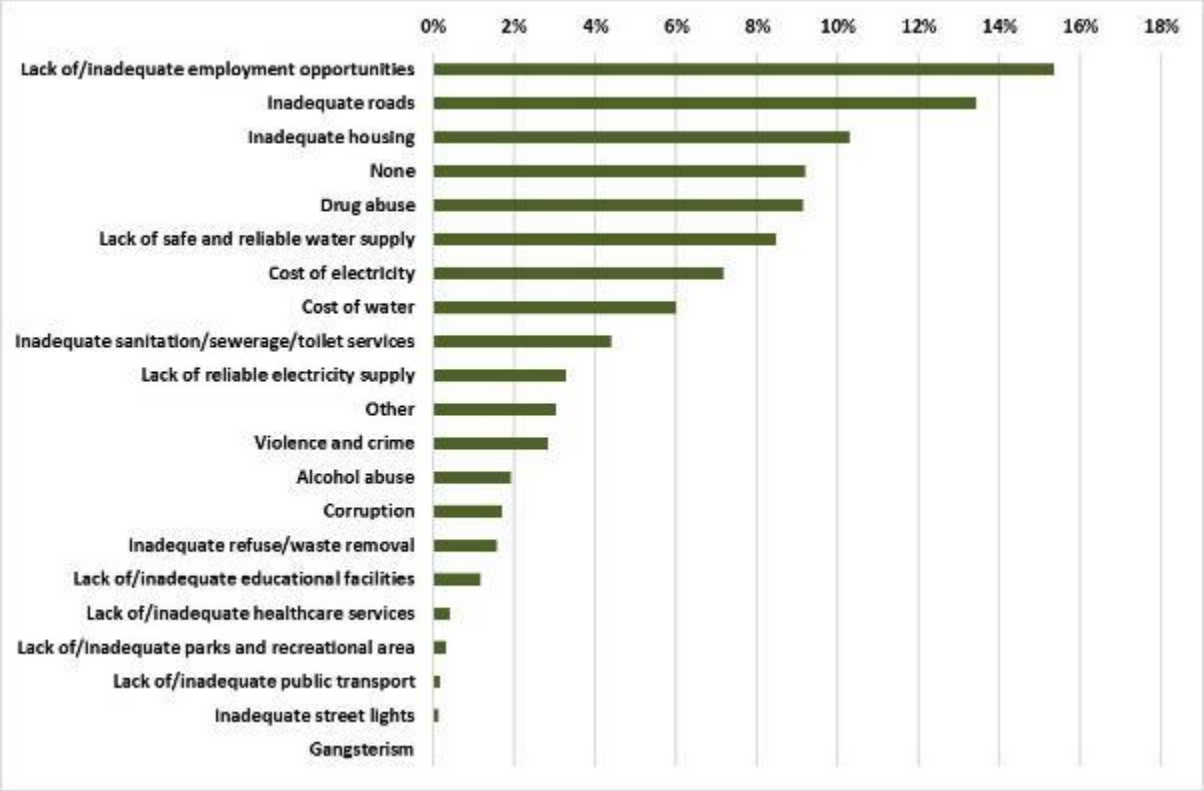


Figure 55: Difficulties experienced by the municipality (Community Profile 2016)

8.4.5 Local Analysis (MRA area & 1km radius)

8.4.5.1 Settlements and Land Occupants

Within the broader project area there are no formal towns. There are, however, built-up areas and residential structures located on many of the AHs, which may constitute a rural dispersed settlement in the broader context. Figure 56 indicates residential structures and built-up areas in relation to the MRA area. In the study areas the following residential structures can be found:

Structure Type	MRA area	Within 500m of MRA area	Between 500m and 1km of the MRA area	Total
Owner / Tenant Residential Structures	12	36	28	**76**
Worker Residential Structures	13	36	13	**62**
Support Structures	22	39	27	**88**
Informal Settlement	0	140	0	**140**
Total	**47**	**251**	**68**	**366**

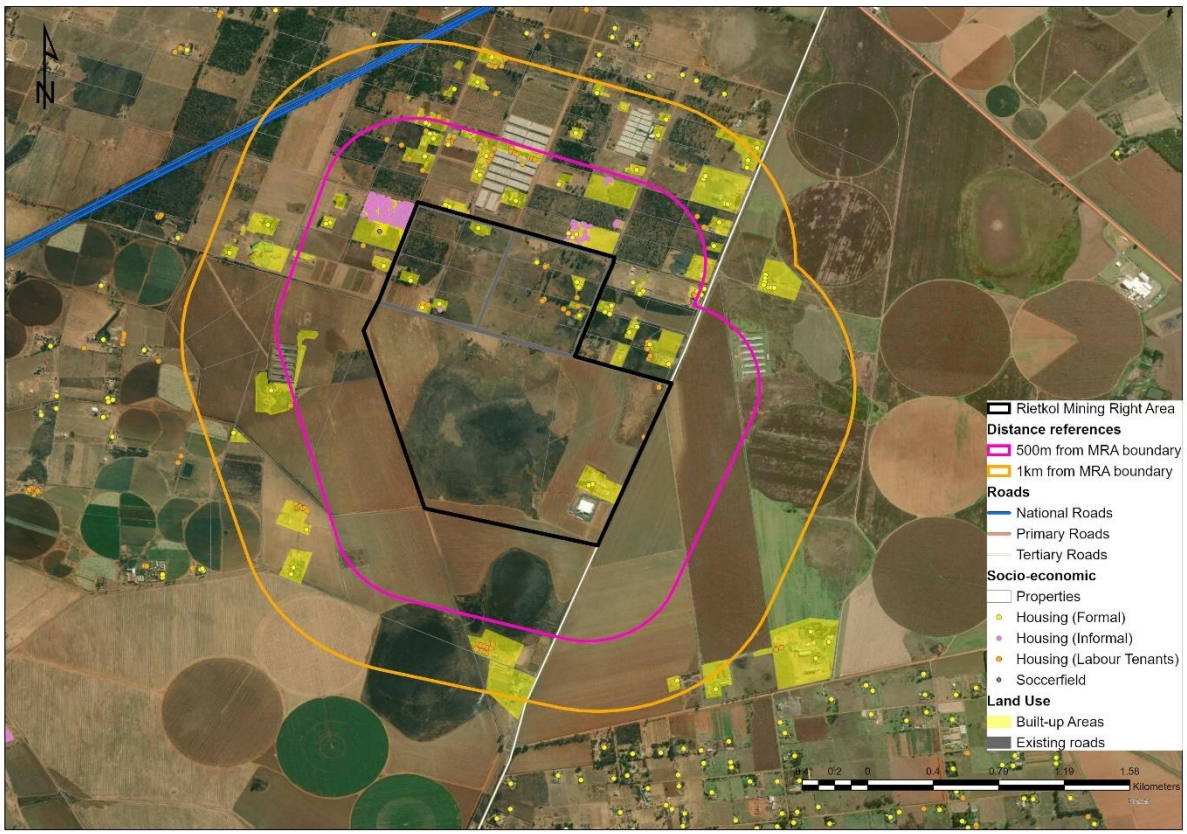


Figure 56: Residential and built-up areas

Apart from the land occupants or labour tenant housing located on the various properties, there are five AHs that have occupants that constitute the start of or an informal settlement. These are AH 152 spreading over to AH 151, and AHs 226, 227 and 230.

A skills assessment conducted in 2018 on the informal settlements located within 500m from the MRA area revealed the following:

Table 55: Informal settlement skills assessment (2018)

AH	Total persons between 18 - 60	% currently employed	% with formal skills	% with informal skills	% with no specific skill
152/151	85	64.7% (55)	8.2% (7)	42.4% (36)	49.4% (42)
226	32	90.6% (29)	6.3% (2)	87.5% (28)	6.3% (2)
227	9	77.8% (7)	0% (0)	77.8% (7)	22.2% (2)
230	10	100% (10)	0% (0)	100% (10)	0% (0)
TOTAL	**136**	**74.3% (101)**	**6.6% (9)**	**59.6% (81)**	**33.8% (45)**

The following further information was found:

- Employed: In total 74.3% (101 of 136) of the employable workforce is currently employed or self-employed. The major employers of the people residing in these settlements are:

- Unex Roses & Prickley Pears employs 37 people (36.6%)
- Rossgro employs 11 people (10.9%)
- MBFi employs 8 people (7.9%)
- Pretorius Blomme employs 8 people (7.9%)
- Properties surrounding the MRA area employ 11 people as domestic/other workers (10.9%)
- Parties/companies within Eloff employs 11 people (10.9%)
- Parties/companies within Delmas employs 10 people (9.9%)
- Self-employed: 5 people (5%)

- Formal skills: In total 6.6% (9 of 136) of the employable workforce have formal skills. Two (2) of these are unemployed but do have formal artisan and operator skills and are therefore highly employable.
- Informal skills: In total 59.6% (81 of 136) of the employable workforce have informal skills. Of the 81 only 6 are currently unemployed, amongst them cleaners, security, and agricultural workers.
- No specific skills: In total 33.8% (46 of 136) of the employable workforce have no specific skills. Of the 46, 30 are unemployed. Of the 30 currently unemployed, 9 have their Matric, a further 8 is functionally literate, and 13 have low literacy and education.

Further social surveys will be conducted during the EIA Phase to update the information with more recent data.

8.4.5.2 Residential Investment or Commercial Development

Residential and commercial development within the Victor Khanye Local Municipality (LM) is mostly around primary and secondary development nodes, such as Delmas/Botleng and Eloff. In recent years AHs have been increasingly developed for commercial or residential investment properties rather than agriculture.

In terms of the Victor Khanye LM Land Use Management plan the Modder East AHs are to be utilised for low density residential development (Figure 57).

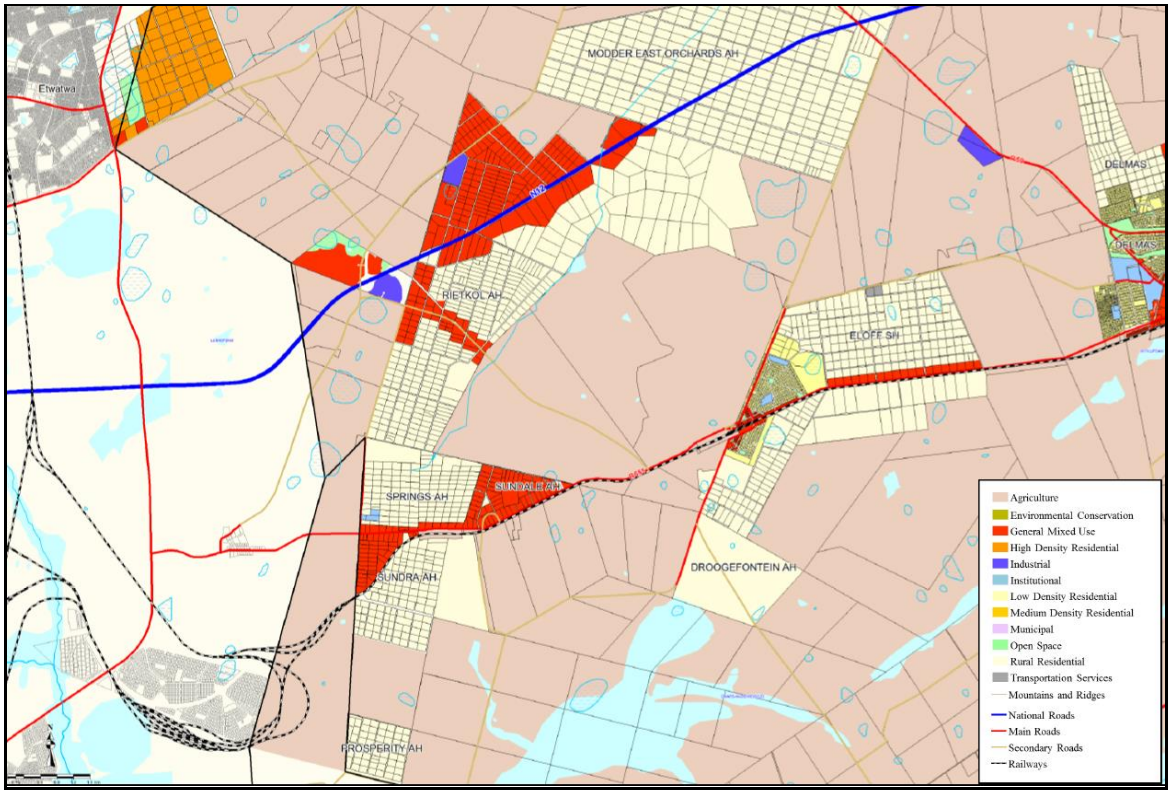


Figure 57: Victor Khanye LM land use management plan

Within the Modder East AHs, many properties have been converted from rural residential to residential investment properties (properties constructed to rent out) with more than 1 residential structure on a property and commercial development (workshops, panel beaters, offices, etc.). Figure 58 indicates the study areas and where either residential investment or commercial development was found.

8.4.5.3 Agricultural Land Use Activities

The agricultural land use in the study areas consists of a variety of agricultural businesses, i.e. pasture grass, crop cultivation grown in rain fed and pivot irrigation areas, horticulture (rose and cut flowers), egg layer houses, livestock farming and horse training (equestrian centre). Crops include maize, soya, and vegetables. Pecan nut trees have been planted on AH 213. Pasture production includes Teff and Russian grass for livestock feed. With the good rainfall in the area, dry land production is high. Microbial Biological Fertilizers International (MBFi) also have their Fungal Department on AH 144 with experimental crops on AHs 146, 147 and 216.

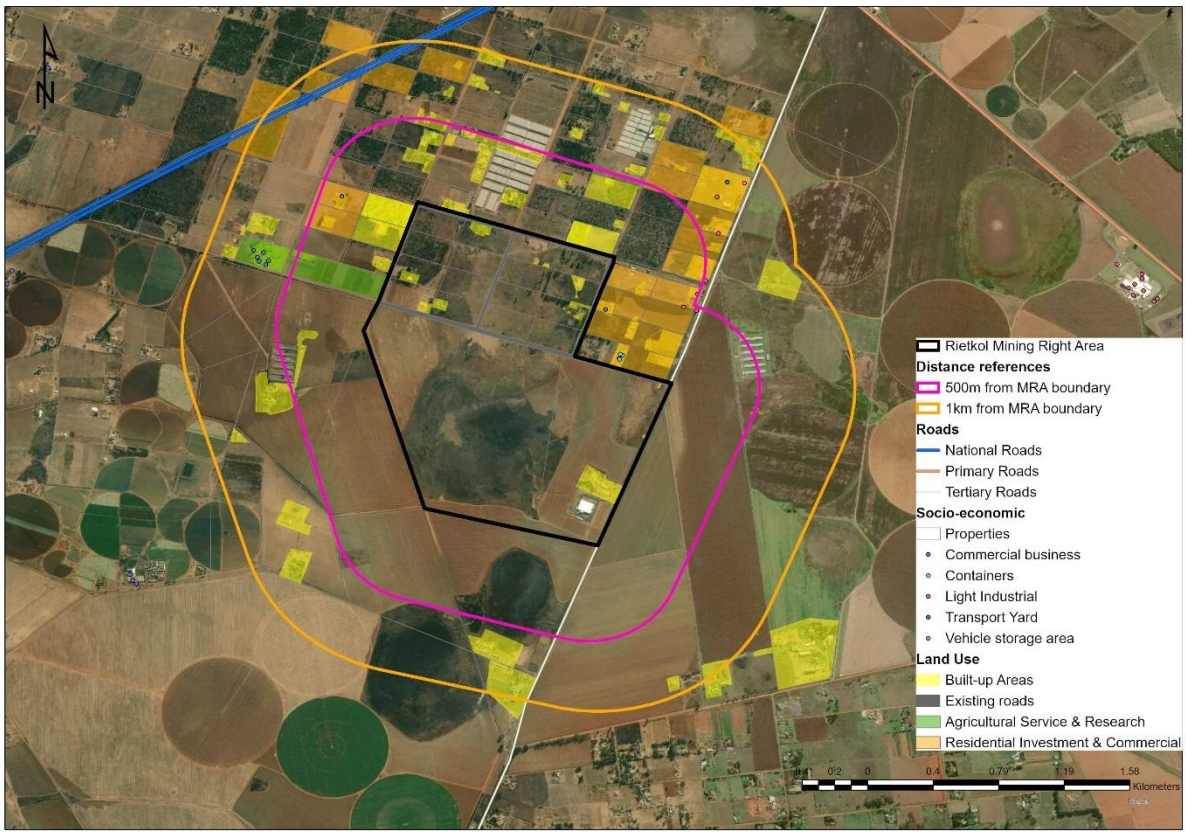


Figure 58: Residential investment or commercial development

The agricultural activities are summarised in Table 56 as indicated in Figure 59.

Table 56: Agricultural land use activities

Primary Land Use	MRA area		Within 500m of MRA area		Between 500m and 1km of MRA area		Total	
	No	ha	No	ha	No	ha	No	ha
Agricultural Land use								
Grazing	13	99.40	31	151.71	32	448.89	77	700
Crops	5	56.43	14	336.11	21	671.82	40	1064.36
Vegetables					2	19.91	2	19.91
Cactus Pears			1	6.95	1	7.33	2	14.28
Pecan Nuts	1	1.52					1	
Teff/Hay/Russian Grass			7	10.44			7	10.11
Floriculture / Roses			3	6.93	3	3.43	6	10.36
Equestrian					3	3.2	3	3.2
Poultry			2	6.30			2	6.3
Vegetables					3	19.91		
Other natural areas		50.8						
Built-up areas								
Farm Homesteads and Outbuildings		6.54		21.1		11.95		
Informal Settlements (squatters)				5.0				

Primary Land Use	MRA area		Within 500m of MRA area		Between 500m and 1km of MRA area		Total	
	No	ha	No	ha	No	ha	No	ha
Business Administration and Premises				17.4		24.3		
Equestrian						3.2		
Security Business				0.49				
Roads		**7.35**						
Total properties assessed	**19**	**222.04**	**58**	**562.43**	**65**	**1239.65**	**126**	**1828.52**

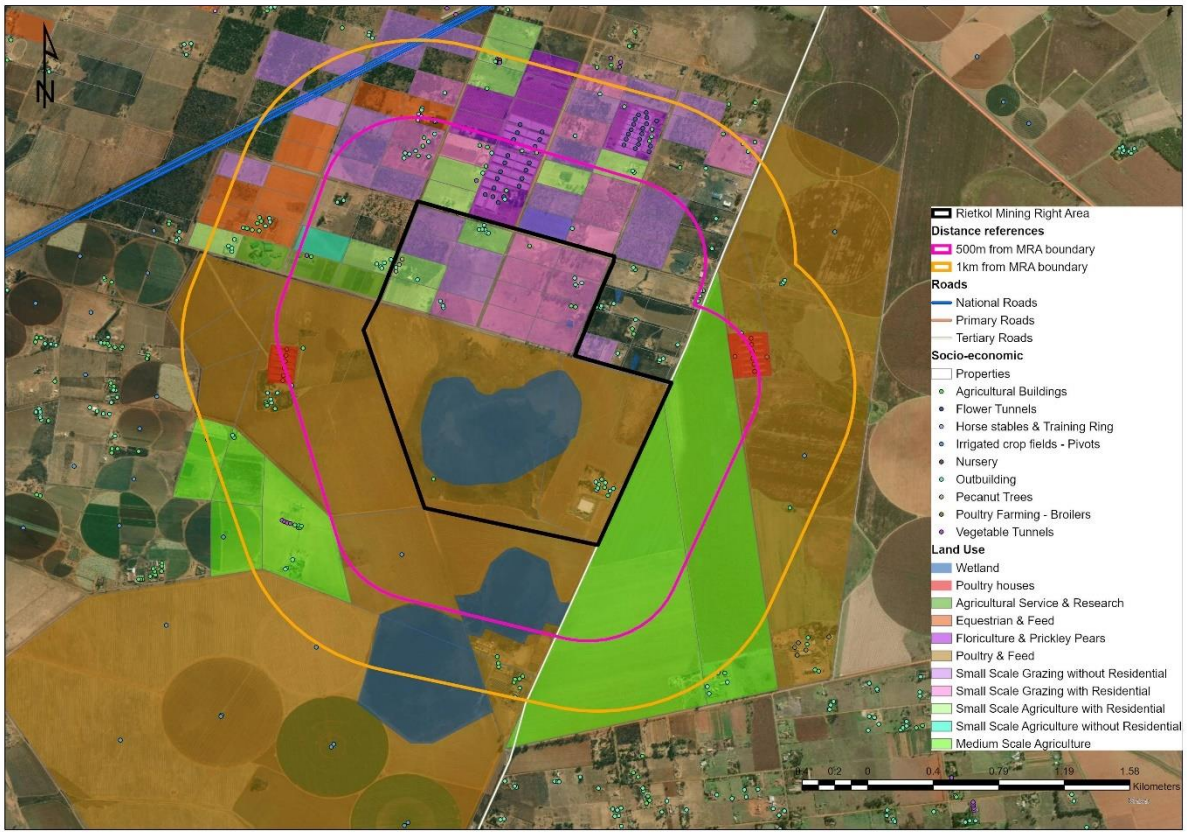


Figure 59: Agricultural activities in project area

8.4.5.4 Mining Activities

Figure 60 illustrates the spatial distribution of applications for mining and prospecting licenses in the municipal area (source Victor Khanye SDF). The entire eastern and southern extents of the municipal area are covered by mining license applications, while there are prospecting license applications on almost the entire remainder of the municipal area.

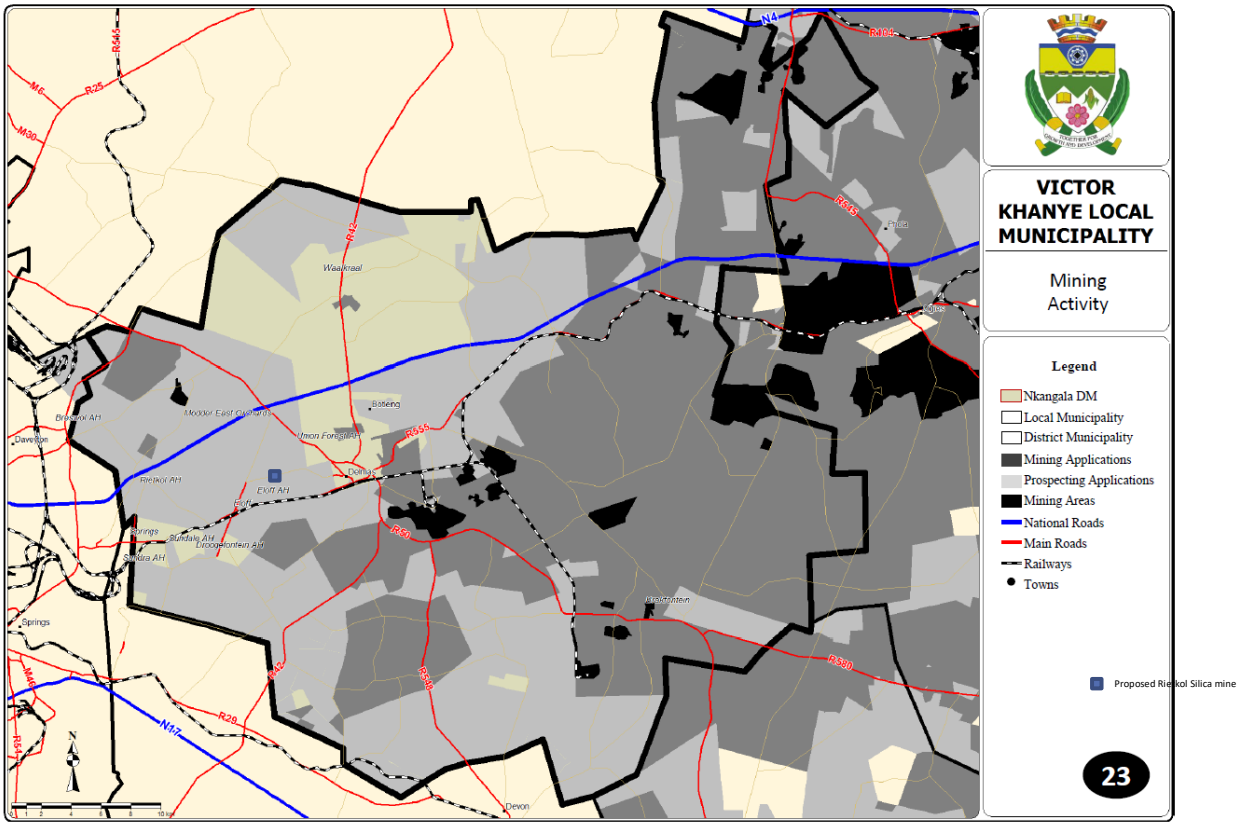


Figure 60: Prospecting, mining applications and mining areas (Victor Khanye SDF, 2015)

Also shown on Figure 60 is the footprint of existing mining activities (as per the SDF). The spatial extent of mining activities is significantly less than the area covered by the license applications. The two predominant mining areas are around Delmas, and in the far north-eastern corner of the municipal area. Mining activities recently also expanded to the west of the municipal area. Based on available information the mining activities are mostly related to coal, quarrying and/or sand mining activities.

Figure 61 shows the mining activities near the proposed Rietkol Project. The Palmietkuilen Coal mine of Canyon Coal is located 11.3 km to the south, the Eloff Mining of Exxaro 5 km to the south and Kangala Colliery of Universal Coal 7 km to the south-east of the Rietkol MRA area.

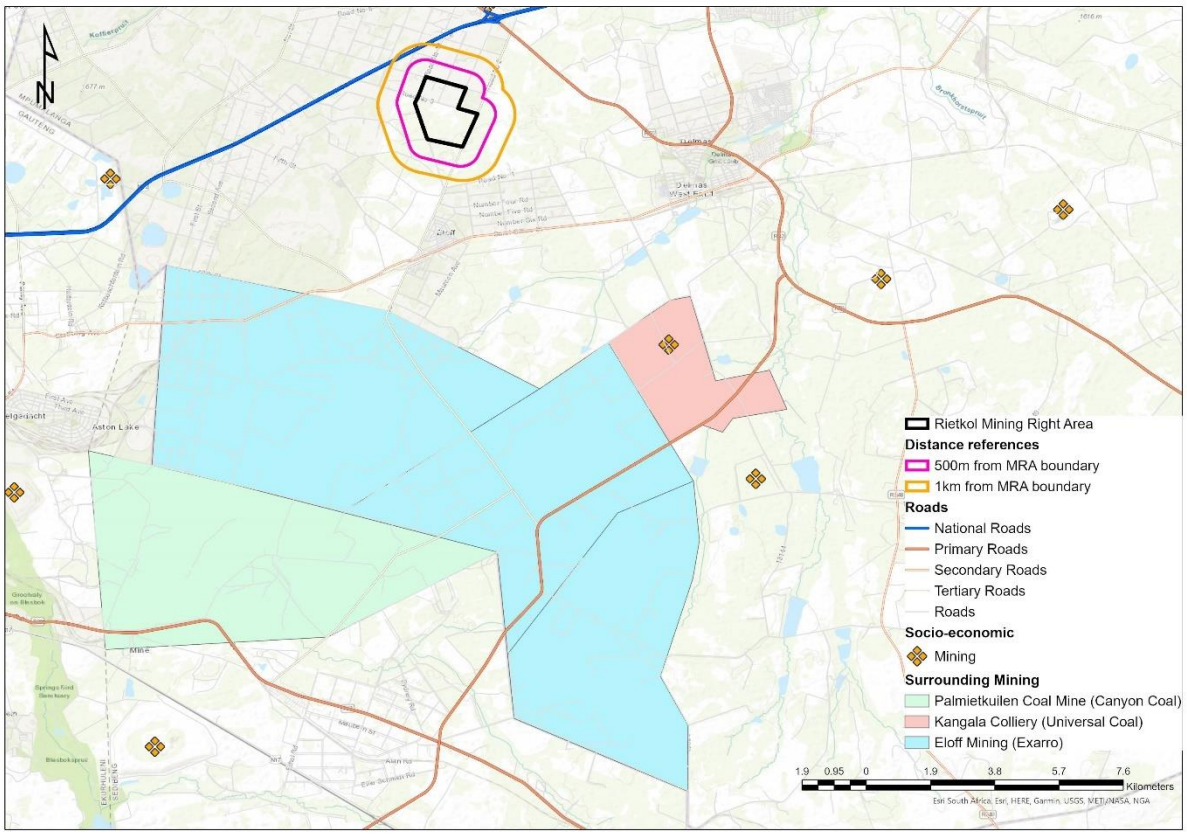


Figure 61: Mining activities near the proposed Rietkol Project

8.4.6 Monetary Value of Current Activities

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

- Economic growth, i.e. the impact on GDP;
- Employment creation, i.e. the impact on labour requirements; and
- Payments to households, i.e. low income and medium/high income.

A breakdown of the different effects of the agricultural sector multipliers used in this calculation is as follows:

- Direct Impacts: the effects occurring directly in the agriculture sector.
- Indirect Impacts: those effects occurring in the different economic sectors that link backwards to agriculture due to the supply of intermediate inputs, e.g. fertiliser, seed, professional services, transport, etc.

- Induced Impacts: the chain reaction triggered by the salaries and profits (less retained earnings) that are ploughed back into the economy in the form of private consumption expenditure.
- Total Impacts: Represents the direct, indirect, and induced summed effect.

Table 57 presents the socio-economic parameters for agricultural activities of the MRA and surrounding area within 1 km before any mining took place, based on the 2018 macro-economic analysis. The macro-economic analysis will be updated during the EIA Phase with more recent monetary values and price indexes.

Table 57: Socio-Economic Parameters for the area within 1 km of the Rietkol MRA area (2017 prices)

	GDP (R Mil)			Employment (Numbers)			Household Income (R Mil)		
	Direct	**Indirect and Induced**	**Total**	**Direct**	**Indirect and Induced**	**Total**	**Total**	**Medium**	**Direct Low**
Maize	R 1.96	R 8.98	R 10.94	12	34	46	R 5.29	R 4.02	R 1.27
Soya	R 1.53	R 3.03	R 4.55	9	13	22	R 1.95	R 1.51	R 0.44
Rose Flowers	R 40.40	R 25.65	R 66.05	156	86	241	R 15.33	R 11.49	R 3.84
Beef	R 0.32	R 0.49	R 0.82	4	2	5	R 0.30	R 0.22	R 0.08
Teff	R 0.08	R 0.10	R 0.17	0	0	1	R 0.06	R 0.04	R 0.02
Cactus Pears	R 1.10	R 0.74	R 1.84	11	2	14	R 0.43	R 0.33	R 0.10
Vegetables	R 1.70	R 1.28	R 2.98	27	3	30	R 0.76	R 0.57	R 0.20
Pecan Nuts	R 0.18	R 0.05	R 0.22	1	0	1	R 0.02	R 0.02	R 0.01
Poultry Layers	R 43.41	R 78.04	R 121.45	90	404	494	R 39.29	R 28.17	R 11.12
Cut Flowers	R 16.88	R 10.10	R 26.98	65	35	100	R 6.06	R 4.55	R 1.51
Total	**R 107.5**	**R 128.4**	**R 236.0**	**375**	**579**	**954**	**R 69.5**	**R 50.9**	**R 18.6**

The direct GDP is estimated at R 107.5 million with a total of R 236.0 million if the ripple impact is taken into consideration. The total employment number is estimated 954 jobs of which 375 is direct employment and 579 indirect and induced. The main labour-intensive activities are eggs, roses and cut flower production.

Total salaries and management fees paid to households, not only those working on the farms but also the indirect and induced labour, are estimated at R 69.5 million with R 18.6 million to low-income households. It is clear that current agricultural activities provide a large number of direct jobs as well as a healthy income to households.

8.5 SENSITIVE RECEPTORS

Available information, orthophotos and satellite imagery was utilised to identify sensitive receptors. The following sensitive receptors have been included where applicable:

- Residential areas (towns, rural & labour houses)
- Agricultural residences and infrastructure
- Labour tenants or land occupants
- Existing mining activities and Power Stations

Figure 62 indicates the sensitive receptors identified, whilst Figure 63 indicate the categories of these sensitive receptors from a social perspective (air quality, noise, blasting, lighting, etc.) as follow:

- High – Residential and housing
- Medium – Commercial and agriculture
- Low – Mining, industrial and outbuildings

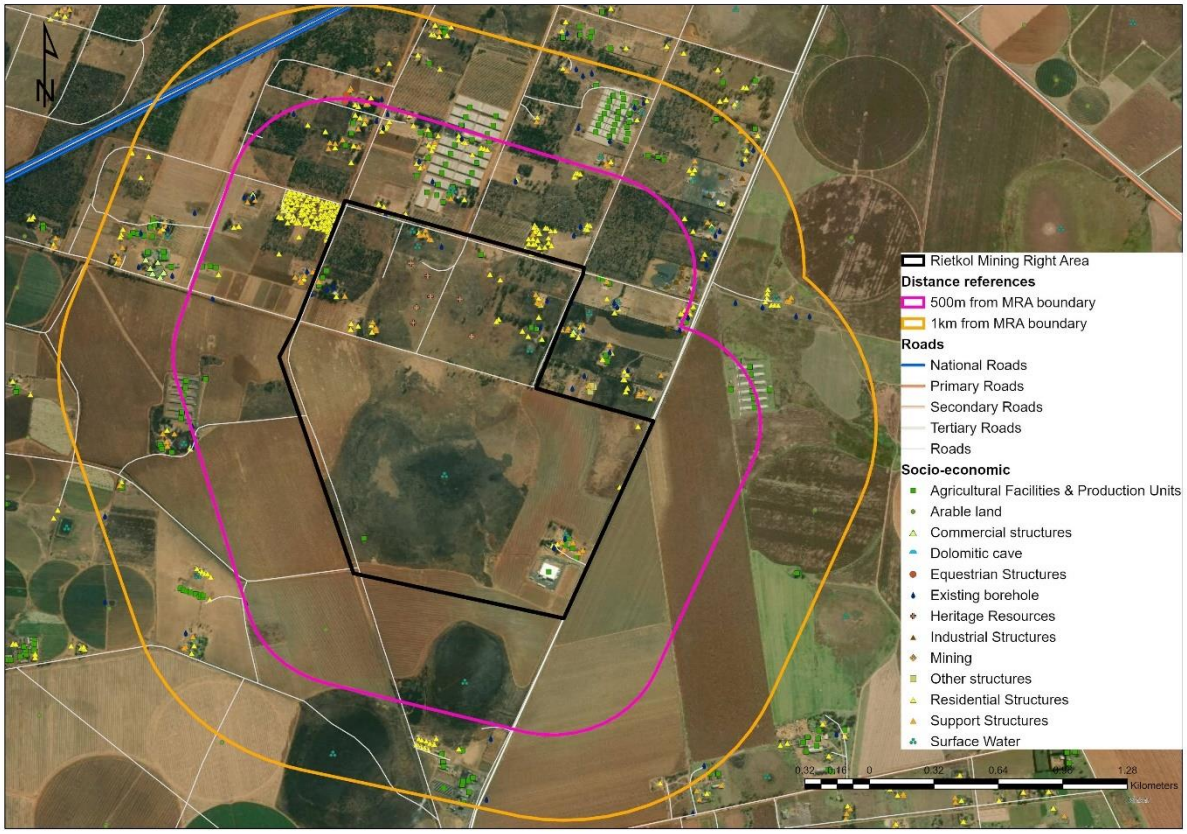


Figure 62: Sensitive receptors

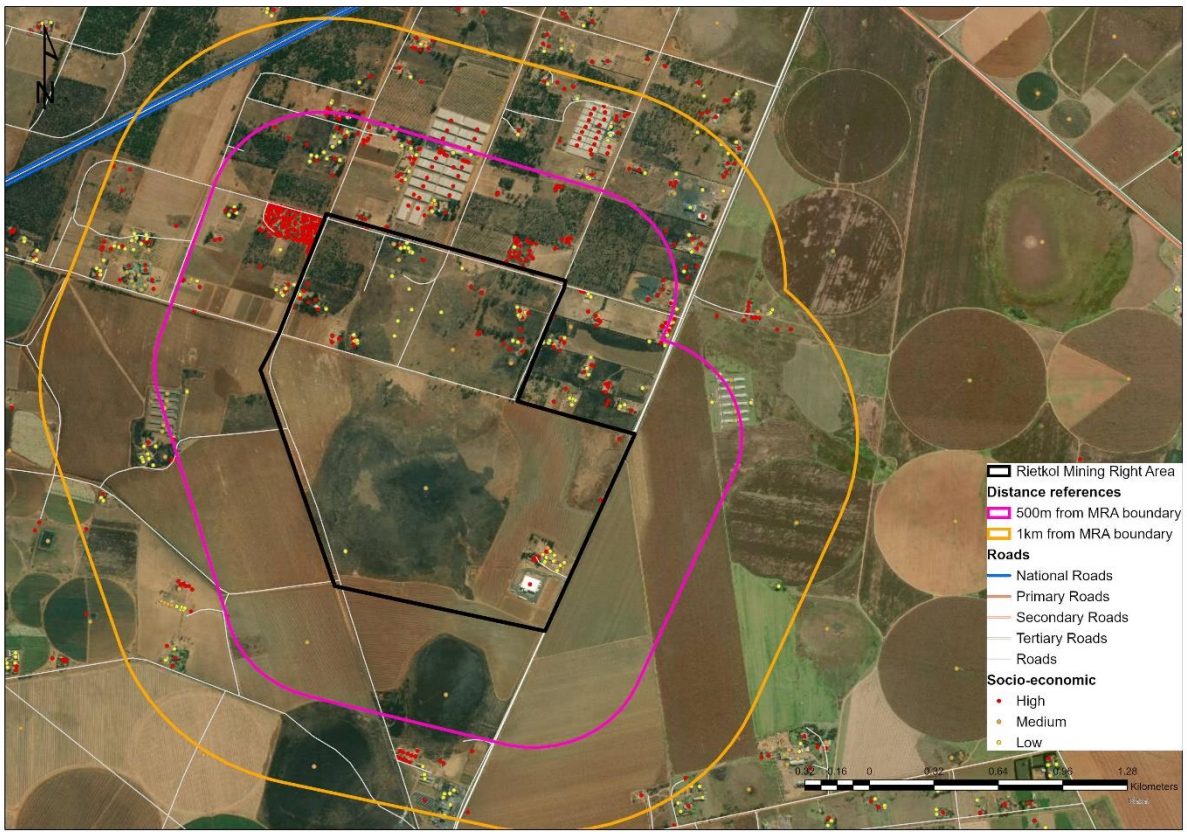


Figure 63: Sensitive receptor categories

9 ENVIRONMENTAL IMPACT ASSESSMENT

9.1 SOILS AND LAND USE

The Rietkol MRA area in its present state has not been significantly affected by mining and industrial activities and therefore the proposed mining activities will lead to a noticeable change in land use. This impact will however be less severe as the region surrounding the MRA area is strongly associated with mining.

The nature of the impact of mining and mining related development (infrastructure development) on soils include the stripping and stockpiling of soils, heavy machinery traffic that could compact soil surface and subsurface layers, stockpiling of RoM and product and contamination from the latter as well as wash-bays and service bays.

Stripping, stockpiling and compaction of soil usually result in:

- Loss of the original spatial distribution of natural soil forms and horizon sequences.
- 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 will adversely affect root development, effective soil depth and general soil fertility (in certain instances extensive surface crusting can occur that has a negative impact on revegetation efforts).

9.2 FLORAL ENVIRONMENT

Several potential risks to the receiving floral environment by the proposed mining operation have been identified which relate to floral habitat integrity, floral diversity, and the impact on floral SCC. These impacts will be assessed in detail in the impact assessment phase of the project and as far as possible mitigatory recommendations will be presented in line with the mitigation hierarchy as advocated by the DMR (2013) to ensure informed decision making and improved sustainable development in the area.

- The mining footprint, mining related activities and the placement of infrastructure are likely to have an impact on floral habitat present in the MRA area, notably so if infrastructure is located in or near the wetland habitat;
- Encroachment of infrastructure or construction or operational waste materials into sensitive habitat units could occur and would affect the habitat integrity of these areas;

- Discharge from general dirty water areas as well as spillages of hydrocarbons, has the potential to contaminate the surface water environment which in turn can affect water quality in the area;
- Potential indiscriminate fires by construction personnel may lead to uncontrolled fires, affecting floral communities of the property;
- Ineffective monitoring of the burning regime could lead to either destruction of existing plant communities or in the case of decreased burning frequency, dead organic matter build-up, preventing establishment of healthy plant communities;
- Vehicles may negatively affect sensitive habitat areas during construction, operation and rehabilitation phases, resulting in a loss of habitat;
- Mining related activities may lead to destruction of habitat and overall loss of biodiversity through expansion activities, road construction, waste facilities etc.;
- Dust generated by ineffective rehabilitation of exposed areas may affect the floral characteristics of the property;
- Construction and introduction of foreign material e.g. soils may lead to the further introduction of alien invader species, impacting on the floral characteristics of the MRA area;
- Ineffective removal of alien invader species and exposed areas could lead to re-establishment of invasive species, impacting on floral community rehabilitation efforts;
- The proposed activities may lead to the loss of floral SCC which rely on specific areas in the landscape for survival; and
- Ineffective rehabilitation and monitoring of disturbed areas could lead to loss of species diversity.

Please note that the above list is not exhaustive, and during the detailed impact assessment phase additional impacts may be identified. These impacts will be assessed further in the impact assessment phase of the project according to a pre-defined impact assessment methodology which has been optimised for ecological impact significance determination.

9.3 FAUNAL ENVIRONMENT

Several potential risks to the receiving faunal environment because of the proposed mining operation have been identified which relate to faunal habitat integrity, faunal diversity and the impact on faunal SCC. These impacts will be assessed in detail in the impact assessment phase of the project and as far as possible mitigatory recommendations will be presented in line with the mitigation hierarchy as advocated by the DMR (2013) to ensure informed decision making and improved sustainable development in the area.

- Mining activities, especially the placement of infrastructure, is likely to have an impact on sensitive habitat present in the MRA area, and will affect sensitive faunal SCC which may occur within the MRA area;
- Encroachment of infrastructure, construction or operational waste materials into sensitive habitat units could occur and would affect the habitat integrity of these areas;
- Discharge from general dirty water areas as well as spillages of hydrocarbons, has the potential to contaminate the surface water environment which in turn can affect water quality in the area;
- Indiscriminate fires by personnel may lead to uncontrolled fires, affecting faunal species and communities of the MRA area;
- Vehicles indiscriminately driving through the MRA area may negatively affect sensitive habitat areas during construction, operation and rehabilitation, resulting in a loss of habitat;
- Mining activities may lead to destruction of habitat and overall loss of biodiversity through expansion activities, road construction and waste facilities etc.;
- Dust generated through mining activities, dirt roads and discard dumps may affect faunal habitat as well as faunal species within the MRA area;
- Construction and introduction of foreign material e.g. soils may lead to the further introduction of alien invader species, impacting on the faunal habitat of the MRA area;
- Ineffective removal of alien invader species and exposed areas could lead to re-establishment of invasive species, resulting in an altered faunal habitat that may not be suitable to the current faunal assemblage of the MRA area;
- The proposed activities may lead to the loss of faunal SCC which rely on specific areas in the landscape for survival;
- Increased personnel within the MRA area may result in an increase in hunting and snaring, which will directly impact upon the faunal assemblage of the study and surrounding areas; and
- Ineffective rehabilitation and monitoring of disturbed areas could lead to loss of species diversity and habitat.

Please note that the above list is not exhaustive, and during the detailed impact assessment phase additional impacts may be identified.

9.4 SURFACE WATER RESOURCES

9.4.1 Reduction in storm water runoff

Rainwater falling on the open portions of the mining pits and infrastructure area will be collected as dirty water and be re-used. This dirty water will not form part of the natural storm water runoff and will thus cause a reduction in catchment yield. To limit the impact as far as possible, the footprint area of all the dirty water infrastructure areas will be minimised. Berms and/or drains on the highwall side of the open pits and infrastructure will prevent the influx of clean water into those dirty water areas. The impact of the dirty water areas on the runoff is therefore considered insignificant.

9.4.2 Increased sediment load

In the natural state of the project site, vegetation cover causes friction to rainfall run-off, that reduces flow velocities and consequently shear forces between the water and the ground surface, resulting in the ground surface remaining intact and not being eroded away. If for any reason flow velocities are increased, there is a potential for increased erosion to occur. Increased erosion means that the run-off contains a higher silt or sediment load, which is discharged to the major rivers. A component of this sediment load is particles fine enough to remain in suspension, 'clouding' or 'muddying' the water. The extent of this effect can be quantified by measuring a water quality parameter, viz. suspended solids. If there are too many suspended solids in the water this can negatively affect biological life. In addition, a changed sediment load could have similar morphological effects to the river as changing peak flow rates, such as changes in channel character or dimensions and changes to bed roughness. These changes could potentially affect biological life. The following activities are likely to cause an increase in flow velocities, or directly increase erosion:

- Stripping (vegetation clearance) of construction areas;
- Construction of hard-standing areas that increase run-off volumes, including roads, buildings and paved areas;
- Canalisation of run-off due to poor storm water management; and
- Construction activities that loosen the ground surface.

9.4.3 Impaired water quality

The Koffiespruit is regarded as a perennial river; however, in its upper reaches and directly west of the Rietkol MRA area this is not the case, and it is therefore not believed to receive any significant baseflow. The Koffiespruit is thus not considered to be an important receptor of contamination that

may potentially originate from the MRA area. Furthermore, the mineral to be mined is silica, a chemically inert mineral, that is hosted within a very clean (inert) quartzite. Both the resource mineral and host rock are inert, meaning that any seepage or runoff that may potentially originate from the MRA area is expected to be of good quality.

Storm water runoff from the infrastructure and overburden stockpile areas are however a potential source of contamination. Unless proper measures are taken, polluted runoff may affect the surface water resources (mainly wetlands) in the area. However, runoff from the contaminated areas will be collected in dirty water dams for re-use and the impact will be limited to a very slight reduction in runoff, which is negligible. Control methods need to be formulated, of which proper 'housekeeping' in the contaminated areas will be one.

Run-off of pollutants (chemicals, hydrocarbons, sewage effluent) from the construction / infrastructure areas could contain pollutants in excess of the target water quality ranges for the water uses of the receiving water body and discharge of this would impact negatively on the surface water quality.

Leakages, fuel, or oil spills from construction vehicles could seriously contaminate surface water resources and unless proper measures are taken. The fuelling areas and fuel or lubricant storage areas should be plastic lined and bunded to collect any hydrocarbon spillages for safe disposal.

The following conclusions and recommendations were made in the baseline monitoring report:

- The water quality results indicated that the environmental state of the system prior to the development of the proposed Rietkol Project cannot be considered as pristine;
- It is recommended that, during the planning of the Rietkol Project careful planning must take place in line with the requirements of GN704 to prevent runoff and discharge affecting the receiving environment; and
- It is recommended that all possible pollution prevention measures be implemented within the mining operations of the proposed Rietkol Project to maintain or improve upon the existing water quality of the receiving environment. Potential mitigatory actions will be determined during the further phases of the environmental assessment and authorisation process.

9.4.4 Blasting impacts

When ammonium nitrate dry explosives (usually referred to as ANFO) are used for blasting, their solubility poses a risk to the water resources in the area. ANFO dissolves very easily and can enter the

water system through spillages and charging into wet holes. This will elevate the nitrates in solution in the water system.

With the application of waterproof explosives, and mitigating measures to control spillage, the negative impact significance will be low.

9.5 GROUNDWATER

9.5.1 Potential for Acid Mine Drainage

Metal sulphides (usually pyrite) are very prone to oxidation when brought into contact with water and oxygen. The chemical reactions are collectively referred to as acid mine/rock drainage (AMD) and as the name suggests lead to the generation of acidic leachate rich in sulphate (among other chemical elements). The following are the most commonly occurring reaction train:

$$2FeS_2 + 7O_2 + 2H_2 – 2FeSO_4 + H_2SO_4 \quad (1)$$

$$4FeSO_4 + 2H_2SO_4 + O_2 – 2Fe_2(SO_4)_3 + 2H_2O \quad (2)$$

$$3Fe_2(SO_4)_3 + 12H_2O - 2HFe_3(SO_4)_2(OH)_6 + 5H_2SO_4 \quad (3)$$

In AMD affected groundwater the pH and bicarbonate values are expected to decrease. Metals go into solution and SO_4 and TDS values increase. As the water leaves the mining area, it usually mixes with better quality water and the pH and bicarbonate values are buffered back to more acceptable levels. Metals then also precipitate, and the sulphate and TDS concentrations decrease.

Acid Base Accounting (ABA) is done to determine the net acid generating and neutralising potentials of material. The main principles of acid-base accounting are:

- Samples are exposed to complete oxidation of all sulphide-bearing minerals.
- This generates acid, which is counteracted by the natural base potential in the material.
- The initial pH before oxidation and the oxidised pH are recorded for each sample.

Little or no drop in pH occurs whenever the base potential exceeds the acid potential. The opposite holds true when the acid potential exceeds the base potential – such a sample is therefore expected to generate acidic conditions when exposed to oxygen and water.

Exploration drilling in the MRA area found that the Rietkol quartzite deposit is exceptionally pure (MWP, 2019). No ABA was therefore deemed necessary for this investigation as the targeted quartzite is predominantly composed of inert silica (i.e. amount of metal sulphide minerals is negligible, if any).

Leachate from overburden- and waste rock dumps is therefore expected to be of reasonably good quality, however, may potentially be high in nitrate content.

9.5.2 Potential Sources of Contamination

A source area is defined as an area in which groundwater contamination is generated or released from as seepage or leachate. Source areas are subdivided into two main groups:

- Point sources: The contamination can easily be traced back to the source.
- Diffuse sources: Diffuse sources of groundwater contamination are typically associated with poor quality leachate formation through numerous surface sources.

An evaluation of the project description revealed numerous potential source areas, which are listed and briefly discussed in Table 58.

Table 58: Potential sources of groundwater contamination

Source	Contamination risk	Comments
Plant area	Low	Impact on the groundwater only occurs through leachate formation from surface. Impacts thus only occur because of rainfall recharge or when water is introduced in some form where leachate can form that seeps to the groundwater.
Waste rock dumps and stockpiles	Low	Effective recharge through waste rock dumps and stockpiles is much higher than the natural recharge of the area due to lower evaporation rates. Surface water run-off originating from these source areas, toe-seeps and seepage through the base could contaminate the groundwater if the seepage is of poor quality.
Dirty water retaining facilities	Low/Medium	These facilities are developed and constructed for the sole purpose of containing dirty/affected water and therefore minimising the risk of it contaminating the groundwater. Mismanagement of these facilities may however lead to spills and/or leakages that have the potential to contaminate the underlying groundwater.
Workshops and washing/cleaning bays	Low/Medium	Impact on the groundwater only occurs through leachate formation from surface. Impacts thus only occur because of rainfall recharge or when water is introduced in some form where leachate can form that seeps to the groundwater. Organic contaminants are usually the main pollutants of concern (e.g. oil, grease, diesel, petrol, hydraulic fluid, solvents, etc.).

Most potential source areas listed in Table 58 pose no real threat to the underlying aquifer in terms of impacts on groundwater quality. Both the target mineral and host rock that will be processed in the plant and then stockpiled/dumped are inert and will therefore not react with oxygen and water to create poor quality seepage, i.e. acid mine/rock drainage.

Explosives will be used in the opencast mining process, which likely will be nitrate based. Remnants of the explosives still contain significant amounts of nitrate and get attached to the blasted rock material. Nitrate dissolves readily in water, resulting in nitrate enriched leachate being generated whenever water is available for dissolution (usually during and directly after a rainfall event). Waste rock dumps and stockpiles are therefore regarded as potential sources of nitrate contamination.

9.5.3 Potential Pathways for Contamination

For contamination to reach and eventually affect a receptor/s, it needs to travel along a preferred pathway. The effectiveness of a pathway to conduit contamination is determined by three main factors, namely:

- Hydraulic conductivity of pathway;
- Groundwater hydraulic gradient; and
- Area through which flow occurs.

All three abovementioned factors have a linear relationship with the flow of contamination through a preferred pathway, meaning an increase in any one of the three will lead to an increase in flow.

The following potential pathways were identified in the MRA area:

9.5.3.1 Saturated Weathered Zone (weathered zone aquifer)

The weathered zone aquifer is composed of soil and weathered bedrock, which depending on the weathering depth and depth to groundwater level, may be between 0 and nearly 30 meters thick.

The rate of flow depends on the hydraulic conductivity of the aquifer and groundwater hydraulic gradient. Groundwater/contaminant flux in this aquifer is expected to be in the order of 70 to 170 m/y, which is very high.

The weathered zone aquifer system is undeveloped in areas where the groundwater level is deeper than the contact between the weathered zone and fresh bedrock. The very high groundwater seepage rates calculated for the MRA area are the combined result of the relatively high hydraulic conductivity of the underlying aquifer and steep hydraulic gradients resulting from groundwater abstraction.

9.5.3.2 Geological Structures

Geological structures such as dykes and faults have the potential to serve as sufficient pathways for contamination. The crystalline nature of an igneous dyke is characteristic of an aquiclude, however rapid cooling during intrusion caused highly transmissive fracture zones to form along the contact between the intrusive and surrounding rock.

The flow rates calculated for the MRA area may increase by several orders of magnitude should a transmissive geological structure be located in the down gradient groundwater flow direction and if it is also orientated parallel to the local flow direction.

No detailed structural geological information is available for the MRA area, which is a data gap. A flat dipping dolerite sill of approximately 30 m thick is however known to cut through the Rietkol quartzite deposit and divides it into an Upper- and a Lower Quartzite band.

9.5.4 Potential Receptors of Contamination

A receptor of groundwater contamination usually occurs in the form of a groundwater user that relies on groundwater for domestic, irrigation or livestock watering purposes. Surface water features (stream, river, dam, etc.) that rely on groundwater base flow for the sustainment of the aquatic environment are also considered to be important receptors.

Numerous groundwater users were located during the user survey. Approximately 80% of these boreholes are located within a two-kilometre radius of the planned mining and related infrastructure and activities. The Koffiespruit is located ± 2.5 km west of the Rietkol MRA area, however these upper reaches of the river are not perennial. Groundwater baseflow to this portion of the Koffiespruit is therefore expected to be negligible and it is consequently not considered to be an important receptor.

For a negative groundwater quality impact to be registered the following three components should be present:

- A source to generate and release the contamination;
- A pathway along which the contamination may migrate; and
- A receptor to receive the contamination.

All three these components are present within the Rietkol MRA area, which stresses the importance of a comprehensive early detection groundwater monitoring program (source monitoring).

9.5.5 Groundwater Yield Impact

The planned opencast mining will progressively deepen to eventually intersect the groundwater table. From this point onwards, groundwater is expected to migrate towards and to eventually flow into the pit.

As indicated in the vertical cross section provided in Figure 64, the final mining depth will determine what portion of the pit floor intersects the water table. Compared to a maximum or final pit depth of 30 mbs (i.e. yellow dotted line in Figure 64), a larger portion of the pit floor is expected to intersect the water table at a depth of 50 mbs (orange dotted line) – ultimately resulting in higher groundwater influx volumes.

Dolerite dykes and sills, such as the one that cuts the Rietkol quartzite deposit into an Upper- and a Lower Quartzite band, have the potential to yield significant volumes of groundwater. Over and above the groundwater influx from the saturated aquifer host rock/s that cannot be prevented, the risk of additional (and potentially high) groundwater influx from the abovementioned sill is very high should mining cut into or through the structure (if below the groundwater level).

It is important to note that the opencast mining of the silica rich quartzite will not cut into the underlying dolomite aquifer, which will be separated from the overlying pit by a dolerite sill of approximately 30 meters thick and many more meters of quartzite (i.e. Lower Quartzite band).

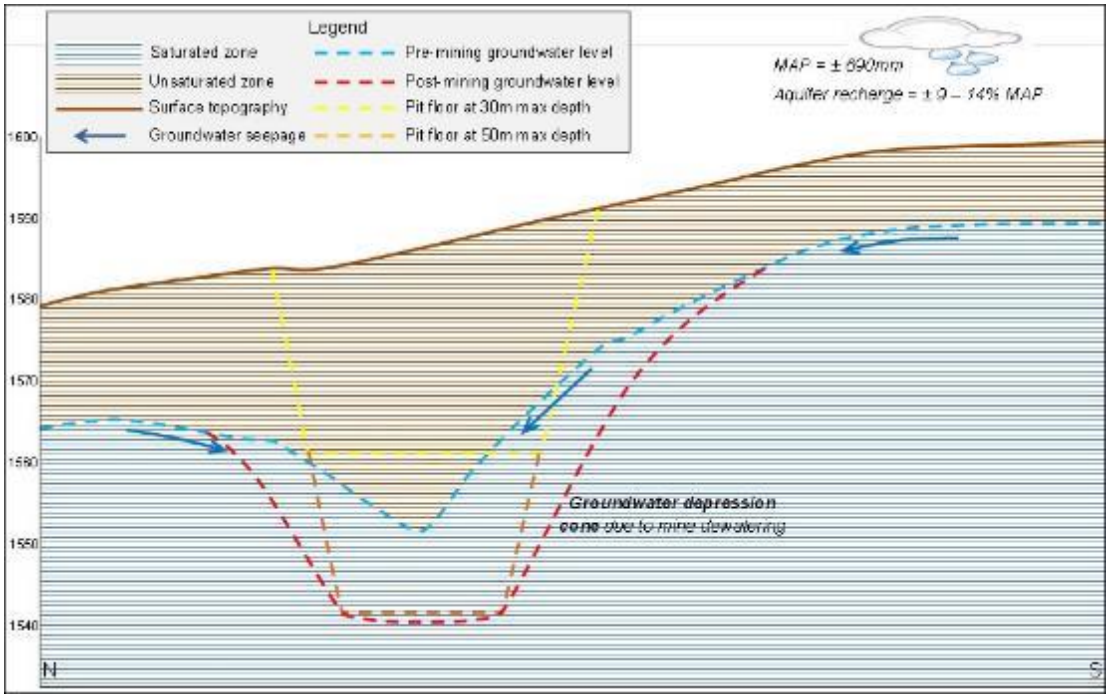


Figure 64: Vertical cross section from north to south through proposed opencast pit

9.6 VISUAL EXPOSURE AND VISIBILITY

Visual exposure refers to the geographic area from which the proposed project will be visible and is defined by the degree of visibility of a proposed project from various receptors sites. Visibility, in turn, is determined by distance between the components of a proposed project and the viewer.

Visual exposure is determined by the zone of visual influence or the "viewshed". A viewshed is the topographically defined area that includes all the major observation sites from where a proposed development will be visible. The boundary of the viewshed tends to connect high points in the landscape through following ridgelines and demarcates the zone of visual influence. The zone of visual influence usually fades out beyond 5 km distance and the further away from an observer the project is, the less visible it would be. It is also important to note that the actual zone of visual influence of the proposed project may be smaller than indicated because of screening by existing vegetation and infrastructure, which may partially or totally obscure a view. General visibility classes are indicated below.

Table 59: Visibility classes (IEMA, 2002)

Class	Description
Highly visible	Clearly noticeable within the observer's view frame 0 to 5km
Moderately visible	Recognisable feature within observer's view frame 5 to 7.5km
Marginally visible	Not particularly noticeable within observer's view frame 7.5 to 10km
Hardly visible	Practically not visible unless pointed out to observer 10 to 15km+

Three distance zones have been identified (BLM, 1984) based on visibility from travel routes and observation points. These have been determined and confirmed through field verification:

- Foreground – includes local and sub-regional areas visible from highways, rivers, or other viewing locations which are less than 1 km away.
- Middle ground – includes sub-regional areas located less than 5 km away.
- Seldom seen – includes areas that are not part of the foreground-middle ground or the background and that are generally hidden from view and is usually between 5 and 10 km away.

9.6.1 Viewshed Analysis

The viewshed analysis calculates the geographical locations from where the proposed project might be visible. This potential visual exposure of the project has been modelled by creating a Digital Terrain Model (DTM) from 20m contour data, and applying a viewshed analysis using GIS software, whereby all areas with a line of sight towards the proposed project is indicated. It must be noted that the heights of existing infrastructure and vegetation are not included in the calculation of the viewshed

and it is, therefore, important to bear in mind that the proposed development will not be visible from all points within the viewshed, as views may be obstructed by visual elements, whereby such intervening objects will modify the viewshed at ground level.

The combined viewshed (preliminary) created by the proposed project infrastructure are illustrated in Figure 65, with 1 km, 5 km and 10 km distance radii or buffers also indicated.

From the viewshed analyses (which does not consider vegetation and local topography), it is evident that the proposed project will be highly visible from within 1 km of the MRA area, mainly because of the 2.4m high perimeter fence and the processing plant. The offices and stores, weighbridge and the opencast pit do not contribute significantly to the viewshed, and the opencast pit will, for instance be mostly screened by the perimeter fence. The processing plant and the perimeter fence will be mostly visible from the north and west of the MRA area up to 5 km. Beyond 5 km it is unlikely that the perimeter fence will be highly visible, however the processing plant may be visible from the southwest and northwest at a distance further than 5 km. The combined viewshed analysis indicates that the project will be visible from beyond 10 km of the MRA area to the northwest, however it is important to note that at a distance further than 10 km from a development, visual exposure and visibility is expected to significantly decrease due to objects being difficult to distinguish from the background at such significant distances.

It is important to note that the visual impact from mining infrastructure is not expected to be permanent, provided that effective rehabilitation of impacted areas takes place, and that the mine processing plant and related will be demolished upon mine closure.

9.6.2 Visual Receptors

The number of observers and their perception of the proposed project will have an impact on the VIA and on the perceived sensitivity of the landscape. The perception of viewers is difficult to ascertain as there are many variables to consider, such as cultural background, state of mind, reason for the sighting and how often the project is viewed within a set period. It is therefore necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the project. It is also necessary to generalise the viewer sensitivity to the proposed project to some degree (Oberholzer, 2005).

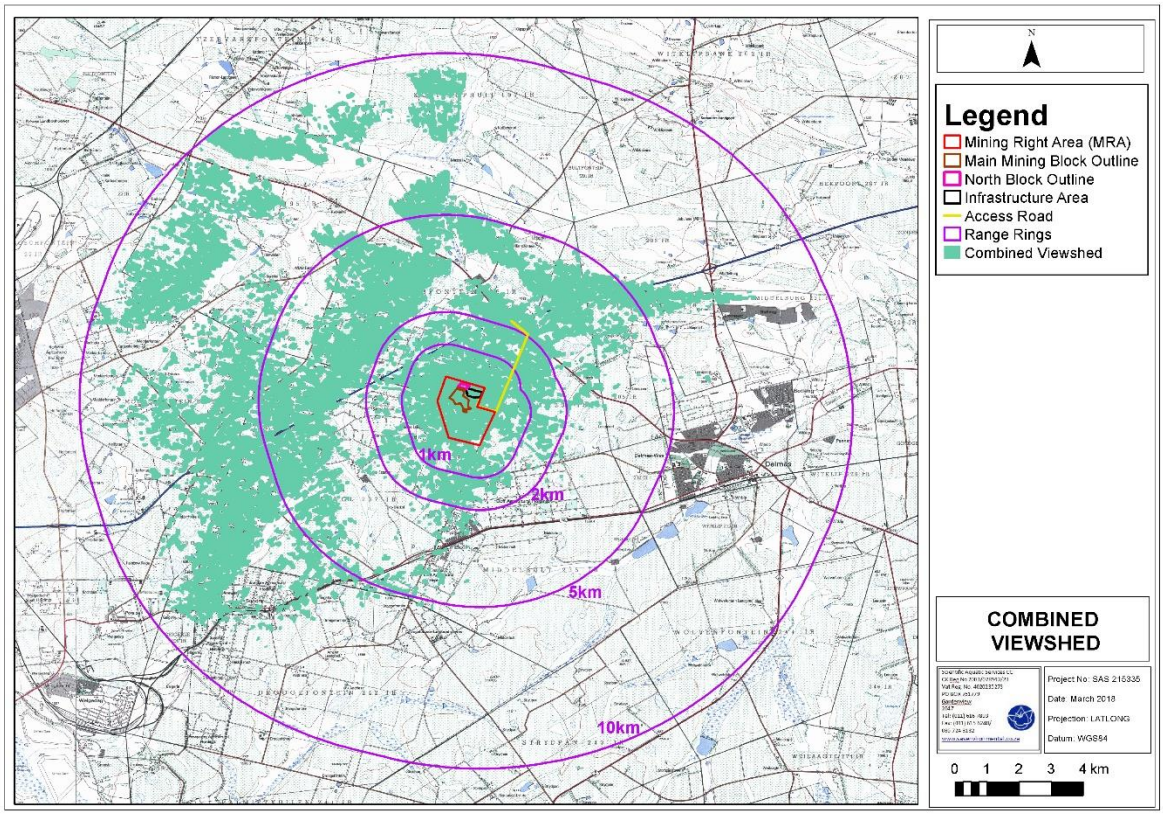


Figure 65: Combined viewshed (indicated as shaded areas) of all proposed mining infrastructure overlaid onto the 1:50 000 topographic map

The IEMA (2002) identifies several potential sensitive receptors that may be affected by a proposed development, namely:

- Users of recreational landscapes/ public footpaths and bridleways, including tourists and visitors;
- Residents;
- Users of public sports grounds and amenity open space;
- Users of public roads and railways;
- Workers; and
- Views of or from within valued landscapes.

The sensitivity of visual receptors and views will depend on:

- The location and context of the viewpoint;
- The expectation and occupation or activity of the receptor; and
- The importance of the view.

The most sensitive receptors may include:

- Users of outdoor recreational facilities, including public rights of way, whose attention or interest may be focused on the landscape;
- Communities where the development results in changes in the landscape setting or valued views enjoyed by the community; and
- Occupiers of residential properties with views affected by the development.

Other receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscape of acknowledges importance or value);
- People travelling through or past the affected landscape in cars on trains or other transport routes; and
- People at their place of work.

With reference to the MRA area, the main visual receptors include local residents (including those of informal settlements), farmers, workers on farms within the immediate vicinity, as well as residents, farmers and workers on farms located further away from the MRA area within areas from where the proposed project will also be visible. The immediate region associated with the MRA area is not specifically known to be a tourist area, however birders are known to visit the area. Other potential sensitive receptors are people travelling on the N12 to the north, the R50 to the north-east and the R555 to the south. The viewshed analysis indicates that the proposed project will be highly visible from the N12 and R50, but not highly visible from the R555. The proposed project is likely to only be intermittently visible from these main roads due to screening from existing infrastructure and tree and the duration of visual exposure will be of a limited duration.

From the viewshed analysis, it was also found that the proposed project will not be visible from the town of Delmas, the most prominent town in the region.

Less sensitive receptors, who will be visually affected to a lesser degree, are likely to be people at their place of work, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view.

9.6.3 Night-time Lighting

To understand the potential visual impacts from night lighting, it is important to understand the existing lighting levels. The Institute of Lighting Engineers (ILP) (2011) identifies five environmental

zones for exterior lighting control and with which to describe the existing lighting conditions within the landscape (Table 60). These environmental zones are supported by design guidance for the reduction of light pollution, which can then inform proposed mitigation measures and techniques. Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.

Table 60: Environmental zones

Environmental Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically Dark	National Parks, Areas of Outstanding Natural Beauty etc.
E2	Rural	Low District Brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium District Brightness	Small town centres or suburban locations
E4	Urban	High District Brightness	Town/city centres with high levels of night-time activity

Night lighting sources, mainly from existing residences are currently present within and adjacent to the MRA, and vehicular light sources also coming from the adjacent gravel road and the N12 to the north of the MRA. The lighting environment of the MRA area is considered consistent with Environmental Zone E2 – Low District Brightness. Overall, although night-time lighting is currently impacting on the MRA area, this area is still considered to be relatively dark during the night. Should the proposed Rietkol Project operate during the night-time hours, some degree of additional lighting is likely to be contributed, as lighting from particularly vehicles within rural areas will generally be more intrusive than in urban settings and, therefore, will have a potentially greater impact due the general lack of existing ambient light.

9.7 AIR QUALITY

9.7.1 Construction Impacts

Construction is a source of dust emission which has a temporary impact on the local air quality. Infrastructure and road construction are the two types of construction activity with high emission potentials. The emissions associated during the construction of a building or road can be associated with land clearing, drilling, and blasting, ground excavation and depending on the level of activity, the specific operation and the prevailing meteorological conditions. It has been noted that large quantities

of the emissions are generated due to the traffic movement of equipment across temporary roads and around the construction site.

The temporary nature of construction activities is what distinguishes it from other fugitive sources present within the locality. Emissions from construction activities are expected to have a definitive start and end period and will vary depending on the various construction phases. In contrast to other fugitive sources, here the emissions occur in a steady state or follow a discernible pattern. The quantity of dust emissions from construction activities is proportional to the area of land under construction.

During the construction phase it is expected that the main sources of impact will result from the construction of access roads and infrastructure area, as well as the open pit development. These predicted impacts cannot accurately be quantified, primarily due to the lack of information related to scheduling and positioning of construction related activities on a day-to-day basis. A qualitative description of the impacts has been provided. This will involve the identification of possible sources of emissions and the provision of details related to their impacts.

The following possible sources of fugitive dust have been identified as activities which could potentially generate dust during construction operations at the mine:

- Product Transport
    - Construction of haul roads;
    - Scraping;
    - Debris handling;
    - Debris stockpiles; and
    - Truck transport and dumping of debris.
- Mining and Infrastructure
    - Removal of overburden;
    - Construction of infrastructure; and
    - Construction of access sites.

The impact on air quality and air pollution of fugitive dust is dependent on the quantity and drift potential of the dust particles. Large particles settle out near the source causing a local nuisance problem. Fine particles can be dispersed over much greater distances. Fugitive dust may have significant adverse impacts such as reduced visibility, soiling of buildings and materials, reduced growth and production in vegetation and may affect sensitive areas and aesthetics. Fugitive dust can also adversely affect human health.

The following components of the environment may be impacted upon during the project construction phase:

- The ambient air quality;
- Local residents, farms and neighbouring communities; and
- The surrounding environment and possibly the fauna and flora.

Because of the relatively short-term nature of construction activities, some control measures are more cost effective than others. Wet suppression and wind speed reduction are two common methods used to control open dust sources at a construction site as water and material for wind barrier are readily available.

9.7.2 Operational Impacts

In open pit mining, topsoil and/or overburden will have to be removed to reach the mineral deposits below. This may require excavators, transporters and loaders which will result in a discharge of fine particulates from the overburden material. Similarly, normal operations will also require excavation, transportation, loading, unloading, size reduction, stockpiling, etc. These activities will generate particulate matter (PM). Drilling and wind erosion over open and exposed surfaces are major sources of fugitive dust emissions. The source and characteristic of fugitive emissions from mining operations vary in each case, as do their impacts. Diesel trucks and equipment used in mining activities are also a source of PM.

Exposures to PM emissions are associated with a range of serious respiratory and cardiovascular health problems. The key effects associated with exposure to ambient particulate matter include premature mortality, aggravation of respiratory disease, aggravated asthma, acute respiratory symptoms, chronic bronchitis, and decreased lung function.

The EIA modelling will aim to deal with the potential air quality impacts which could result due to the construction of the mining facilities and everyday mining operations. The details regarding the source characteristics will be obtained from site layout plans and process specific information provided and a questionnaire filled in by the client. Such information relates to the type of activities carried out on site as well as equipment used. Once all site layout plans and final geotechnical works are complete, site specific information should then be sufficient for dispersion modelling simulations. More information pertaining to the operational impacts will be available at the EIA Phase.

9.8 AMBIENT NOISE

The impact expected to arise from this project can be divided into two phases, 1) Construction and 2) Operational. During the construction of the project, the noise will be limited to daylight hours (~06:00 to 18:00) and is likely to be only local to the proposed infrastructure and open pit areas. The noise generated can easily be stopped and mitigated once found there is a nuisance associated with the activity.

The operational phase of the project will likely produce noise during blasting events, handling of RoM and processing plant noises. The mine is likely to be active 24 hours a day, although the activity and intensity will be less during the night.

9.8.1 Potential Noise Sources – Construction

The following activities are viewed as construction activities. These activities can be investigated separately or combined for a process of period or scenario investigation.

- Earth works: site clearing;
- Earth works: site levelling;
- Earth works: trench digging for laying of cables and service lines;
- Access road construction;
- Establishment and operating of site construction laydown area;
- Construction of buildings of any type (include the processing plant);
- Transportation of construction workers and material to and from site; and
- Construction camp.

The level and character of the construction noise will be highly variable as different activities with different equipment take place at different times, for different periods of time (operating cycles), in different combinations/sequences and on different parts of the construction site.

9.8.2 Potential Noise Sources – Operational

The following activities are characteristic to operational procedures of opencast mining methods. These activities can be investigated individually, combined (for a process), time-period or scenario investigation and include mechanical sources due to operation of plant equipment, material impact noises (such as the noise made when materials are dropped at a height to ground level) and electrical noise (reverse hooters from mining equipment).

- RoM hauling;
- Processing plant;

- Crushing and screening;
- Materials handling;
- Stockpiling;
- Transportation of product and waste rock; and
- Offices, etc.

The potential noise levels that receptors may experience are highly dependent on the distance between the receptors and the activities (generating a noise).

9.8.3 Traffic

An additional source of noise is additional traffic to and from the site, as well as traffic on the site. This will include heavy and light vehicles transporting equipment, topsoil, overburden, as well as contractors / employees to and from the site.

Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period. During the operational phase, additional traffic to and from the mine infrastructure as well as product hauling activities will be a source of noise.

9.9 BLASTING

Blasting operations' primary objective is breaking rock for excavation to access the medium of material to be mine. 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 pit is located in close proximity of houses or structures or installations.
- ***Noise***: Blasts will be an infrequent occurrence, with a loud but a relative instantaneous character. Potentially affected parties normally receive sufficient notice (siren), and the knowledge that the duration of the siren noise as well as the blast will be over relatively fast resulting in a higher acceptance of the noise.

There are various structures and areas where people congregate within 500m from the pit boundaries. These points of interest will be confirmed and evaluated.

9.10 CULTURAL AND HERITAGE RESOURCES

9.10.1 Findings of Phase 1 HIA

Apart from the informal graveyard, no other significant heritage resources were recorded in the project area.

Regarding the built environment, the recorded ruins have no cultural significance and are judged to be less than 60 years old – they contain no intrinsic architecture design or pioneer building material and building methods that require further assessment.

The informal graveyard is significant and will be impacted on by the development.

The trigonometrical beacon will also be impacted on. It is unclear wat process should be followed if it is to be demolished. However, it is advised that the office of the Chief Directorate: National Geo-Spatial Information (NGI) in the Department of Rural Development and Land Reform be informed.

9.10.2 Statement of Significance

- Significance criteria in terms of Section 3(3) of the National Heritage Resources Act.

Significance		Rating
1.	The importance of the cultural heritage in the community or pattern of South Africa's history. (Historical and political significance)	Low
2.	Possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage. (Scientific significance)	None
3.	Potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage. (Research/scientific significance)	None
4.	Importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects. (Scientific significance)	None
5.	Importance in exhibiting particular aesthetic characteristics valued by a community or cultural group. (Aesthetic significance)	None
6.	Importance in demonstrating a high degree of creative or technical achievement at a particular period. (Scientific significance)	None
7.	Strong or special association with a particular community or cultural group for social, cultural or spiritual reasons. (Social significance)	Low
8.	Strong or special association with the life and work of a person, group or organization of importance in the history of South Africa. (Historic significance)	None
9.	The significance of the site relating to the history of slavery in South Africa.	None

- Section 38(3) (c) An assessment of the impact of the development on such heritage resources.
  - The development will have a negligible effect on heritage remains.

- Section 38(3) (d) An evaluation of the impact of the development on heritage resources relative to the sustainable economic benefits to be derived from the development.
  - None of the recorded heritage remains within the direct mining area are uncommon, rare or unique. The sustainable economic benefits outweigh the conservation benefits.

- Section 38(3) (e) The results of consultation with the communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources.
  - Social consultative process with landowners is ongoing.

- Section 38(3)(f) If heritage resources will be adversely affected by the proposed development the consideration of alternatives.
  - No viable alternatives exist.

- Section 38(3)(g) Plans for mitigation of any adverse effects during and after the completion of the proposed development.
  - Refer to recommendations for management and mitigation measures.

9.10.3 Recommendations for Management and Mitigation

The following mitigation measures are recommended:

- The informal graveyard may have to be relocated to a suitable area after consultation with the affected families when mining takes place near the graves from Year 15 onwards. The status quo must be reassessed before then. The correct legal procedures and protocols for consent and permitting must be followed.
- The office Chief Directorate: National Geo-Spatial Information must be consulted to establish the correct procedure for the removal of the trigonometrical beacon, if required.
- No action is required for the demolished structures on the properties (recording 1-6).
- The discovery of undetected heritage remains must be reported to the archaeologist or the Heritage Authority.

The Phase 1 HIA concluded that there are no objections regarding the development from a heritage point of view, provided the mitigation measures are implemented. No further work was proposed by the heritage specialist.

9.10.4 Palaeontology

The palaeontological sensitivity of the MRA area is indicated in Figure 50. The mining blocks are of Low sensitivity, whilst the infrastructure area is partly of Very High sensitivity and partly of Low sensitivity.

The desk-top PIA concluded that no mitigation for palaeontological heritage is recommended for this project before excavations reach a depth of 1.5m. A suitably qualified palaeontologist must visit the area indicated as Very High sensitivity during the first week of excavations. If excavations expose fossils, a Phase 1 PIA must be conducted, and a CFP document developed. The CFP document must then be included as part of the EMPr of the project, to record all unexpected fossils associated with the geological formations on site.

9.11 SOCIAL IMPACTS AND BENEFITS

The impacts and benefits identified have been grouped according to the cause of the impact, or the driver. For example, the mine will require land for infrastructure development, the impact of this land take may be physical displacement. The potential impact drivers include the following:

- Driver 1: Land Take
  - Impact on current land/property value
  - Impact on agricultural infrastructure
  - Loss of access to productive land and livelihood activities (economic displacement)
  - Loss of employment opportunities
  - Physical displacement of affected worker households and/or labour tenants through land acquisition

- Driver 2: Mine Construction and Operation
  - Influx of job seekers
  - Population growth pressures
  - Changes in settlement and housing patterns
  - Impacts on community services and facilities
  - Increase in crime
  - Disruption of daily living and movement patterns
  - Displacement due to secondary impacts caused by noise, blasting and air quality
  - Impact on health and social well-being
  - Quality of the physical environment
  - Adequacy of physical infrastructure
  - Personal safety and risk exposure

- Driver 3: Stakeholder Engagement and Social Organisation
  - Improved relations with local landowners, settlements and local government
  - Impact equity
  - Community organisations
  - Social networks
  - Community relationships/networks

- Driver 4: Economic Opportunities, Improved Living Conditions and Employment
  - Impact on property values
  - Creation of temporary construction employment

- Increase in mining and decrease in land use employment opportunities
- Local procurement opportunities
- Economic change in local area
- Generation of revenue and GDP contribution
- Loss of job opportunities due to downscaling of the mine employment post-closure

- Driver 5: Human Resource and Socio-economic Investment
  - Human Resource Development programmes
  - Local Economic and Infrastructure Development programmes

9.12 HEALTH AND SAFETY RISKS

A Hazard Identification and Risk Assessment (HIRA) was conducted to identify and assess the potential health and safety hazards that may be presented to construction workers, employees, as well as to members of the public, by the proposed Rietkol Project (AirCheck, 2017).

Although the health risks are varied, the respiratory impacts due to the inhalation of respirable silica dust are the key health risk related to the industry. The health and safety hazards that are relevant to the proposed silica mine were assessed as part of the HIRA and are inclusive of the following:

- Occupational Hazards
  - Crystalline Silica Dust
  - Diesel Exhaust Emissions
  - Blasting Fumes
  - Noise & Vibration
  - Thermal Comfort
  - Non-ionising Radiation
  - Shift Work
  - Ergonomic Stressors
  - Slips, trips, and falls (STFs)
- Public Exposure Risks
  - Particulate Matter
  - Air Pollutants other than Dust
  - Noise
  - Shock and Vibration, Fly Rock
  - Water pollution

The following conclusions were drawn from the assessment:

9.12.1 Construction Workers

Construction workers may be presented with a High Risk of contracting noise induced hearing loss because of exposure to noise from equipment such as, *inter alia*, chain saws, earthmoving equipment, compactors, jack hammers and grinders. Construction workers, who often work outdoors, may also have a High Risk of skin cancer due to exposure to UV radiation from the sun. Furthermore, construction work presents workers with a particularly High Risk of struck-by, as well as STF accidents.

Exposure to air pollutants, such as agricultural and construction dusts, exhaust emissions and welding fumes may present construction workers with a Moderate Risk. Hand-arm and whole-body vibration resulting from the use of hand tools and earthmoving equipment, respectively, may present employees with a Moderate Risk of suffering ill health. Roll-over accidents and collapsing trenches also presented workers with Moderate Risks. The congregation of many workers on a work site without proper infrastructure may present a Moderate Risk of contracting vector borne diseases, infections, sexually transmitted diseases and even attacks by wild animals.

Some of the environmental agents assessed were assigned Risk Scores that fell within the Low Risk categories. Examples included exposure to hazardous chemicals (other than dust) and thermal discomfort.

9.12.2 Mine Employees

Employees at the proposed Rietkol Project may be presented with a High Risk of contracting silicosis because of the dusty nature of the operations and the high crystalline silica content of the dust. Exposure to noise from various noisy operations, including mobile equipment, crushers, and the beneficiation plant, may present a High Risk of contracting noise induced hearing loss. Safety risks such as STFs remain ever present in the mining environment with its many levels, trenches, and different plant infrastructure. The 24/7 operations require shift work, which may be the cause of serious health problems, if not managed well.

Several hazards were identified that may present employees with a Moderate Risk of suffering ill health. These included an increased risk of contracting respiratory diseases due to exposure to diesel exhaust fumes, exposure to vibration during the operation of mobile equipment and bacteriological agents, including *E. coli,* faecal coliforms, and cholera due to a lack of potable drinking water,

refrigeration, preservation, and sanitation facilities. Poor night-time illumination may present a Moderate Risk of poor visual acuity, eye strain, and an increased risk of accidents and injury.

Thermal discomfort when working outdoors may present employees with a Low Risk.

9.12.3 Members of the Public

During construction and operation of the proposed Rietkol Project, dust and diesel exhaust emissions may be generated, which may present members of the public with a Moderate Risk of contracting respiratory diseases such as chronic obstructive pulmonary disease (COPD), wheezing and cough, lung cancer.

Members of the public are also presented with Moderate Risk of annoyance caused by noisy activities during both the construction and operational phases of the mine, especially those in proximity and along the transport routes.

9.12.4 Recommendations for Management and Mitigation

The HIRA (attached as Appendix 5) concluded that the implementation of certain engineering, administrative and Personal Protective Equipment (PPE) control measures may reduce the above risks to acceptable levels.

Several control measures were recommended by the specialists, which will be included in the EMPr for Rietkol Project. In addition, occupational hygiene monitoring, environmental monitoring and medical surveillance programmes for employees and the community were recommended, which will be included in the mine's monitoring programme.

9.13 CUMULATIVE IMPACT ASSESSMENT

The potential cumulative impact associated with the Rietkol Project will be investigated during the EIA Phase, and will include the impact on the following environmental aspects:

- Bulk water and power requirements
- Vegetation clearance and impact on grasslands, including protected fauna and flora species
- Land use / land capability
- Groundwater drawdown impact zone
- Surface water quality impact on aquatic resources and wetlands
- Ambient air quality and noise levels

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

Cumulative effects will be investigated as far as it is practical and relevant. It is important to note that the cumulative impact will be quantified as far as possible based on available information; however, not all information may be readily available due to possible confidentiality and the level of technical detail. The cumulative impact will therefore not be determined to the same level as the impacts associated with the Rietkol Project.

9.14 ENVIRONMENTAL IMPACT EVALUATION AND MITIGATION MEASURES

9.14.1 Impact Risk Matrix

Table 61: Initial High-Level Impact Risk Matrix Summary

Sensitive Receptor	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting Factor	Impact Significance	Mitigation Efficiency	Impact Significance
Biophysical Environment	Soils	Loss of soil depth (volume), fertility and organic carbon content	Negative	Long Term	Site specific	Highly Probable	High	Low to Medium	Low to Medium	Medium	Low
Biophysical Environment	Fauna & Flora	Impact on sensitive floral and faunal habitat & diversity	Negative	Long Term	Local	Highly Probable	Medium	Medium	Low to Medium	Low to Medium	Low to Medium
Biophysical Environment	Fauna & Flora	Impact on species of conservation concern	Negative	Long Term	Local	Probable	High	High	Medium to High	Low to Medium	Medium
Biophysical Environment	Fauna & Flora	Killing of animals and avifauna on the roads, especially nocturnal animals/birds	Negative	Long Term	District	Highly Probable	High	High	Medium to High	Low to Medium	Medium to High
Biophysical Environment	Wetlands and Aquatic Systems	Loss of aquatic habitat, biodiversity and sensitive taxa and socio-cultural service provision	Negative	Long Term	Local	Probable	High	High	Medium to High	Medium	Low to Medium
Biophysical Environment	Surface Water	Increased sediment loads due to vegetation clearance and compaction	Negative	Long Term	Local	Probable	Medium	Medium	Low to Medium	Medium to High	Low
Biophysical Environment	Surface Water	Pollution due to uncontrolled releases from the infrastructure areas	Negative	Long Term	Local	Probable	Medium	Medium to High	Medium	Medium to High	Low
Biophysical Environment	Surface Water	Pollution because of accidental spillages of chemicals and hazardous material	Negative	Long Term	Local	Probable	High	High	Medium to High	High	Low
Biophysical Environment	Groundwater	Lowering of groundwater levels, including cumulative drawdown due to surrounding agricultural abstraction	Negative	Long Term	District	Probable	High	High	Medium to High	Not Efficient	Medium to High
Biophysical Environment	Groundwater	Effect on groundwater quality due to infiltration of poor quality water/effluent and hazardous material	Negative	Long Term	District	Probable	High	High	Medium to High	Medium to High	Low to Medium

Sensitive Receptor	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting Factor	Impact Significance	Mitigation Efficiency	Impact Significance
Communities	Air Quality	Increased dust levels because of construction and hauling operations	Negative	Long Term	District	Highly Probable	Medium	High	Medium to High	Medium to High	Low to Medium
Communities	Ambient noise	Potential for noise impact during construction and mining in surrounding communities	Negative	Long Term	Local	Highly Probable	High	High	Medium to High	Low to Medium	Medium
Communities	Visual	Visual intrusion of mining activities, impacting on the sense of place	Negative	Long Term	District	Highly Probable	High	Medium to High	Medium to High	Medium	Low to Medium
Communities	Lighting	Impact due to night-time lighting	Negative	Long Term	District	Definite	High	Medium to High	Medium to High	Medium	Low to Medium
Communities	Traffic	Safety of other road users, increase in traffic accidents	Negative	Long Term	Regional	Highly Probable	High	High	High	Medium	Medium
Communities	Heritage and Cultural Aspects	Impact on graves and any undetected sub-surface heritage resources	Negative	Long Term	Local	Highly Probable	Very High	High	Medium to High	Medium	Medium
Communities	Social	Increase in available employment opportunities locally	Positive	Long Term	Provincial	Definite	High	Medium to High	Medium to High	Not Efficient	Medium to High
Communities	Social	Increase in skills development programmes and therefore skill levels of the local communities	Positive	Long Term	Local	Highly Probable	High	Medium to High	Medium	Not Efficient	Medium
Communities	Social	Empowerment of local business through procurement and capacity building	Positive	Long Term	Regional	Highly Probable	High	Medium to High	Medium to High	Not Efficient	Medium to High
Communities	Employee and public health	Employee and public exposure to health and safety hazards, and specifically respiratory impacts due to the inhalation of respirable silica dust	Negative	Permanent	Local	Highly Probable	Very High	High	High	Medium to High	Low to Medium
Residual Impacts	Land Use and land capability	Post-closure land use and land capability	Negative	Permanent	Local	Highly Probable	Medium	High	Medium to High	Medium	Medium

The Risk Assessment Methodology is described in the Plan of Study (Appendix 6).

9.14.2 Measures to avoid, reverse, mitigate or manage impacts

Table 62: Initial High-Level identification of Mitigation Measures

Activity	Potential Impact	Possible Mitigation Measures (to be confirmed during the EIA Phase)	Potential for Residual Risk
Infrastructure area	Loss of soil depth (volume), fertility and organic carbon content	• The available topsoil will be stripped prior to construction for final rehabilitation. • Topsoil stockpile areas will be seeded and maintained for the LOM. • Soil analysis will be performed prior to seeding (post rehabilitation) and the soil fertility rectified (if necessary) to facilitate vigorous growth. • Organic fertilisers will be used as far as possible.	Low
Infrastructure area	Impact on sensitive floral and faunal habitat & diversity	• Development of Biodiversity Action Plan (BAP) prior to construction. • In areas not impacted by the mining activities, the natural vegetation will be maintained by implementing an alien vegetation eradication programme and by restricting vehicle movement to existing roads. • An alien floral control plan must be designed and implemented to monitor and control alien floral recruitment in disturbed areas. • No collection of firewood, RDL/Protected or medicinal floral species must be allowed by mining personnel. • Access will be controlled to prevent illegal hunting and snaring of fauna in the area. • An environmental awareness campaign will be implemented, both internally and externally (local communities).	Low to Medium
Infrastructure area	Impact on species of conservation concern	• A protected and RDL floral relocation, monitoring and management plan will be designed and implemented by a suitably qualified specialist and should address all species which can be successfully rescued and relocated. • A flora rescue operation will be undertaken prior to construction during the growing season. The necessary permits must be obtained from MTPA prior to relocation of the species. • A rescue and relocation programme for fauna species will be developed and implemented with the assistance of specialists in this field. • An environmental awareness campaign will be launched, both internally and externally (local communities).	Medium
RoM and product haulage	Killing of animals and avifauna on the roads, especially nocturnal animals/birds	• Limiting vehicle speeds. • Off-site hauling of product should be limited to daylight hours. • Implementation of an Environmental Awareness Programme for trucking contractor.	Medium to High
Infrastructure area	Loss of aquatic habitat, biodiversity and sensitive taxa and socio-cultural service provision	• Buffer zones should be determined for each wetland system to ensure that the wetland areas and their associated integrity and biodiversity support functions are not negatively affected, e.g.: o No roads or infrastructure to be placed within the wetland areas and associated buffer zones. o No dumping of waste should take place within the wetland areas and associated buffers. If any	Low to Medium

Activity	Potential Impact	Possible Mitigation Measures (to be confirmed during the EIA Phase)	Potential for Residual Risk
		spills occur, they should be immediately cleaned up. o No abstraction of water from the wetlands. o No water to be pumped into the wetlands. • Implementation of a biodiversity & wetland monitoring programme for early detection of potential impacts and deterioration in the PES of the wetland systems. • Implement alien vegetation control program within wetland areas with special mention of water-loving tree species. • Water quality and aquatic monitoring to assess the suitability of the water to support aquatic life.	
Infrastructure and storm water management	Increased sediment loads due to vegetation clearance and compaction	• Design and install appropriate outlet structures to retard flow velocity. • Construct energy dissipating structures along steep slopes. • Side slopes of earth berms / canals to be designed to 1:3 and protected & vegetated to prevent erosion. • Final topsoiling and re-vegetation according to the rehabilitation plan. • All available topsoil areas will be seeded prior to the start of the rainy season.	Low
Infrastructure area	Pollution due to uncontrolled releases from the infrastructure areas	• No discharge of dirty water into the natural environment. • No dirty water runoff will be permitted to reach the wetland resources. • Separation of clean and dirty water through implementation of the SWMP. • Construction of return water facility to store excess water from the pit and dirty water runoff. • Directing and containment of dirty water runoff to dirty water dams and providing silt traps. • Design dirty water management infrastructure for the 1:50 year flood event.	Low
Hazardous chemicals and waste	Pollution because of accidental spillages of chemicals and hazardous material	• Strict control of sewage water treatment must take place and the sewage system should form part of the mine's closed process water system. • Develop and implement hydrocarbon management procedures to prevent accidental spillages. • Bulk facilities and chemical stores to be concrete lined and bunded to a capacity of 110%. • Spillages must be cleaned up immediately in line with the Spill Management procedure.	Low
Mining	Lowering of groundwater levels, including cumulative drawdown due to agricultural abstraction	• Reuse and recycling of water to minimise the drawdown cone and impact on borehole levels. • Implementation of a monitoring programme to confirm impact predictions. • Compensate or provide alternative water supply to affected groundwater users.	Medium to High
Infrastructure area	Effect on groundwater quality due to infiltration of poor quality water/effluent and hazardous material	• Any dirty water to be captured and pumped to the processing facility for re-use. • Dirty water dams to and canals be constructed with appropriate geo-liners depending on the waste classification. • Stockpiles will be compacted to minimise infiltration. • Monitoring boreholes will be installed in appropriately selected sites prior to commencement	Low to Medium

Activity	Potential Impact	Possible Mitigation Measures (to be confirmed during the EIA Phase)	Potential for Residual Risk
		of mining to detect changes in water quality and water levels with time.	
Construction Hauling operations	Increased dust levels because of construction and hauling operations	• Set the speed limit for on-site hauling vehicles and other vehicles to 40 km/h. • Set the speed limit for off-site hauling vehicles to 60 km/h on unpaved roads. • Actively enforce the speed limits specified. • Include speedbumps where appropriate to control the speed limits. • Implement a program of wet suppression of the unpaved roads with major vehicle activity. • Trucks transporting product will be covered, with tarpaulins, to minimise the generation of dust and the impact on ambient air quality. The covers/tarpaulin used to cover the transported material will be secured. • Trucks will be weighed on site before departing to limit the risk of product spillage.	Low to Medium
Construction Hauling operations	Potential for noise impact during construction and operations in surrounding communities	• The timber plantation situated in the north-western corner will be kept intact, to act as a noise barrier between the mine and the informal community. • Construction to be restricted from 06h00 to 18h00 with no activities (or at least no noisy construction activities) at night. • Use of low-noise generation plant and equipment. • All plant, equipment and vehicles are to be kept in good repair. • Maintaining vehicle speeds. • Off-site hauling of product should be limited to daylight hours. • At commissioning of the mine, noise monitoring guidelines are to be prepared and implemented.	Medium
Infrastructure area	Visual intrusion of mining activities, impacting on the sense of place	• The development footprint and disturbed areas are to be kept as small as possible and the areas cleared of natural vegetation must be kept to a minimum. • The height of infrastructure and stockpiles should be kept as low as possible. • Natural colours should be used in all instances and the use of highly reflective material should be avoided. Any metal surfaces should be painted to fit in with the natural environment in a colour that blends in effectively with the background. White structures are to be avoided as these will contrast significantly with the natural surroundings. • In areas where screening topography and vegetation are absent, natural-looking constructed landforms and vegetative or architectural screening may be used to minimise visual impacts. Care should however be taken to avoid additional surface disturbance.	Low to Medium
Lighting	Impact due to night-time lighting	• Outdoor lighting must be strictly controlled. • High light masts should be avoided. Any high lighting masts should be covered to reduce the glow. • Lighting fixtures must be selected and placed so that they direct their light on the intended area only, to avoid light spill and offsite light trespass. • Light sources must be shielded by physical barriers. • The use of low-pressure sodium lamps, yellow LED lighting, or an equivalent reduces sky-glow and wildlife impacts. Bluish-white lighting is more likely to	Low to Medium

Activity	Potential Impact	Possible Mitigation Measures (to be confirmed during the EIA Phase)	Potential for Residual Risk
		cause glare and attract insects and is associated with other human physiological issues.	
Product transport Increase in traffic	Safety of other road users, increase in traffic accidents	• All heavy vehicles must be restricted to designated routes and not permitted on other roads. • Off-site hauling of product should be limited to daylight hours. • Set the speed limit for off-site hauling vehicles to 60 km/h on gravel roads and enforce the speed limits specified. • Include speedbumps where appropriate to control the speed limits. • Trucks transporting product will be covered, with tarpaulins, to minimise the generation of dust and the impact on ambient air quality. The covers/tarpaulin used to cover the transported material will be secured. • Trucks will be weighed on site before departing to limit the risk of product spillage. • As part of the development there will be road geometric improvements made to the road network. These upgrades are focused on improving the safety of the road and will hence have a positive impact on other road users.	Medium
Heritage and Cultural aspects	Impact on graves and any undetected sub-surface heritage resources	• The informal graveyard must be relocated to a suitable area after consultation with the affected families. The correct legal procedures and protocols for consent and permitting must be followed. This must be done prior to mining commences within 100m of the grave sites. • The discovery of undetected heritage remains must be reported to the archaeologist or the Heritage Authority. • A suitably qualified palaeontologist must visit the area indicated as Very High sensitivity during the first week of excavations. If excavations expose fossils, a Phase 1 PIA must be conducted, and a CFP document developed.	Medium
Social aspects	Increase in available employment opportunities locally	• Source the maximum number of employees from the local area for job opportunities. • Implement skills development programmes in the areas where most job opportunities will be created, i.e. operators and drivers. • Make available bursary opportunities to build skill capital in the region. • Establish a database of local people with information on qualifications and skills, utilize this database to develop skills plans and recruit local people. • Implement portable skills development programmes. • Implementation of programmes to minimize and mitigate the impact of downscaling and retrenchment.	Medium to High (Positive)
Social aspects	Increase in skills development programmes and therefore skill levels of the local communities		Medium (Positive)
Social aspects	Empowerment of local business through procurement and capacity building	• Establish a database of local businesses, utilize this database to establish partnerships between local and larger service providers as well as locally preferred work packages. • Consultation and feedback on results on a regular basis. • Implementation of capacity building programmes to minimize and mitigate the impact of mine downscaling and closure.	Medium to High (Positive)

Activity	Potential Impact	Possible Mitigation Measures (to be confirmed during the EIA Phase)	Potential for Residual Risk
Employee and public health	Employee and public exposure to health and safety hazards	• Implement control measures as defined by the HIRA. • Implement occupational hygiene and medical surveillance programmes for employees. • Implement environmental monitoring and community medical surveillance programmes.	Low to Medium
Residual Impacts	Impact on ecosystem Post-closure land use and land capability	• Define, in consultation with all IAPs, the final (post-closure) land use for the MRA area. • Set final closure objectives and standards to ensure conformance to the final land use plan, the requirements of the IAPs and relevant environmental legislation.	Medium

The mitigation measures will be further investigated during the EIA Phase, and a final list of mitigation measures included in the EIAR/EMPr.

10 PLAN OF STUDY

10.1 DESCRIPTION OF ALTERNATIVES TO BE CONSIDERED

The following alternative land use options have been identified:

- **Commercial farming:** The area is an important agricultural producing area with extensive maize and soya bean fields (both dryland and irrigated), and intensive horticulture and poultry enterprises. Vegetable production (dry land, irrigated and tunnel) is also observed together with feedlots. The area is rich with good quality groundwater, hence the high agricultural activity in the area.
- **Grazing:** Grazing for domestic animals (cattle, goats) is a viable alternative to mining, especially within the MRA area, that has a slightly lower land capability than the surrounding areas due to the rocky outcrops.
- **Residential Investment or Commercial Development:** In recent years AHs have been increasingly developed for commercial or residential investment properties rather than agriculture. Within the Modder East AHs, many properties have been converted from rural residential to residential investment properties (properties constructed to rent out) with more than 1 residential structure on a property and commercial development (workshops, panel beaters, offices, etc.).
- **Communal land:** The area may be utilised by the informal settlements for housing and subsistence farming / grazing land.

The viability of these alternative land use options will be determined during the EIA Phase by utilising the collected site-specific data to determine the comparative feasibility of the project and the impact on local activities. A macro-economic study is aimed at determining the economic and socio-economic indicators and assist in identifying the best alternative land use option.

The basic function of this specialist study would be to determine whether the Rietkol Project will enhance net societal welfare. At a broad level, investigating impacts on overall welfare requires considering the efficiency, equity, and sustainability of the project. Keeping these principles in mind, the core concept applied by the economist when considering trade-offs is “opportunity cost” – the net benefit that would have been yielded by the next best alternative. For example, if farming is the next best alternative for a piece of land, then the foregone benefit associated with it will be the opportunity cost of any other land use. It is vital information if decision-makers are to understand the trade-offs involved in projects. A key part of considering opportunity costs is commonly to highlight

the impacts of doing nothing, i.e. the "no-go alternative" or also referred to as the "economic baseline".

10.2 DESCRIPTION OF ASPECTS TO BE ASSESSED DURING THE EIA PROCESS

The aspects that will be investigated during the EIA Phase are inclusive of all the mining and associated activities and will include the following:

Main activities / processes	Associated activities
Mining activities – Open Pits	Drilling & blasting Mine water management Storm water management Dust suppression Closure planning and rehabilitation
Processing plant & infrastructure	Access road RoM crushers Plant infrastructure Product stockpiles Silt traps / dirty water canals Workshops & wash-bay Bulk hydrocarbon facilities Clean water storage tanks Dirty water holdings dams Offices & stores Ablution facilities & change houses Potable water & sewage treatment plants
On-site conveyance of RoM & product	Haul / service roads Conveyors
Mine residue / waste management	Topsoil stockpiles Slimes pipeline & disposal Waste rock stockpile Stormwater management and leachate control Waste management (general & hazardous)
Off-site product transport	Upgrading of Road D1550 and access road (gravel road) Implementation of calming / traffic safety measures
Bulk water & power	Pipelines Power lines

The impacts associated with the above activities will be investigated during the EIA Phase as far as practically possible, and where the necessary technical information is available.

10.3 DESCRIPTION OF ASPECTS TO BE ASSESSED BY SPECIALISTS

Several specialist studies were commissioned for the Rietkol Project during 2016-2018 in support of the previous application, as listed in Section 1.2.3. The methods of assessment for the specialist studies are contained in the 2018 Plan of Study, attached as Appendix 6.

10.3.1 EIA Screening Tool and Site Sensitivity Verification Statement

Several additional requirements when applying for Environmental Authorisation (EA) have emerged since the 2018 EIA process, including but not limited to:

1. Notice was given in Government Notice No. 960 (GN 960) dated 5 July 2019 of the requirement to submit a report generated by the National Web Based Environmental Screening Tool in terms of section 24(5)(h) of the NEMA and regulation 16(1)(b)(v) of the 2014 EIA Regulations. Such a Screening Report became compulsory when applying for an EA 90 days from publication of GN 960 (5 October 2019). The purpose of the Screening Report is to identify the list of specialist assessments that needs to be conducted in support of the EA application, based on the selected classification, and the environmental sensitivities of the proposed development footprint. The Screening Report for the Rietkol Project is attached as Appendix 7.
2. Government Notice No. 320 (GN 320) dated 20 March 2020 prescribes general requirements for undertaking site sensitivity verification and for protocols for the assessment and minimum report content requirements of environmental impacts for environmental themes for activities requiring EA in terms of sections 24(5)(a), (h) and 44 of NEMA. These procedures and requirements came into effect 50 days after publication of GN 320 (15 May 2020). The purpose of the site sensitivity verification is to verify (confirm or dispute) the current use of the land and the environmental sensitivity of the site under consideration as identified in the Screening Report. This will determine the level of assessment required for each environmental theme, i.e. Specialist Assessment or Compliance Statement.

As indicated above, several specialist studies were commissioned for the Rietkol Project during 2016-2018 in support of the previous application, including:

- Soils, land use and capability, Hydropedology
- Terrestrial / Aquatic Biodiversity
- Groundwater
- Air Quality

- Ambient Noise
- Blasting & Vibration
- Traffic
- Heritage and Cultural Resources
- Palaeontology
- Visual and Aesthetics
- Social
- Hazard Identification and Risk Assessment (HIRA)
- Land Trade-off & Macro-Economic Analysis

Comprehensive specialist assessments were conducted for all the environmental and social themes listed above, irrespective of the sensitivity identified by the specialist assessment (2018) or the Screening Report. Therefore, no site sensitivity verification has been done for this EA application as all themes have been considered to have a **high to very high sensitivity**, requiring a full Specialist Assessment.

The list of specialist assessments listed in the Screening Report and the extent to which it has been addressed in the re-application for EA for the Rietkol Project is indicated Table 63. Where applicable, motivation is provided for the exclusion of certain specialist assessments.

Table 63: GN 960 specialist assessment requirements

GN 960 requirement (Appendix 7)	**Extent to which it is included in the Plan of Study**
Agricultural Impact Assessment	Soil and Land Capability Assessment by Scientific Aquatic Services.
Landscape/Visual Impact Assessment	Visual Impact Assessment by Scientific Aquatic Services.
Archaeological and Cultural Heritage Impact Assessment	Phase 1 Heritage Impact Assessment by R&R Cultural Resource Consultants.
Palaeontology Impact Assessment	Palaeontology Impact Assessment by ASG Geo Consultants (Pty) Ltd {Dr Gideon Groenewald}.
Terrestrial Biodiversity Impact Assessment	Faunal, Floral and Freshwater Assessment by Scientific Terrestrial Services.
Aquatic Biodiversity Impact Assessment	Faunal, Floral and Freshwater Assessment by Scientific Terrestrial Services.
Hydrology Assessment	Baseline Water Quality Assessment by Scientific Aquatic Services. Water Management Plan – Preliminary Design Report by Onno Fortuin Consulting.

GN 960 requirement (Appendix 7)	Extent to which it is included in the Plan of Study
Noise Impact Assessment	Environmental Noise Impact Assessment by Enviro Acoustic Research.
Radioactivity Impact Assessment	Waste Classification by Groundwater Complete. Analysis will include Uranium and Thorium to determine potential for radioactivity within the resource.
Traffic Impact Assessment	Traffic Impact Assessment by Avzcons Civil Engineering Consultant.
Geotechnical Assessment	A geotechnical assessment will be undertaken as part of the Water Management Plan developed by Onno Fortuin Consulting.
Climate Impact Assessment	A greenhouse gas emissions statement is included in the Air Quality Impact Assessment by EBS Advisory.
Health Impact Assessment	Hazard Identification and Risk Assessment by AirCheck Occupational Health, Environmental & Training Services.
Socio-Economic Assessment	Socio-Economic Impact Assessment by Diphororo Development.
Ambient Air Quality Impact Assessment	Air Quality Impact Assessment by EBS Advisory.
Seismicity Assessment	A Blasting Impact Assessment is included and has been conducted by Blast Management Consulting. It deals extensively with the potential impact in respect of air blast and vibration from blasting operations.
Plant Species Assessment	Part of Terrestrial Biodiversity Impact Assessment.
Animal Species Assessment	Part of Terrestrial Biodiversity Impact Assessment.

Further studies that are not included in the GN 960 requirements, but were commissioned for the Rietkol Project, are:

- Hydropedological Assessment and Impact Modelling by Scientific Aquatic Services.
- Geohydrological Investigation by Groundwater Complete.
- Blasting Impact Assessment by Blast Management Consulting.
- Land Trade-off Study and Macro-Economic Impact Analysis by Mosaka Economic Consultants.
- Rehabilitation, Decommissioning and Closure Plan by Jacana Environmentals.
- Medical Research Study by EBS Advisory. This study is commissioned in response to comments made by the IAPs on the DSR.

Where a specific environmental theme protocol has been prescribed by GN 320, the specialist assessment will adhere to such protocol. Where no protocol has been prescribed, the report will comply with Appendix 6 of the EIA Regulations.

10.3.2 Specialist Studies' Review

This re-application comes some 3 years after the previous specialist fieldwork was conducted. The environmental context in the area has not changed significantly, nor has the mining and infrastructure footprint been altered from the 2018 application. The findings of the specialist reports are therefore considered valid for this re-application and limited additional specialist work is planned for this re-application.

The following additional specialist work will be conducted to confirm the baseline environmental context, based on further desk-top and fieldwork investigations planned for March 2021:

- Revision of sensitive receptors map and landownership.
- Update community surveys and social baseline information.
- Additional baseline fauna and flora fieldwork will be conducted to confirm the existing baseline information.
- The wetland and aquatic specialist will conduct further baseline fieldwork and water quality sampling to confirm the PES of the wetlands. The water quality assessment will be updated accordingly.
- Updating of the groundwater numerical model (pollution plume) and impact assessment based on the preferred layout for the project.
- Conducting a classification of waste material to confirm waste properties at Rietkol.
- Additional round of baseline noise monitoring will be conducted.
- Additional round of baseline air quality monitoring will be conducted and the dispersion model re-run.
- The heritage specialist will address the comments received from SAHRA during the previous EIA process and liaise with the Mpumalanga Heritage Authority in this regard.
- The socio-economic impact analysis and cost benefit analysis will be updated with more recent prices and adapted costs, and remodelled.
- The traffic review has allowed for consultation (meetings) with SANRAL and Mpumalanga Roads & Transport to confirm the proposed upgrading of the roads.
- The GN1147 Rehabilitation, Decommissioning and Closure Plan will be updated in respect of comments received from the IAPs and authorities during the EIA Phase and the financial provision revised.
- Commissioning of the Medical Research Study.

The other specialist impact assessments will only be reviewed considering the IAP comments received during the 2018 Scoping Phase to ensure that all relevant issues are addressed satisfactorily. No further impact modelling will however be conducted apart from that listed above.

10.4 PROPOSED METHOD OF ASSESSING DURATION AND SIGNIFICANCE

The proposed Risk Assessment Methodology is described in Section 2.15 of the Plan of Study (Appendix 6).

10.5 PUBLIC PARTICIPATION PROCESS TO BE FOLLOWED DURING THE EIA PHASE

Refer to the Public Participation Plan attached as Appendix 8.

11 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

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

Refer to Section 9.11 of this report.

11.2 IMPACT ON ANY NATIONAL ESTATE

Refer to Section 9.10 of this report.

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

As indicated in Section 7.1.1 of this report, no alternatives site locations have been considered as mining can only be undertaken in areas where economically mineable resources occur. The Rietkol resource was established through extensive prospecting and geological modelling over many years.

Infrastructure to support the Rietkol Project has been laid out and engineered to best suit the topography and mining pit layouts, as well as the relatively small footprint of the MRA area. Environmental and cultural aspects have been considered in the final infrastructure layout – refer to Section 7.1.3.

The only real alternative to the mine is the No-Go Option. Based on the macro-economic analysis of the baseline activities (Mosaka Economic Consultants, 2018), the total GDP generated by the existing land use activities within the MRA area is estimated at a total of R 1.13 million per annum and the direct at R 0.41 per annum (2017 prices). Only two direct permanent employment opportunities are sustained by the land use activities, with a total of 6 if the indirect and induced is added.

The main consequence of the No-Go Option is the loss of opportunity to develop a high-quality mineral resource with an estimated LOM of 20 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 projects / programmes and local procurement and SMME opportunities.

Furthermore, most of the silica is earmarked for the domestic market including the glass-making industry. The glass-making industry is a major contributor to the national GDP and provides further

economic opportunities downstream of the mine and factories, including the bottling and container glass industries (wine, soda, and beer) as well as building and float glass industries.

Other socio-economic benefits that will be lost include the skills development opportunities, community development projects as proposed in the SLP and local procurement and SMME opportunities.

12 UNDERTAKING

12.1 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: 7 May 2021

12.2 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: 7 May 2021

13 APPENDICES

Appendix 1: Public Participation Report and Records

Appendix 2: Hydrocensus Reports

Appendix 3: Phase 1 Heritage Impact Assessment

Appendix 4: Palaeontological Desk-top Study

Appendix 5: Hazard Identification and Risk Assessment

Appendix 6: Plan of Study – Specialist Studies Methodology (2016-2018)

Appendix 7: GN 960 Screening Report

Appendix 8: Public Participation Plan

Appendix 9: Curriculum Vitae of EAP