IMERYS REFRACTORY MINERALS SOUTH AFRICA (PTY) LTD – KRUGERSPOST ANDALUSITE MINE – KLIPFONTEIN MINE

Closure Plan and Rehabilitation Plan

Based on Appendix 5 (Closure Plan) of the Environmental Impact Assessment Regulations, 2014 and Appendix 4 (Minimum content of a final rehabilitation, decommissioning and closure plan) of the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations, 2015 i.t.o. the National Environmental Management Act No 107 of 1998 (as amended), and regulation 60 of the Minerals and Petroleum Resources Development Regulations, GN 527 of 2004 (as amended) i.t.o. the Minerals and Petroleum Resources Development Act No 28 of 2002

Name of Applicant: Imerys Refractory Minerals South Africa, Krugerspost Mine
DMR ref: MP30/5/1/2/2/196MR
DWS ref: 16/2/7/B400/C373
Application Property: Portions 31 and Portion 32 of the Farm Klipfontein 400KT, Thaba Chweu Local Municipality, Mpumalanga

November 2020

BECS Environmental (Pty) Ltd
In association with BECS Services (Pty) Ltd

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OBJECTIVE OF THE FINAL REHABILITATION, DECOMMISSIONING AND MINE CLOSURE PLAN

The objective of the final rehabilitation, decommissioning and mine closure plan, which must be measurable and auditable, is to identify a post-mining land use that is feasible through—

a) providing the vision, objectives, targets and criteria for final rehabilitation, decommissioning and closure of the project;
b) outlining the design principles for closure;
c) explaining the risk assessment approach and outcomes and link closure activities to risk rehabilitation;
d) detailing the closure actions that clearly indicate the measures that will be taken to mitigate and/or manage identified risks and describes the nature of residual risks that will need to be monitored and managed post closure;
e) committing to a schedule, budget, roles and responsibilities for final rehabilitation, decommissioning and closure of each relevant activity or item of infrastructure;
f) identifying knowledge gaps and how these will be addressed and filled;
g) detailing the full closure costs for the life of project at increasing levels of accuracy as the project develops and approaches closure in line with the final land use proposed; and
h) outlining monitoring, auditing and reporting requirements.

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ABBREVIATIONS

AMD	Acid Mine Drainage
AP	Acid Generating Potential
BoQ	Bill of Quantities
CPI	Consumer Price Index
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental assessment practitioner

EAPASA	Environmental Assessment Practitioners Association of South Africa
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
ERF	Emission factor rating
GN 982	Environmental Impact Assessment Regulations, GN 982 of 2014 i.t.o. the National Environmental Management Act No 107 of 1998 (as amended)
GN 1147	Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production, GN 1147 of 2015 i.t.o. the National Environmental Management Act No 107 of 1998 (as amended)
HD	Horizontal Dipole
HIA	Heritage Impact Assessment
IAIAsa	International Association for Impact Assessment
IDP	Integrated Development Plan
Imerys	Imerys Refractory Minerals South Africa (Pty) Ltd
MHSA	Mine Health and Safety Act, 1996 (Act No. 29 of 1996)
MPRDA	Minerals and Petroleum Resources Development Act (Act 28 of 2002 as amended)
MPRDR	Minerals and Petroleum Resources Development Regulations, GN 527 of 2004 (as amended) i.t.o. the Minerals and Petroleum Resources Development Act No 28 of 2002
NAAQS	National Ambient Air Quality Standards
NAFCOC	National Federated Chamber of Commerce and Industry
NDCR	National Dust Control Regulation
NEMA	National Environmental Management Act No 107 of 1998 (as amended)
NEMWA	National Environmental Management Waste Act No 59 of 2008 (as amended)
NGA	National Groundwater Archive
NPI	National Pollutant Inventory's
NNP	Net Neutralising Potential
NWA	National Water Act 36 of 1998
PPE	Personal protective equipment
SACNASP	South African Council for Natural Scientific Professions
SAHRA	South African Heritage Resources Agency
SANS	South African National Standards
TCLM	Thaba Chweu Local Municipality
TWQG	Target Water Quality Guidelines
VD	Vertical Dipole
WHO	World Health Organisation
IWUL	Integrated Water use licence
IWULA	Integrated Water Use Licence Application

EXECUTIVE SUMMARY

BECS Environmental has been appointed by Imerys Refractory Minerals South Africa (Pty) Ltd to apply for an environmental impact assessment (EIA), and an Integrated Water Use License Application (IWULA). These activities include the pumping of water from Quarry 6 and Quarry 7 or the backfilling of Quarry 6 with mine residue (slimes and waste rock).

The DMR stated that a Category B(11) waste license in terms of GN 921 (as amended by GN 633 of 2015) under NEMWA for the backfilling of mine residue in to Quarry 6 (this includes slimes and waste rock) is not necessary and that a closure plan can be submitted instead to demonstrate the rehabilitation of the quarry. It was confirmed by the DMR that the mine is not applying for closure and that no closure application will need to be lodged as the purpose of the closure plan is to demonstrate the rehabilitation of Quarry 6. This closure plan is attached to the EIA report as an addendum.

Krugerspost Mine has been mining for over 35 years and has an existing mining right for the mining of andalusite on portions 31, 32, 36 and the remaining extent of portion 1 of the farm Klipfontein 400 KT in Thaba Chweu Local Municipality, Mpumalanga Province. The mine is in the B42E quaternary catchment of the Olifants Water Management Area and the Central Transvaal (Bushveld) Basin. Krugerspost is located at S24°56'13.20" and E30°26'9.60" (central coordinates). Approximately 978ha on the farm Klipfontein is used for the Krugerspost mining operations. The Spekboom River runs approximately 3km to the south west from the current mining activities.

This Closure Plan is compiled in line with the requirements of Appendix 5 of the Environmental Impact Assessment Regulations, GN 982 of 2014 i.t.o. the National Environmental Management Act No 107 of 1998 (as amended) NEMA); and regulations 6(b) & 12(2) & Appendix 4 of the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production, GN 1147 of 2015 i.t.o. NEMA.

Layout of document

Refer to the Table 1 below for a layout of this documents, considering the requirements as set out in regulation 62 of the MPRDR, Appendix 5 of GN 982, and Appendix 4 of GN 1147.

According to Appendix 4 of GN 1147:

'The final rehabilitation, decommissioning and mine closure plan must be measurable and auditable, must take into consideration the proposed post-mining end use of the affected area and must contain information that is necessary for the definition of the closure vision, objectives and design and relinquishment criteria, indicating what infrastructure and activities will ultimately be decommissioned, closed, removed and remediated and the risk drivers determining actions, indicating how the closure actions will be implemented to achieve closure relinquishment criteria and indicating monitoring, auditing and reporting requirements.'

Table 1: Layout of document

GN 527	GN 982	GN 1147	Description	Section
a			A description of the closure objectives and how these relate to the mine operation and its environmental and social setting	4
b			A plan contemplated in regulation 2(2), showing the land or area under closure	Figure 2
c			A summary of the regulatory requirements and conditions for closure negotiated	3.1
d			A summary of the results of the environmental risk report and details of identified residual and latent impacts	EIA
e			A summary of the results of progressive rehabilitation undertaken	4.2
f			A description of the methods to decommission each prospecting or mining component and the mitigation or management strategy proposed to avoid, minimize and manage residual or latent impacts	4.2
g			Details of any long-term management and maintenance expected	5
h			Details of a proposed closure cost and financial provision for monitoring, maintenance and post closure management	6
i			A sketch plan drawn on an appropriate scale describing the final and future land use proposal and arrangements for the site	4.1
j			A record of interested and affected persons consulted	2.3
k			Technical appendices	None
	1(a)		i. Details of the EAP who prepared the closure plan; and	1.2

GN 527	GN 982	GN 1147	Description	Section
			ii. the expertise of that EAP	
	1(b)		Closure objectives	3.2
	1(c)		Proposed mechanisms for monitoring compliance with and performance assessment against the closure plan and reporting thereon	5
	1(d)		Measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity and associated closure to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including a handover report, where applicable	3.1 4.2
	1(e)		Information on any proposed avoidance, management and mitigation measures that will be taken to address the environmental impacts resulting from the undertaking of the closure activity;	EIA
	1(f)		A description of the manner in which it intends to: i. modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation during closure; ii. remedy the cause of pollution or degradation and migration of pollutants during closure; iii. comply with any prescribed environmental management standards or practices; and iv. comply with any applicable provisions of the Act regarding the closure	EIA
	1(g)		Time periods within which the measures contemplated in the closure plan must be implemented	4.2
	1(h)		The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of the closure	EIA
	1(i)		Details of all public participation processes conducted in terms of regulation 41 of the EIA Regulations, including - i. copies of any representations and comments received from registered interested and affected parties; ii. a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; iii. the minutes of any meetings held by the EAP with interested and affected parties and other role players which record the views of the participants; iv. where applicable, an indication of the amendments made to the plan as a result of public participation processes conducted in terms of regulation 41 of these Regulations	2.3
	1(j)		Where applicable, details of any financial provisions for the rehabilitation, closure and on-going post decommissioning management of negative environmental impacts	6

GN 527	GN 982	GN 1147	Description	Section
		3(a)	Details of: i. the person or persons that prepared the plan; ii. the professional registrations and experience of the preparers	1.2
		3(b)	The context of the project, including: i. material information and issues that have guided the development of the plan	2.1
		3(b)	The context of the project, including: ii. an overview of (aa) the environmental context, including but not limited to air quality, quantity and quality of surface and groundwater, land, soils and biodiversity; and (bb) the social context that may influence closure activities and post-mining land use or be influenced by closure activities and post-mining land use;	2.2
		3(b)	The context of the project, including: iii. stakeholder issues and comments that have informed the plan	2.3
		3(b)	The context of the project, including: iv. the mine plan and schedule for the full approved operations, and must include: (aa) an appropriate description of the mine plan; (bb) drawings and figures to indicate how the mine develops; (cc) what areas are disturbed; and (dd) how infrastructure and structures (including ponds, residue stockpiles etc.) develops during operations	2.4
		3(c)	Findings of an environmental risk assessment leading to the most appropriate closure strategy, including: i. a description of the risk assessment methodology including risk identification and quantification, to be undertaken for all areas of infrastructure or activity or aspects for which a holder of a right or permit has a responsibility to mitigate an impact or risk at closure	EIA
		3(c)	Findings of an environmental risk assessment leading to the most appropriate closure strategy, including: ii. an identification of indicators that are most sensitive to potential risks and the monitoring of such risks with a view to informing rehabilitation and remediation activities	EIA
		3(c)	Findings of an environmental risk assessment leading to the most appropriate closure strategy, including:	EIA

GN 527	GN 982	GN 1147	Description	Section
			iii. an identification of conceptual closure strategies to avoid, manage and mitigate the impacts and risks	
		3(c)	Findings of an environmental risk assessment leading to the most appropriate closure strategy, including: iv. a reassessment of the risks to determine whether, after the implementation of the closure strategy, the residual risk has been avoided and/or how it has resulted in avoidance, rehabilitation and management of impacts and whether this is acceptable to the mining operation and stakeholders; and	EIA
		3(c)	Findings of an environmental risk assessment leading to the most appropriate closure strategy, including: v. an explanation of changes to the risk assessment results, as applicable in annual updates to the plan	EIA
		3(d)	Design principles, including: i. the legal and governance framework and interpretation of these requirements for the closure design principles	3.1
		3(d)	Design principles, including: ii. closure vision, objectives and targets, which objectives and targets must reflect the local environmental and socio-economic context and reflect regulatory and corporate requirements and stakeholder expectations	3.2
		3(d)	Design principles, including: iii. a description and evaluation of alternative closure and post closure options where these exist that are practicable within the socioeconomic and environmental opportunities and constraints in which the operation is located	3.3
		3(d)	Design principles, including: iv. a motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	3.4
		3(d)	Design principles, including: v. a definition and motivation of the closure and post closure period, taking cognisance of the probable need to implement post closure monitoring and maintenance for a period sufficient to demonstrate that relinquishment criteria have been achieved	3.5
		3(d)	Design principles, including: vi. details associated with any on-going research on closure options	3.6
		3(d)	Design principles, including: vii. a detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking	3.7
		3(e)	A proposed final post-mining land use which is appropriate, feasible and possible of implementation, including:	4.1

GN 527	GN 982	GN 1147	Description	Section
			i. descriptions of appropriate and feasible final post-mining land use for the overall project and per infrastructure or activity and a description of the methodology used to identify final post-mining land use, including the requirements of the operations stakeholders	
		3(e)	A proposed final post-mining land use which is appropriate, feasible and possible of implementation, including: ii. a map of the proposed final post-mining land use	4.1
		3(f)	Closure actions, including: i. the development and documenting of a description of specific technical solutions related to infrastructure and facilities for the preferred closure option or options, which must include all areas, infrastructure, activities and aspects both within the mine lease area and off of the mine lease area associated with mining for which the mine has the responsibility to implement closure actions	4.2
		3(f)	Closure actions, including: ii. the development and maintenance of a list and assessment of threats and opportunities and any uncertainties associated with the preferred closure option, which list will be used to identify and define any additional work that is needed to reduce the level of uncertainty	4.2
		3(g)	A schedule of actions for final rehabilitation, decommissioning and closure which will ensure avoidance, rehabilitation, management of impacts including pumping and treatment of extraneous water: i. linked to the mine works programme, if greenfields, or to the current mine plan if brownfields	4.2
		3(g)	A schedule of actions for final rehabilitation, decommissioning and closure which will ensure avoidance, rehabilitation, management of impacts including pumping and treatment of extraneous water: ii. including assumptions and schedule drivers; and	4.2
		3(g)	A schedule of actions for final rehabilitation, decommissioning and closure which will ensure avoidance, rehabilitation, management of impacts including pumping and treatment of extraneous water: iii. including a spatial map or schedule, showing planned spatial progression throughout operations	4.2
		3(h)	An indication of the organisational capacity that will be put in place to implement the plan, including: i. organisational structure as it pertains to the plan	4.2
		3(h)	An indication of the organisational capacity that will be put in place to implement the plan, including: ii. responsibilities	4.2
		3(h)	An indication of the organisational capacity that will be put in place to implement the plan, including:	4.3

GN 527	GN 982	GN 1147	Description	Section
			iii. training and capacity building that may be required to build closure competence	
		3(i)	An indication of gaps in the plan, including an auditable action plan and schedule to address the gaps	4.4
		3(j)	Relinquishment criteria for each activity or infrastructure in relation to environmental aspects with auditable indicators	4.5
		3(k)	Closure cost estimation procedure, which ensures that identified rehabilitation, decommissioning, closure and post-closure costs, whether on-going or once-off, are realistically estimated and incorporated into the estimate, on condition that: i. cost estimates for operations or components of operations that are more than 30 years from closure will be prepared as conceptual estimates with an accuracy of ± 50 per cent. Cost estimates will have an accuracy of ± 70 per cent for operations or components of operations, 30 or less years (but more than ten years) from closure and ± 80 per cent for operations, or components of operations ten or less years (but more than five years) from closure. Operations with 5 or less years will have an accuracy of ± 90 per cent. Motivation must be provided to indicate the accuracy in the reported number and as accuracy improves, what actions resulted in an improvement in accuracy	6
		3(k)	Closure cost estimation procedure, which ensures that identified rehabilitation, decommissioning, closure and post-closure costs, whether on-going or once-off, are realistically estimated and incorporated into the estimate, on condition that: ii. the closure cost estimation must include: (aa) an explanation of the closure cost methodology; (bb) auditable calculations of costs per activity or infrastructure; (cc) cost assumptions	6
		3(k)	Closure cost estimation procedure, which ensures that identified rehabilitation, decommissioning, closure and post-closure costs, whether on-going or once-off, are realistically estimated and incorporated into the estimate, on condition that: iii. the closure cost estimate must be updated annually during the operation's life to reflect known developments, including changes from the annual review of the closure strategy assumptions and inputs, scope changes, the effect of a further year's inflation, new regulatory requirements and any other material developments	6
		3(l)	Monitoring, auditing and reporting requirements which relate to the risk assessment, legal requirements and knowledge gaps as a minimum and must include: i. a schedule outlining internal, external and legislated audits of the plan for the year, including: (aa) the person responsible for undertaking the audit(s);	5

GN 527	GN 982	GN 1147	Description	Section
			(bb) the planned date of audit and frequency of audit; (cc) an explanation of the approach that will be taken to address and close out audit results and schedule	
		3(l)	Monitoring, auditing and reporting requirements which relate to the risk assessment, legal requirements and knowledge gaps as a minimum and must include: ii. a schedule of reporting requirements providing an outline of internal and external reporting, including disclosure of updates of the plan to stakeholders	5
		3(l)	Monitoring, auditing and reporting requirements which relate to the risk assessment, legal requirements and knowledge gaps as a minimum and must include: iii. a monitoring plan which outlines: (aa) parameters to be monitored, the frequency of monitoring and period of monitoring; (bb) an explanation of the approach that will be taken to analyse monitoring results and how these results will be used to inform adaptive or corrective management and/or risk reduction activities	5
		3(m)	Motivations for any amendments made to the final rehabilitation, decommissioning and mine closure plan, given the monitoring results in the previous auditing period and the identification of gaps as per 2(i).	7

SECTION 1: INTRODUCTION

1.1 Details of applicant

Table 2: Description of the applicant

Project applicant	Imerys Refractory Minerals South Africa (Pty) Ltd – Krugerspost Mine
Contact person	Hendrik Jones
Designation	Operational Director
Telephone number	+27 12 643 5940
E-mail address	Hendrik.Jones@imerys.com

1.2 Details of Environmental assessment practitioner

Refer to Table 3 below for a description of the environmental assessment practitioner (EAP).

Table 3: Description of the environmental assessment practitioner

Name of company	BECS Environmental
Postal address	PO Box 72960, Lynnwood Ridge, 0040
Telephone number	012 361 9970
Cell phone number	072 191 6074
Facsimile number	012 361 0645
E-mail address	salome@becsenv.co.za
Name of responsible EAP	Salome Beeslaar
Expertise of EAP	B.Sc Environmental Science (UP[1]), B.Sc Honours Geography (UP), M.Sc Geography (UP), member of the IAIAsa[2] with membership number: 5853, Professional Scientist (Environmental Science) with SACNASP[3] number 400385/14, Registered EAP[4] with EAPASA[5], number 2020/846
Name of second responsible EAP	Deshree Pillay
Expertise of EAP	B.Sc Environmental Science (UP), B.Sc Honours Geography & Environmental Science (UP), M.Sc Environment and Society (UP), member of the IAIA with membership number: 6186, Candidate Scientist (Environmental Science) with SACNASP number 123140, Candidate EAP with EAPASA number 2019/947

[1] University of Pretoria
[2] International Association for Impact Assessment South Africa
[3] South African Council for Natural Scientific Professions
[4] Environmental Assessment Practitioner
[5] Environmental Assessment Practitioners Association of South Africa

I, Deshree Pillay (9505080248080), hereby declare that I have no conflict of interest related to the work of this report. Specially, I declare that I have no business, personal, or financial interests in the property and/or mining right being assessed in this report, and that I have no personal or financial connections to the relevant property owners, or mine. I declare that the opinions expressed in this report are my own and a true reflection of my professional expertise and that there are no circumstances that may compromise my objectivity in performing such work.

_____

November 2020

1.3 Background on locality

Refer to Table 4 below for a description of the property. A locality map of Krugerspost Mine is provided below in Figure 1.

Table 4: Farm names, 21-Digit Surveyor General codes, and coordinates

	Portion 31 of the farm Klipfontein 400 KT	**Portion 32 of the farm Klipfontein 400 KT**
Title deed number	T17811/1996	T17811/1996
Deeds office	Pretoria	Pretoria
Property owner	Samrec	Samrec
Property size	215.0467ha	231.2068ha
21-digit Surveyor General Code for each farm portion	T0KT00000000040000031	T0KT00000000040000032
Coordinates	S24°54'43.08", E30°27'4.51" S24°55'11.65", E30°27'34.58" S24°55'45.30", E30°27'18.25" S24°55'21.33", E30°26'17.76"	S24°56'4.12", E30°26'3.27" S24°56'20.98", E30°27'1.06" S24°55'45.12", E30°27'18.38" S24°55'20.52", E30°26'17.63"

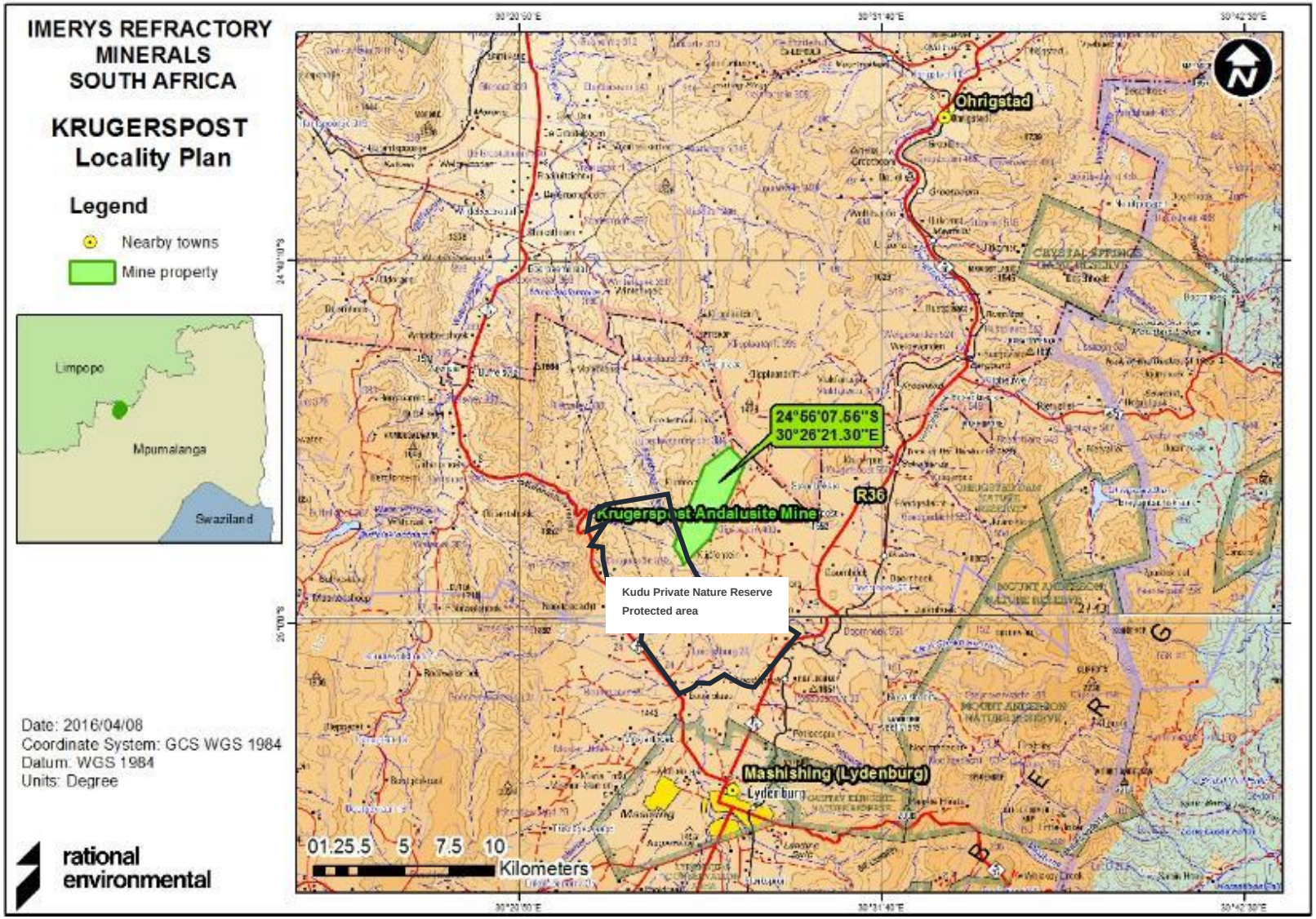


Figure 1: Locality map of Krugerspost Mine

SECTION 2: THE CONTEXT OF THE PROJECT

2.1 Material information and issues that have guided the development of the plan

Information regarding the background to the mine was taken from various sources. A site visit was held on 18th January 2016 and a follow up on the rehabilitation monitoring was conducted on the 24th October 2017. A site visit took place on the 22nd March 2018 to gather any additional information related to closure.

2.2 The environmental context and the social context that may influence closure activities and post-mining land use or be influenced by closure activities and post-mining land use

The environmental context must include but not limited to air quality, quantity and quality of surface and groundwater, land, soils and biodiversity.

2.2.1 Geology

Information for this section was extracted from the Klipplaatdrift Mine EMP (Shangoni Management Services (Pty) Ltd, 2014):

The Rustenburg Layered Suite (Bushveld Complex) covers Gauteng, Limpopo and Mpumalanga Province as seen in Figure 2 below. The aluminous shales of the Pretoria Group within the thermal metamorphic aureole of the Bushveld Complex were metamorphosed to andalusite hornfels. The Krugerspost andalusite deposit occurs in the Magaliesburg Subgroup of the Pretoria Group, and its extent is largely defined by the subsurface weathering profile of the andalusite host rock.

Additional information was sourced from the originally approved Environmental Management Programme (author unknown, 1999).as seen below.

Karoo age dolerite intrusive dykes strike N-S, parallel to the ore body and are rarely evident within the ore zone. The associated minerology is biotite, chlorite, quartz, and sericite. No associated sulphide mineralisation occurs within the Krugerspost deposit. Orthorhombic andalusite crystals occur speckled throughout the ore body and show no preferred orientation. The crystals vary in size from less than 0,5mm to 3mm in cross section. The andalusite releases readily from the weathered host rock due to the retrogressive formation of secrete along the crystal margins.

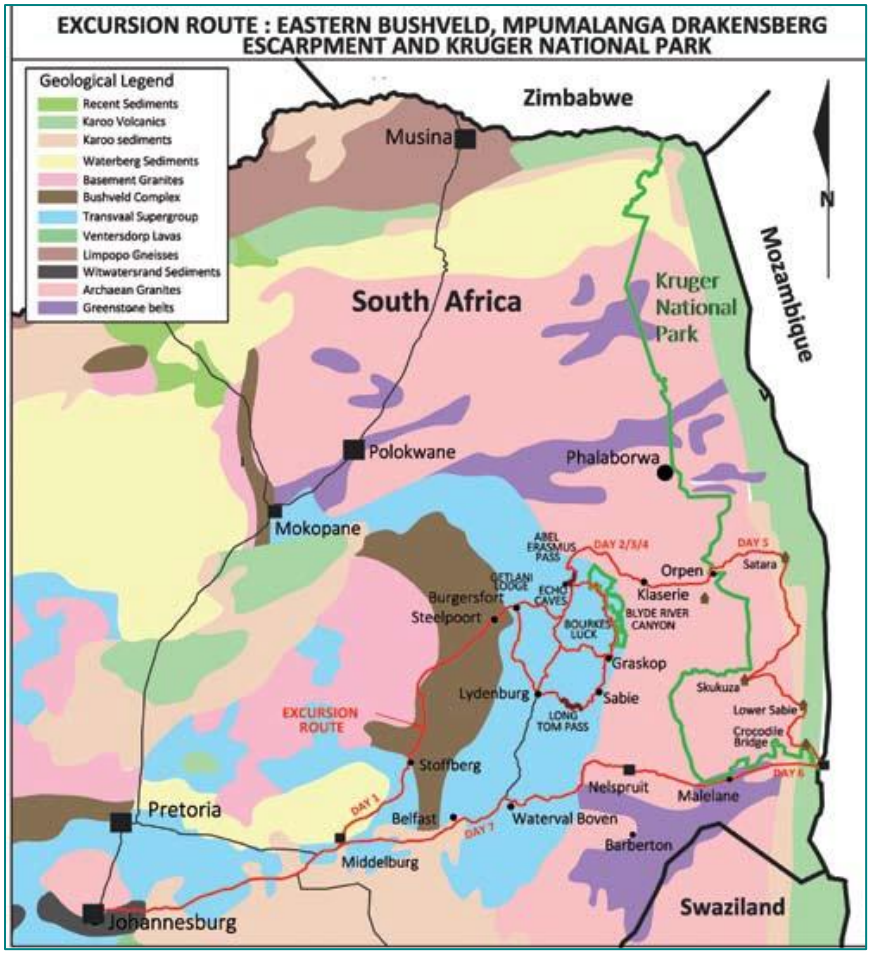


Figure 2: Bushveld complex (35th International Geological Congress, 2016)

2.2.2 Topography

Information for this section was extracted from the Klipplaatdrift Stormwater Management Plan (SWMP) (Rational Environmental (Pty) Ltd, 2019):

The site is located along a flat regional area with a slight drainage to the East. Most of the surroundings are naturally vegetated bushveld. The site has a slight drainage towards the North East. Drainage within the site is uniform with clean runoff will be diverted around the operations, while internal runoff will be collected within the quarry and dewatering discharged into the adjacent quarry. There is no surface water exiting the site. According to Figure 3 below, the topography of the site ranges from 1400m to 1450m.

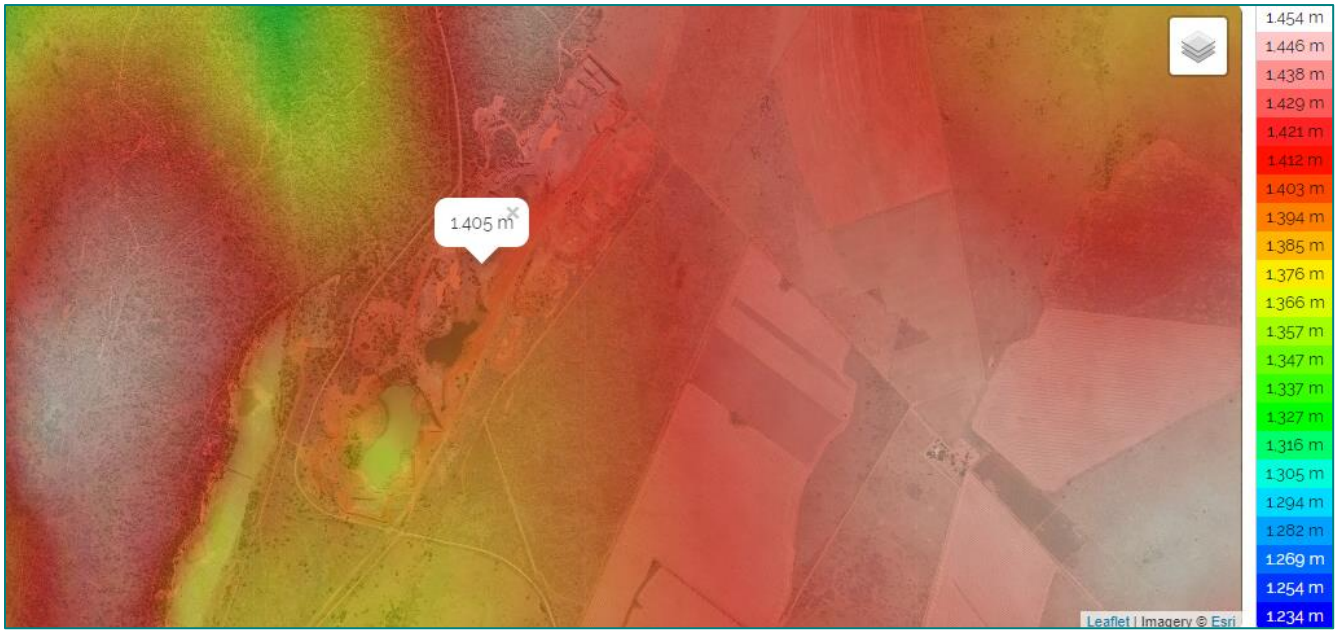


Figure 3: Topography of Quarry 6 (https://en-za.topographic-map.com/maps/jmbz/Mashishing-Lydenburg/)

2.2.3 Climate

The following information has been extracted from the Air Quality Impact Assessment for the Environmental Impact Assessment on Klipplaatdrift Mine (Tikotech, 2019). The information below represents the general climate of the region.

The MM5 meteorological data from 2016 to 2018 shows the average monthly temperature ranges between approximately 20°C in the summer months to 10°C in the winter months, reaching highs of 32°C and lows of 3°C. Day temperatures are higher than night temperatures, temperatures increase from around 7:00 and start to decrease again after 16:00 (Refer to Figure 4, Figure 5 and Figure 6).

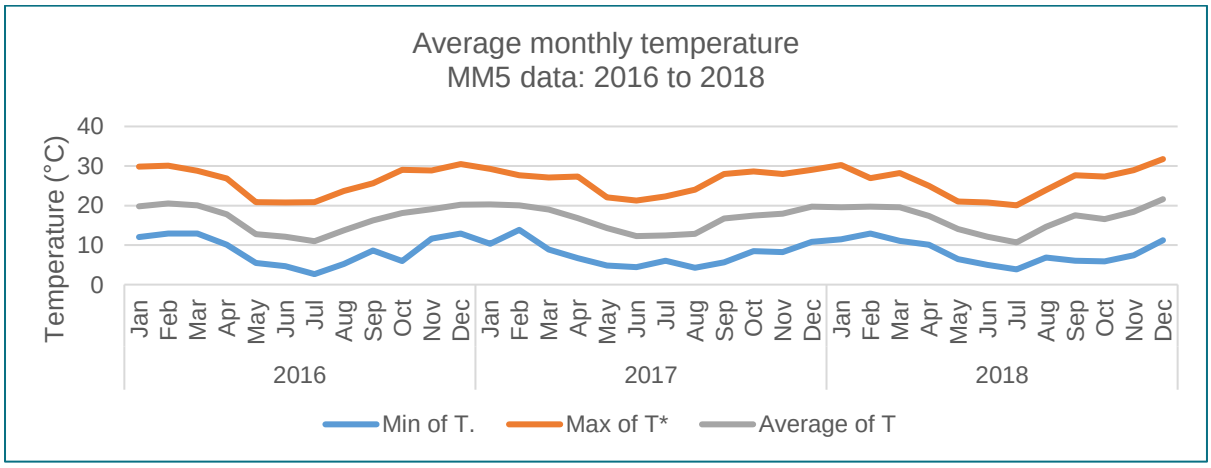


Figure 4: Average monthly temperature.

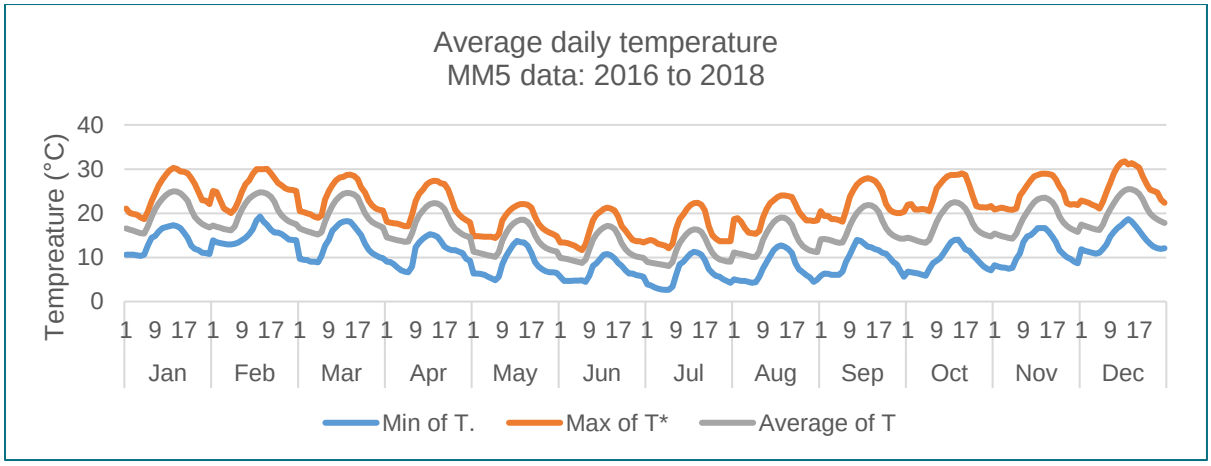


Figure 5: Average daily temperature.

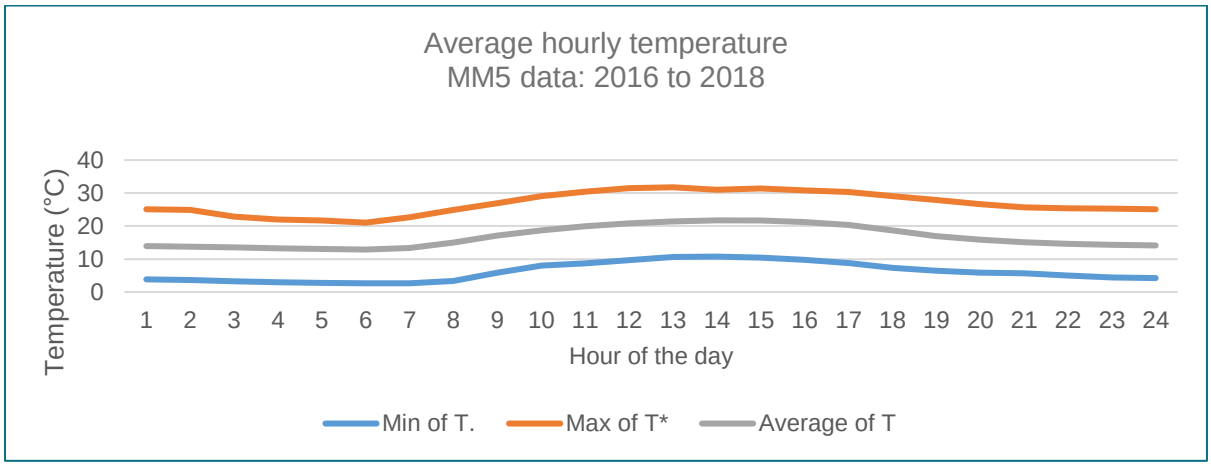


Figure 6: Average hourly temperature.

Annual rainfall in the Lydenburg thornveld grassland unit (580-810mm) and the Ohrigstad mountain bushveld unit (500-800mm) is generally lower than in surrounding areas (Mucina et al., 2006). The MM5 data shows the average annual precipitation for the site is approximately 673.89 mm/year. Precipitation is higher during the spring and summer months (Refer to Figure 7, Figure 8, and Figure 9).

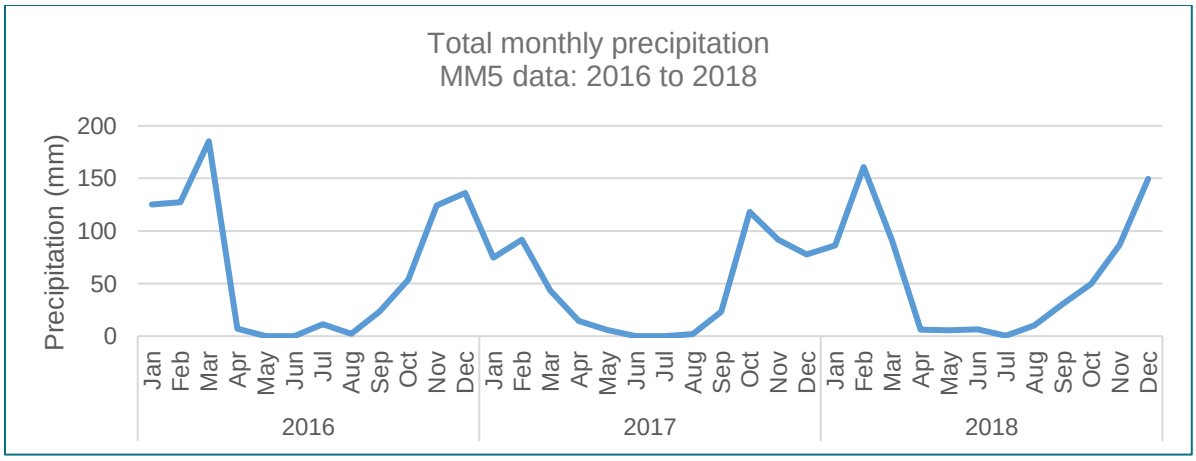


Figure 7: Total monthly precipitation

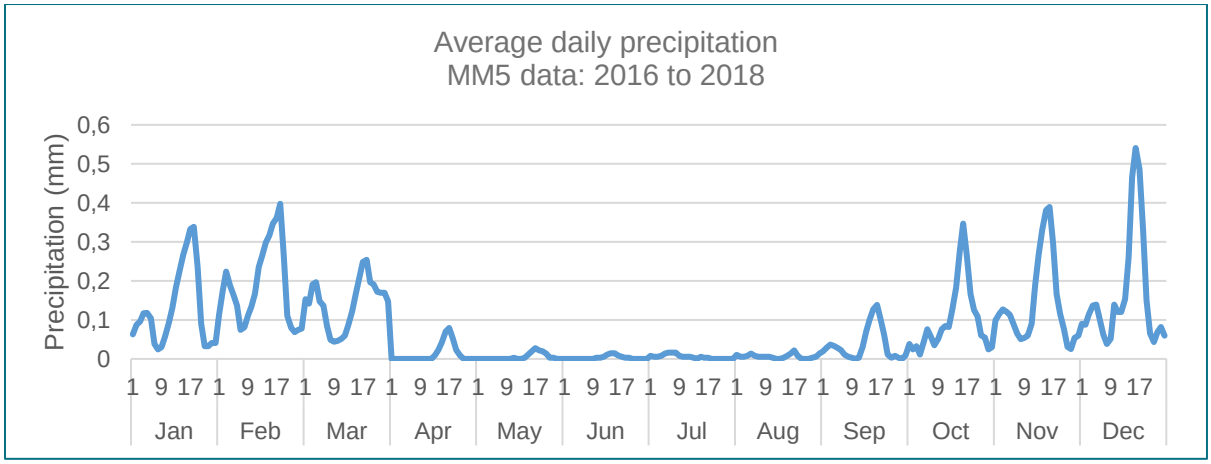


Figure 8: Average daily precipitation

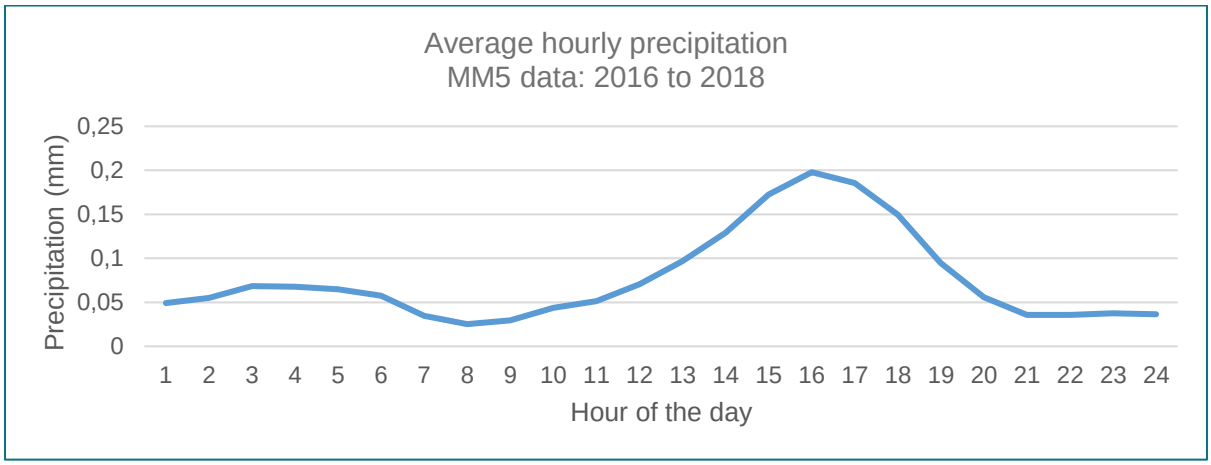
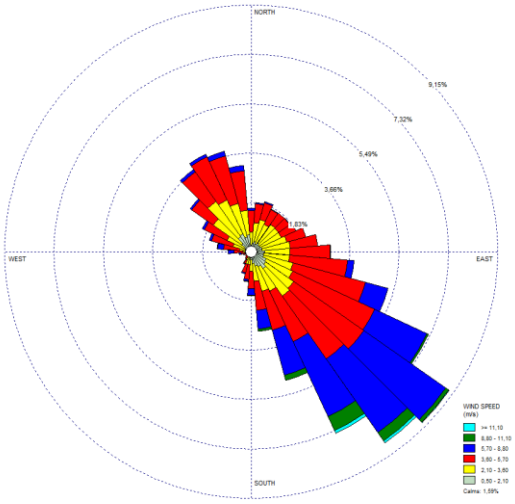
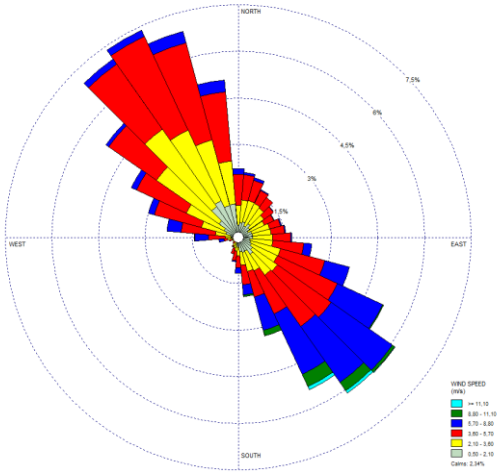


Figure 9: Average hourly precipitation

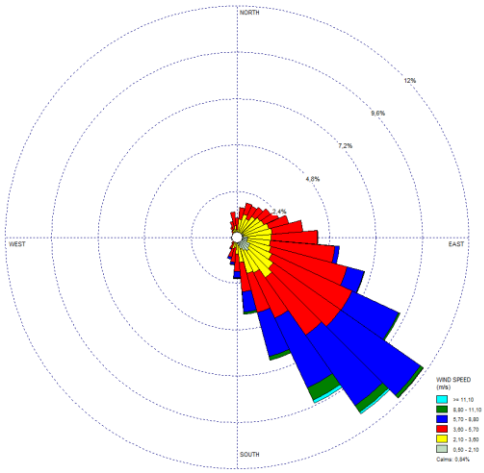
The MM5 data shows the prevailing wind direction from an east south easterly direction (104°) and an average annual wind speed of 3.87m/s. Winds of this speed can be described as a gentle breeze, characterised by leaves and small twigs in constant motion (SEPA, 2010). The dominant, stronger winds are primarily from the south east. Wind rarely blows from the north east and the south west. Calm winds (<0.5m/s) are expected approximately 1.59% of the time. Calm winds are more prevalent during the day (2.34% from 06:00 to 17:00 and 0.84% from 18:00 to 05:00). The average wind speeds are greater during the night (4.16m/s) than the day (3.58m/s) and wind speeds are on average higher than during the winter (4.14m/s) than the rest of the year (3.77m/s in spring, 3.82m/s in summer and 3.74m/s in autumn) (Refer to Figure 10 and Figure 11).



MM5 data 2016 to 2018

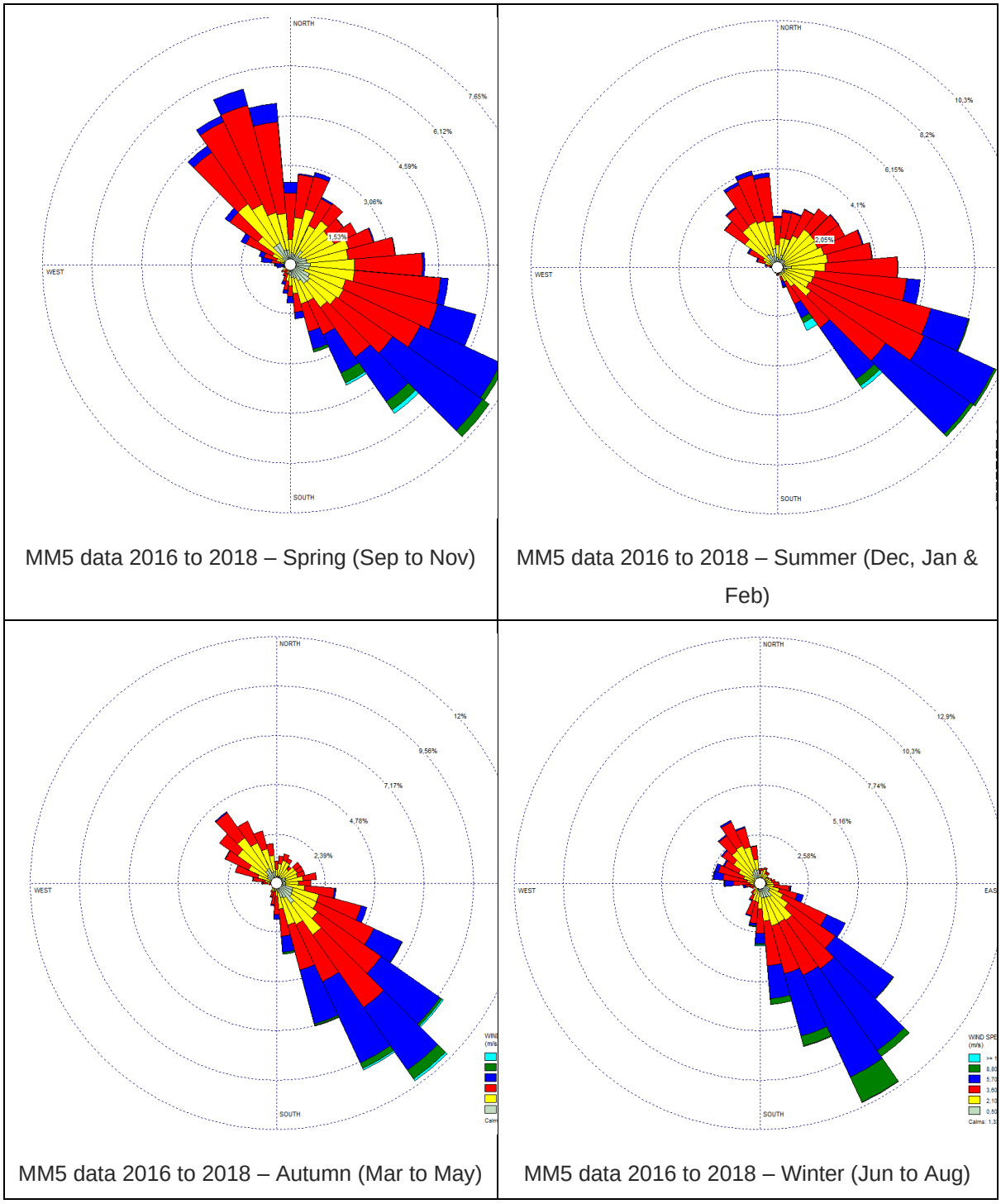


MM5 data 2016 to 2018 – Day (06:00 to 17:00)



MM5 data 2016 to 2018 – Night (18:00 to 5:00)

Figure 10: Wind roses (Annual and diurnal)



MM5 data 2016 to 2018 – Spring (Sep to Nov)

MM5 data 2016 to 2018 – Summer (Dec, Jan & Feb)

MM5 data 2016 to 2018 – Autumn (Mar to May)

MM5 data 2016 to 2018 – Winter (Jun to Aug)

Figure 11: Wind roses (Seasonal)

2.2.4 Soil, land capability, and pre-mining land use

The following information is extracted from the approved Environmental Management Programme (author unknown, 1999).

In the north-eastern sector, approximately 25% of the mining area was relatively good arable land. To the north, west and south of the mined area clay, boulder rich soils suitable for only grazing occurred.

Approximately in the middle of the mined area, deep lowlands-type arable soils occurred. These soils were of poor quality due to the high silt content and moderate blocky structure.

To the north, west and south of the mined area, and probably underlying the southern dump of transported materials, red, clayley soils of variable depth, containing 10 to 60% surface boukders occur. These soils are situated to grazing only due to rockiness and/steep slopes. They are slightly acid, with high exchangeable magnesium and high silt content.

Approximately in the middle of the mined area, deep, red-brown, structured, lowland-type soils occur. These soils are arable. Their quality is, however, negatively affected by high silt content and moderate block structure. Much of the land originally constituted by these soils is now covered by the eastern, levelled, dumps.

The dumps of dark coloured, coarse sand contain very little, if any, fine material. It has a high cation exchange capacity, which is almost fully occupied by magnesium. The material is slightly acid. Phosphate is released in places. This material is not suitable as reclamation material on its own, due to very low water holding capacity and susceptibility to wind and water erosion.

No mention is made of the residual impacts on the soil in any of the specialist studies. It is, however, assumed that the residual impacts on the soil will be significant. Very little topsoil was stockpiled during the mining activities. Topsoil is mixed with overburden and shows signs of erosion. Until such time that revegetation is completed, these areas will be prone to soil erosion.

2.2.5 Vegetation

The following information is extracted from the approved Environmental Management Programme (author unknown, 1999).

The area as described by Acocks is mixed bushveld, which is very mixed bush and may be characterised as "*Acacia nigresens* veld". The hill slopes are well wooded with a large variety of medium species of trees as well as shrubs and aloes. No endangered or rare species have been found. No invader species were identified prior to mining. The dominant grass species found in undisturbed areas are Aristida scrabrivalus and Enneapoga centroides. The following species of trees occur on the area of the ore body; Acacia nigrescence (Knob thorn), Acacia Tortillas (Umbrella thron), Acacia sieberana (Paperbark acacia), Acacia permixta (Slender thorn), Acacia senegalis (Three hook thorn), Commiphora chimperi (Glossy-leaved Commiphora), Kerkil wilmsii (Mountain seringa). There have been no endangered or rare species found on site as well as invader species. However, it must be noted that these were identified a while ago, an updated study must be conducted for current site conditions.

2.2.6 Animal life

Information for this section was extracted from the Aquatic ecosystem delineation, fauna and flora assessment for the proposed expansion of the Krugerspost mine, Mpumalanga (Limnology, 2019):

The local occurrences of mammals are closely dependent on broadly defined habitat types: terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges. From a mammal habitat perspective, it was established that all four major habitats are naturally present on Klipplaatdrift, namely terrestrial, arboreal, rupicolous and wetlands.

No moribund termitaria were recorded on Klipplaatdrift. These structures are good indicators of the occurrence of small mammals. Accordingly, it is estimated that the mammal population density for Klipplaatdrift is lower. At the time of the site visit the basal cover was good in many places and would provide adequate nourishment and cover for small terrestrial mammals.

Rupicolous habitats were found in some areas on the Klipplaatdrift. Good manmade rupicolous habitat for small mammals exists in the form of loose stones along the gravel road of Klipplaatdrift. These rupicolous habitats offer nooks and crannies as refuge for most rupicolous mammals.

Natural arboreal habitat is also present on Klipplaatdrift especially north of Klipplaatdrift. The larger trees may offer refuge for arboreal mammals. There are several dead logs, which would provide shelter and food for mammals.

The site does not have any caves suitable for cave-dwelling bats. The buildings near the site may act as substitute daytime roosts. The Echo caves are situated some distance to the north of the site. It is likely that common bats commute from roosting sites elsewhere to hawk for insects over the wetlands on the study site.

- Connectivity is very good with areas around the study site. Real opportunities for migration exist along the drainage line and ridges.
- Sight records were also used to compile this mammal report.

From a herpetological habitat perspective, it was established that all four major habitats are naturally present on Klipplaatdrift, namely terrestrial, arboreal, rupicolous and wetland-associated vegetation cover.

Most of Klipplaatdrift consists of secondary grassland. The natural grassland has been transformed in some parts for agricultural purposes like old fields and grazing by cattle. Other anthropogenic influences such as roads, fences and invasive plants have also altered parts of the site. Klipplaatdrift is thus

ecologically disturbed in places. No moribund termitaria were recorded. These structures are good indicators of the occurrence of small herpetofauna. Accordingly, it is estimated that the reptile and amphibian population density for Klipplaatdrift is lower. At the time of the site visit, the basal cover was good in most places, despite grazing by cattle, and would provide adequate cover for small terrestrial herpetofauna. The grasslands on Klipplaatdrift have not been severely transformed and prey is probably widely distributed, so foraging grounds would not need to be very extensive to support the different populations of herpetofauna.

Five (5) major avifaunal habitat systems were identified within Klipplaatdrift. These habitat systems are as follow:

- Acacia dominated mountain bushveld
- Acacia dominated woodland savanna
- Cultivated and fallow fields
- Man-made impoundments and water filled quarries
- Disturbed and transformed area

Of the 291 avifaunal species recorded for the 2430CD q.d.g.c. during the current SABA2 period, 101 are likely to occur on Klipplaatdrift and 64 of these avifaunal species were actually observed within Klipplaatdrift during the time of the survey.

2.2.7 Surface water

Information for this section was extracted from the Aquatic ecosystem delineation, fauna and flora assessment for the proposed expansion of the Krugerspost mine, Mpumalanga (Limnology, 2019):

Krugerspost falls in the Eastern Bankenveld (no 7) as described in the Level 1 Ecoregions by the Department of Water Affairs and Forestry (DWAF, 2005).

Primary boundary determinants are closed hills and mountains with moderate and high relief together with North-eastern Mountain Grassland and Mixed Bushveld are definitive of the region. Distinctive escarpments occur along the eastern boundary. Large rivers that traverse the area are the Olifants, Elands and Steelpoort with perennial tributaries in the region contributing to their flow. The Crocodile River (East) has many of its sources in this area.

- Mean annual precipitation: Moderate to moderately high.
- Coefficient of variation of annual precipitation: Low to moderate.
- Drainage density: Predominantly medium.
- Stream frequency: Medium/high but low/medium in limited areas.
- Slopes <5%: <20%, 20-50% in limited areas.
- Median annual simulated runoff: Mostly moderate but moderately high in areas.

- Mean annual temperature: Mostly moderate

The mine is in the B42E quaternary catchment of the Olifants Water Management Area and the Central Transvaal (Bushveld) Basin. The Spekboom River runs approximately 3km to the south west from the current mining activities.

2.2.8 Groundwater

The following was extracted from the Geohydrological impact assessment for the quarry operations at Klipplaatdrift and Klipfontein (Shangoni Aquascience, 2019):

A desk study was conducted to gather all relevant environmental information, including topographical, hydrological and geohydrological data. Data/information was also gathered from previous relevant studies conducted for Krugerspost Mine as well as data published in the public domain National Groundwater Archive (NGA) hydrocensus.

The aquifer classification system used to classify South African aquifers is the National Aquifer Classification System developed by Parsons (1995). This system has a certain amount of flexibility and can be linked to second classifications such as a vulnerability or usage classification. Parsons suggested that aquifer classification forms a very useful planning tool that can be used to guide the management of groundwater issues.

2.2.8.1 Aquifer classification

The South African Aquifer System Management Classification is presented by five major classes listed below and defined in Table 5:

- Sole Source Aquifer System
- Major Aquifer System
- Minor Aquifer System
- Non-Aquifer System
- Special Aquifer System

Table 5*:* Aquifer classification scheme *(Parsons, 1995)*

Aquifer system	Defined by Parsons (1995)	Defined by DWA minimum requirements (DWAF, 1998)
Sole source aquifer	An aquifer that is used to supply 50% or more of domestic water for a given area, and for which there are no reasonable alternative sources should the aquifer become depleted or impacted upon. Aquifer yields and natural water quality are immaterial.	An aquifer, which is used to supply 50% or more of urban domestic water for a given area for which there are no reasonably available alternative sources should this aquifer be impacted upon or depleted.
Major aquifer	Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be	High yielding aquifer (5-20l/s) of acceptable water quality.

Aquifer system	Defined by Parsons (1995)	Defined by DWA minimum requirements (DWAF, 1998)
	highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good.	
Minor aquifer	These can be fractured or potentially fractured rocks that do not have a high primary hydraulic conductivity, or other formations of variable hydraulic conductivity. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are both important for local supplies and in supplying base flow for rivers.	Moderately yielding aquifer (1-5l/s) of acceptable quality or high yielding aquifer (5-20l/s) of poor quality water.
Non-aquifer	These are formations with negligible hydraulic conductivity that are generally regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks does occur, although imperceptible, and needs to be considered when assessing risk associated with persistent pollutants.	Insignificantly yielding aquifer (< 1l/s) of good quality water or moderately yielding aquifer (1-5l/s) of poor quality or aquifer which will never be utilised for water supply and which will not contaminate other aquifers.
Special aquifer	An aquifer designated as such by the Minister of Water Affairs, after due process.	

2.2.8.2 Aquifer vulnerability

Groundwater plays an important role in supplying water to many regions of Southern Africa due to its low annual average precipitation of 460mm, which is well below the world average of 860mm. The quality of groundwater resources in South Africa has therefore received considerable focus and attention on the need for a proactive approach to protect these sources from contamination (Lynch *et. al*., 1994). Groundwater protection needs to be prioritised based upon the susceptibility of an aquifer towards pollution. This can be done in two ways, namely i) pollution risk assessments and ii) aquifer vulnerability. Pollution risk assessments consider the characteristics of a specific pollutant, including source and loading while aquifer vulnerability considers the characteristics of the aquifer itself or parts of the aquifer in terms of its sensitivity to being adversely affected by a contaminant should it be released.

The DRASTIC model concept developed for the USA (Aller *et. al*., 1987) is well suited for producing a groundwater vulnerability evaluation for South African aquifers. The DRASTIC evaluates the intrinsic vulnerability (*IV*) of an aquifer by considering factors including **D**epth to water table, natural **R**echarge rates, **A**quifer media, **S**oil media, **T**opographic aspect, **I**mpact of vadose zone media, and hydraulic **C**onductivity. Different ratings are assigned to each factor and then summed together with respective constant weights to obtain a numerical value to quantify the vulnerability:

$$\text{DRASTIC Index } (IV) = DrDw + RrRw + ArAw + SrSw + TrTw + IrIw + CrCw$$

Where *D*, *R*, *A*, *S*, *T*, *I*, and *C* are the parameters, *r* is the rating value, and *w* the constant weight assigned to each parameter (Lynch *et al*, 1994). The scores associated with the vulnerability of South African aquifers are shown in Table 6.

Table 6: South African National Groundwater Vulnerability Index to Pollution (Lynch et al, 1994)

Score	Vulnerability
50-87	Least susceptible
87 - 109	Moderate susceptible
109 - 226	Most susceptible

The concept of DRASTIC in vulnerability assessments is based on:

- A contaminant is introduced at the surface of the earth or just below it (such as in backfilling).
- A contaminant is flushed into the groundwater by precipitation.
- A contaminant has the mobility of water.
- The area evaluated is 0.4km^2 or larger.

The weighting for each parameter is constant. The minimum value for the DRASTIC index that one can calculate (assuming all seven factors were used in the calculation) is therefore 24 with the maximum value being 226. The higher the DRASTIC index the greater the vulnerability and possibility of the aquifer to become polluted if a pollutant is introduced at the surface or just below it.

2.2.8.3 Hydrocensus

A hydrocensus was performed on and around the study areas to identify groundwater users, groundwater potential and baseline data. The survey was conducted in June 2019. A previous hydrocensus was conducted in May 2013 during a hydrogeological study for Krugerspost (Shangoni, 2013). In addition to these boreholes being re-surveyed new boreholes were also included in the hydrocensus.

During the hydrocensus, all available details of boreholes and borehole-owners were collected and recorded. Where possible, information was collected on water use, water levels and yields of boreholes, etc. This information was used to assess the potential risk posed by the mining activities on the groundwater regime and users thereof. The following parameters were captured during the hydrocensus:

- XYZ Coordinates
- Existing equipment
- Current use
- Future use
- Yield
- Drill depth
- Static/dynamic water level
- Water quality

- Photograph

The hydrochemical data generated from this phase should be used as baseline quality to enable impact quantification by means of long-term monitoring.

2.2.8.4 Geophysical survey and results

As discussed above, magnetic and electro-magnetic investigations were carried out on suspected geological anomalies. The results can be viewed in Appendix A. To summarise the findings the following:

Traverse 1:

A spike in the magnetic data, indicative of a dolerite dyke, was recorded at stations 255 and 260m. The EM data indicate areas of increased weathering in the vicinity of the suspected dyke.

Traverse 2:

The magnetic data was inconclusive to suggest the presence of a linear dolerite dyke, although a small spike is visible at station 280m. The EM data does show increasing low vertical dipole (VD) and increasing horizontal dipole (HD) readings at station 290m, which could indicate an area of weathering or increased mineralisation.

Traverse 3:

A magnetic anomaly was recorded at station 340m. The EM data also indicate areas of weathering in this area, indicating the presence of a dolerite dyke.

Traverse 5:

The magnetic data shows no significant anomaly, although a magnetic high was recorded at the beginning of the traverse at station 5m. VD readings do show high but erratic readings and could indicate areas of shallow weathering or mineralisation.

2.2.8.5 Acid generation capacity

A variety of mining wastes, most notably tailings, overburden and slimes contain sulphidic material (mostly pyrite) which may oxidise to produce acid mine drainage (AMD). The result is sulphuric acid generation which acidifies water it comes in contact with. This has several negative consequences and most notably includes the solubilisation of a variety of trace metals and metalloids. A number of factors control the generation of AMD, but the most important are the relative abundance of acid producing minerals (generally the sulphides) and acid consuming minerals (generally carbonates), moisture content/ ingress and exposure to air. As AMD has the potential to impact significantly on surface and groundwater quality, it is necessary to also quantify the potential of waste to generate acid.

Acid-Base Accounting is a straightforward test to determine the acid potential of rock. The total acid generating potential (AP) is calculated from the total sulphur content of the rock material. The

neutralising potential (NP) of minerals in the material is measured by reacting a finely ground sample of the test material with a measured excess of hydrochloric acid and back-titrating to a selected pH endpoint between 6.0 and 8.3 (to differentiate between the actions of carbonates and silicates). The balance between the potentially acid consuming and potentially acid generating minerals in the sample is expressed as the net neutralising potential (NNP).

The ABA analysis conducted for residue waste indicates that the mine residue generated is non-acid producing (Table 7). The total sulphur (S) percentage analysed and the resultant AP are very low. The NP and NNP are relatively high indicating an abundance of neutralising minerals such as carbonates and silicates. The waste would therefore have the potential to neutralise any acidity *in situ* should it be produced.

Table 7: Acid base accounting results for Krugerspost mining waste

Acid – Base Accounting Modified Sobek (EPA-600)	**Sample Identification**	
	Waste Rock	
Paste pH	6.1	6.0
Total Sulphur (%) (LECO)	0.01	0.01
Acid Potential (AP) (kg/t)	0.31	0.31
Neutralization Potential (NP)	3.96	4.71
Nett Neutralization Potential (NNP)	3.65	4.39
Neutralising Potential Ratio (NPR) (NP : AP)	12.7	15.1
Rock Type	**III**	**III**

If NNP (NP – AP) < 0, the sample has the potential to generate acid

If NNP (NP – AP) > 0, the sample has the potential to neutralise acid produced

As a result of the low acid forming potential, it is unlikely that significant acid (if any) will be generated from the waste. The pH is likely to be neutral to slightly alkaline and heavy metal solubilisation will therefore be minimal. The rock type can therefore be classified as a ***Type III*** which is defined as "***non-acid*" forming** (Table 8).

Table 8: Rock Classification

TYPE I	Potentially Acid Forming	Total S(%) > 0.25% and NP:AP ratio 1:1 or less
TYPE II	Intermediate	Total S(%) > 0.25% and NP:AP ratio 1:3 or less
TYPE III	Non-Acid Forming	Total S(%) < 0.25% and NP:AP ratio 1:3 or greater

2.2.8.6 Groundwater levels

Groundwater levels were measured during the hydrocensus survey conducted. Groundwater levels including other details captured can be viewed in Table 9 below.

Twenty-three (23) boreholes were surveyed during June 2019, including five (5) mine pits and two (2) dams. Most of the in-use boreholes are utilised for domestic and livestock watering while some are not currently used.

Borehole water levels recorded range between 3.1 and 26.4 meters below surface (mbs) with an average of 11.20mbs.

A map showing the positions of the localities surveyed can be viewed in Figure 12.

2.2.8.7 Groundwater potential contaminants

An Acid Rain leaching procedure was performed on mine residue to assess the potential of harmful substances to be released if exposed to weakly acidic solutions (Shangoni, 2012). Because the waste rock does not have any acid potential, the results as shown in Table 10 are based on a worst-case scenario.

The results of the acid leach indicate a high prevalence of alkalinity/ $CaCO_3$ and lower than detection limits of major elements including sulphate (SO_4), chloride (Cl), fluoride (F) and nitrate (NO_3) (Table 11). The end pH value of 6.8 including the high prevalence of $CaCO_3$ and absence of SO_4 corresponds to the low AP and relatively high NP and NNP of the sample as recorded for the ABA analyses. Trace elements including metalloids recorded in the acid rain leach can be viewed in Appendix C of the geohydrological study.

Table 9: Hydrocensus information

Borehole ID	Coordinates		Farm name	Type	SWL (m)	Application	Owner	Sampling method
H/BH20	-24.886260	30.463970	Klipplaatdrift	Borehole	25.34	Livestock	Mine Property	
H/BH10	-24.953510	30.449990	Klipfontein	Borehole	3.08	Domestic	GT Roth	Tank
H/BH11	-24.962370	30.442130	Klipfontein	Borehole	11.47	Domestic	GT Roth	Tank
H/BH15	-24.907900	30.471740	Klipplaatdrift	Borehole	7.04	Domestic & Livestock	J Stenekamp	Pumping
H/BH16	-24.904710	30.469550	Klipplaatdrift	Borehole	5.78	Livestock	J Stenekamp	Tank
H/BH17	-24.901330	30.470830	Klipplaatdrift	Borehole	7.58	Domestic & Livestock	J Stenekamp	Tank
H/BH18	-24.899400	30.471550	Klipplaatdrift	Borehole	4.94	Livestock	J Stenekamp	Pumping
H/BH13	-24.910470	30.465440	Klipplaatdrift	Borehole	24.10	Domestic	J Stenekamp	Tank
H/BH12	-24.910560	30.465800	Klipplaatdrift	Borehole	23.60	Domestic	J Stenekamp	-
H/BH04	-24.935950	30.444640	Klipfontein	Borehole	11.89	Domestic & Livestock	Mine Property	Tank
H/BH02	-24.940360	30.445440	Klipfontein	Borehole	5.52	Domestic	Mine Property	Tank
H/BH01	-24.941520	30.449170	Klipfontein	Borehole	15.17	Not in use	Mine Property / GT Roth	Bailer
H/BH05	-24.942960	30.440160	Klipfontein	Borehole	5.08	Not in use	Mine Property	Bailer
H/BH06	-24.949020	30.439420	Klipfontein	Borehole	7.79	Not in use	Mine Property	Bailer
H/BH08	-24.944360	30.436310	Klipfontein	Borehole	8.77	Not in use	Mine Property	Bailer
H/BH21	-24.940070	30.439540	Klipplaatdrift	Borehole	5.97	Not in use	Mine Property	Bailer
H/BH07	-24.943450	30.436780	Klipfontein	Borehole	9.83	Not in use	Mine Property	Bailer
H/BH22	-24.901510	30.451730	Klipplaatdrift	Borehole	13.88	Not in use	Mine Property	Bailer
H/BH23	-24.886890	30.463330	Klipplaatdrift	Borehole	26.35	Not in use	Mine Property	Bailer
H/BH24	-24.925700	30.450610	Klipfontein	Borehole	8.90	Not in use	Mine Property	Bailer
-	-24.944580	30.447300	Klipfontein	Borehole	25.34	Not in use	-	-
-	-24.908570	30.471810	Klipplaatdrift	Borehole	3.08	Not in use	-	-
-	-24.903320	30.471420	Klipplaatdrift	Borehole	11.47	Not in use	-	-
SW 01	-24.917260	30.452700	Klipfontein	Pit	7.04	Not in use	Mine Property	Grab
SW 02	-24.918470	30.451460	Klipfontein	Pit	5.78	Not in use	Mine Property	Grab

Borehole ID	Coordinates		Farm name	Type	SWL (m)	Application	Owner	Sampling method
SW 03	-24.919530	30.450390	Klipfontein	Pit	7.58	Not in use	Mine Property	Grab
SW 04	-24.923670	30.449090	Klipfontein	Pit	4.94	Not in use	Mine Property	Grab
SW 05	-24.924610	30.448490	Klipfontein	Pit	24.10	Not in use	Mine Property	Grab
SW 06	-24.952990	30.449510	Klipfontein	Dam	23.60	Irrigation	GT Roth	Grab
SW 07	-24.950530	30.440630	Klipfontein	Dam	11.89	Not in use	Mine Property	Grab

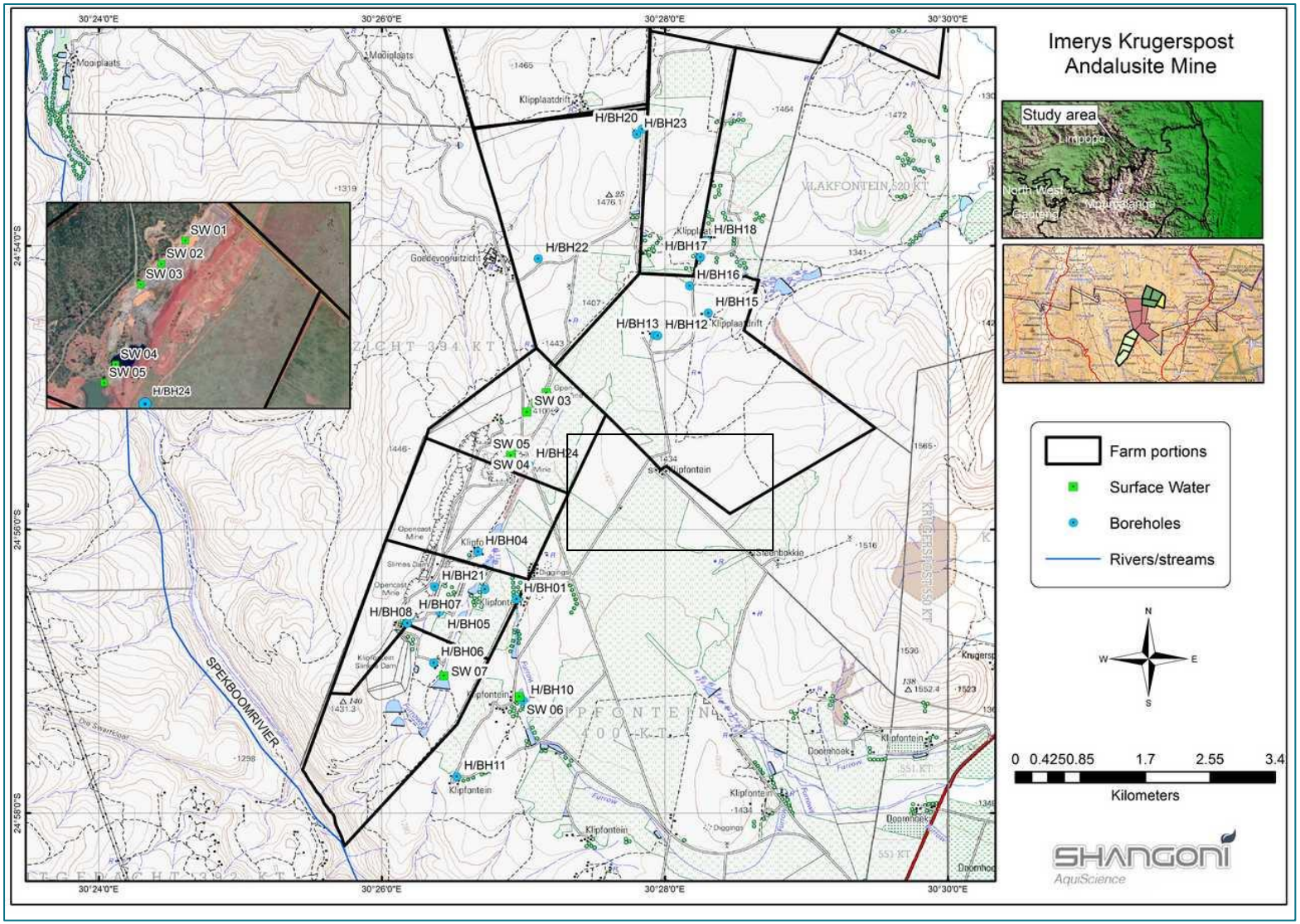


Figure 12: Hydrocensus map

Table 10: Results of the Acid Rain leach

Analyses	**Sample Identification**	
	Waste Rock	
Sample number	3128	
TCLP / Acid Rain / Distilled Water / H_2O_2	Acid Rain	
Dry Mass Used (g)	50	
Volume Used (mℓ)	1000	
pH Value at 25˚C	6.8	
Electrical Conductivity in mS/m at 25˚C	5.7	
Units	mg/ℓ	mg/kg
Alkalinity as $CaCO_3$	28	560
Chloride as Cl	<5	<100
Sulphate as SO_4	<5	<100
Nitrate as N	<0.2	<4.0
Fluoride as F	<0.2	<4.0
ICP-OES Scan	Appendix B	

As indicated by the values highlighted in the ICP-OES table as in Appendix C, traces of aluminium (Al), iron (Fe), magnesium (Mg), potassium (K) and silica (Si) were solubilised under the mildly acidic conditions of the Acid Rain leach. Based on the information above, it can be determined that the **waste present a slight/ low risk** to the environment posed by the backfilling material in the pits. Despite the low risk it is nevertheless recommended that a monitoring programme be implemented to monitor the ongoing performance.

2.2.8.8 Groundwater Quality

During the hydrocensus, samples were taken from surveyed boreholes and analysed for hydrochemical quality. The hydrochemical data are displayed in Tables 17 and 18 while interpretation based on hydrogeochemical Stiff diagrams and a Piper diagram can be viewed in Figures 13 and 14, respectively.

Table 11: Groundwater quality for Krugerspost hydrocensus boreholes

Locality / Guideline Parameter	Unit	Domestic use SANS 241(1)[a]	H/BH01	H/BH02	H/BH04	H/BH05	H/BH06	H/BH07	H/BH08	H/BH10	H/BH11
pH	-	5 - 9.7	6.81	7.05	7.04	7.16	7.05	7.3	6.66	7.2	7.29
EC	mS/m	≤170	34.9	36.6	26	41.4	44.6	23	17.8	33.4	26.8
TDS	mg/l	1200	174	193	131	209	198	113	80	159	123
Calcium (Ca)	mg/l		18.9	18.9	12.1	22.4	14.7	11.73	9.8	10.43	9.56
Magnesium (Mg)	mg/l	-	26.2	21.2	12.9	21.3	26.3	9.69	7.66	34.5	25.4
Sodium (Na)	mg/l	200	7.46	21.9	18.1	28.7	21.8	15.2	6.36	1.96	0.93
Potassium (K)	mg/l	-	0.89	0.69	1.78	2.84	1.3	2.57	2.8	0.32	0.46
Total alkalinity (MALK)	mg/l	-	155	151	110	187	149	104	77	161	120
Chloride (Cl)	mg/l	300	5.6	8.48	6.16	6.61	11.1	5.25	3.65	2.48	3.2
Sulphate (SO_4)	mg/l	500	9.42	5.15	<0.5	8.12	23.8	3.87	1.35	5.06	4.84
Nitrate as N (NO_3-N)	mg/l	11	2.73	5.64	3.12	1.43	2.1	<0.35	<0.35	1.78	1.5
Total ammonia (NH_3-N + NH_4-N)	mg/l	1.5	<0.45	<0.45	<0.45	<0.45	<0.45	1.31	1.8	<0.45	<0.45
Ortho-phosphate (PO_4)	mg/l	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Fluoride (F)	mg/l	1.5	0.29	0.21	0.2	0.21	0.24	0.19	0.18	0.2	0.31
Aluminium (Al)	mg/l	0.3	<0.01	0.31	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron (Fe)	mg/l	2	<0.01	0.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese (Mn)	mg/l	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Hardness	mg/l	-	155	134	83	144	145	69	56	168	128
[a] SANS 241: 2011											

Table 12: Groundwater quality for Krugerspost hydrocensus boreholes

Locality / Guideline Parameter	Unit	Domestic use SANS 241(1)[a]	H/BH13	H/BH15	H/BH16	H/BH17	H/BH18	H/BH21	H/BH22	H/BH23	H/BH24
pH	-	5 - 9.7	7.82	7.25	7.47	7.49	7.47	7.21	7.35	6.97	7.27
EC	mS/m	≤170	40.7	75.3	55.3	61.6	66	46.5	41.4	28.8	38.2
TDS	mg/l	1200	221	398	288	324	339	244	213	148	199
Calcium (Ca)	mg/l		23.2	58.8	31.2	31.4	34.4	27.1	16.7	9.23	21.7
Magnesium (Mg)	mg/l	-	25.3	45.6	41.3	46.4	49.7	23	18.7	9.21	21.1
Sodium (Na)	mg/l	200	20.2	24.7	20.2	26.2	26.3	26.3	36.6	27	19
Potassium (K)	mg/l	-	4.06	1.26	2.59	2.5	3.96	4.1	6.17	7.63	1.74
Total alkalinity (MALK)	mg/l	-	173	290	270	301	320	238	196	102	156
Chloride (Cl)	mg/l	300	8.63	45.3	8.56	10.9	10.4	11.5	10	12.1	9
Sulphate (SO_4)	mg/l	500	4.79	13.2	1.69	12.7	3.94	0.51	4.01	<0.5	0.64
Nitrate as N (NO_3-N)	mg/l	11	7.07	7.99	4.63	2.81	4.11	0.41	0.5	4.94	7.31
Total ammonia (NH_3-N + NH_4-N)	mg/l	1.5	<0.45	<0.45	<0.45	<0.45	<0.45	4.98	<0.45	<0.45	<0.45
Ortho-phosphate (PO_4)	mg/l	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Fluoride (F)	mg/l	1.5	0.19	0.15	0.18	0.43	0.14	0.84	0.57	0.17	0.12
Aluminium (Al)	mg/l	0.3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron (Fe)	mg/l	2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.24	<0.01	<0.01
Manganese (Mn)	mg/l	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	0.06	0.66	<0.01	<0.01
Total Hardness	mg/l	-	162	335	248	269	291	162	119	61	141
[a] SANS 241: 2011											

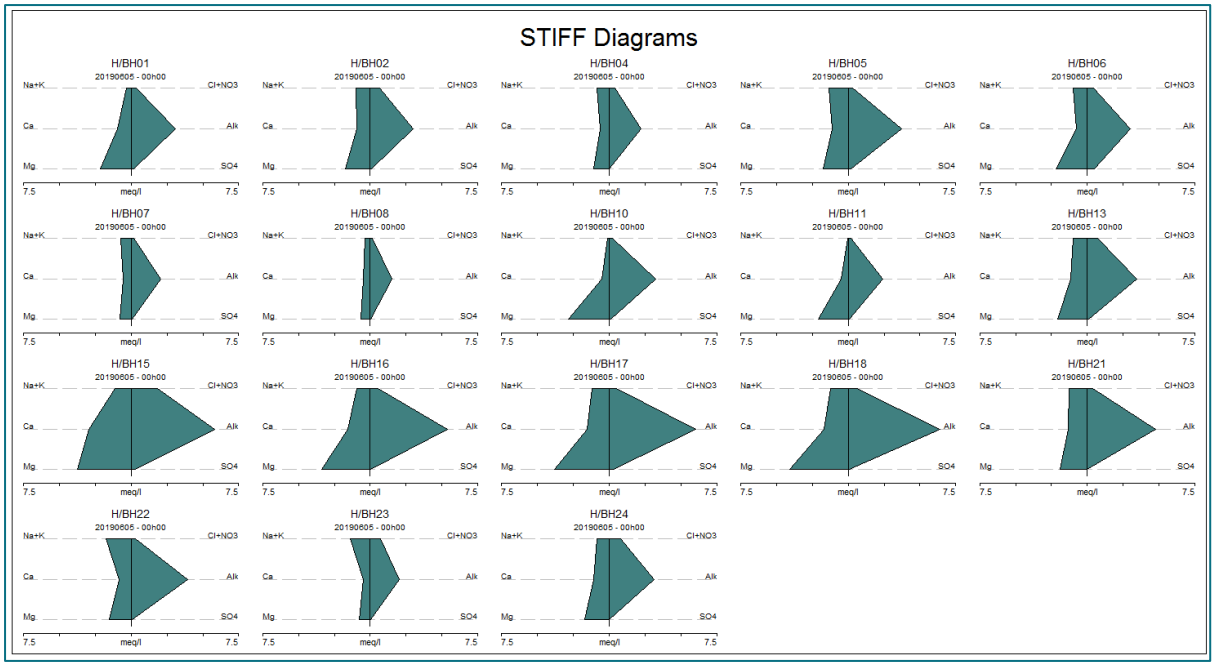


Figure 13: Stiff Diagrams based on meq/l

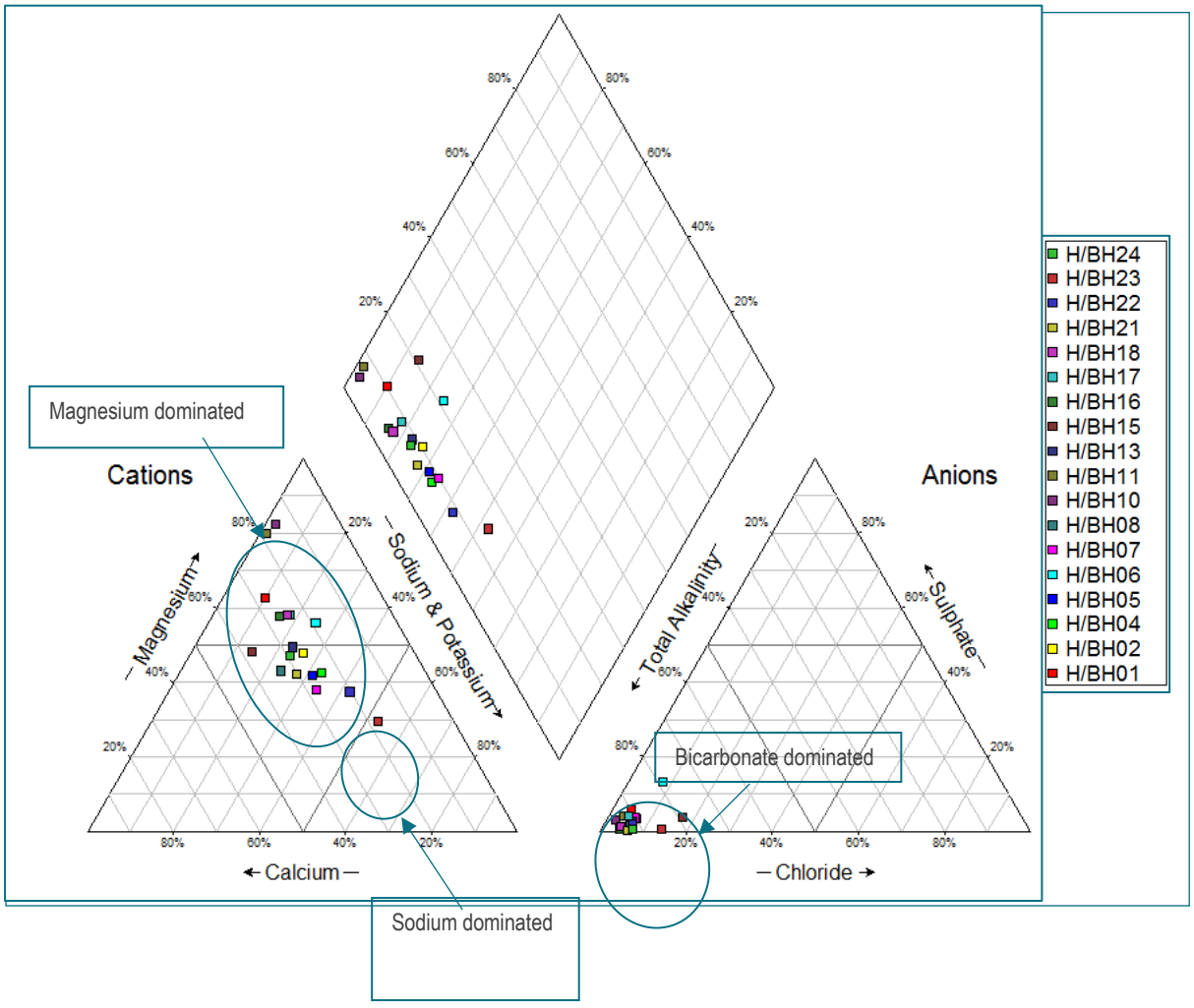


Figure 14: Piper diagram based on relative meq/l

Based on the data in Tables 17 and 18, the following:

- The pH levels of groundwater from the boreholes are circum-neutral ranging between 6.66 and 7.82 with an average of 7.21.
- In terms of salinity the quality can be described as Ideal (class 0) to Good (Class 1) in terms of the potable standards proposed by the DWS (WRC, 1998) with EC ranging between 17.8 and 75.3mS/m with an average of 41.0mS/m.
- Groundwater range between moderately soft and very hard with the majority of hardness contributed to by the Mg cation. Total hardness levels vary between 56 and 335mg/l with an average of 160mg/l. At the high end of the scale, scaling of hot water appliances may expected.
- Nitrate (NO_3) concentrations range between Ideal (class 0) to Good (Class 1) with concentrations between <0.35 and 7.99mgN/l with an average of 3.19mgN/l.
- Total ammonia (NH_3 + NH_4) levels range between low to relatively high ranging between <0.45 and 4.98mgN/l. The ammonium cation (NH_4^+) is the reduced form of nitrogen and high values indicate reducing conditions, which could either be natural or due to organic breakdown. It is not uncommon for groundwater to be in a reducing state due to low oxygen conditions but at the high end of the spectrum, organic pollution is the most likely cause.
- Trace metals recorded in low to very low concentrations.
- All parameters except for total ammonia in H/BH07, H/BH08 and H/BH21, are well within the SANS:241 drinking water quality guidelines.

Based on the hydrogeochemical diagrams, the following:

- Two distinct groundwater types can be distinguished, namely Mg-HCO_3 types and Na-HCO_3 types.
- The majority of samples are Mg-HCO_3 types representing fresh, clean, relatively young groundwater that has started to undergo Mg ion exchange.
- Only one sample, H/BH23 is a Na-HCO_3 type representing fresh, clean, relatively young groundwater that has undergone sodium (Na) ion exchange typically found in Na enriched granites or other felsic rocks.

2.2.9 Surface water

Information for this section was extracted from the Aquatic ecosystem delineation, fauna and flora assessment for the proposed expansion of the Krugerspost mine, Mpumalanga (Limnology, 2019):

Krugerspost falls in the Eastern Bankenveld (no 7) as described in the Level 1 Ecoregions by the Department of Water Affairs and Forestry (DWAF, 2005).

Primary boundary determinants are closed hills and mountains with moderate and high relief together with North-eastern Mountain Grassland and Mixed Bushveld are definitive of the region. Distinctive escarpments occur along the eastern boundary. Large rivers that traverse the area are the Olifants,

Elands and Steelpoort with perennial tributaries in the region contributing to their flow. The Crocodile River (East) has many of its sources in this area.

- Mean annual precipitation: Moderate to moderately high.
- Coefficient of variation of annual precipitation: Low to moderate.
- Drainage density: Predominantly medium.
- Stream frequency: Medium/high but low/medium in limited areas.
- Slopes <5%: <20%, 20-50% in limited areas.
- Median annual simulated runoff: Mostly moderate but moderately high in areas.
- Mean annual temperature: Mostly moderate

The mine is in the B42E quaternary catchment of the Olifants Water Management Area and the Central Transvaal (Bushveld) Basin. The Spekboom River runs approximately 3km to the south west from the current mining activities.

2.2.10 Air quality

Information for this section was extracted from the "Air Quality Impact Assessment" (Tikotech, 2019):

2.2.10.1 Ambient air quality background

The mine falls outside South Africa's declared airshed priority areas (the Vaal Triangle Airshed Priority Area, the Highveld Priority Area; and the Waterberg Bojanala Priority Area). Emission sources within a 50km radius of the mine include: agriculture, mining, smelting, incineration (Tswelopele funeral services), commercial and industrial industries associated with the towns and settlements, domestic fuel burning (an example is open cooking areas in Burgersfort), forest burning, burning at landfill sites and vehicles on roads and rails.

No local dustfall monitoring or hourly ambient air quality monitoring data was available at the time of the assessment. For an understanding of the ambient particulate air pollution, reference was made to the WHO's global ambient air pollution. The interactive map showed the modelled annual mean ambient PM2.5 for the year 2016 to range between 16 and 25µg/m3 for the assessment area. Refer to the table below for the modelled annual mean PM2.5 and PM10 for the Waterberg area in the Limpopo province and the Emalahleni, Middleburg, Sekunda and Ermelo area in the Mpumalanga province (based on updated information in 2018).

Table 13: Mean PM10 and PM2.5 ambient air pollution (WHO).

Area	Province	Priority area	PM2.5 ($\mu g/m^3$)	PM10 ($\mu g/m^3$)
Waterberg	Limpopo	Waterberg Bojanala Priority Area	18	37

Witbank (Emalahleni)	Mpumalanga	Highveld Priority Area	16	30
Middleburg	Mpumalanga	Highveld Priority Area	13	24
Sekunda	Mpumalanga	Highveld Priority Area	26	54
Ermelo	Mpumalanga	Highveld Priority Area	16	33

2.2.10.2 Standards and critical levels

South Africa's National Ambient Air Quality Standards (NAAQS) and National Dust Control Regulation' (NDCR) standards are targets set for air quality management to prevent the deterioration of air quality and to ensure that levels of air pollution are not harmful to human health or well-being. Table 14 and Table 15 provides South Africa's national ambient air quality standards for particulate matter and its national dust control standards. Refer to Table 16 for the Department of Environmental Affairs' (DEA) categorisation of dust deposition rates.

Table 14: PM10 and PM2.5 National ambient air quality standards

Pollutant	Averaging Period	Concentration (at 25°C and 101,3 kPa)	Frequency of Exceedance	Compliance Date
PM10	24 hours	75 µg/m^3	4	1 January 2015
	1 year	40 µg/m^3	0	1 January 2015
PM2.5	24 hours	40 µg/m^3	4	1 January 2016 - 31 December 2029
	1 year	20 µg/m^3	0	
	24 hours	25 µg/m^3	4	1 January 2030
	1 year	15 µg/m^3	0	

Table 15: National dust control standards

Restriction Areas	Dustfall rate (D) (mg/m^2/day, 30 days average)	Permitted frequency of exceeding dustfall rate
Residential area	D<600	Two within a year, not sequential months.
Non-residential area	600<D<1200	Two within a year, not sequential months.

Table 16: DEA categories of dust deposition rates

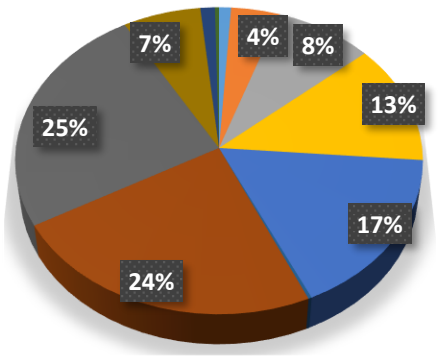
Group	Deposition rate	Description
Slight	< 250 mg/m^2/day	Barely visible to the naked eye.
Moderate	250–500 mg/m^2/day	

Group	Deposition rate	Description
Heavy	500–1 200 mg/m^2/day	A fine layer of dust on a surface.
Very Heavy	1 200 mg/m^2/day	Easily visible when a surface is not cleaned for a few days.
	>2 000 mg/m^2/day	Characterised by a layer of dust thick enough to allow a person to 'write' words in the dust with their fingers.

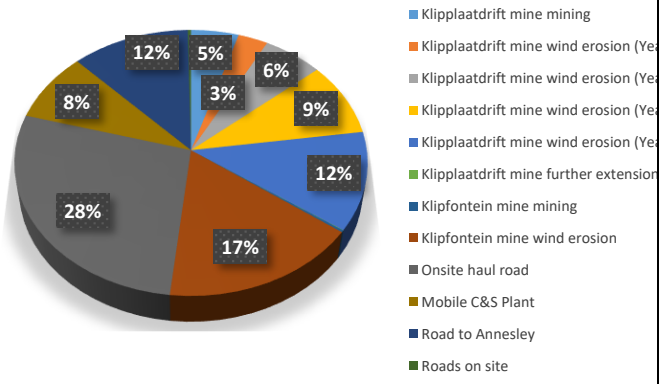
2.2.10.3 Point source maximum emission rates (start-up, maintenance and or shut down)

The planned mining operation's fugitive TSP and PM10 emissions were estimated based on default emission factors taken from the National Pollutant Inventory's (NPI) emission estimation technique manual for mining (2012) and the NPI's emission estimation technique manual for aggregated emissions from paved and unpaved roads (1999). No PM2.5 emission factors were available at the time of the assessment.

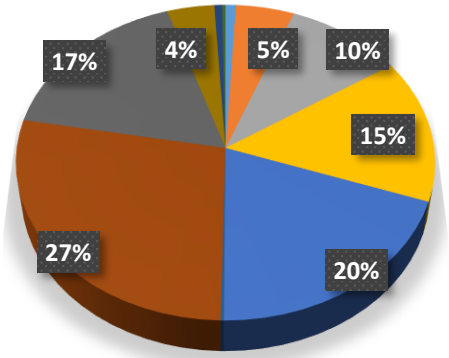
The emission inventory shows wind erosion, hauling, mining and crushing and screening to be the most significant sources of dust and PM10 air pollution (Refer Figure 15 and to Table 17). The section applicable to Klipfontein can be found in green in Table 18 below.

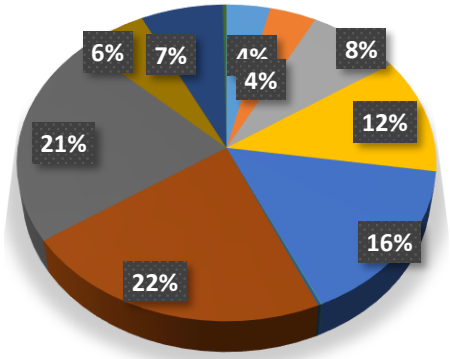


Average annual TSP emissions



Average daily TSP emissions





Average daily PM10 emissions

Average annual PM10 emissions	

Figure 15: Average emission source apportionment

Table 17: Emission inventory

Source	Activity	Emission Factors				Activity data		Emissions (tonne/year)	
		TSP	PM 10	Units	EFR[6]	Activity	Unit	TSP	PM10
Klipfontein mining	Run of mine removed by excavators and placed on tipper trucks.	0,025	0,012	kg/tonne	U	144	tonne/day	0,78	0,37
	Rehabilitation (Filling quarries with slimes, OB and waste rock, dumped with trucks from mobile C&S Plant).	0,012	0,0043	kg/tonne	U	1137	tonne/day	4,25	1,52
Klipfontein mine wind erosion	Wind erosion from exposed areas, stockpiles and dumps.	0,4	0,2	kg/ha/hr	U	24	hr/day	475,84	237,92
Onsite haul road	Tipper trucks transporting run of mine to the C&S Plant.	4,23	1,25	kg/VKT	B	46	VKT/day	39,78	11,76
	Tipper trucks transporting slimes and overburden to the quarry.	4,23	1,25	kg/VKT	B	346	VKT/day	448,46	132,53
	P1 transported by road trucks on the onsite haul road.	4,23	1,25	kg/VKT	B	115,98	VKT/day	13,40	3,96
	P1 transported from mobile C&S Plant to Annesley by road trucks on paved portion of road.	0,34	0,06	kg/VKT	Unknown	1939,8	VKT/day	17,81	3,41
LDVs and grader on internal roads	LDVs traveling on internal roads.	0,94	0,33	kg/VKT	B	20	VKT/day	6,77	2,38
	Grader levelling roads.	0,19	0,085	kg/VKT	B	30	VKT/day	0,27	0,12

[6] NPI Emission factor rating (ERF) system: A – Excellent, B - Above Average, C – Average, D - Below Average, E – Poor, U – Unrated.

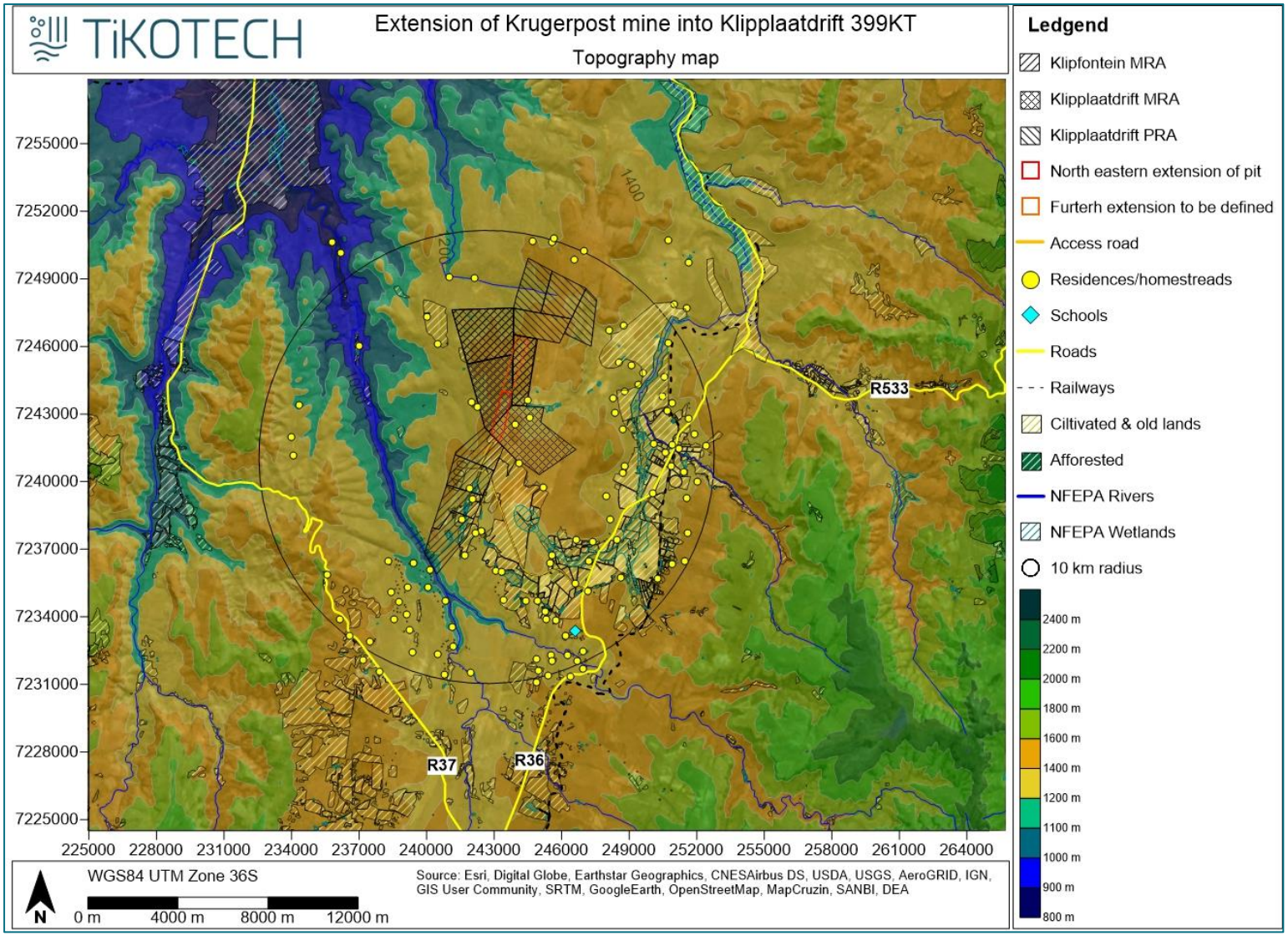


Figure 16: Topography map.

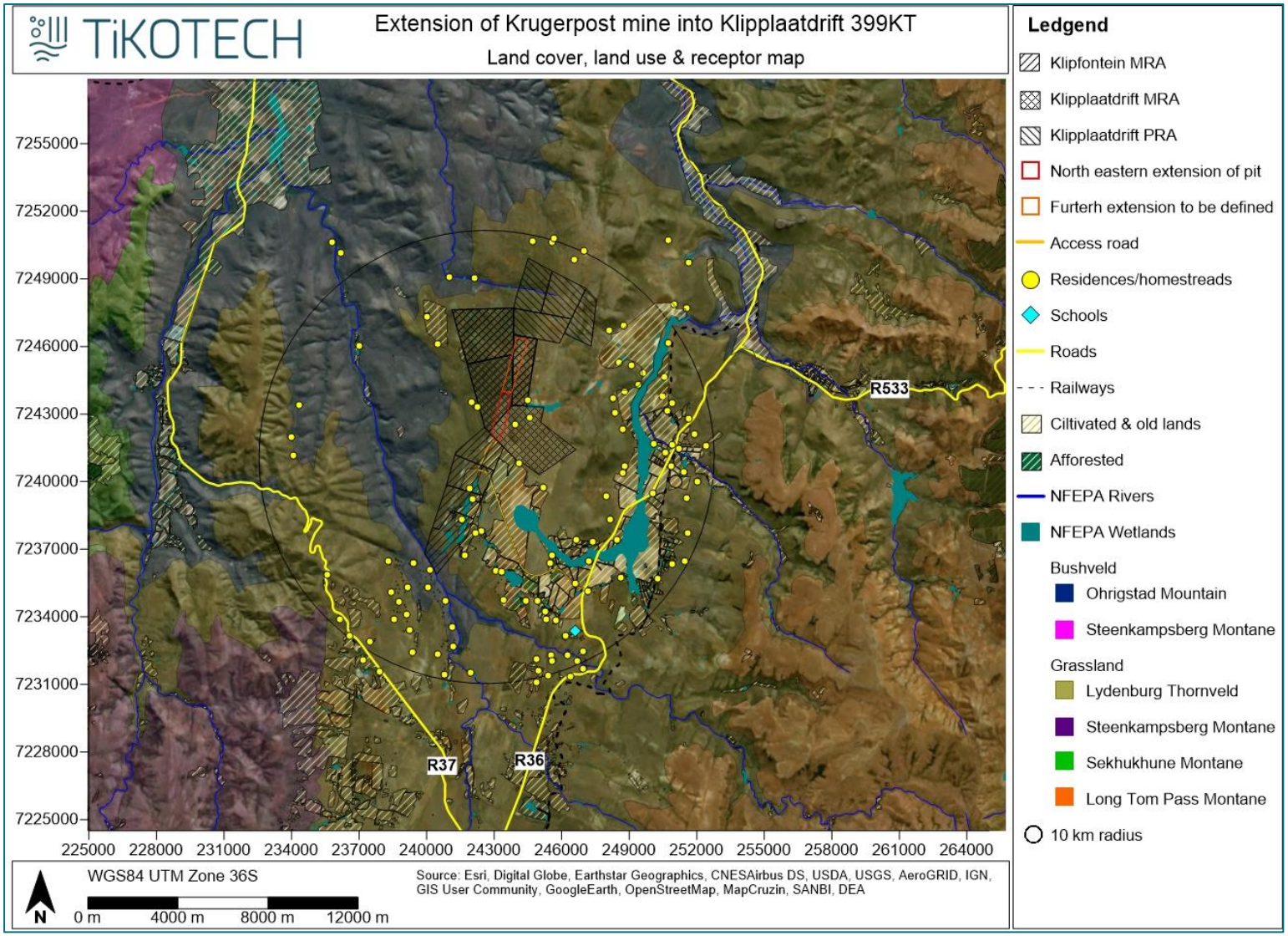


Figure 17: Land cover, land use and receptor map

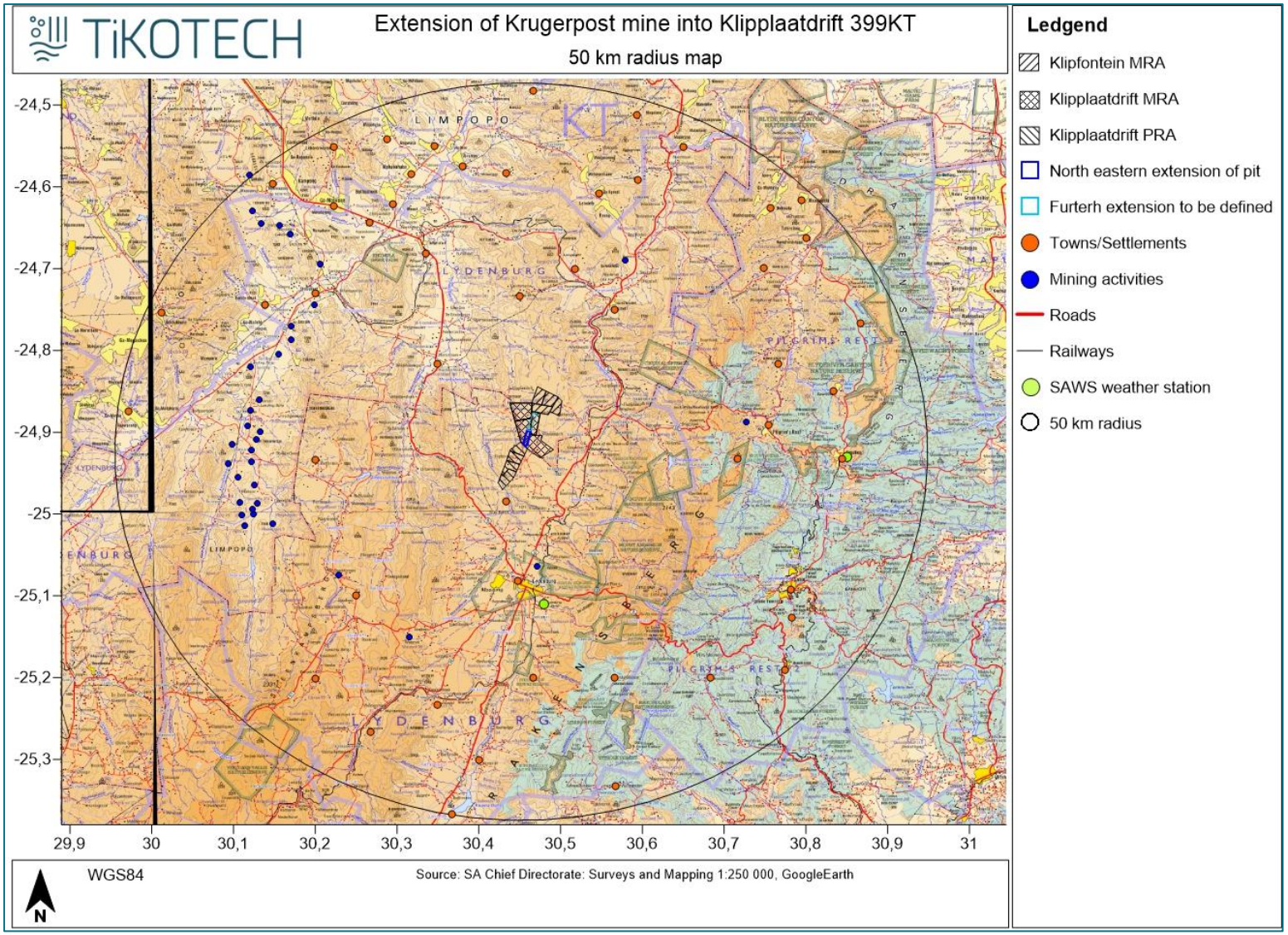


Figure 18: 50km radius map

2.2.11 Environmental noise

Information for this section was extracted from the Klipplaatdrift Mine EMP (Shangoni Management Services (Pty) Ltd, 2014):

Noise pollution and vibrations caused by existing mining machinery and vehicles. The noise level is only significant in the immediate vicinity of the source, with no impact beyond the boundaries of the site. There are no notable sources of the noise from the surrounding area.

2.2.12 Visual aspects

Information for this section was extracted from the Klipplaatdrift Mine EMP (Shangoni Management Services (Pty) Ltd, 2014):

The mining area is somewhat visible from JC Steenekamp, landowner of the remainder of Klipplaatdrift 399KT. The residence on the remainder of the farm Klipplaatdrift 399 KT is approximately 2.4km away from the proposed new mining right activities. The existing mine pits on the adjacent mine are visible from the R36 from approximately 7km outside of Mashishing for approximately 2km.

2.2.13 Cultural and heritage resources

Information for this section was extracted from the Cultural Heritage Resources Impact Assessment on Mine at Krugerpos (African Heritage Consultants cc, 2011).

The present mining plan used in this report is 'estimated' from information given by the mine manager, David Bellicini.

The fact that 'stone circles' were identified and could not be found on site during the site visit was illuminated by the correct application of the Google Earth technology. This image is dated to 2010 although the present author misinterpreted the image as dating to 2003. When the 2003 image was acquired the original suspicion that the fields were cleared for agriculture was confirmed, with not a single stone wall in site.

The question that now confronted the investigator was 'where did the stone walling in the 2010 image come from?'

In retrospect the answer is rather straightforward. While the walling was originally in place, the walls acted as collectors for biological material such as vegetation, ash and water. This altered the chemical composition of the soils under the walls, with the result that with the removal of the stones that formed the walls some time prior to 2003 by the farmer it created zones of preference for different pioneer grass species. From the stand of pioneer acacia species on the fields now in 2011 it is clear that the fields were not used for possibly more than a couple of years so that ploughing could not really influence the change in chemicals that were deposited under the walls.

It is therefore the re-habitation of a pioneer grass in the 'footprints' of the walls that show up in the 2010 Google Earth images that appears to be 'stone walls'

For purposes of the heritage report therefore the 2003 Google Earth image shows that the area was used for agriculture and therefore totally disturbed. From 2010 Google Earth images to the east and west of this disturbed area it is clear though that a continuous archaeological Later Iron Age site existed here.

This was then also confirmed on site by the identification of a large collection of rocks in the direct vicinity of the cleared area. Amongst these rocks the investigative team also identified lower grinding stone. A bored stone and a hammer stone used for breaking marula pipes to extract the kernels.

2.2.14 Sensitive landscapes

A screening tool report was generated for the site and found that the site does have a very high agricultural sensitivity and terrestrial biodiversity as seen in the maps below. The area falls within Critical Biodiversity Area 2, Ecological Support Area 1 and 2 as well as focus areas for land-based protected areas expansion. It must be noted that the site is an existing quarry. Backfilling thereof will help to ensure rehabilitation of the area.

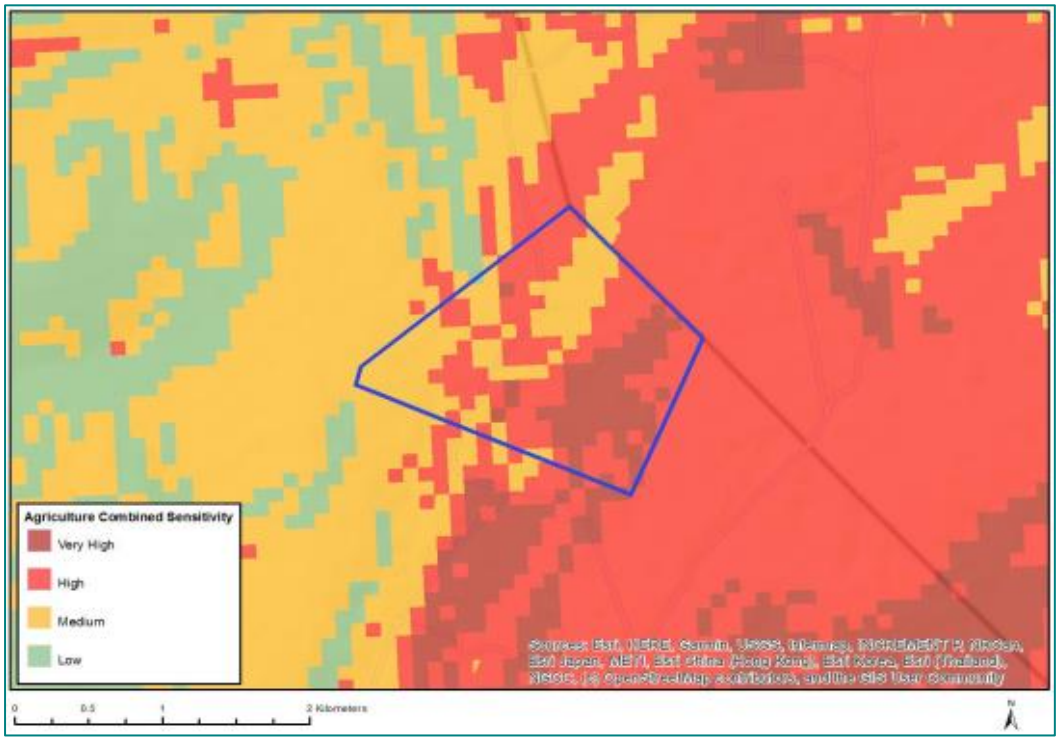


Figure 19: Map of relative agricultural sensitivity

Figure 20: Map of terrestrial biodiversity

2.2.15 Socio-economic environment

Information for this section was extracted from the Thaba Chweu Local Municipality IDP (Cllr S Mashigo-Sekgobela and team, 2017-2022):

According to the Census results of Statss SA the population size in 1996 was at 65909, 2001 it stood at 81681 and in 2011 it was 98387 as at 2016 we are sitting at 101895 and it is projected that by 2030 we will be around 113920. According to this statistic there has been an increase in population size from 1996 to 2016. This statistical information becomes important in TCLM planning in order to accurately determine the service demand and focus areas for basic service improvement from all pieces of municipal sector plans and policies. In simple terms this becomes a key directive for planning and budgeting within the municipality.

The population of Thaba Chweu municipality shows a typical age structure of a different age group distribution in the year 2011. There is a high proportion of the age group of between 25-29 to be highest and 0-4 to be the second highest of both female and male. The number decreases as the age goes up. The age group of 80+ has the lowest proportion compared to the rest of the other groups. In terms of gender balance, the females have the highest proportion in almost all the age groups. Despite this population distribution by sex and age, the population of the municipality has concentration of younger age groups.

Race and ethnic group

Blacks/black people are the most dominant in the year 1996, 2001 and 2011 followed by whites/white people. This means that the municipal planning in terms of socioeconomic related up-liftment"s programmes and projects must target groups or speak or respond to the race with the highest percentage. Amongst all the three groups the one that has hit a peak in the years (1996, 2001 and 2011) is the age group of 15-64 which sat at a percentage 64,49 in 1996, 67,16 in 2001 and 69,91 in 2011. The lowest age group is 65+ in the years (1996, 2001 and 2011) whereas the age group 0-14 years had a percentage ranging from 25,17 to 29,21.

Gender

In terms of gender there has been not much change in the years 1996, 2001 and 2011. The percentage of males and females fairly remained the same, in the year 1996, the number of males went down to 49 percent while the number of females was at 50 percent in the year 2001 at least higher than the males, and in the 2011 there has been a slight change in the number females at least this time males were higher by 1% to the females.

Employment

The general unemployment of TCLM population comprises of classified persons i.e People with disabilities, Women and Youth. It has been observed that a large number of employment opportunities come from the mining sector followed by community services and then agriculture. Trade is also contributing a better percentage in employment. Manufacturing, trade and private household share almost the same percentage in terms employment whereas finance, utilities and transport contribute the least in absorbing labour.

2.3 Stakeholder issues and comments that have informed the plan

This section must include:

i. copies of any representations and comments received from registered interested and affected parties;
ii. a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments;
iii. the minutes of any meetings held by the EAP with interested and affected parties and other role players which record the views of the participants;
iv. where applicable, an indication of the amendments made to the plan as a result of public participation processes conducted in terms of regulation 41 of these Regulations

A public participation process was held that includes the activities set to take place in this closure plan. Refer to the information below regarding the details of the public participation process.

An advertisement was published in the local newspaper, the “Steelburger” on the 6thof March 2020.

One site notice was placed at the entrance to the road from the R36 towards the mining right area.

Letters were sent to all stakeholders as well landowners to the site.

A public meeting was supposed to be held on 14th April 2020 at 10h00. However, due to Covid-19 and a restriction on the number of guests at a venue, the public meeting did not take place.

A public participation plan was compiled in line with the Covid -19 regulations stating the full plan for public participation. This was then accepted by the case official. Therefore, no public meeting has taken or will take place in terms of the EIA and closure plan.

Table 18: Comments received

I&APs	Comments summary and date	EAPs response to issues as mandated by the applicant and date	Registered I&AP or stakeholder
Affected parties			
Landowner/s or lawful occupier/s of the land and adjacent land			
Portion 36 of the farm Klipfontein 400 KT Samrec Pty Ltd	No comments received	N/A	N/A
Portion 2 of the farm Klipfontein 400 KT Axlewood Trading & Inv 104 Pty Ltd- T424/2019	No comments received	N/A	N/A
Portion 15 of the farm Klipplaatdrift 339 KT Imerys Refractory Minerals SA	No comments received	N/A	N/A
RE of the farm Klipplaatdrift 399 KT Steenekamp Jacobus Christoffel	No comments received	N/A	N/A
RE of the farm Goedvooruitzicht 394 KT Batau Ba Ga Mabelane Communal Prop Association	No comments received	N/A	N/A
Municipal councillor – ward 4			
Ms Khulumile Elizabeth Maziya	No comments received	N/A	N/A

I&APs	Comments summary and date	EAPs response to issues as mandated by the applicant and date	Registered I&AP or stakeholder
Thaba Chweu Local Municipality			
Ms Puleng Mapheto		No comments received	N/A
Ehlanzeni District Municipality			
Mr Thapelo Shabangu	No comments received	N/A	N/A
Organs of state			
DWS Mpumalanga – Lydenburg/Mashishing Office Portia Munyai	1 July 2019 Pre-application meeting for the IWULA took place whereby the IWULA was discussed.	4 July 2019 Minutes of pre-application meeting sent to DWS.	Stakeholder
Department of Agriculture Forestry and Fisheries Zinzile Mtotywa/ Andrew Tshivhase	No comments received.	N/A	N/A
Department of Rural Development and Land Reform David Maraba	No comments received	N/A	N/A
South African Heritage Resources Agency Nokukhanya Khumalo	12th March 2020 Nokukhanya stated that she is the case officer for developments in Mpumalanga and Limpopo. She asked if a case was created for the proposed development. 24th March 2020 Nokukhanya thanked the EAP for notifying her that a case has been created for this development and stated that she is working from home but will assign herself to this case.	The EAP sent the proof of submission of the Environmental Scoping Report to the SAHRA official. The EAP also stated that a case was created on SAHRA for the development. Once the EIA and closure plan is complete, this will be submitted to SAHRA.	Stakeholder.

I&APs	Comments summary and date	EAPs response to issues as mandated by the applicant and date	Registered I&AP or stakeholder
	30th of April 2020 A letter was sent to the applicant from SAHRA. It stated that the Heritage Impact Assessment (HIA) is more than 5 years and may be outdated. Therefore, an archaeologist must be out to site to review the HIA which must be submitted for comment. A palaeontological resources assessment must be conducted by a palaeontologist due to the high palaeontological sensitivity. This must be submitted for commenting.	The EAP stated that the activities being applied for on this site is to backfill an already disturbed quarry with no resources occurring. The plant to be constructed is also on top of mine residue, therefore, no heritage resources can occur on this residue and respectfully requested that a heritage and paleontological study will only be necessary, if the mine, with mining right MP196MR extents to undisturbed areas.	Stakeholder.
Communities and traditional leaders			
Mabelane Communal Prop Association	No comments received	N/A	N/A
Historical disadvantaged communities			
None identified	N/A	N/A	N/A
Land claimants			
See above regarding land claims	N/A	N/A	N/A
Interested and affected parties			
National Federated Chamber of Commerce and Industry	10th March 2020 Edward Mobogoane, NAFCOC chairperson under NAFCOC mining sector Mpumalanga stated that they fully support the application and are willing to be part of this project as going on.	The EAP called NFCOC and discussed the matter telephonically. The EAP stated that they will provide NAFCOC with the venue of the public meeting closer to the time. The EAP further stated that they	I&AP

I&APs	Comments summary and date	EAPs response to issues as mandated by the applicant and date	Registered I&AP or stakeholder
		will be provided with the Environmental Scoping Report once complete.	
Ladwin Moraba	25th March 2020 Ladwin stated that they are an interested party over an SMS.	The EAP stated that Ladwin has now been registered as an I&AP and will receive communication henceforth.	I&AP

2.4 The mine plan and schedule for the full approved operations

This section must include:

(aa) appropriate description of the mine plan;

(bb) drawings and figures to indicate how the mine develops;

(cc) what areas are disturbed; and

(dd) how infrastructure and structures (including ponds, residue stockpiles etc.) develops during operations

The mine is currently in the process of mining Quarry 6. However, all other activities have ceased. It was an opencast rip-and-doze operation along the gentle scarp slope of a range of low hills. The mine is proposing to backfill Quarry 6 with mine residue as part of its rehabilitation. Due to the size of the quarry, water pumped from the new quarry on Klipplaatdrift, will be stored in Quarry 6.

The mine will also erect a new plant on already disturebed soil. Concept Design includes a full scale plant essentially including a primary crushing & screening with first stage DMS followed by a 3 stage processing plant, Dryer, and Mag plant. Mining activities will hence extend the life of mine and the associated activites.

Krugerspost Mine consisted of the following infrastructures.

- Plant and workshops- removed,
- Offices – remaining but to be removed,
- Scrap yard - removed,
- Magnetic waste site – sloped and topsoil spread for revegetation,
- Office Slimes Dam – non-operational with penstock still remaining,
- Old Slimes Dam – non-operational with no infrastructure and completely revegetated;

- Quarries (1, 2, 3, 4, 6/7, Hostel Quarry) – backfilled as far as possible with some backfilling still to be done at Quarry 6/7,
- Barge Dam – removed, now only a wetland area,
- Spekboom Reservoir Dam and Borrow Pit Dam - removed,
- Settling Dams (1 and 2) – remaining and to be used in future for other operations, and
- Ericsson Dams (1 to 5) – three have been removed with last two remaining completely empty and non-operational.

Refer to the figure below for a site layout plan of the area.

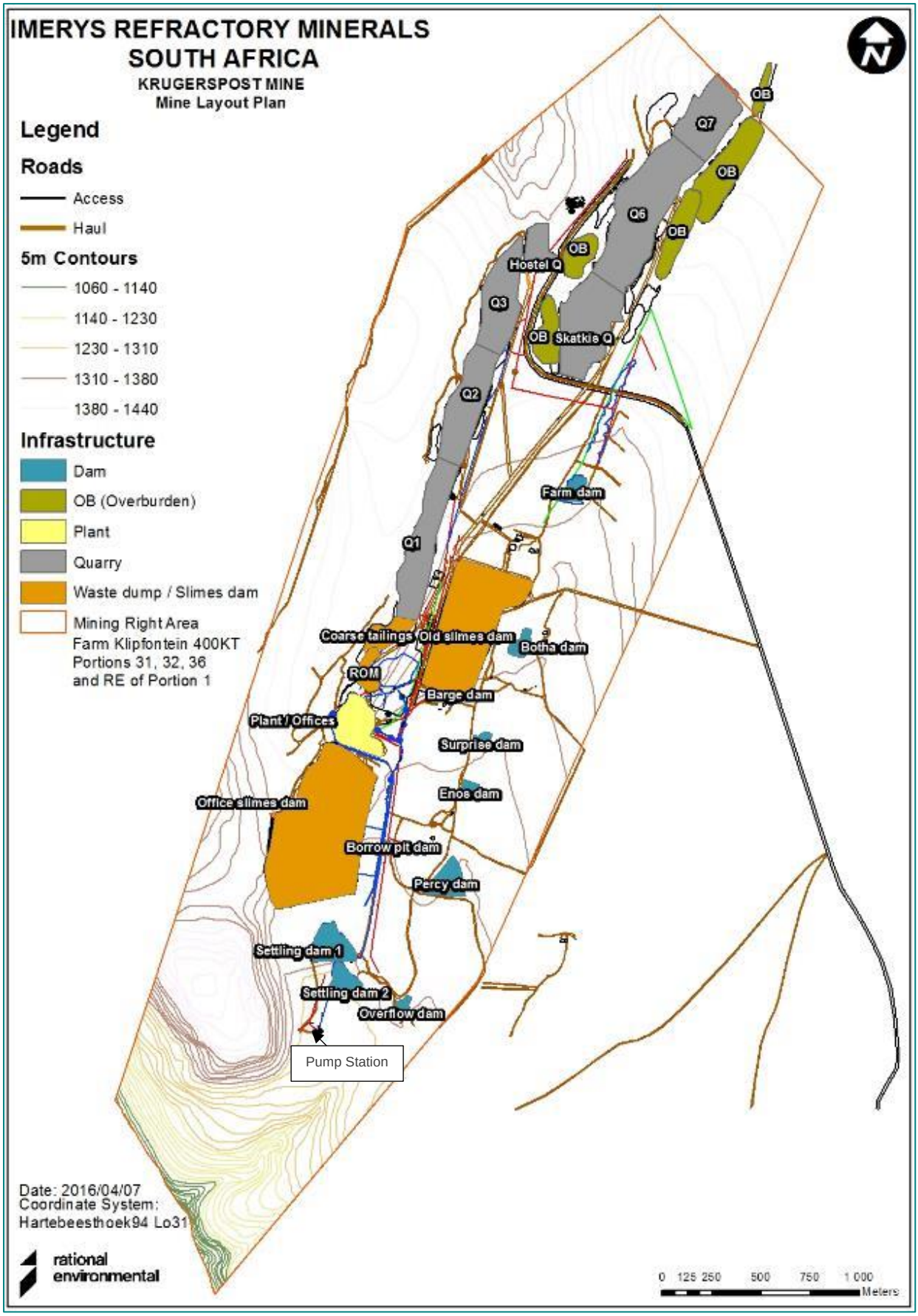


Figure 21: Site layout plan of the mining area

SECTION 3: DESIGN PRINCIPLES

3.1 The legal and governance framework and interpretation of these requirements for the closure design principles

This section includes the legal and governance framework and interpretation of these requirements for the closure design principles. It also includes measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity and associated closure to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including a handover report, where applicable

The requirements of closure are documented in various legislation. The various legislation and interpretation of these requirements for the closure design principles are discussed in Table 19 below.

Table 19: Legislation and interpretation of these requirements for the closure design principles

Legislation	Requirements	Interpretation of these requirements for the closure design principles
Regulation 56 of MPRDR	In accordance with applicable legislative requirements for mine closure, the holder of a mining right must ensure that - (a) the closure of a mining operation incorporates a process which must start at the commencement of the operation and continue throughout the life of the operation; (b) risks pertaining to environmental impacts must be quantified and managed proactively, which includes the gathering of relevant information throughout the life of a mining operation; (c) the safety and health requirements in terms of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA) are complied with; (d) residual and possible latent environmental impacts are identified and quantified;	The approved EMP (1999) includes reference to rehabilitation and closure of the mine. The mine compiles and submits annual rehabilitation plans which include updated progress on rehabilitation as a work in progress towards closure. As part of these various residual and latent risks are identified with the following objectives; 1. ensure the timeous prediction and quantification of environmental risk associated with the operations. 2. ensure timeous risk reduction through appropriate interventions. 3. identify the potential residual and latent environmental risks which will manifest post closure. 4. detail the approach to managing post closure risks. 5. quantify the potential risks and liabilities associated with the management of the risks.

Legislation	Requirements	Interpretation of these requirements for the closure design principles
	(e) the land is rehabilitated, as far as is practicable, to its natural state, or to a predetermined and agreed standard or land use which conforms with the concept of sustainable development; and (f) mining operations are closed efficiently and cost effectively.	6. the quantification must be based on market related costs. 7. calculate a risk threshold and timeframe in which to reach the risk threshold. 8. outline and cost the post closure monitoring, auditing and reporting requirements. This closure plan serves as a mechanism to ensure the risks pertaining to closure are reduced along with any possible latent or residual impacts. If rehabilitation is implemented correctly the closure of the mines when the time comes will be carried out efficiently in a cost-effective manner as included in the financial provision.
Regulation 57 of MPRDR	An application for a closure certificate by the holder of a mining right in terms of section 43(4) of the MPRDA must be completed in the form of Form P, contained in Annexure II. (2) The application referred to in sub-regulation (1) must be accompanied by the following documentation - (a) A closure plan contemplated in regulation 62; (b) an environmental risk report contemplated in regulation 60; (c) a final performance assessment report contemplated in regulation 55(9); and (d) a completed application form contemplated in regulation 58(1) to transfer environmental liabilities and responsibilities, if the transfer of such liabilities have been applied for.	This is noted and will only be done once applying for closure. All necessary closure information will also be included as part of this application. This closure plan serves to reveal the rehabilitation planned for the backfilling of Quarry 6 and is submitted as an addendum to the EIA.
Regulation 61 of MPRDR	Closure objectives form part of the draft environmental management programme and must -	Closure objectives were included in the approved EMP (1999). The closure costs are updated on an annual basis. Objectives are expanded on further in this report.

Legislation	Requirements	Interpretation of these requirements for the closure design principles
	(a) identify the key objectives for mine closure to guide the project design, development and management of environmental impacts; (b) provide broad future land use objective(s) for the site; and (c) provide proposed closure costs.	
Section 43 of MPRDA, Section 24R of NEMA	Every holder remains responsible for any environmental liability, pollution or ecological degradation, the pumping and treatment of polluted or extraneous water, the management and sustainable closure thereof notwithstanding the issuing of a closure certificate by the Minister responsible for mineral resources in terms of the MPRDA to the holder or owner concerned.	There will be no transfer of liabilities once the mine applies for closure. The residual impact is included in this closure plan. Risks in terms of environmental pollution will thus be minimised prior to closure of the mine to reduce the impact post closure.
	When the Minister responsible for mineral resources issues a closure certificate, he or she must return such portion of the financial provision contemplated in section 24P as the Minister may deem appropriate to the holder concerned, but may retain a portion of such financial provision referred to in subsection (1) for any latent, residual or any other environmental impact, including the pumping of polluted or extraneous water, for a prescribed period after issuing a closure certificate.	The closure liability update was based on the disturbed areas and changes at Krugerspost Mine. The liability was calculated using decommissioning and rehabilitation rates obtained from contractors. This is assessed on an annual basis and the guarantee is updated according to these calculations. <u>Mining right</u> The mine has a mining right in terms of the Minerals and Petroleum Resources Development Act no 28 of 2002. The mining right commenced on the 4th May 2010 and continues for a period of 10 years therefore expiring on the 3rd May 2020. The mine is in the process of extending the mining right period and will therefore not be applying for closure.
	Every holder of works must plan, manage and implement such procedures and requirements in respect of the closure of a mine as may be prescribed.	The mine will adhere to the requirements as set out in this Closure Plan, once approved and finalised by the DMR.
	The Minister may, in consultation with the Minister responsible for mineral resources and by notice in the Gazette, identify areas where mines are	

Legislation	Requirements	Interpretation of these requirements for the closure design principles
	interconnected or their impacts are integrated to such an extent that the interconnection results in a cumulative impact.	This condition is noted. However, the mine has not received any communication from the Minister stating that there are areas where the mines are interconnected, and their impacts integrated.
	The Minister may, by notice in the Gazette, publish strategies to facilitate mine closure where mines are interconnected, have an integrated impact or pose a cumulative impact.	
Regulation 19(6) of GN 982	A closure plan must contain the information set out in Appendix 5 to these Regulations, and the closure plan must address the requirements as set in the regulations, pertaining to the financial provision for the rehabilitation, closure and post closure of mining operations, made in terms of NEMA.	This Closure Plan is based on the requirements of the MPRDA, Appendix 5 of GN 982 as well as Appendix 4 of GN 1147.
Regulations 6(b) of GN 1147	An applicant must determine the financial provision through a detailed itemisation of all activities and costs, calculated based on the actual costs of implementation of the measures required for final rehabilitation, decommissioning and closure of the mining operations at the end of the life of operations, as reflected in a final rehabilitation, decommissioning and closure plan.	The financial provision is included in Section 6 of the is Closure Plan.
Regulations 12(2) of GN 1147	The final rehabilitation, decommissioning and closure plan must contain all information set out in Appendix 4.	This Closure Plan is based on the requirements of the MPRDA, Appendix 5 of GN 982 as well as Appendix 4 of GN 1147.

3.2 Closure vision, objectives and targets

This section must reflect the local environmental and socio-economic context and reflect regulatory and corporate requirements and stakeholder expectations

Closure objectives form part of the draft EMP, and must:

a. Identify the key objectives for mine closure to guide the project design, development and management of environmental impacts;
b. Provide broad future land use objective(s) for the site; and
c. Provide proposed closure costs.

According to the Approved Environmental Management Programme for Krugerspost Andalusite Mine, 196 MR, approved 1999:
Key closure objectives are necessary for mine closure, to guide the project design, development and management of environmental impacts. The closure objectives for the mine are as follow:

1. To rehabilitate the land to a level where natural topography, vegetation and land use approach the original state as closely as possible.
2. That stormwater control is permanent in view of the large volumes of fine erodible materials that have been created.
3. That the water quality and catchment yield return to the original state as closely as possible.

The rehabilitation of Krugerspost will focus on sloping of quarries and sloping and levelling of any additional overburden; removal of alien vegetation and establishment of natural vegetation on all disturbed areas to also prevent erosion; adequate stormwater control to prevent siltation and pollution of the Spekboom River; and removal of all old infrastructure. The rehabilitation plan will, therefore, be compatible with the closure objectives.

3.3 A description and evaluation of alternative closure and post closure options where these exist that are practicable within the socioeconomic and environmental opportunities and constraints in which the operation is located

There is no alternative to the pumping of water from Quarry 6 and Quarry 7 or the backfilling of Quarry 6 with mine residue (slimes and waste rock). This is the best rehabilitation activities that were proposed for the mine and various specialist studies were undertaken based on this.

3.4 A motivation for the preferred closure action within the context of the risks and impacts that are being mitigated

Refer to Section 4.2 for a complete description.

3.5 A definition and motivation of the closure and post closure period

This must take cognisance of the probable need to implement post closure monitoring and maintenance for a period sufficient to demonstrate that relinquishment criteria have been achieved.

Refer to Section 4.2 for a complete description.

3.6 Details associated with any on-going research on closure options

Refer to Section 4.2 for a complete description.

3.7 A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking

Refer to Section 4.2 for a complete description.

SECTION 4: FINAL REHABILITATION PLAN

4.1 Proposed final post-mining land use which is appropriate, feasible and possible of implementation

This section includes:

a. descriptions of appropriate and feasible final post-mining land use for the overall project and per infrastructure or activity and a description of the methodology used to identify final post-mining land use, including the requirements of the operations stakeholders; and
b. a map of the proposed final post-mining land use

The end land-use has been identified as grazing and game farming. Water accumulating within the remaining quarries will be utilised and optimised to compliment the end land-use. Sloping should be at a safe angle for cattle and other animals to graze on site and provide easy access to the water. Sloping should allow for free drainage and prevent siltation of the water resources.

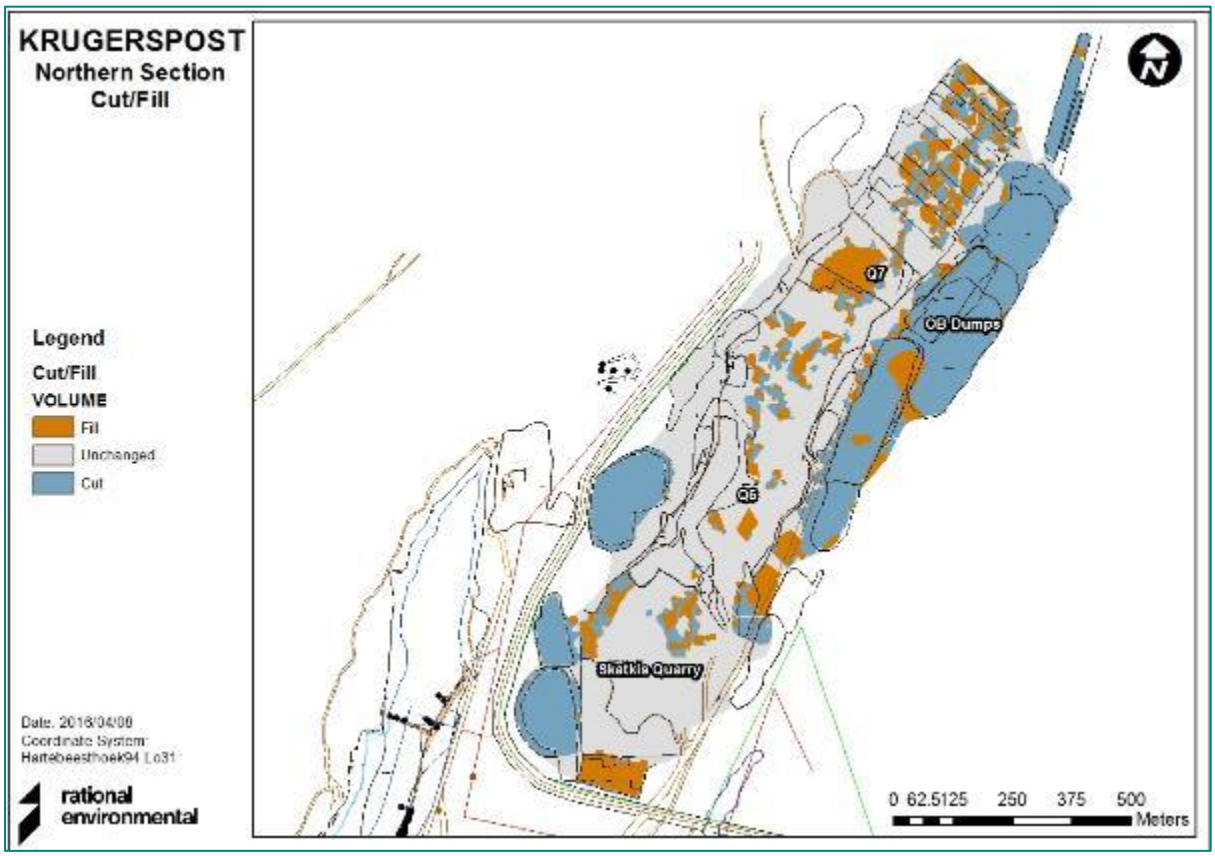


Figure 22: Final cut and fill of the northern section of the mine

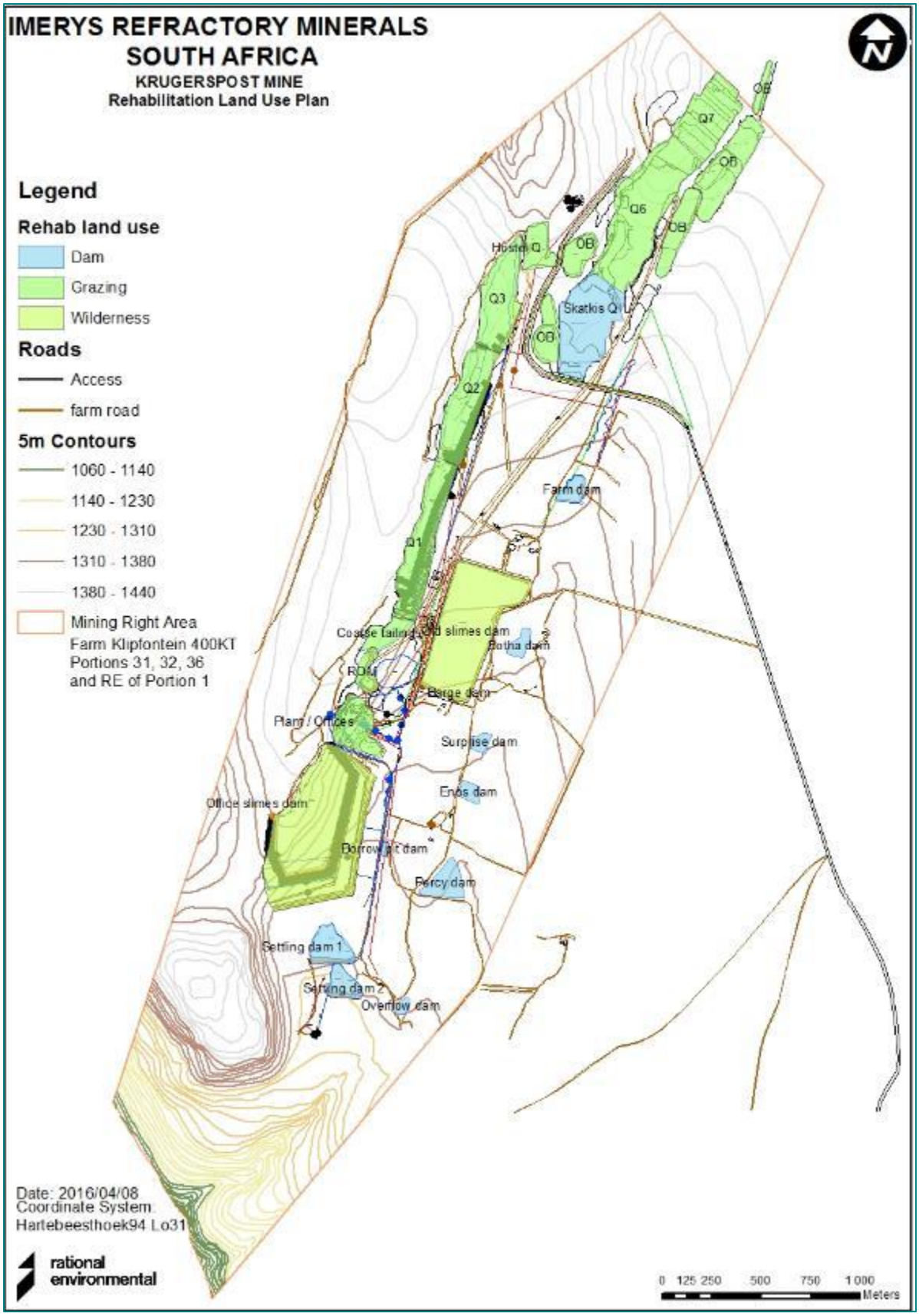


Figure 23: A sketch plan describing the final and future land use proposal and arrangements for the site

4.2 Closure actions, and schedule of actions

The closure actions include:

i. the development and documenting of a description of specific technical solutions related to infrastructure and facilities for the preferred closure option or options, which must include all areas, infrastructure, activities and aspects both within the mine lease area and off of the mine lease area associated with mining for which the mine has the responsibility to implement closure actions; and
ii. the development and maintenance of a list and assessment of threats and opportunities and any uncertainties associated with the preferred closure option, which list will be used to identify and define any additional work that is needed to reduce the level of uncertainty

The schedule of actions for final rehabilitation, decommissioning and closure which will ensure avoidance, rehabilitation, management of impacts including pumping and treatment of extraneous water must be:

i. linked to the mine works programme, if greenfields, or to the current mine plan if brownfields
ii. including assumptions and schedule drivers; and
iii. including a spatial map or schedule, showing planned spatial progression throughout operations

Resloping information was extracted from Sloping and Earthworks Plan (Rational Environmental, 2016). Refer to Figure 24 for the layout plan indicating the areas to be rehabilitated corresponding with the sub-sections below.

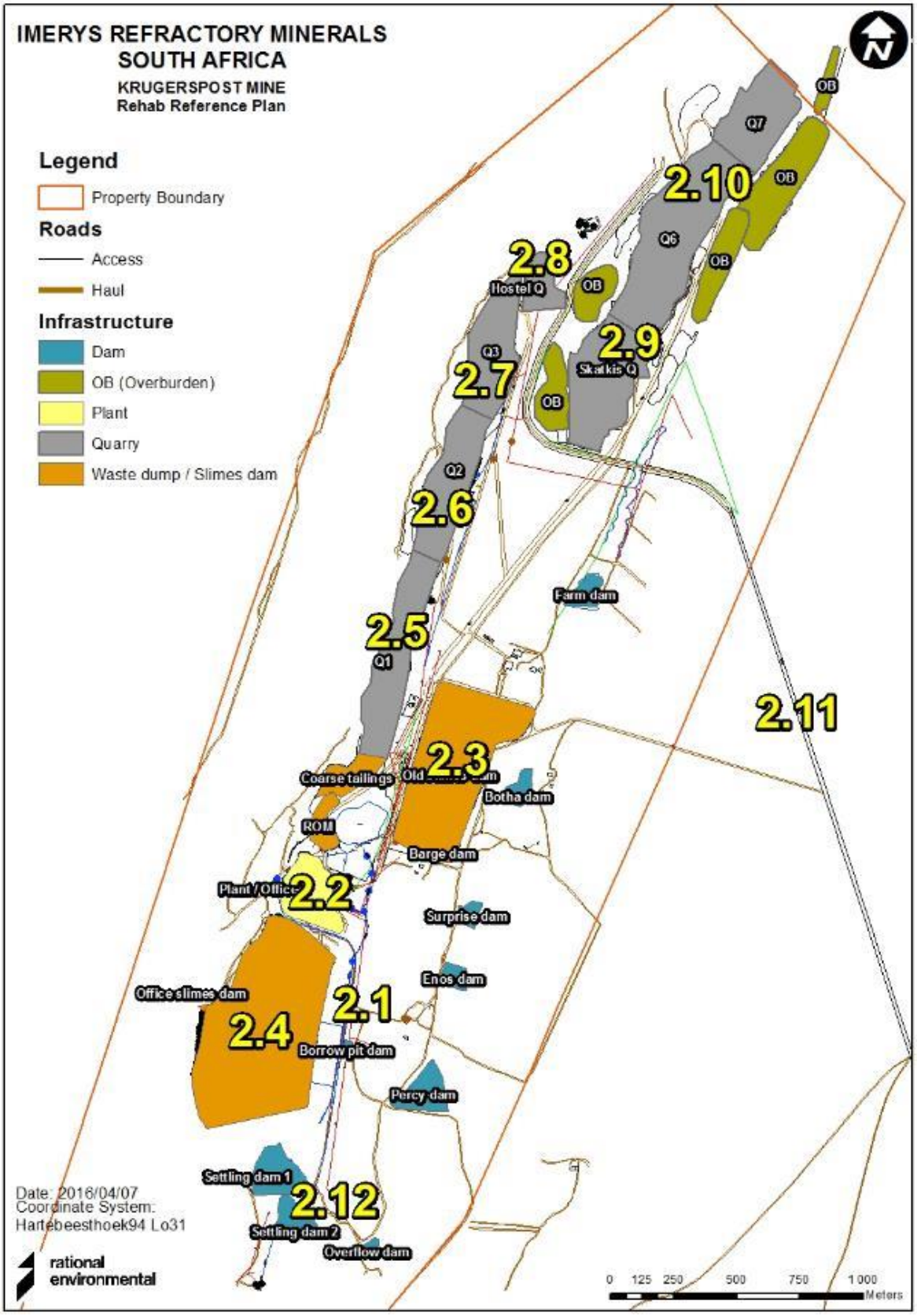


Figure 24: Areas to be rehabilitated

4.2.1 Removal of remaining pipelines on site

Specific closure vision, objectives and targets	To remove all pipes in accordance with all environmental principles as well as the requirements of the MHSA.
Original closure plan action plans	All asbestos waste will be disposed of only on sites specifically designated for this purpose. All vehicles, re-usable containers or any other similar articles which have been in contact with asbestos waste will be cleaned and decontaminated after use. All persons occupied in the collection, transport and disposal of asbestos waste, will wear personal protective equipment (PPE). The remainder of the pipes will be removed to other mines within the Imerys Group.
Current situation	There are various pipes that were on site due to mining activities. Some of these pipes were used for piping of water and slimes. It then became evident that there were more pipes on site that were not known due to vegetation growth. These pipes included clay, steel and asbestos pipes. The mine is currently in the process or removing the rest of the pipes as part of rehabilitation activities.
Updated action plans	Remove all remaining pipes that have been discovered. Remove final pipeline from Office Slimes dam once an engineer has given the go-ahead.
Schedule	This is ongoing until all pipes have been removed.
Description and evaluation of alternative closure and post closure options	This is not applicable as rehabilitation includes the removal of **all** pipelines.
Motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	The reuse of the steel pipes on other mines or by the contractor to reduce the generation of waste. All asbestos pipes will be removed per the requirements as stipulated in the Asbestos Regulations (GN 155) of 2001 of the Occupational Health and Safety Act (No 85 of 1993).
Details associated with any on-going research on closure options.	All research regarding closure options has already been conducted and is represented in this report.
A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking.	The only assumption made is that the mines within the Imerys Group or the contractor will use the steel pipes that have been removed. Specialists have proposed that this will be the best method of rehabilitating the area.
Financial provision	R36,000.00

4.2.2 Removal of plant and associated buildings, RoM and coarse tailings area

Specific closure vision, objectives and targets	To keep the existing terraces with only minor cut and fill operations; and To allow a gradual drainage to the east of the plant.
Original closure plan action plans	All hazardous materials such as hydrocarbons, fluorescent tubes, etc. will be removed by a licensed waste contractor to a licensed disposal area. The mine will obtain all the correct documentation such as safe disposal certificates and copy of the disposal site license. All asbestos cement will be removed. All salvageable material is being removed by either SA Metals or other mine operations. Concrete will be removed to a depth of 1m below surface. Building rubble (inert waste) could be used for backfilling of the quarries, however, the disposal of more than 25tons need a waste license excluding the disposal of such waste for the purposes of levelling which has been authorised by or under other legislation. This will be discussed with DMR prior to disposal. Once all remaining infrastructure is removed the sloping can be done with the aim to keep the existing terraces with only minor cut and fill operations by pushing the edges of the high wall down. Refer to the figure below marked as '1'. Sloping of the floor is recommended to be done towards the terraces to allow a gradual drainage to the east.
Current situation	The plant has been removed completely and the area has been rehabilitated as sloping is complete. During the last site visit there were no hazardous chemicals observed on site. However, the offices above the plant area are still intact; however, some of the ceiling was stolen.
Updated action plans	The old office at the plant shall be removed.
Schedule	This is ongoing until all infrastructure has been removed.
Description and evaluation of alternative closure and post closure options	There are no alternative post closure options to the removal of the plant and associated structures. Specialists were consulted to ensure that the best rehabilitation methods are implemented for the mine.

Motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	The removal of all plant material will allow the resloping of the area to ensure the free flow of water. This will also allow revegetation for the planned end use.
Details associated with any on-going research on closure options.	All research regarding closure options has already been conducted and is represented in this report.
A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking.	It is assumed that all infrastructure will be removed and disposed off at a registered site or shall be sold as scrap. Resloping of the area shall be done based on surveyor data that the mine has collected.
Financial provision	No costs set aside.

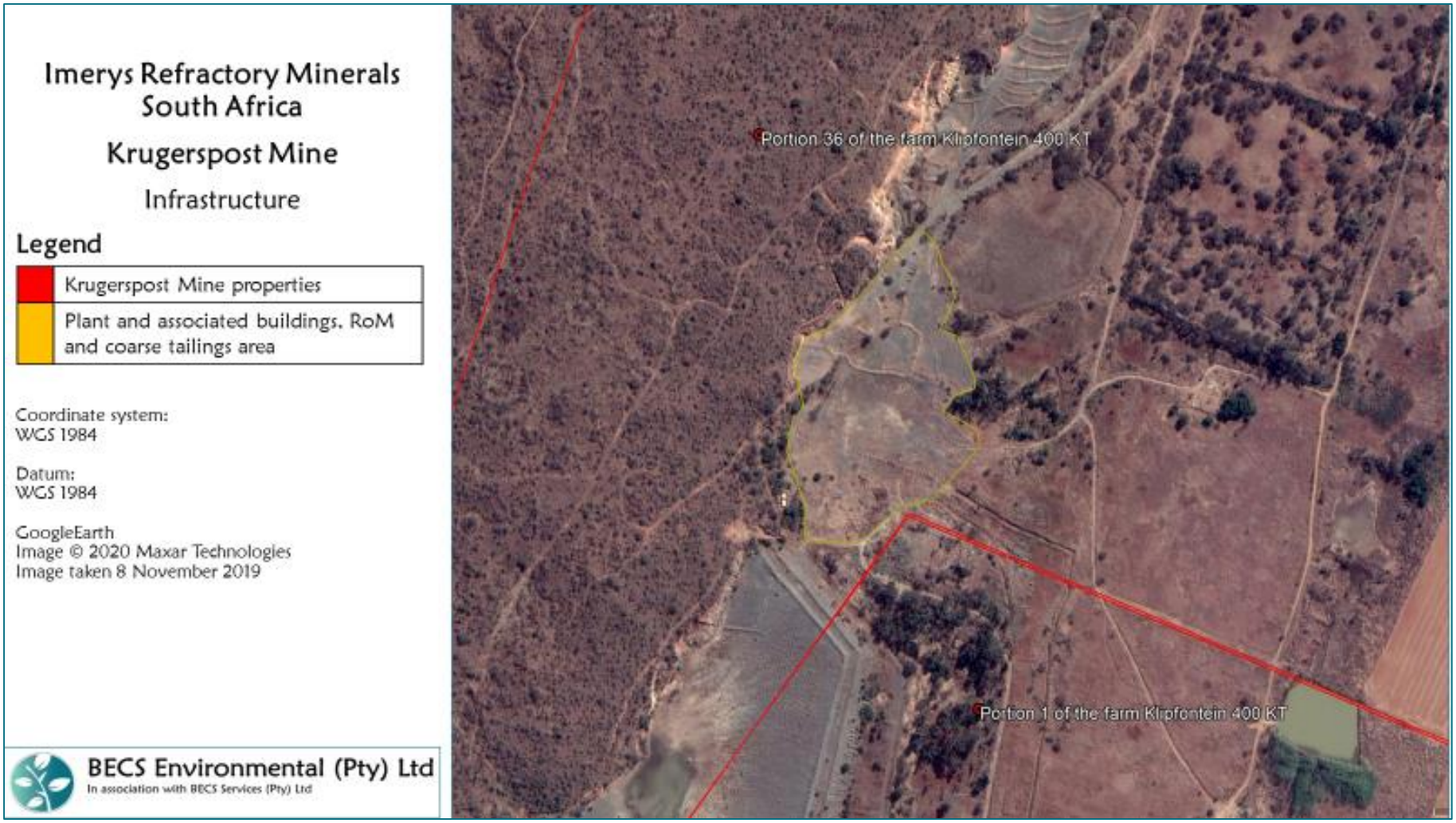


Figure 25: Plant and office area

4.2.3 Old slimes dam removal and rehabilitation

Specific closure vision, objectives and targets	Any seepage from the old slimes dam must be prevented by the removal and rehabilitation of the old slimes dam.
Original closure plan action plans	There were no original action plans in the closure plan.
Current situation	The old slimes dam has already been revegetated as part of rehabilitation. There is therefore no additional rehabilitation that is envisaged.
Updated action plans	It will not be beneficial to disturb the slimes dam along the sidewalls. It is recommended to construct small berms on the top to allow even distribution of runoff to assist vegetation growth and prevent ponding. Therefore, there is no action necessary in terms of rehabilitation but rather monitoring to ensure alien vegetation does not occur.
Schedule	Since the dam has already been rehabilitated there is no additional schedule anticipated.
Description and evaluation of alternative closure and post closure options	There are no alternative closure and post closure options necessary as the mine has already rehabilitated the old office slimes dam.
Motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	The preferred action plan has already been implemented as the old slimes dam has been rehabilitated.
Details associated with any on-going research on closure options.	This is currently not applicable as the mine has already implemented rehabilitation based on specialist opinions.
A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking.	Rehabilitation and sloping of the old slimes dam were performed based on surveyor data that was received from the mine. The seepage potential information is derived based on information from the Hydrogeological Report (Shangoni, 2013).
Financial provision	The old slimes dam has been revegetated. No additional rehabilitation costs are envisaged.

4.2.4 Removal and rehabilitation of the office slimes dam

Specific closure vision, objectives and targets	Specific closure objectives for the rehabilitation of the office slimes dam includes the following; • To allow even distribution of runoff; • To assist vegetation growth; • To prevent ponding at the sealed penstock; and • To prevent seepage from old slimes.
Original closure plan action plans	The penstock shall be sealed. All berms are already paddocked; therefore, no additional paddocks are necessary. The Office Slimes Dam has some vegetation already established on parts of the sidewalls. It will not be beneficial to disturb the slimes dam along the sidewalls. It is recommended to construct small berms on the top to allow even distribution of runoff to assist vegetation growth and prevent ponding at the sealed penstock.
Current situation	It must be noted that the Office dam (slimes dam) is non-operational. Some natural revegetation has commenced but the walls are not yet covered in vegetation. The penstock has not yet been sealed; the engineer must indicate whether this is feasible and can be done.
Updated action plans	Revegetating the office slimes dam is necessary. An approved EMP, dated 1998 states that rehabilitated slimes areas and residue dumps will be monitored to ensure successful establishment of vegetation. Therefore, the mine must assess what vegetation practices are best for the environment and most efficient on this dam.
Schedule	The revegetation of the office slimes shall be an ongoing process.
Description and evaluation of alternative closure and post closure options	There are no alternative closure and post closure options regarding the office slimes dam. Specialist were consulted to ensure that the best rehabilitation practices take place which is the revegetation of the office slimes dam.
Motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	The preferred method of rehabilitation shall ensure the free flow of water. Revegetation will then aid the reduction of any residual seepage that may come from the dam.
Details associated with any on-going research on closure options.	Water quality monitoring is ongoing at the mine. Water quality monitoring reveals whether the residual seepage from the office slimes dam enters the groundwater leading to elevated concentrations of variables and hence groundwater pollution.

A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking.	Rehabilitation and sloping of the office slimes dam is based on surveyor data collected from the mine. The seepage potential information is derived based on information from the Hydrogeological Report (Shangoni, 2013).
Financial provision	The office slimes dam has been revegetated. No additional rehabilitation costs are envisaged.

Figure 26: Old slimes dam

Figure 27: Old slimes dam

4.2.5 Rehabilitation of Quarry 1

Specific closure vision, objectives and targets	Specific closure objectives for the rehabilitation of Quarry 1 include the following; • To allow free flowing of surface water; • To promote even vegetation growth; and • To ensure the safety of quarry for community and animals.
Original closure plan action plans	This quarry has been backfilled to a flat slope in line with the natural topography on the eastern side. Therefore, there is no major sloping that is proposed. Only paddocks on the top surface are proposed to promote the growth of vegetation.
Current situation	Quarry 1 has been backfilled to a flat slope ratio and blends in with the natural topography. Vegetation growth on this quarry is minimal and paddocks are proposed to promote vegetation growth. Soil replacement is currently taking place to ensure that water is retained.
Updated action plans	Revegetation with the aid of the surveyor is proposed as part of rehabilitation. Final maintenance of Quarry 1 will include erosion monitoring and repair if necessary, as well as alien vegetation monitoring and eradication if necessary.
Schedule	The revegetation and maintenance of Quarry 1 is an ongoing process.
Description and evaluation of alternative closure and post closure options	There are no alternative closure and post closure options that were evaluated in this instance as the best method of rehabilitation for Quarry 1 has already been implemented.
Motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	The sloping of the quarry has already been completed which ensures the free flow of water as well as revegetation. It also ensures that the quarry is safe, and the planned land use is obtained.
Details associated with any on-going research on closure options.	All research regarding the rehabilitation and maintenance of Quarries 1 has already been undertaken and is currently being implemented.
A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking.	Rehabilitation and sloping of Quarry 1 is based on surveyor data collected from the mine. The seepage potential information is derived based on information from the Hydrogeological Report (Shangoni, 2013).
Financial provision	R419,000.00 for seeding and R150,000.00 for soil erosion, vegetation growth, and alien vegetation monitoring.

4.2.6 Rehabilitation of Quarries 2&3

Specific closure vision, objectives and targets	The rehabilitation of Quarries 2&3 include the following; • To allow free flowing of surface water; • To prevent ponding at the sealed penstock; • To promote even vegetation growth; and • To ensure the safety of quarry for community and animals.
Original closure plan action plans	There is no sloping planned for Quarry 2, this quarry will be revegetated. Small contour berms are suggested along all the backfilled tailings quarries to runoff water to be dispersed as part of the vegetation establishment and prevent ponding at the sealed penstocks. Quarry 3 has been backfilled flat with the natural topography on the eastern side. No major sloping is proposed. Only paddocks on the top surface are proposed to promote even vegetation growth. Paddocks should not commence without the approval of the responsible engineer as the dam is still draining through the penstock.
Current situation	The backfilling (sloping) of Quarry 2 and Quarry 3 is complete. Topsoil is being spread over the area and berms have been incorporated to assist with water retention. There is still some topsoil that can be applied to the area.
Updated action plans	The mine must ensure that the revegetation process is completed. It is recommended that a surveyor ensures these quarries have been sloped to an appropriate angle in line with the closure plan and the surrounding environment. Provision has also been made to manage soil erosion and the monitoring of alien vegetation.
Schedule	Revegetation and alien invasive monitoring at Quarries 2&3 is ongoing at the mine.
Description and evaluation of alternative closure and post closure options	There are no alternative closure and post closure options as Quarries 2&3 have already been rehabilitated.
Motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	The sloping of the quarries has already been completed which ensures the free flow of water as well as revegetation. It also ensures that the quarry is safe, and the planned land use is obtained.

Details associated with any on-going research on closure options.	All research regarding the rehabilitation and maintenance of Quarries 2&3 has already been undertaken and is currently being implemented.
A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking.	Resloping of the area was designed based on surveyor data provided by the mine.
Financial provision	R585,343.00 for seeding and R150,000.00 for soil erosion, vegetation growth, and alien vegetation monitoring.

Figure 28: Quarry 1

Figure 29: Quarry 2 & 3

4.2.7 Rehabilitation of the Hostel Quarry

Specific closure vision, objectives and targets	The rehabilitation of the Hostel Quarry will include the following: • To allow free flowing of surface water; • To promote even vegetation growth; and • To ensure the safety of quarry for community and animals.
Original closure plan action plans	There were no original action plans in the closure plan.
Current situation	The replacement of topsoil at the Hostel Quarry has already taken place. Currently, the mine is spreading more topsoil onto the quarry to ensure that re-vegetation and seeding can take place as part of rehabilitation with optimal results.
Updated action plans	The mine shall ensure that revegetation is complete as well as any final sloping that may be required.
Schedule	Revegetation and alien invasive monitoring at the Hostel Quarry is ongoing at the mine.
Description and evaluation of alternative closure and post closure options	All closure and post closure options are already being implemented as per specialist input for rehabilitation. Therefore, there are no alternative closure and post closure options are evaluated.
Motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	The quarry is already been sloped, only revegetation is necessary. This has already reduced the impacts associated with the Hostel Quarry as the free flow of water can now take place.
Details associated with any on-going research on closure options.	All research regarding the rehabilitation and maintenance of Hostel Quarry has already been undertaken and is currently being implemented.
A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking.	It is assumed that in the past, the Hostel Quarry was exploited for very little ore.
Financial provision	R103,074.00 for seeding and R150,000.00 for soil erosion, vegetation growth, and alien vegetation monitoring.

4.2.8 Rehabilitation of the Skatkis Quarry/Quarry 6

Specific closure vision, objectives and targets	Rehabilitation of the Skatkis Quarry/Quarry 6 will include the following; • To allow free flowing of surface water; • To promote even vegetation growth; and • To ensure the safety of quarry for community and animals.
Original closure plan action plans	The overburden dumps on site shall be sloped to a natural gradient and grassed as part of rehabilitation. The two overburden stockpiles on the west is 164,301m³ combined. Refer to the figures below marked as '2'. Dig open separation wall between Skatkis Quarry and Quarry 6 to allow free flowing of surface water between quarries as it gradually rises. Refer to the figures below marked as '3'. Use remainder of overburden together with the proposed trench berm concept to construct safety berms along steep slopes. Refer to the figures below marked as '4'.
Current situation	Sloping has taken place at Skatis quarry. This quarry will be used in the future for wastewater disposal as well as mine residue backfilling.
Updated action plans	Ensure that the separation wall is broken down and construct safety berms. It is recommended that a surveyor ensure these quarries have been sloped to the angle as indicated in the closure plan.
Schedule	The rehabilitation of the Skatkis Quarry is ongoing.
Description and evaluation of alternative closure and post closure options	A Section 21g water use license for the backfilling of this quarry has been applied for as well as exemption under GN 704 of 1999 under NWA. Various specialist studies were conducted as part of this process to decide the rehabilitation method most applicable. Therefore, no alternative closure and post closure options have been analysed.
Motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	The backfilling and sloping of the quarry shall ensure the free flow of water. Once the quarry is rehabilitated, revegetation can take place and the safety of the quarry shall be ensured. Once this complete, the end land use can be obtained.

Details associated with any on-going research on closure options.	A geohydrological study was undertaken by Shangoni AquiScience in 2020 to determine the impact of backfilling Quarry 6 on the groundwater in the environment. The following was noted; *"Backfilling can significantly reduce the areas of land left in a disturbed state (post-closure), related closure rehabilitation costs, e.g. ongoing water management, and the safety issues associated with leaving an open pit. In addition, backfilling makes efficient use of the excavated storage space with improved containment or encapsulation by geological materials adjacent to the void rather than constructing above ground facilities such as tailings dams with specifically engineered liners and waste rock dumps with covers. In addition, regulatory agencies are increasingly seeing backfilling as a way of returning land to a form that supports pre-mining land use."*
A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking.	Based on the findings of the geohydrological assessment, no fatal flaws have been identified that may limit the expansion activities. It is the opinion of the specialist that the proposed project may proceed on condition that all mitigation measures as outlined and discussed in this report be adhered to.
Financial provision	No costs set aside. The financial provision will be amended subject to authorisation of the proposed activities.

Figure 30: Resloping of Skatkis Quarry

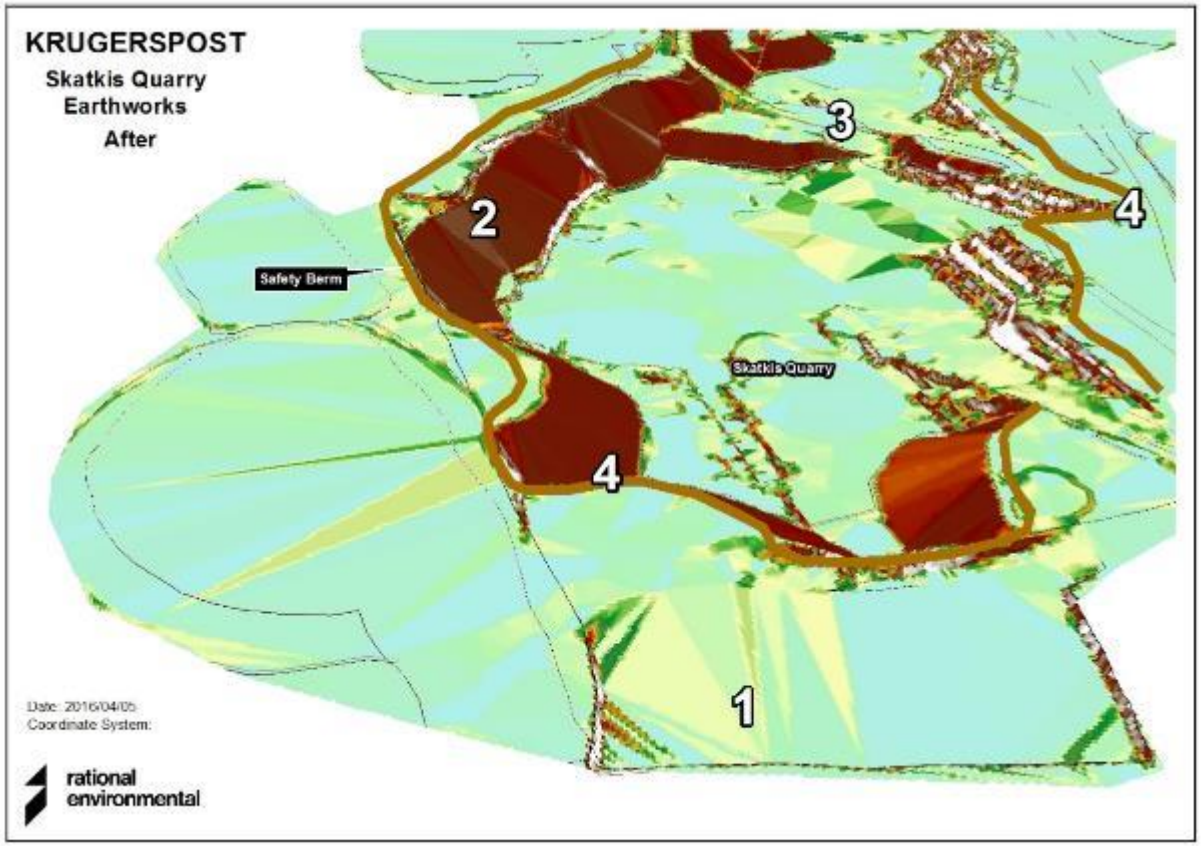


Figure 31: Measure after resloping of Skatkis Quarry

Figure 32: Hostel Quarry

Figure 33: Skatkis Quarry / Quarry 6

4.2.9 Rehabilitation of Quarry 6

Specific closure vision, objectives and targets	The rehabilitation of Quarry 6 include the following; • To allow free flowing of surface water; • To promote even vegetation growth; and • To ensure the safety of quarry for community and animals.
Original closure plan action plans	Quarry 6 should be free draining towards Skatkis Quarry to the south. The strategy is to safeguard the high walls, fill in some material to the western benches to allow vegetation growth. Overburden dumps shall be sloped and grassed as part of rehabilitation. An estimated 134,256m³ is to be moved from this stockpile. Refer to the figure below marked as '1'. The total estimated overburden to be moved from the east into the quarry is 245,000m³. Note that there are no detailed survey data available for the calculation of the volume above. Only the footprints of the overburden stockpiles are available. The volume is calculated based on the natural angle of repose for the overburden in the area together with a predetermined height of four metres. Refer to the figure below marked as '2'. Together with the gradual sloping using overburden, the remaining benches within the quarry should also be flattened to produce a more natural surface for vegetation. Refer to the figure below marked as '3'. Construct a safety berm along remaining high walls. Refer to the figure below marked as '4'.
Current situation	Sloping of Quarries 6 and 7 is already taking place. A Section 21g water use license for the backfilling of quarry 6 has been applied for as well as exemption under GN 704 of 1999 under NWA.
Updated action plans	Ensure that the separation wall is broken down and construct safety berms. It is recommended that a surveyor ensure these quarries have been sloped to the angle as indicated in the closure plan.
Schedule	The rehabilitation of these quarries is ongoing.
Description and evaluation of alternative closure and post closure options	Various specialist studies were conducted as part of this process to decide the rehabilitation method most applicable. Therefore, no alternative closure and post closure options have been analysed.

Motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	The rehabilitation of the quarry shall ensure the free flow of water. Once the quarry is backfilled, revegetation can take place and the safety of the quarry shall be ensured. Once this complete, the end land use can be obtained.
Details associated with any on-going research on closure options.	A geohydrological study was undertaken by Shangoni AquiScience in 2020 to determine the impact of backfilling Quarry 6 on the groundwater in the environment. The following was noted; *"Backfilling can significantly reduce the areas of land left in a disturbed state (post-closure), related closure rehabilitation costs, e.g. ongoing water management, and the safety issues associated with leaving an open pit. In addition, backfilling makes efficient use of the excavated storage space with improved containment or encapsulation by geological materials adjacent to the void rather than constructing above ground facilities such as tailings dams with specifically engineered liners and waste rock dumps with covers. In addition, regulatory agencies are increasingly seeing backfilling as a way of returning land to a form that supports pre-mining land use."*
A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking.	Note that there are no detailed survey data available for the calculation of the volume above. Only the footprints of the overburden stockpiles are available. The volume is calculated based on the natural angle of repose for the overburden in the area together with a predetermined height of four metres.
Financial provision	No costs set aside. The financial provision will be amended subject to authorisation of the proposed activities.

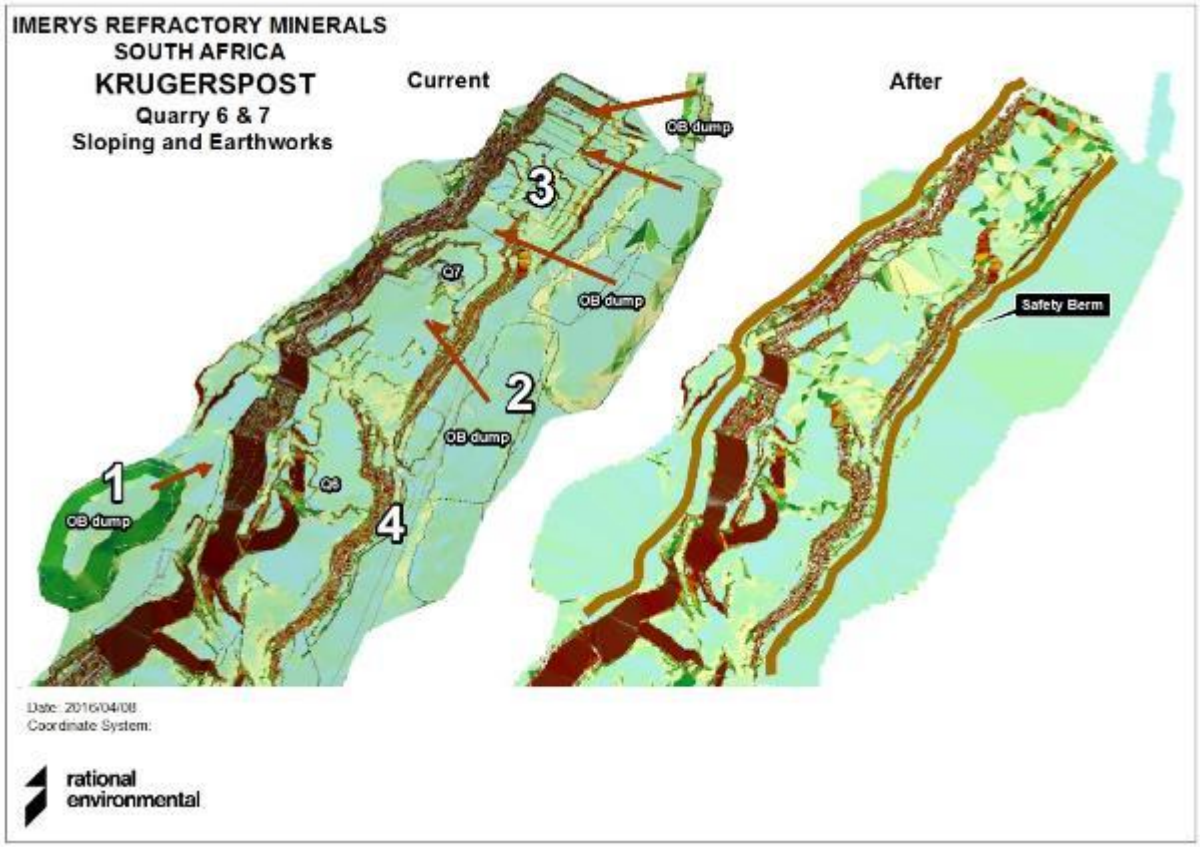


Figure 34: Resloping of Quarry 6

4.2.10 Removal of water dams

Specific closure vision, objectives and targets	Ensure that all dams used for farming remain in the area.
Original closure plan action plans	The farm dams will be kept after mining for farming purposes. These dams are not part of the mining right. The Barge dam will be closed, and water will be directed away from this dam. The Ericson dam will be removed. The borrow pit dam will remain.
Current situation	The Barge dam has been removed. This area is now classified as a wetland area. The settling dams will remain intact, however, no water from the mine moves towards these dams. Two of the Erickson dams have not yet been removed.
Updated action plans	The farm dams will be kept afterwards for farming. These dams are not part of the mining right. The Barge dam will be closed, and water will be directed away from this dam. The Ericson dam will be removed. The borrow pit dam will remain in place.
Schedule	The removal of the remaining dams is an ongoing process.
Description and evaluation of alternative closure and post closure options	This is not applicable as rehabilitation includes the removal or transfer of water dams.
Motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	These dams can be used by farmers and will therefore be kept. The settling dams will aid the drainage of water in the area.
Details associated with any on-going research on closure options.	There is no ongoing research regarding the removal of the farm dams. The rehabilitation was agreed on by the mine and the farmers.
A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking.	It is assumed that some of the dams on site will remain for usage by the surrounding farmers.
Financial provision	No costs set aside. The financial provision will be amended subject to authorisation of the proposed activities.

Number	Water Dam
1	Enose Dam
2	Surprise Dam
3	Barge Dam
4	Botha Dam
5	Farm Dam
6	Percy Dam
7	Settling Dam 1
8	Settling Dam 2
9	Overflow Dam

4.2.11 Removal of primary and secondary access roads

Specific closure vision, objectives and targets	Any unnecessary roads shall be removed.
Original closure plan action plans	Remove all hydrocarbon spillages and dispose of as hazardous waste. Rip all roads. Ripping is done by using a dozer with one or two ripper tines. Ripping must penetrate through soil into the underlying overburden materials to ensure free drainage and to ensure root penetration. The road to the pump stations will be kept because these stations will still be used.
Current situation	Most of the primary and secondary roads on site have already been ripped and seeded. However, due to a lack of rain, no grasses are yet visible.
Updated action plans	The mine will apply for closure in terms of Section 43 (3) of MPRDA and adhere to rehabilitation principles. The mine will also follow up on seeding processes.
Schedule	The ripping and removal of any remaining roads shall be ongoing.
Description and evaluation of alternative closure and post closure options	There is no alternative to the removal of any remaining roads. If the mine is approached regarding the roads, an alternative will then be considered.

Motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	The removal of unwanted roads will prevent erosion of these areas. Some roads will still be used by farmers and cannot be removed.
Details associated with any on-going research on closure options.	There is no ongoing research regarding the removal of roads on site. The mine and various specialists have decided that the roads should be removed if they are not used by farmers.
A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking.	The assumption is that the remaining roads will be used by farmers.
Financial provision	No costs set aside. The financial provision will be amended subject to authorisation of the proposed activities.

4.2.12 Clean up of pump stations

Specific closure vision, objectives and targets	The removal of any unwanted material and clean-up of the area.
Original closure plan action plans	No decommissioning will take place; however, all unwanted material will be removed. This area will be cleared immediately of all loose debris, piping, poles and cabling that is in the reaches of flood waters to prevent an aquatic pollution event.
Current situation	According to the mine personnel, these stations have been removed with only the pumps remaining.
Updated action plans	There is no updated action plan required as the stations were removed.
Schedule	There are no stations on site, therefore, there is no schedule required.
Description and evaluation of alternative closure and post closure options	Total removal of pump station is not feasible as these pump stations will be used in the future.
Motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	The remaining stations are already existing and shall be used in the future.
Details associated with any on-going research on closure options.	There is no ongoing research necessary as the stations are already existing and shall be used for future activities.

A detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking.	It is assumed that these stations will be used in the future and will thus remain on site.
Financial provision	None necessary.

Figure 35: Water Dams

4.3 The indication of the organisational capacity that will be put in place to implement the plan

This section must include:

i. the organisational structure as it pertains to the plan
ii. responsibilities
iii. training and capacity building that may be required to build closure competence

The mining contractor and the contractor removing the infrastructure will be responsible for rehabilitation. The operational management of Imerys will ultimately be responsible for final rehabilitation. No training has been done.

4.4 An indication of gaps in the plan, including an auditable action plan and schedule to address the gaps

The work conducted in this report is compiled from specialist studies and the EIA. There is nothing additional that is done.

4.5 Relinquishment criteria for each activity or infrastructure in relation to environmental aspects with auditable indicators

The area will only be relinquished once adequate drainage and natural vegetation is retained, with no erosion on roads to be removed.

SECTION 5: POST REHABILITATION ACTIVTIES

Post rehabilitation will take place after closure of the mine. These activities will be in the form of maintenance and monitoring.

5.1 Monitoring plan

Monitoring of any rehabilitation is absolutely necessary to ensure that the integrity and performance of the rehabilitation method are still in line with the original objectives and purposes of the method. It is very important that monitoring takes place continuously throughout and after rehabilitation. The main goals of a monitoring program are (van Deventer, 2009):

1. To meet legal requirements. In the EMP, a description of methods to be followed to monitor compliance with the approved rehabilitation plan is included. Closure application should also be substantiated with adequate monitoring data. Closure objectives must be specified upfront and accepted by all parties. Objectives must be prescribed for at least the following:
    - Topographical reshaping
    - Erosion (surface stability);
    - Alien vegetation monitoring;
    - Surface water quality
    - Groundwater quality
2. Evaluating mine residue and vegetation quality. Dynamic assessment requires a monitoring system to provide a regular surveillance of mine residue and vegetation quality attributes or indicators.
3. Land management. The annual results of the monitoring program will determine the actions to be taken for the following year to ensure the site is improving in the direction of the stipulated end result.
4. Improving our understanding of new ecosystems. For the new ecosystem, the biological productivity, stocks and exchange of nutrients, and the regulation of other ecological processes need to be characterized, quantified and modelled.

Refer below for the parameters of monitoring. This includes an explanation of the approach that will be taken to analyse monitoring results and how these results will be used to inform adaptive or corrective management and/or risk reduction activities.

5.1.1 Topography

Mechanism for monitoring compliance:

- After reshaping the resultant topography must be surveyed to determine the degree to which the final topography meets planned objectives
- Surface drainage and slope must meet land capability objectives, a surveyor must assess this
- Deviations from plan must be documented, and the final reshaped surface should be signed off by the responsible person prior to the replacement of topsoil.

Environmental component affected and impact	Monitoring and reporting frequency	Responsible persons
Visual aspect. Change in topography	Once after reshaping	Mine manager / site geologist and surveyor.

5.1.2 Soil erosion

Mechanism for monitoring compliance:

- Checks must be carried out to identify areas where erosion is occurring.
- Take photographs to indicate any signs of erosion.
- Inspections should be conducted on all channels, trenches, berms and pollution control dams to ensure function and capacity of infrastructure is maintained as well as maintenance where signs of erosion become evident. High risk erosion areas include all road and berms where surface water is concentrated into sheet flow.

Environmental component affected and impact	Monitoring and reporting frequency	Responsible persons
• Soil. Soil erosion • Surface water. Erosion and siltation	Monthly.	Mine manager / site geologist with specialist

5.1.3 Alien vegetation

Mechanism for monitoring compliance:

- The mine must ensure that a specialist compile an alien eradication programme. This programme will indicate areas with alien vegetation.
- The mine personnel must further also monitor the area very any additional alien vegetation or regrowth

Environmental component affected and impact	Monitoring and reporting frequency	Responsible persons
• Vegetation. Loss of floristic communities (affecting floristic richness, floristic structure, and ecological condition).	Once-off programme. Quarterly monitoring of regrowth.	Mine manager / site geologist with specialist

5.1.4 Soil pollution and change in landscape

Mechanism for monitoring compliance:

Monitoring will take place in accordance to the rehabilitation plan.

- Maintenance as per maintenance register.
- Inspections of routes for any pollution.
- Inspections of pipeline routes.
- Inspections of plant and infrastructure area.
- Inspection of road routes.

- Erosion monitoring.
- Surface water quality monitoring; groundwater quality monitoring; and monitoring of surface water drainage systems in accordance to the water monitoring programme
- Spill handling procedures should be adopted in the event of a spillage.

Environmental component affected and impact	Monitoring and reporting frequency	Responsible persons
• Soils, land capability, surrounding land use and landscape character. Pollution of topsoil • Environmental noise from vehicles and machinery that is not maintained • Surface and groundwater: Runoff or infiltration of spillages	Weekly basis.	Mine manager / site geologist.

5.1.5 Surface water monitoring

Mechanism for monitoring compliance:

Surface water monitoring will take place as per the water monitoring programme. The water monitoring programme was compiled in line with the stipulated conditions as per the IWUL. The various parameters can be seen in Table 20 and 21 below. It is the responsibility of the specialist to ensure these parameters are monitored.

The following information is extracted from the Water Monitoring Programme (BECS Environmental, 2019).

Parameters to be monitored

5.1.5.1 Surface water quantity

Table 20: Section 21a water uses - Taking water from a water resource quantities

Name	Description of point	Water use description	Coordinates
BH01	Borehole at house 1	Abstracting water for domestic purposes	S 24°56'9.52" E 30°26'40.55"
BH02	Borehole at house 2	Abstracting water for domestic purposes	S 24°56'25.26" E 30°26'43.53"
Q06	Dewatering at Quarry 6	Abstracting water for industrial purposes	S 24°55'17.83" E 30°27'0.02"
SBR01	Abstraction from Spekboom River	Abstracting water for industrial purposes	

Table 21: Section 21a water uses - Taking water from a water resource quantities

Name	Maximum volume annually (m^3)	Metering frequency	Recording frequency	Reporting frequency
BH01	3,600	Daily	Monthly	Biannually
BH02	1,800			
Q06	620,000			

Figure 36: Water quantities abstracted

5.1.5.2 Surface water quality

Table 22: Section 21g water uses – Surface water qualities

Name	Description of point	Coordinates
SW01	Upstream in the Spekboom River	S 25° 0'33.84" E 30°30'0.36"
SW02	Downstream in the Spekboom River	S 24°57'20.70" E 30°26'3.42"

Table 23: Section 21g water uses – Surface water qualities

SW01, SW02			
Variable	**Limit (Domestic use: TWQG)**	**Monitoring frequency**	**Reporting frequency**
pH	6.0-9.0	Monthly	Quarterly
EC in mS/m	≤70		
TDS in mg/l	≤450		
Ca in mg/l	≤32		
Mg in mg/l	≤30		

SW01, SW02			
Variable	**Limit (Domestic use: TWQG)**	**Monitoring frequency**	**Reporting frequency**
Na in mg/l	≤100		
K in mg/l	≤50		
Cl in mg/l	≤100		
SO_4 in mg/l	≤200		
T-Alk (HCO_3^-/CO_3^-)			
Fe in mg/l	≤0.1		
Al in mg/l	≤0.15		
Mn in mg/l	≤0.05		
Si in mg/l			
F in mg/l	≤1.0		
PO_4^-	≤2.5		
NO_3^-	≤6		
NH_4^+	≤1.0		

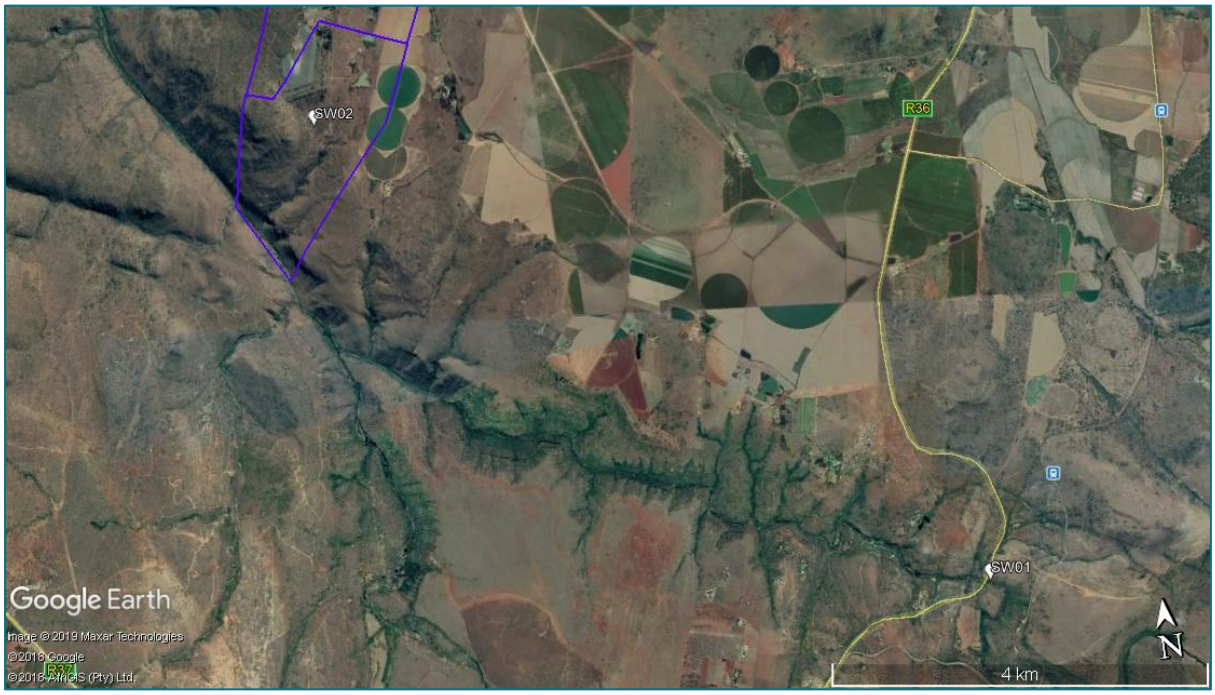


Figure 37: Surface water qualities

5.1.5.3 Biomonitoring

Table 24: Section 21g water uses – Biomonitoring

Name	Description of point	Coordinates
BM01	Upstream in the Spekboom River	S 25° 0'33.84" E 30°30'0.36"
BM02	Downstream in the Spekboom River	S 24°57'20.70" E 30°26'3.42"

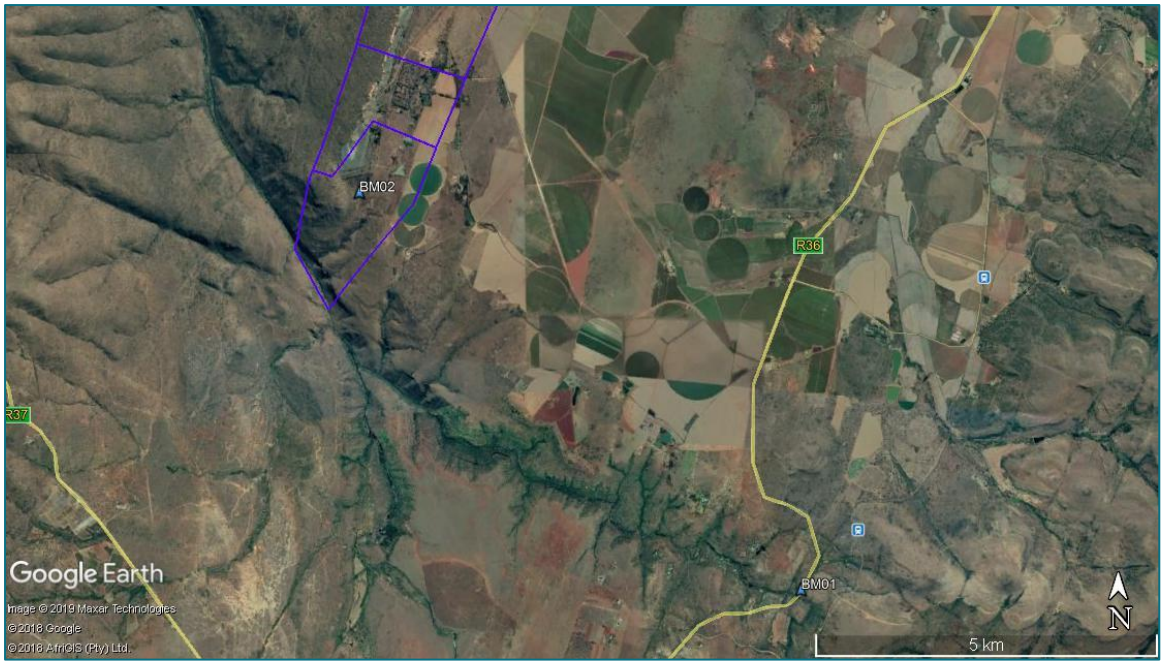


Figure 38: Biomonitoring

5.1.6 Wastewater qualities

Table 25: Section 21g water uses – Wastewater qualities

Name	Description of point	Origin of water / description	Comment	Owner	Coordinates
WW01	Skatkis	Quarry dam & slimes. Waste backfilling. Gravity fed to barge dam & back to process	No active waste backfilling.	Imerys	S 24°55'37.63" E 30°26'50.06"
	~~Quarry 2-3~~	~~Slimes / waste pumped from mine & separated water back to plant~~	Quarry 2-3 rehabilitated. No water in quarries except during rainy events.	~~Imerys~~	N/A
	~~Barge Dam~~	~~Return water~~	Removed. Now only a wetland area.	~~Imerys~~	N/A
	~~Ericsson dams~~	~~Water from Ericsson Dams~~	Three have been removed with last two remaining completely	~~Imerys~~	N/A

Name	Description of point	Origin of water / description	Comment	Owner	Coordinates
			empty and non-operational		
	~~HMS Plant~~	~~Process water~~	No plant on site.	~~Imerys~~	N/A
	~~Plant~~	~~Ground Water from the plant~~	Not included in the Desktop Hydrogeological Study, 2013	~~Imerys~~	N/A
	~~Office slimes dam~~	~~Slimes disposal~~	No active disposal of slimes; therefore, no wastewater.	~~Imerys~~	N/A
WW02	Settling dam 1	Water from Office slimes dam.	Still in use	Imerys	S 24°57'14.21" E 30°26'5.19"
WW03	Settling dam 2	Water from Settling dam 1	Still in use	Imerys	S 24°57'19.41" E 30°26'6.61"
	~~Botha Dam~~	~~Stormwater dam~~	~~Dam is in general empty~~	Imerys	S 24°56'25.58" E 30°26'36.71"
	~~Surprise Dam 1~~	~~Water from Botha Dam & excess water from Barge Dam (RWD)~~	~~Dam is in general empty~~	Imerys	S 24°56'42.32" E 30°26'30.12"
WW04	Surprise Dam 2 (Enos)	Water from Surprise Dam 1	Used as farm dam	Imerys	S 24°56'49.96" E 30°26'27.89"
WW05	Percy Dam 1-3	Water received from Surprise Dam to settling Dams	Used as farm dam	Imerys	S 24°57'7.63" E 30°26'26.12"

Table 26: Section 21g water uses – Wastewater qualities

WW01, WW02, WW03, WW04, WW05			
Substance / parameter	**Limit (IWUL)**	**Monitoring frequency**	**Reporting frequency**
pH	6.34-6.98	Quarterly	Quarterly
EC in mS/m	34		
TDS in mg/l	250		
Cl in mg/l	15		
SO4 in mg/l	60		
Na in mg/l	24		

Figure 39: Wastewater qualities

5.1.7 Groundwater monitoring

Mechanism for monitoring compliance:

Ground water monitoring will take place as per the water monitoring programme. The water monitoring programme was compiled in line with the stipulated conditions as per the IWUL. The various parameters can be seen in Table 27 below. It is the responsibility of the specialist to ensure these parameters are monitored.

The following information is extracted from the Water Monitoring Programme (BECS Environmental, 2019).

Parameters to be monitored

5.1.8 Groundwater qualities for potable

Table 27: Section 21g water uses - Groundwater qualities for potable water

Name	Description of point	Origin of water / description	Comments	Owner	Coordinates
	KRBH01	No use	Potable, pollution & receptor monitoring	Imerys	S 24°56'36.56" E 30°26'12.30"
	KRBH02	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'10.61"
	House#2	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'43.66"

Name	Description of point	Origin of water / description	Comments	Owner	Coordinates
	House#3	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'40.67"
	House#4	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'24.36"
	House#5	Domestic borehole		Imerys	S 24°56'56.58" E 30°26'21.80"
	House#1	Domestic borehole	Potable monitoring	Imerys	S 24°56'51.28" E 30°26'56.94"

Figure 40: Groundwater qualities for potable

Table 28: Section 21g water uses - Groundwater monitoring for potable

KRBH01, KRBH02, House#2, House#3, House#4, House#5, House#1			
Variable	**Limit (TWQG)**	**Monitoring frequency**	**Reporting frequency**
pH	6.0-9.0	Monthly	Quarterly
EC in mS/m	≤70		
TDS in mg/l	≤450		
Ca in mg/l	≤32		
Mg in mg/l	≤30		
Na in mg/l	≤100		
K in mg/l	≤50		
Cl in mg/l	≤100		
SO_4 in mg/l	≤200		

KRBH01, KRBH02, House#2, House#3, House#4, House#5, House#1			
Variable	**Limit (TWQG)**	**Monitoring frequency**	**Reporting frequency**
T-Alk (HCO_3^- /CO_3^-)			
Fe in mg/l	≤0.1		
Al in mg/l	≤0.15		
Mn in mg/l	≤0.05		
Si in mg/l			
F in mg/l	≤1.0		
PO_4^-	≤2.5		
NO_3^-	≤6		
NH_4^+	≤1.0		
Total coliforms	≤5.0		
E.coli			

5.1.9 Groundwater qualities for pollution, receptor, zone of influence & background monitoring

Table 29: Section 21g water uses - Groundwater qualities for pollution, receptor, zone of influence & background monitoring

Name	Origin of water / description	Comments	Owner	Coordinates
KRBH01	No use	Potable, pollution & receptor monitoring	Imerys	S 24°56'36.56" E 30°26'12.30"
KRBH02	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'10.61"
House#2	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'43.66"
House#3	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'40.67
House#4	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'24.36"
House#5	Domestic borehole		Imerys	S 24°56'56.58" E 30°26'21.80"
KRBH07	Domestic, garden & irrigation borehole	Zone of influence & receptor monitoring	Steenekamp	S 24°54'37.76" E 30°27'55.30"
KRBH08	Livestock borehole		Steenekamp	S 24°56'39.34" E 30°28'18.23"
KRBH10	Domestic borehole		Steenekamp	S 24°54'17.17" E 30°28'10.24"
KRBH13	Domestic borehole		Steenekamp	S 24°56'39.34" E 30°28'17.11"

Name	Origin of water / description	Comments	Owner	Coordinates
KRBH03	No use	Background monitoring	Roth	S 24°56'40.49" E 30°26'50.75"
KRBH04	Domestic & garden borehole		Roth	S 24°56'39.34" E 30°26'59.64"
KRBH05	Domestic & garden borehole		Roth	S 24°56'41.52" E 30°26'21.80"
KRBH12	Livestock borehole		Steenekamp	S 24°56'41.52" E 30°28'17.58"

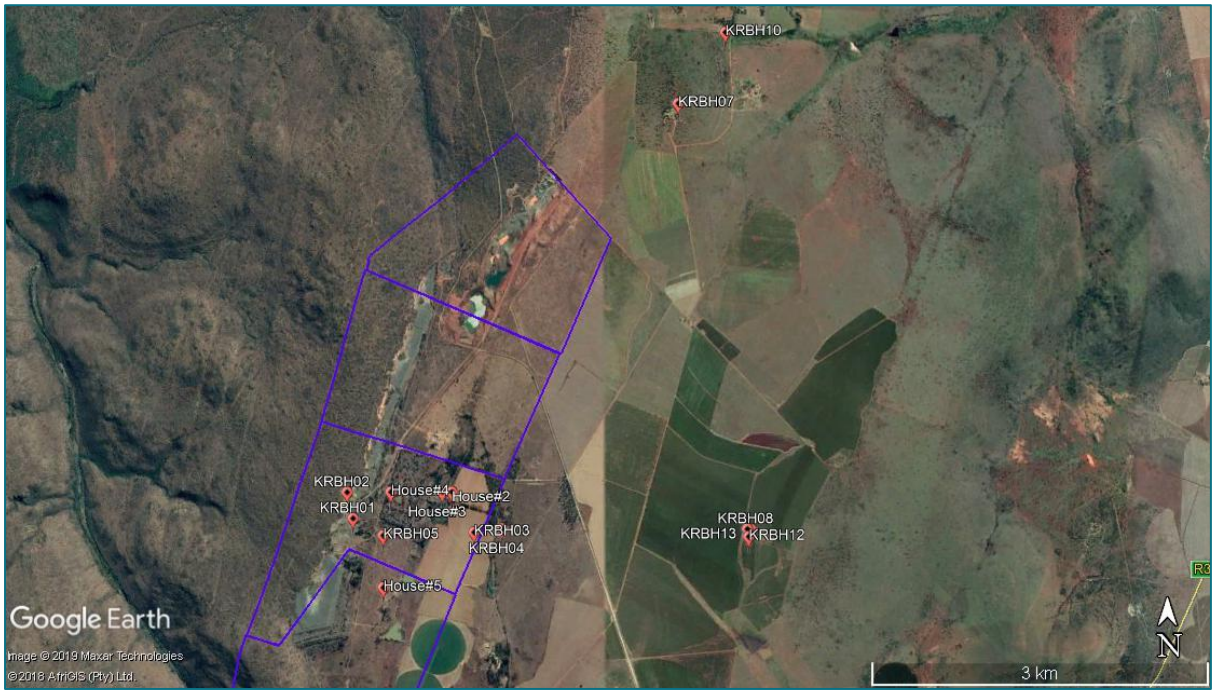


Figure 41: Groundwater qualities for pollution, receptor, zone of influence & background monitoring

Table 30: Section 21g water uses - Groundwater monitoring for pollution, receptor, zone of influence & background monitoring

KRBH01, KRBH02, House#2, House#3, House#4, House#5, KRBH07, KRBH08, KRBH10, KRBH13, KRBH03, KRBH04, KRBH05, KRBH12			
Variable	**Limit (IWUL)**	**Monitoring frequency**	**Reporting frequency**
pH	6-8.6	Quarterly	Quarterly
EC in mS/m	32.89		
TDS in mg/l	450		
Ca in mg/l	23.1		
Mg in mg/l	13.53		
Na in mg/l	24.31		
K in mg/l	50		
Cl in mg/l	5.94		

KRBH01, KRBH02, House#2, House#3, House#4, House#5, KRBH07, KRBH08, KRBH10, KRBH13, KRBH03, KRBH04, KRBH05, KRBH12			
Variable	**Limit (IWUL)**	**Monitoring frequency**	**Reporting frequency**
SO_4 in mg/l	4.51		
T-Alk (HCO_3^-/CO_3^-)	50		
Fe in mg/l	0.1		
Al in mg/l	0.15		
Mn in mg/l	0.02		
Si in mg/l			
F in mg/l	0.33		
PO_4^-			
NO_3^-	0.41		
NH_4^+			

5.1.10 Groundwater levels

Table 31: Section 21j water uses – Groundwater levels

Name	Origin of water / description	Comments	Owner	Coordinates
KRBH01	No use	Potable, pollution & receptor monitoring	Imerys	S 24°56'36.56" E 30°26'12.30"
KRBH02	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'10.61"
House#2	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'43.66"
House#3	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'40.67
House#4	Domestic borehole		Imerys	S 24°56'28.96" E 30°26'24.36"
House#5	Domestic borehole		Imerys	S 24°56'56.58" E 30°26'21.80"
KRBH07	Domestic, garden & irrigation borehole	Zone of influence & receptor monitoring	Steenekamp	S 24°54'37.76" E 30°27'55.30"
KRBH08	Livestock borehole		Steenekamp	S 24°56'39.34" E 30°28'18.23"
KRBH10	Domestic borehole		Steenekamp	S 24°54'17.17" E 30°28'10.24"
KRBH13	Domestic borehole		Steenekamp	S 24°56'39.34" E 30°28'17.11"
House#1	Domestic borehole	Potable monitoring	Imerys	S 24°56'51.28" E 30°26'56.94"

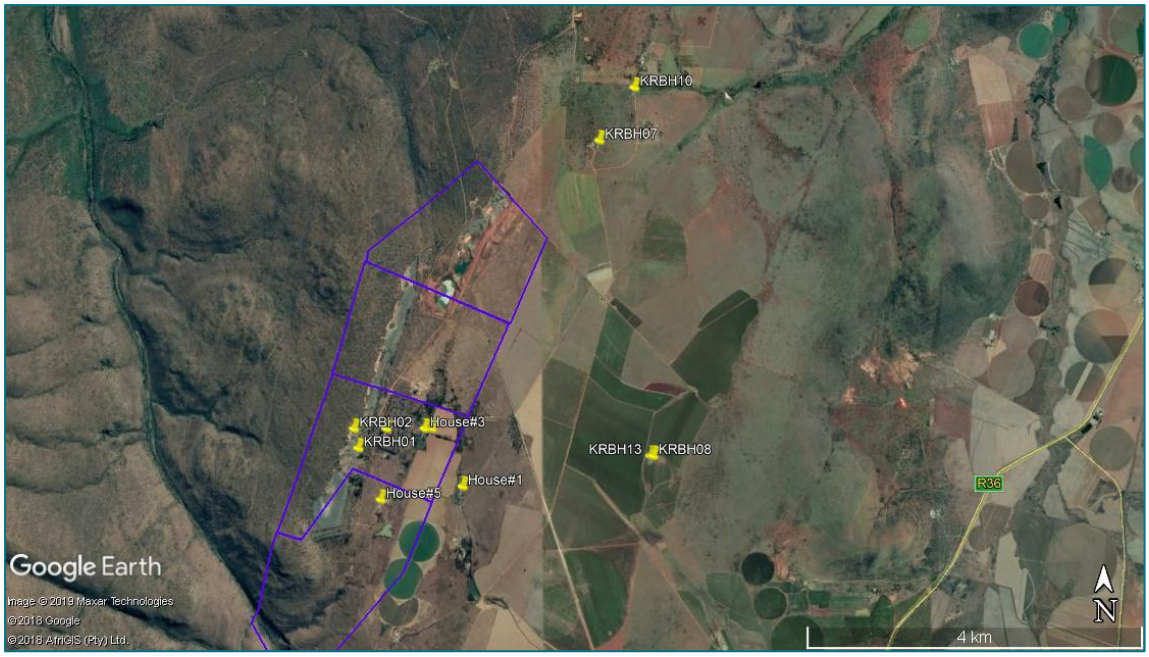


Figure 42: Groundwater levels

KRBH01, KRBH02, House#2, House#3, House#4, House#5, KRBH07, KRBH08, KRBH10, KRBH13, House#1		
Levels	**Monitoring frequency**	**Reporting frequency**
Compare against previous results	Biannually (once in the beginning of the dry season and once in the beginning of the wet season).	Biannually

5.1.11 Job creation and community safety

Mechanism for monitoring compliance:

- Monitor and evaluate the Social and labour plan.

Environmental component affected and impact	Monitoring and reporting frequency	Responsible persons
• Socio-economic aspects. Job creation.	Continuous monitor. Annually reporting.	Site manager.

5.2 Internal, external and legislated audits of the monitoring plan

The monitoring plan will be audited to ensure effective implementation.

5.2.1 Person responsible for undertaking the audit

Health Safety and Environmental Manager for internal audits and consultant for external audits.

5.2.2 Planned date of audit and frequency of audit

Annually.

5.2.3 An explanation of the approach that will be taken to address and close out audit results and schedule

Refer to the monitoring plan in section 5.1 for an approach that will be taken to address and close out audit results and schedule.

5.2.4 Disclosure of updates of the plan to stakeholders

The audit report will be sent to all stakeholders once finalised, therefore on a quarterly basis.

SECTION 6: MINE CLOSURE FINANCIAL PROVISION UPDATE

The annual forecasted financial provision calculation must include an explanation of the financial provision methodology; auditable calculations per activity or infrastructure; and financial provision assumptions.

6.1 Financial provision methodology

The CES Group was contracted by Shangoni to acquire rates for demolition and rehabilitation of mining activities. Procurement of budget pricing approached by identifying reputable demolition companies, various sites of varying sizes at various locations and identifying local companies in the study area with ability to work on similar scale project. A bill of quantities (BoQ) was distributed to the various companies. The table below indicates the number of contractors to which the BoQ was distributed and the number of tenders received afterwards.

Table 32: Results of rate acquisition process

Area	Number of contractors identified	Tenders received
National	6	1
North West	6	3
Free State	5	1
Northern Cape	7	2
Limpopo	5	3 (One joint venture with national based company)
Total	29	10

The prices received from contractors were reviewed by the CES Group, after which average and meridian rates were drawn rates to correctly establish a baseline rate. The following methods to establish the baseline rates were followed:

Price A - Average if priced – across the board average of rates received per category;

Price B - Median pricing – “middle” rate of all rates in series per category;

Price C - Average between Price A & B;

Price D - Average rate excluding top and bottom rates per category.

Price D - rate category that was used in the closure cost calculation, unless otherwise indicated in the closure cost spreadsheet “Rate” sheet.

The above-mentioned method was utilised to establish the baseline rates. Shangoni updated the bill of quantities in 2018 with rates acquired form a demolition and rehabilitation contractor that operates nationally. BECS updated the 2018 to 2019 rates using the CPI inflation index. The rates / tariffs used during the closure cost calculation is indicated in the table below.

The closure budget consists of the following areas:

- Physical - Demolition of infrastructure where infrastructure does not form part of end land use. Potential to transfer to third party was identified.

- Biophysical - Actions to safeguard (making safe and stable) and re-establish the biophysical to ensure a sustainable landform and mitigate identified risks. This includes levelling of the dumps, seeding of the trees and grass.

6.2 Auditable calculations of financial provision per activity or infrastructure

Table 33: Tariffs used for quantum determination

List reference	Unit	Rates (2018)	Rates (2019)	Rate used
800mm concrete structures	m³	R 598.21	R 624.41	National
400mm concrete structure	m³	R 532.71	R 556.04	National
250mm concrete structure	m³	R 416.86	R435.12	Northern Cape
340mm concrete structures	m³	R 476.41	R 497.28	Northern Cape
Single storey double brick building	m²	R 532.71	R 558.28	National
Multi-level double brick building	m³	R 518.09	R 542.96	Limpopo
Excavating foundations	m³	R 381.13	R 399.42	North West
Light steel	m²	R 63.28	R 66.32	National
Medium steel	m²	R 345.39	R 361.97	Limpopo
Heavy steel	m³	R 174.39	R 182. 76	Lowest ave (converted from R/t to R/m3 - R/t:7.85t/m3)
Infrastructure: Railway lines	m	R 95.28	R 99. 85	North West
Infrastructure: Pipelines <400mm	m	R 44.89	R 47.04	Lowest quote (National)
Infrastructure: Pipelines >400mm	m	R 80.87	R 84.75	Lowest quote (National)
Dismantling fences 1.2m	m	R 14.29	R 14.98	North West
Dismantling fences 1.8m Mesh	m	R 14.29	R 14.98	North West
Dismantling fences 1.8m Security	m	R 16.08	R 16.85	North West
Dismantling fences 1.m Steel pallisade	m	R 26.20	R 27.46	National
Dismantling fences 1.8m Pallisade & concrete	m	R 26.20	R 27.46	National
Dismantling fences 2.1m Elec.	m	R 26.20	R 27.46	National
Dismantling fences 2.4m Diamond mesh	m	R 26.20	R 27.46	National
Dismantling fences 1.8m Pre-cast	m	R 26.20	R 27.46	National
Erecting fences	m	R 158.18	R 165.77	Quote from fencing company
Infrastructure: Powerlines	m	R 53.60	R 56.17	Northern Cape
Silos	m³	R 89.77	R 94.08	(Lowest quote, National - 2018 actual quote)
Infrastructure: Sub-stations	no	R 31 978.78	R 33 513.76	North West
Infrastructure: Transformers	no	R 12 600.95	R 13 205.80	North West
Fuel pumps & tanks	m³	R 1 012.36	R 1060.95	North West

List reference	Unit	Rates (2018)	Rates (2019)	Rate used
Workshop cranes	no	R 7 741.60	R 8113.20	Limpopo
French drain	no	R 7 842.84	R 8219.30	North West
Soakaway toilet	no	R 7 842.84	R 8219.30	North West
Water tanks	m³	R 535.96	R 561.69	Limpopo
Underground fuel tanks	m³	R 1 361.00	R 1426.33	(Lowest quote, National - 2018 actual quote)
Conveyor belts	m	R 643.15	R 674.01	Northern Cape
Earth dams	m³	R 46.00	R 48.21	(Lowest quote, National - 2018 actual quote)
Temporary office 6m	no	R 1 786.52	R 1872.27	North West
Temporary office 12m	no	R 1 786.52	R 1872.27	North West
Temporary office 9.6m	no	R 1 786.52	R 1872.27	North West
Maintenance	ha	R 11 361.43	R 11 906.78	Mine rate
Ripping	m²	R 20.00	R 20.96	(Lowest quote, National - 2018 actual quote)
Tar road ripping	m²	R 28.00	R 29.34	(Lowest quote, National - 2018 actual quote)
Tar removal	m²	R 40.17	R 42.10	National
Paving removal: Bricks	m²	R 58.00	R 60.78	(Lowest quote, National - 2018 actual quote)
Paving removal: Concrete	m²	R 52.00	R 54.50	(Lowest quote, National - 2018 actual quote)
Weigh bridges	m³	R 1 195.27	R 1252.64	Lowest ave (top and bottom removed)
Pumps & pump rooms	no	R 2 150.68	R 2253.91	National
Return water dams	m²	R 25.00	R 26.2	(Lowest quote, National - 2018 actual quote)
Fresh water earth dams	m³	R 46.00	R 48.21	(Lowest quote, National - 2018 actual quote)
Dump levelling: Bulldozer	m³	R 36.86	R 38.63	National
Dump levelling: Grader	m³	R 36.42	R 38.17	National
Planting trees 20l	no	R 178.65	R 187.26	Northern Cape
Planting trees 50l	no	R 357.30	R 374.45	Northern Cape
Planting trees 100l	no	R 535.96	R 561.69	Northern Cape
Seeding	m²	R 4.00	R 4.19	National
Planting grass	m²	R 43.55	R 45.64	Lowest ave (top and bottom removed)
Backfilling of pit	m³	R 9.14	R 9.58	QS rate
Enviroberm	m	R 25.48	R 26.70	Quote from specialist
Hydro-seeding/mulching	m²	R 32.80	R 34.37	Lowest ave (top and bottom removed)

6.3 Financial provision estimation

The following table contains a summary of the calculations made for the financial provision based on the rehabilitation monitoring plan.

Table 34: Summary of the financial provision estimation until closure

Item	Size or number of years	Rate	Final cost	Comment
Removal of pipelines	1	R36 000.00	R36 000.00	Estimated costs
Seeding Office dam	262 000	R4.19	R1 097 780.00	
Seeding Quarry 1	100 000	R4.19	R419 000.00	
Seeding Quarries 2 & 3	139 700	R4.19	R585 343.00	
Seeding Hostel Quarry	24 600	R4.19	R103 074.00	
Removal of Ericson Dam	500	R561.69	R280 845.00	
Seeding of Skatkis Quarry / Quarry 6	242 500	R4.19	R1 016 075.00	
Removal of alien vegetation	5	R50 000.00	R250 000.00	Estimated costs for 5 years
Soil erosion, vegetation growth, and alien vegetation monitoring	5	R30 000.00	R150 000.00	Estimated costs for 5 years
Groundwater monitoring	20	R30 000.00	R600 000.00	Quarterly for 5 years
Sub-total			R4 538 117.00	
P&G (13.5%)			R612 645.80	
Contingency (10%)			R453 811.70	
Total			**R5 604 574.50**	

6.4 Financial provision assumptions

1. A third party will be employed to undertake rehabilitation and remediation work.
2. All costs are based on actual market related figures based on prevailing rates.
3. Mine infrastructure asset salvage value has not been taken into account.
4. Provisional and general costs (P&G) and contingencies as per the industry standard are included.

Extensive rehabilitation has already taken place.

- The entire plant area has been removed and sloped. Only the offices are still intact.
- The old slimes dam has been revegetated. No additional rehabilitation is envisaged.
- Most of the structures on the Office slimes dam has been removed. Vegetation is still limited. The side must be revegetated.
- Quarries 1, 2 and 3 have been sloped and topsoil cover is underway. Topsoil replacement on Hostel Quarry has taken place. Revegetation must now be done. Sloping at Skatkis Quarry has taken place. Quarries 6 and 7 will not currently be backfilled.

- Most of the roads have already been ripped. These roads were seeded. However, due to a lack of rain, no grasses are yet visible.
- Barge dam has been removed. This area is now a wetland area. The settling dams will remain intact.
- The pump station area has been cleaned with some pipes and other rubble still remaining to be removed. The contractors take rubble away and resell.
- Sloping and replacement of topsoil is underway on the coarse tailings and run of mine.

SECTION 7 MOTIVATIONS FOR ANY AMENDMENTS MADE TO THE FINAL REHABILITATION, DECOMMISSIONING AND MINE CLOSURE PLAN, GIVEN THE MONITORING RESULTS IN THE PREVIOUS AUDITING PERIOD AND THE IDENTIFICATION OF GAPS AS PER 2(I)

There have been no amendments made to the rehabilitation, decommissioning and closure plan given the monitoring results.

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