mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

And

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

FOR LISTED ACTIVITIES ASSOCIATED WITH MINING RIGHT

SUBMITTED FOR INTEGRATED ENVIRONMENTAL AUTHORISATION LODGED IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 READ WITH REGULATION 19 OF THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS OF 2014 FOR MINING AND RELATED INFRASTRUCTURAL ACTIVITIES ON THE FARM ANNESLEY 109 KT, AND THE FARM HAVERCROFT 99 KT, SITUATED IN THE GREATER TUBATSE MUNICIPALITY OF THE LIMPOPO REGION

NAME OF APPLICANT: NAME OF APPLICANT: IMERYS REFRACTORY MINERALS SOUTH AFRICA (PTY) LTD - ANNESLEY ANDALUSITE MINE (ANNESLEY OPERATION AND HAVERCROFT OPERATION)
TEL NO: (012) 643-5940
PHYSICAL ADDRESS: Annesley Mine, Penge Road, Burgersfort, 1150
FILE REFERENCE NUMBER SAMRAD FOR SECTION 102: LP- 00062-MR/102
MINING RIGHT NUMBER: 73 MRC

January 2019

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

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IMPORTANT NOTICE

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

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

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

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

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

1 Objective of the environmental impact assessment

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

a. determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
b. describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
c. identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
d. determine the—-
    i. nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
    ii. degree to which these impacts—
        aa. can be reversed;
        bb. may cause irreplaceable loss of resources, and
        cc. can be avoided, managed or mitigated;
e. identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
f. identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
g. identify suitable measures to manage, avoid or mitigate identified impacts; and
h. identify residual risks that need to be managed and monitored.

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ABBREVIATIONS

AEL	Air emission licence
AMD	Acid mine drainage
CoP	Code of Practice
DMR	Department of Mineral Resources
DMS	Dense Media Separator
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
EA	Environmental authorisation
EAP	Environment Assessment Practitioner
EC	Electric conductivity
ECA	Environmental Conservation Act No 73 of 1989 (as amended)
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIA Regulations	Environmental Impact Assessment Regulations, GN 982 of 2014 i.t.o. the National Environmental Management Act No 107 of 1998
EIS	Ecological Importance and Sensitivity
EMP	Environmental management programme
EPWP	Expanded Public Works Programme

FFFARSRA	Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act No 36 of 1947
GA	General authorisations
GGP	Gross Geographic Product
GDP	Gross Domestic Product
GQM	Groundwater Quality Management
HCS	Hazardous chemical substance
HDSA	Historically Disadvantaged South Africans
HMS	Heavy Medium Separation
HRD	Human Resource Development
HSA	Hazardous Substances Act No 15 of 1973 (as amended)
I&APs	Interested and affected parties
IWWMP	Integrated water and waste management plan
IWUL	Integrated Water Use License
IWULA	Integrated Water Use License Application
LED	Local Economic Development
LEDET	Limpopo Department of Economic Development, Environment and Tourism
LoM	Life of Mine
MA	Minerals Act No 50 of 1991
MHSA	Mine Health and Safety Act No 29 of 1996 (as amended)
MPRDA	Mineral and Petroleum Resources Development Act No 28 of 2002 (as amended)
MPRDR	Mineral and Petroleum Resources Development Regulations, GN 527 of 2004 (as amended) i.t.o. the Mineral and Petroleum Resources Development Act No 28 of 2002
MSDS	Material safety data sheet
mS/m	Millisiemens/meter
MWP	Mining works programme
NDEA	National Department of Environmental Affairs
NEMA	National Environmental Management Act No 107 of 1998 (as amended)
NEMAQA	National Environmental Management Air Quality Act No 39 of 2004 (as amended)
NEMBA	National Environmental Management Biodiversity Act No 10 of 2004 (as amended)
NEMWA	National Environmental Management Waste Act 59 of 2009 (as amended)
NFA	National Forest Act No 84 of 1998
NHRA	National Heritage Resources Act No 25 of 1999
NRTA	National Road Traffic Act No 93 0f 1996
NVFFA	National Veld and Forest Fire Act No 101 of 1998
NWA	National Water Act No 36 of 1998 (as amended)
OHSA	Occupational Health and Safety Act No 85 of 1993 (as amended)
PCB	Polychlorinated biphenyl
PCD	Pollution control dam
PES	Present Ecological Score
POPs	Persistent organic pollutants

PPE	Personal Protective Equipment
PPP	Public participation process
PTO	Permission to Occupy
RoD	Record of decision
RWD	Return water dam
SABS	South African Bureau of Standards
SANAS	South African National Accreditation System
SLP	Social and Labour Plan
TDF	Tailings disposal facility, also tailings dam or slimes dam
TDS	Total Dissolved Solid
TWQR	Target Water Quality Range
WQP	Water quality parameters
WRD	Waste rock dump

Executive summary

Applicant

BECS Environmental has been appointed by Imerys Refractory Minerals South Africa (Pty) Ltd: Annesley Andalusite Mine (Annesley Mine) to apply for an environmental impact assessment (EIA) and a waste license (WL).

Annesley Mine has an existing mining right on the farm Annesley 109 KT, the farm Holfontein 126 KT, the farm Morgenzon 125 KT, the farm Streatham 100 KT, and Havercroft 99 KT, in Limpopo Province. This mine consists of two operations, the Annesley Operation and the Havercroft Operation. This environmental application includes only the farm Annesley 109 KT, and the farm Havercroft 99 KT. The Section 102 application that forms part of this application includes the farm Annesley 109 KT, and the farm Havercroft 99 KT as well as the farm Penge 108 KT.

Annesley Mine was previously known as Rhino Minerals (Pty) Ltd (refer to the mining right attached as Addendum 5A). The name has changed to Imerys Refractory Minerals South Africa (Pty) Ltd (a member of the Imerys Group), however, it is still the same company with same company registration number. Annesley Operation was originally the Timeball Andalusite Mine. Annesley Andalusite Mine was originally the Havercroft Andalusite Mine. The EIA and a WL are located on the farm Annesley 109 KT, and the farm Havercroft 99 KT.

Refer to Table 1 below for a description of the applicant, and Figure 1 for an organogram of the applicant. The properties are owned by two different tribal communities, under the Republic of South Africa as indicated on the title deeds.

Table 1: Description of the applicant

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

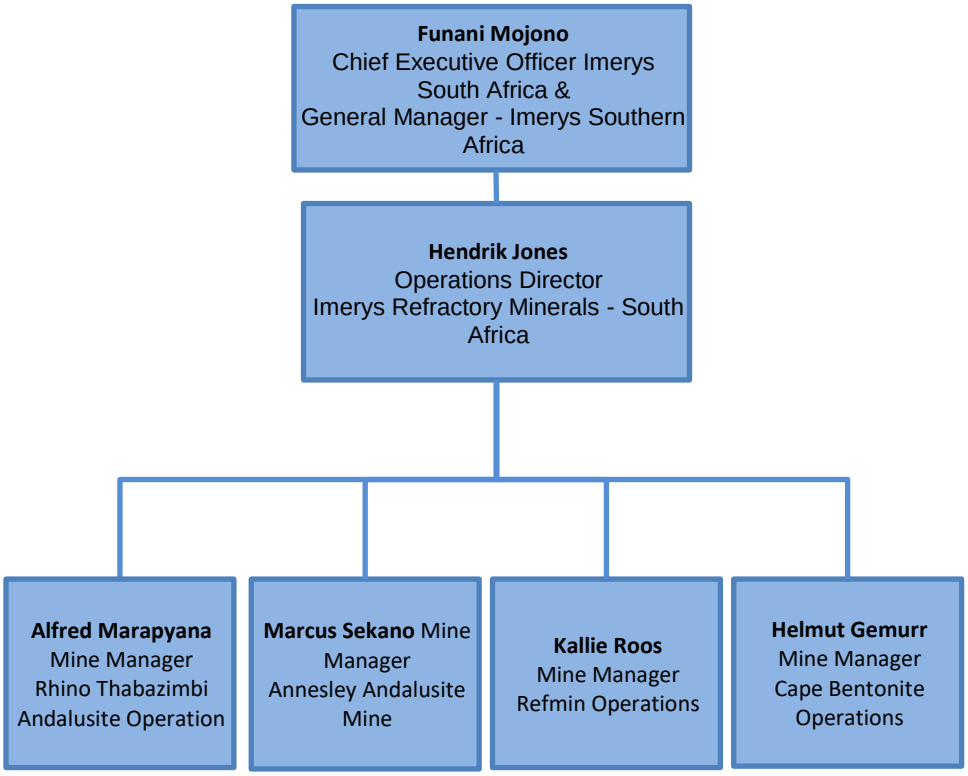

Figure 1: Annesley Andalusite Mine organogram

The applicant decided to apply for an extension for the submission of the EMP as the Department requested an Air Quality Impact Assessment and that public participation included meetings with the communities. The meeting with the Babina Tlou community only happened on the 14th January 2019 as there was unrest within the community. The extension application was received by the DMR on the 19th of September 2018 and was granted on the 23rd of October 2018. The new date for submission granted an extension of 50 days which was the 25th of January 2019 for submission.

Project description

The proposed activities are as follow:

- Construction of a catchment/settling point to catch dirty water from the plant area. This point is necessary to catch all dirty water from the plant area and construction hereof was advised by the Department of Mineral Resources (DMR).
- Diversion of a river for the continuation of mining activities. The mining area with its waste rock dump (WRD) will be located within a drainage line, therefore the diversion of this drainage line is necessary.
- Backfilling of Quarries 6 & 7 with mine residue. This is done as part of rehabilitation of the mine.
- The remining of the Havercroft Operation slimes dam and waste rock dump, located on the farm Havercroft 99 KT.

- The remining of the Segorong waste rock dump and HMS waste rock dump, located on the farm Annesley 109 KT
- The remining of backfilled tailings in Quarry 1, located on farm Annesley 109 KT.
- The extension of the mining right area to include the Penge Shaft and associated tanks om the farm Penge 108 KT (no environmental authorisation necessary for this step).

No alternative is considered for the catchment/settling point. This area is necessary to prevent pollution from dirty water. The only alternative for the river diversion is the no-go option whereby the mining activities will take place over the river without any river diversion, therefore this will also not be considered. Backfilling of the quarries is also part of the mine's rehabilitation; therefore, no alternative is included.

Legal requirements

According to Section 24(2) and 24(5) of the National Environmental Management Act No 107 of 1998 (as amended) (NEMA):

'The Minister, or an MEC with the concurrence of the Minister, may identify (a) activities which may not commence without environmental authorisation(EA) from the competent authority; (b) geographical areas based on environmental attributes, and as specified in spatial development tools adopted in the prescribed manner by the Minister or MEC, with the concurrence of the Minister, in which specified activities may not commence without EA from the competent authority.

The Minister, or an MEC with the concurrence of the Minister, may make regulations consistent with subsection (4) laying down the procedure to be followed in applying for, the issuing of and monitoring compliance with EAs.'

According to Section 19(1) of the National Environmental Management Waste Act No 59 of 2008 (as amended) (NEMWA):

The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment.

Furthermore, *a person who wishes to commence, undertake or conduct a waste management activity listed under Category B, must conduct a scoping and environmental impact reporting process set out in the EIA Regulations made under section 24(5) of the NEMA as part of a waste management licence application contemplated in section 45 read with section 20(b) of NEMWA.*

Summary of impacts

Impacts from the river diversion are given below. **Please note, with exception of the topographic location of the systems, the wetland indicators necessary for the classification as wetlands were not observed on site.**

- Direct loss of the vegetation on site.
- Loss of certain floral biodiversity aspects.
- Affecting of the ecosystem function through the introduction of alien and invasive species as a result of disturbance to the soil after vegetation clearing which results in the establishment of alien species.
- Disruption of wetland biota.
- Complete loss of wetland habitat.
- Very large destruction of the current drainage channels.
- The flows of water will be diverted thus altering movement, velocity and direction of flows
- The current sediment regime will be completely lost
- Complete loss of geomorphology
- Damage to infrastructure and/or excessive flow into quarry area.
- Erosion of steep slopes accompanied by siltation of downstream receiving environment.
- Seepage from already existing mine residue.

Impacts from the backfilling of fine tailings into Quarries 6 & 7, and construction and operation of the catchment/settling point are given below.

- Mixing of clean and dirty water and siltation of surface water resources.
- Pollution of groundwater through seepage from backfilled quarries.

Impacts from the backfilling of fine tailings into Quarries 6 & 7 are given below.

- Wind erosion from exposed surfaces filled with tailings.
- Change in topography leading to visible intrusions in the rural area.
- Safety of tailings disposal facility (TDF)

PART A

SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

a) Details of the Environmental Assessment Practitioner

This section includes the following: Details of the environmental assessment practitioner (EAP); expertise of the EAP, which includes the qualifications of the EAP (with evidence) and a summary of the EAP's experience - in carrying out the EIA Procedure; and a declaration that the EAP is independent in a form as may be specified by the competent authority

BECS Environmental was appointed as an independent consultant (EAP) to meet the requirements as set out in regulation 13 of the EIA Regulations. Refer to Table 2 below to a description of the EAP, and refer to Addendum 2 for a detailed CV of the EAP, which includes the expertise including qualifications and experience.

Table 2: Description of the EAP

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), B.Sc Honours Geography (UP), M.Sc Geography (UP), Professional Scientist (Environmental Science)
Name of second responsible EAP	Deshree Pillay
Expertise of EAP	B. Sc Environmental Science (UP), B. Sc Honours Geography & Environmental Science (UP)

I, Salome Beeslaar (8310190032081), 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.

_____

Salome Beeslaar
MSc – Geography, SACNASP (400385/14)
January 2019

b) Description of the property

Refer to Table 3 below for a description of the property. A locality map of the Annesley Operations is provided below in Figure 2.

The mining right is located on the Farm Annesley 109 KT, Holfontein 126 KT, Morgenzon 125 KT, Streatham 100 KT, and Havercroft 99 KT, Greater Tubatse Local Municipality, Limpopo Province.

The remining of the Havercroft Operation slimes dam and waste rock dump is located on the farm Havercroft 99 KT. The remining of Segorong waste rock dump and HMS waste rock dump is located on the farm Annesley 109 KT. The remining of backfilled tailings in Quarry 1 is located on the farm Annesley 109 KT. This application also includes the extension of the mining right area to include **ONLY** the Penge Shaft and associated tanks on the farm Penge 108 KT. See the table below.

Table 3: Farm names, 21-Digit Surveyor General codes, and coordinates

Farm Name	The farm Annesley 109 KT, the farm Holfontein 126 KT, the farm Morgenzon 125 KT, the farm Streatham 100 KT, the farm Havercroft 99 KT, and the farm Penge 108 KT.	
Application area (Ha)	16,601.2076ha	
Magisterial district	Sekhukhune District Municipality and Greater Tubatse Local Municipality	
Distance and direction from nearest town	5km of the old Penge mining town, 5km from Ga Malepe, and approximately 31km north of Burgersfort town, on the R37 road towards Penge	
21-digit Surveyor General Code for each farm portion	<u>Annesley 109 KT:</u> T00KT00000000010900000 2603.0193ha <u>Holfontein 126 KT:</u> T00KT00000000012600000 1839.5395ha <u>Morgenzon 125 KT:</u>	<u>Streatham 100 KT:</u> T00KT00000000010000000 3893.7945ha <u>Havercroft 99 KT:</u> T00KT00000000009900000 4289.5123ha <u>Penge 108 KT:</u>

	T00KT00000000012500000 1311.5275ha	T00KT00000000010800000 2663.8145ha
Coordinates	Annesley 109 KT: S24.4385, E30.2583 S24.3685, E30.2016 S24.3580, E30.2226 S24.3784, E30.2635 Holfontein 126 KT: S24.4121, E30.2608 S24.3784, E30.2635 S24.4253, E30.3154 S24.4480, E30.3037 Morgenzon 125 KT: S24.4121, E30.2608 S24.4480, E30.3037	S24.4674, E30.2799 S24.4385, E30.2583 Streatham 100 KT: S24.3139, E30.1623 S24.3487, E30.2155 S24.3050, E30.2557 S24.2830, E30.2387 Havercroft 99 KT: S24.3487, E30.2155 S24.3782, E30.2633 S24.3674, E30.3047 S24.3050, E30.2557 Penge 108 KT: S24.3783, E30.2636 S24.4254, E30.3160 S24.3670, E30.3111 S24.3705, E30.3484
Title deeds numbers	Annesley 109 KT: T8670/1948 Holfontein 126 KT: T8670/1948 Morgenzon 125 KT: T8670/1948	Streatham 100 KT: 1948/03/17 Havercroft 99 KT: 1948/03/17 Penge 108 KT: T30976/1993

c) Locality map

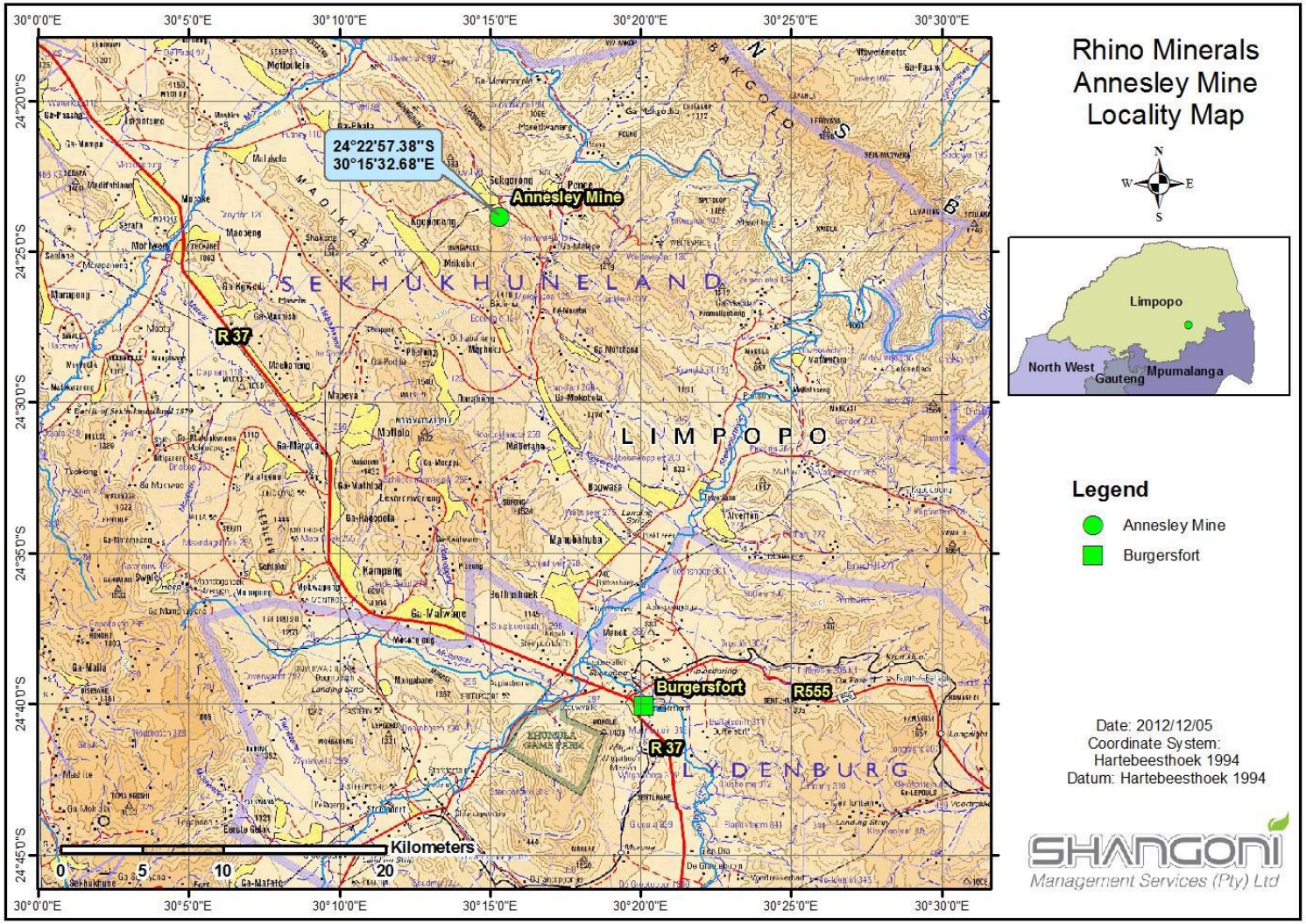

Figure 2: Locality map of Annesley Mine (taken from IWWMP (Shangoni, 2012)

d) Description of the scope of the proposed overall activity

Annesley Andalusite Mine has an existing mining right which elapses on the 5th of July 2026. Refer to Addendum 5A for this mining right. The mineral currently being mined is Andalusite (Al_2SiO_5) and is a refractory mineral. The mine has an approved air emissions license for the mining activities. The mine has two water use licenses, one for the Annesley Operations and one for the Havercroft Operations, which has elapsed. The mine will liaise with DWS to update the Annesley Operation water use license as necessary to include ongoing activities at the mine. The mine will also discuss the Havercroft Operation water use licence with DWS. The mine is currently applying for a Section 24G rectification to obtain an Environmental Authorisation for the unlawful commencement and continuation of silt traps, pollution control dam (PCD) and overflow dams. The mine is further also applying for an EIA and waste licence for a river diversion, backfilling of Quarries 6 & 7 and construction of a settling point. A basic assessment process is also underway to decommission the plant at Havercroft Operation. In accordance to the Section 102 application, the mine has applied for an EIA and waste license for the remining of the slimes dam.

(i) Listed and specified activities

This application is for both EIA and WL applications. Refer below to Table 4 for all listed activities as well as Figure 3 for a surface layout plan for the proposed activities. This layout plan includes having taken into consideration environmental features and current land uses and will include any additional issues raised by interested and affected parties (I&APs).

This process is for the application for the activities listed below.

Table 4: All listed activities for this application

Name of activity	Aerial extent of the activity	Listed activity	Applicable listing notice	Waste management authorisation
Basic Assessment: The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes – (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more;	Pipelines might be constructed for transport. Size not yet applicable	10	GN 983 (GN 327)	
Waste licence: Remining of mine residue.	Surveyor to update sizes.			GNR 633 Category B(11)

Name of activity	Aerial extent of the activity	Listed activity	Applicable listing notice	Waste management authorisation
The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).				

(ii) Description of the activities to be undertaken

The proposed activities are as follow and have been extracted from the amended Mining Work Programme (2018):

This is an already existing mine, therefore no additional infrastructure requirements for this amendment. The dedicated HMS plant will be erected within the boundaries of the existing plant and will use the existing infrastructure for supply of electricity and water. However, time will be required to upgrade the plant and install the dedicated HMS equipment for the processing of remined mine residue.

The remining of the Havercroft Operation slimes dam and waste rock dump is located on the farm Havercroft 99 KT. The remining of Segorong waste rock dump and HMS waste rock dump is located on the farm Annesley 109 KT. The remining of backfilled tailings in Quarry 1 is located on the farm Annesley 109 KT. This application also includes the extension of the mining right area to include ONLY the Penge Shaft and associated tanks on the farm Penge 108 KT. The transfer of slimes from Annesley Andalusite Mine (Havercroft Operation) will be done by truck using the existing road between Annesley and Annesley Andalusite Mine (Havercroft Operation). If necessary, the tailings will be piped to Annesley plant

The mine residue will be mined by conventional mining method using excavator and trucks. The quantities mined will be smoothed all over the life of mine to keep a constant ratio between coarse feed from the mine and fine feed from the dumps. Mining will be processed from top to bottom to avoid generating high-walls and unstable slopes. The waste from crushing and density separation will return to the open-pits to assist with further rehabilitation.

All mining activities are currently taking place at the Segorong Quarry. Mining will further advance over Streatham farm. The mine is opencast using hard rock bench mining. The quarry is cut into the slopes on the bedding plane of the formation for approximately 110m with an average height of 40m (occasionally the height may reach 70m). The mine has authorisation for all pit mining.

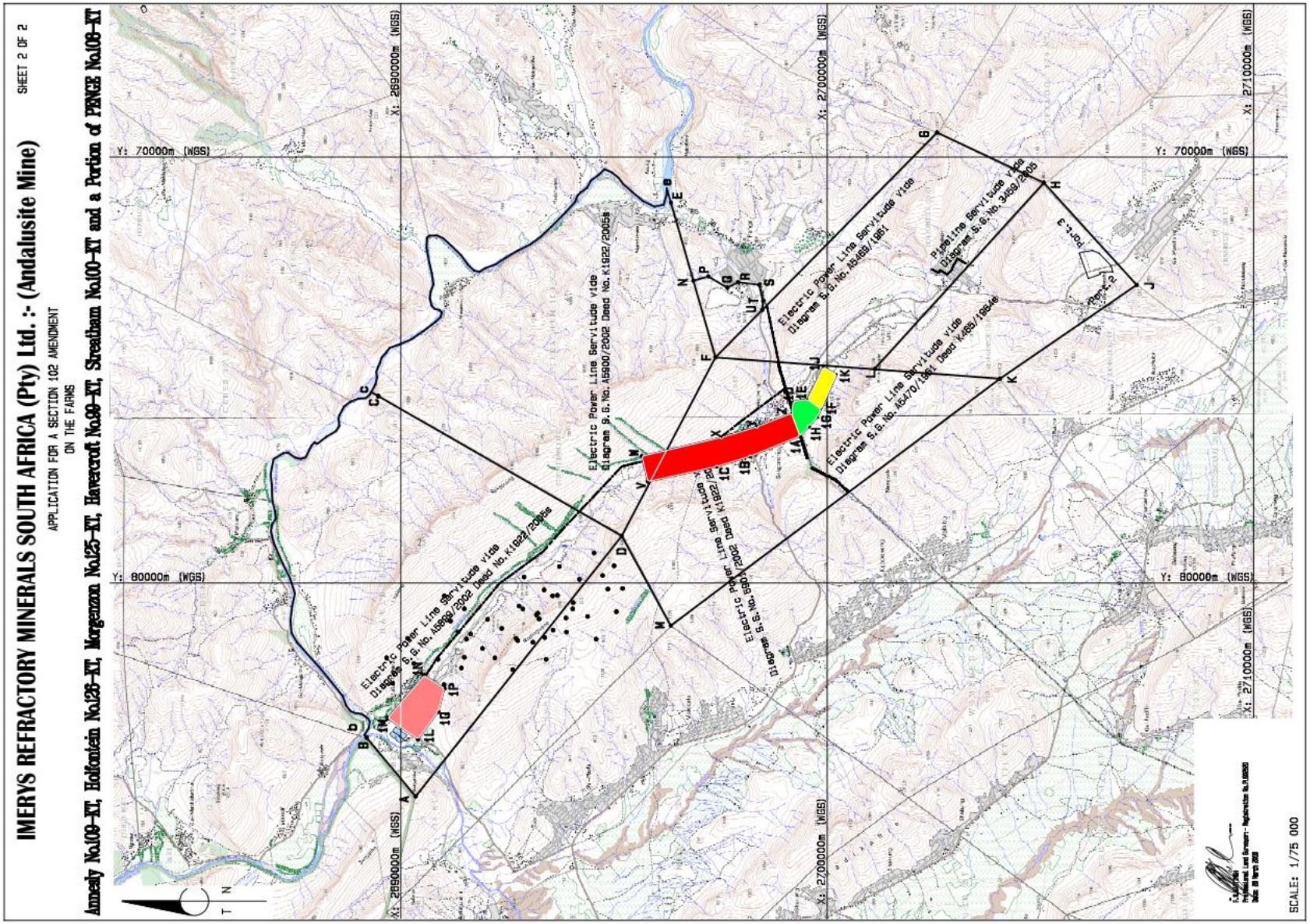

Figure 3: Regulation 2(2) plan indicating all activities already authorised and applied for

e) Policy and legislative context

Information for this section was extracted from the draft Environmental Impact Assessment Report/Environmental Management Programme (EIA/EMP) for Annesley Mine (BECS Environmental, 2017), which must still be submitted to the DMR.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
Authorisation applications			
MPRDA	According to the MPRDA, Annesley Andalusite Mine must have a mining right as well as an approved EMP. Due to changes from the Minerals Act no 50 of 1991 (MA) to the MPRDA in 2002, all mining rights had to be converted in 2009 from the old MA to the new MPRDA. Any mining right application submitted after 8 December 2014 must be done in terms of NEMA and not MPRDA. This application will include the listed activities pertaining to mining (i.e. Activity 17 of GN 984 of the EIA Regulations). These applications are still submitted to DMR.	Addendum 5A	The mine has an approved mining right. This mining right has also been converted to the new MPRDA requirements. The mining right was applied for and approved prior to 8 December 2014, therefore the requirements pertaining to a new mining right is not applicable.
	Any changes in the mining right, EMP, mining works programme (MWP), or EA, must be authorised through a Section 102 (in terms of the MPRDA) amendment.	Addendum 5A	The mine applied for a section 102 amendment, a waste license and an EIA for the remining of the Havercroft Operation slimes dam and waste rock dump, located on the farm Havercroft 99 KT, the remining of the Segorong waste rock dump and HMS waste rock dump, located on the farm Annesley 109 KT, the remining of backfilled tailings in Quarry

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
			1, located on farm Annesley 109 KT, the extension of the mining right area to include the Penge Shaft and associated tanks om the farm Penge 108 KT (no environmental authorisation necessary for this step).
NEMA and the Environmental Conservation Act 73 of 1989 as amended (ECA)	The first listed activities which required an EA (referred to as a record of decision (RoD) in the past) commenced in 1998. These activities were published in the EIA Regulations of 1998 (GN1183). In 2006, the ECA activities and EIA Regulations were replaced by the first NEMA EIA Regulations. The second set of NEMA EIA activities replaced the first set of NEMA EIA activities in 2010. The ECA activities, as well as the first and second NEMA EIA activities, excluded the application for an EIA when applying for a mining right; however, there are various other activities that could potentially trigger an EIA. The third set of NEMA EIA activities commenced on 8 December 2014. According to these listings, an applicant must apply for both a mining right as well as an EA for any new mine, and a prospecting right as well as an EA for any new prospecting activities.	Addendum 5A	The mine is in the process to apply for an EIA for the river diversion, settling point and the backfilling of Quarries 6 & 7 at Annesley Operation. The mine is currently waiting for finalisation of the water use license from DWS. As part of the Section 102 application the mine has also applied for an EIA and a waste license. No EA for the application of a mining right is necessary because the mine is older than 8 December 2014.
NWA	Section 21 of the NWA sets out the water uses for which an IWUL is required. These water uses	Not applicable	Havercroft Operation has and IWUL; however, it has elapsed. DWS will advise whether an

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	commenced on 1 October 1998, and include permissible water uses (water uses for which no licensing or registration is necessary), general authorisations (GA) (water uses for which registration only is required), and water use licenses (water used for which both registration and licensing is required). An existing lawful water use is any water use that commenced 2 years or more prior to the NWA and authorised under the old Act. These water uses are deemed lawful. In 1999, the GN 704 Regulations i.t.o. NWA was published. These Regulations pertained to all mining rights, and exemptions of water uses if necessary.		IWULA is necessary for the decommissioning and rehabilitation. Annesley Operation has an IWUL. A pre-application meeting is set to take place on the 19th of July 2018 where the IWUL will be discussed to make the necessary amendments to the IWUL to ensure it is up to date.
NEMWA GNR 633 Category B(11)	Waste management permits for certain waste activities were required form 1989 i.t.o. the ECA. These permits were repealed by the publishing of the first listed waste management activities licensing in 2009 (GN 718 of 2009 i.t.o. NEMWA). These listings were replaced by new listings in 2013 (GN 921 of 2013 i.t.o. NEMWA). If a site has a permit under ECA, this is still applicable until the National Department of Environmental Affairs (NDEA) requests an update under the new legislation (NEMWA).		The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002). This requires the mine to conduct an EIA and waste license application which the mine has already submitted as part of the Section 102 amendment.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
National Heritage Resources Act no 25 of 1999 (NHRA)	All required permits as per the Act.	Not applicable	In the event of any heritage resource discovered, a qualified specialist will be appointed.
Section 15(1) of the National Forest Act No 84 of 1998 (NFA)	No person may cut, disturb, damage or destroy any protected tree; or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, or any forest product derived from a protected tree, except under a licence granted by the Minister.	Not applicable	A specialist will conduct a study on site to establish the influence of activities on the environment and to identify all alien invasive and indigenous vegetation that are applicable.
Mining			
Mining plans and surveying: GN 447 of 2011 i.t.o. the Mine Health and Safety Act No 29 of 1996 (as amended) (MHSA)	A competent person must survey the mine. No mining operations may be carried out within a horizontal distance of 100m from reserve land, buildings, roads, railways, dams, waste dumps, or any other structure whatsoever including such structures beyond the mining boundaries, or any surface, which it may be necessary to protect in order to prevent any significant risk, unless a lesser distance has been determined safe by risk assessment and all restrictions and conditions determined in terms of the risk assessment are complied with.	N/A N/A	Hattingh Surveyors did the mapping for the mine The mine must compile risk assessment to assess whether any mining operations are carried out within a horizontal distance of 100m from the mentioned infrastructure.
Mine residue			

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
Mine residue management: Regulation 73 of the MPRDR (GN 349 of 2011 i.t.o. MPRDA), GN 632 of 2015 i.t.o. NEMWA.	The assessment of impacts relating to the management of residue deposits must form part of the EMP.	N/A	The impacts of the mine residue are contained within the mine's EIA/EMP. The reclamation of the mine residue forms part of this EIA/EMP.
Mine residue management - Assessment of impacts and analyses of risks Regulations 3 & 9(1)(a&g) & 12 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Mine Residue) under NEMWA, regulation 8 of GN 634 of 2013 (Waste Classification and Management Regulations) under NEMWA, GN 632 of 2015 has replaced regulation 73 of GN 527 of 2004 under MPRDA. Refer to transitional period	A risk analysis based on the characteristics and the classification must be used to determine the appropriate mitigation and management measures.	N/A	Although a Waste Assessment Report was conducted for the mine residue in Annesley Operation, this does not include a risk assessment with appropriate mitigation and management measures.
	The decommissioning, closure and post-closure management of mine residue must be done in accordance with the relevant provisions in the environmental authorisation, an EMP; and any other relevant legislation.	N/A	The decommissioning, closure and post-closure management of mine residue forms part of the EIA/EMP.
	The pollution control barrier system shall be defined by the: GN 635 of 2013 under NEMWA (National Norms and Standards for the Assessment of Waste for Landfill Disposal); and GN 636 of 2013 (National Norms and Standards for Disposal of Waste to Landfill).	N/A	This EIA and WL forms part of the assessment of the pollution control barrier system.
Mine residue management: Regulation 4 of GN 632 of 2015 under NEMWA (Regulations Regarding the	Mine residue must be characterised to identify any potentially significant health or safety hazard and environmental impact that may be associated with the residue when deposited.	N/A	A registered engineer is appointed as the competent person on dams and residue.

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Planning and Management of Mine Residue) under NEMWA	Mine residue must be characterised in terms of its physical characteristics; chemical characteristics; and mineral content that may include the specific gravity of the residue particles and its impact on particle segregation and consolidation.	N/A	The waste assessment has been done by Aquatico and includes these requirements.
	Mine residue must be classified in accordance with SANS 10234 within 180 days of generation.	N/A	Although a Waste Assessment Report was compiled, it does not include the GHS classification.
Mine residue management - Characterisation Regulation 5 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Mine Residue) under NEMWA	A risk analysis must be conducted and documented on all mine residue.	N/A	The waste assessment has been done by Aquatico and includes these requirements.
	The classification of residue stockpile and residue deposit must be undertaken on the basis of the: • characteristics of the residue; • location and dimensions of the deposit (height, surface area); • importance and vulnerability of the environmental components that are at risk; • spatial extent, duration and intensity of potential impacts; and pollution control barrier system compliant with the commensurate norms and standards for disposal of waste to landfill.	N/A	
Mine residue management - Investigation and site selection	The process of investigation and selection of a site mine residue must entail:	N/A	This was not done for any of the sites, however, no new mine residue will be established.

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Regulation 6 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Mine Residue) under NEMWA	• the identification of a sufficient number of possible candidate sites. • qualitative evaluation and ranking of all alternative sites; Qualitative investigation of the top-ranking sites to review the ranking done in terms of paragraph(b); • a feasibility study on the highest-ranking site or sites, involving: o a preliminary health and safety classification; o an environmental classification; o geotechnical investigations; and o hydrological investigations. Further investigation on the preferred site, must be conducted by competent person		
Mine residue management: Regulations 7 & 9(1)(b) of GN 632 of 2015 (Regulations Regarding the Planning and Management of Mine Residue) under NEMWA	The design of the residue stockpile and deposit shall be undertaken by a competent person. The process of investigation and selection of a site for residue stockpiling and residue deposits must entail several factors as per the legislation. This will include geotechnical investigations and groundwater investigations. From these investigations, a preferred site must be identified. Further investigation on the preferred site is also necessary. This must be carried out by a competent person. A	N/A	No designs according to this legislation were undertaken. This cannot be done anymore but must form part of any new mine residue planning.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	competent person must be qualified by virtue of his or her knowledge, expertise, qualifications, skills and experience; and is familiar with the provisions of the Act and other related legislation and has been trained to recognize any potential or actual problem in the performance of the work.		
Mine residue management - Impact Management Regulation 8 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Mine Residue) under NEMWA	Conduct statistical defensible and representative characterisation programme of relevant materials	N/A	Although a Waste Assessment Report was compiled, it does not include a statistical defensible and representative characterisation programme of relevant materials.
	Conduct an impact prediction study to assess the potential impacts of such actions or activities on the water resource over the full life cycle of the mining operations and until the impact from the operation is acceptable, which includes a monitoring programme and an evaluation of the effect of the mitigatory measures to demonstrate acceptable levels of impact.	N/A	Currently, no studies were conducted to assess the impact of reclamation. However, the company GPT will conduct a study on groundwater pollution plume for quarry 6 and 7.
Mine residue management - Impact Management Regulations 9(1)(d-f)&(2) & 11 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Mine Residue) under NEMWA	Preventative or remedial action must be taken in respect of any sign of pollution.	N/A	The mine has an environmental emergency procedure.
	Adequate measures must be implemented to control dust pollution and erosion of the slopes at all residues.	Part A(h)(v)	This will form part of the mine's management measures.
	Dust and mine residue must be managed in accordance with the requirements on dust control as		This will form part of the mine's management measures.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	regulated by Mine Health and Safety Act and in terms of the NEMAQA.		
	A system of routine maintenance and repair in respect of all residues must be implemented to ensure the control of pollution and the integrity of rehabilitation.		This will form part of the mine's management measures.
Mine residue management - Monitoring and reporting system Regulation 9(1)(c) & 10 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Mine Residue) under NEMWA	A monitoring system for a mining residue with respect to potentially significant impacts as identified in the EIA must be included	N/A	As part of monitoring, the mine will ensure the proper management of residue stockpiles and ensure that the tailings disposal facilities conform to measurement systems and correct standards as set out in this EMP.
Rehabilitation and closure			
Section 24R of NEMA, Appendix 5 of the EIA Regulations, sections 43, 56, 61 of MPRDA	A closure plan must be submitted 5 years before closure to DMR and NDEA. An EMP and rehabilitation plan must be submitted 5 years before commencing with closure to DWS. Closure objectives form part of the draft EMP and must identify the key objectives for mine closure to guide the project design, development and management of environmental impacts; provide broad future land use objective(s) for the site and provide proposed closure costs. Imerys must ensure that details of rehabilitation of the residue deposit are provided in the EMP.	This entire ESR	The LoM for Annesley is more than 5 years.

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Financial provision			
Section 24P of the NEMA, Regulations pertaining to financial provisioning for prospecting, exploration, mining, or production operations (GN 1147 of 2015 i.t.o. NEMA	The EMP must address the requirements as determined in the regulations, pertaining to the financial provision for the rehabilitation. The mine must annually update and review the quantum of the financial provision in consultation with a competent person, as required in terms of the approved EMP, or as requested by the Minister.	Part A(s)	The financial provision is updated annually.
Non-mining waste management			
Waste classification and disposal Regulation 5 of GN 634 of 2013 (Waste Classification and Management Regulations) under NEMWA	Safety data sheets • Generators of hazardous waste must ensure that an MSDS for the hazardous waste is prepared in accordance with SANS 10234. • If possible, use MSDS of product or products it originates from. • No MSDS necessary for Health Care Risk Waste.	N/A	This is not in contracts
Waste classification and disposal Regulation 15(d) of GN 1179 of 1995 (Hazardous Chemical Substances Regulations) under OHSA	A waste generator shall, as far as is reasonably practicable ensure that all HCS waste which can cause exposure, is disposed of only on sites specifically designated for this purpose in terms of the ECA (or NEMA), in such a manner that it does not cause a hazard inside or outside the site concerned.		

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	No person may collect waste for removal from premises unless such person is authorised by law to collect that waste, where authorisation is required.		
Waste classification and disposal Regulation 10 of GN 634 of 2013 (Waste Classification and Management Regulations) under NEMWA	Waste generators must keep accurate and up to date records of the management of the waste they generate, which records must reflect: • the classification of the wastes; • the quantity of each waste generated, expressed in tons or m^3 per month; • the quantities of each waste that has either been re-used, recycled, recovered, treated or disposed of; and • by whom the waste was managed. The records must be retained for a period of at least five (5) years, and made available to the Department upon request.		
Waste classification and disposal Regulation 11 of GN 634 of 2013 (Waste Classification and Management Regulations) under NEMWA	Every holder of waste that has been classified as hazardous must be in possession of a waste manifest document containing the relevant information Generators of waste classified as hazardous must complete a waste manifest document for each consignment of waste transported to a waste manager or waste transporter.		

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	All waste generators of hazardous waste must: retain copies, or be able to access copies/records, of the waste manifest documentation for a period of at least five (5) years; and make the waste manifest documentation available to the Department upon request.		
Waste handling, and storage: GN 527 of 2004 i.t.o. MPRDA, GN 1179 i.t.o. OHSA, sections 7 & 24 of NEMWA, and GN 634 of 2013 i.t.o. NEMWA	Employees collecting, transporting, and disposal of hazardous waste must wear suitable Personal Protective Equipment (PPE). A waste disposal contractor must wear suitable PPE. All collectable hazardous waste must be placed into containers that will prevent the likelihood of exposure during handling. Waste containers must be intact and not corroded or in any other way rendered unfit for the safe storage of waste. Adequate measures must be taken to prevent accidental spillage or leaking. Waste must be contained in such a way that it cannot be blown away. Avoid nuisances such as odor, visual impacts, and breeding of vectors. Prevent pollution of the environment and harm to health. Any container or storage impoundment holding waste must be labeled, or where labeling is not possible, records must be kept. A new waste storage facility must be registered with the competent authority within 90 days prior to the	N/A	This will form part of the mine's management measures. Spill handling procedure (AAM-EP-02) and Environmental Emergency Response Plans are in place

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	construction taking place. The assessment of impacts relating to the disposal of waste material must form part of the EMP.		
Waste handling, and storage: Regulation 15(f) of GN 1179 (Hazardous Chemical Substances Regulations) under OHSA, Regulation 13 of GN 926 of 2013 (National norms and standards for the storage of waste) under NEMWA	A waste generator shall, as far as is reasonably practicable ensure that if the services of a waste disposal contractor are used, a provision is incorporated into the contract stating that the contractor shall also comply with the provisions of these regulations.	N/A	This is not in the contracts.
Waste handling, and storage Regulation 6 of GN 634 of 2013 (Waste Classification and Management Regulations) under NEMWA & Regulation 10 of GN 926 of 2013 (National norms and standards for the storage of waste) under NEMWA	Any container or storage impoundment holding waste must be labeled, or where labeling is not possible, records must be kept. Hazardous waste must be stored in covered containers and only open when waste is added or emptied.	N/A	This is not necessary as the mine will not be storing hazardous waste in covered
Waste re-use, recycle, recover: GN 527 of 2004 i.t.o. MPRDA, sections 7 & 24 of NEMWA, and GN 634 of 2013 i.t.o. NEMWA	Waste must be re-used, recycled, recovered, treated and/or disposed of within 18 months of generation. Recycle hazardous waste as far as is reasonably practicable. Any person who undertakes an activity involving the reduction, re-use, recycling or recovery of waste must, before undertaking that activity, ensure that the reduction, re-use, recycling	N/A	Waste is removed from the site via a waste contractor. No recycling takes place on the mine.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	or recovery of the waste use less natural resources than disposal of such waste and to the extent that it is possible, is less harmful to the environment than the disposal of such waste.		
Unlawful disposal and littering: Sections 26 & 27 of NEMWA	No disposal of waste in or on any land, waterbody or at any facility. No disposal of waste in a manner that is likely to cause pollution of the environment or harm to health and well-being. No littering of any public place, land, vacant erf, stream, watercourse, street or road, or on any place to which the general public has access. Unless the disposal of that waste is authorised by law	N/A	This will form part of the mine's management measures. The mine has an Environmental Emergency Response Plan which deals with these cases.
Waste tyres: Regulations in terms of storage of tyres (GN 149 of 2009 i.t.o NEMWA)	All requirements	N/A	The mine does not store tyres.
Asbestos management and disposal: GN 341 of 2008 i.t.o. ECA, and regulation 20 of GN 155 of 2001 i.t.o OHSAS	Ensure that all asbestos waste is placed in containers that will prevent the likelihood of exposure during handling. All vehicles, re-usable containers or any other similar articles which have been in contact with asbestos waste must be cleaned and decontaminated after use. All asbestos waste which can cause exposure must be disposed of only on sites specifically designated for this purpose. All persons occupied in the collection, transport, and disposing of waste in a manner which	N/A	The mine does not have asbestos waste.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	may detrimentally impact on a water resource, disposal of asbestos waste, must wear PPE, including contractors.		
Water management			
Water management and pollution control: GN 527 of 2004 i.t.o. MPRDA	An assessment of impacts relating to water management and pollution control at mining operations must form part of the EMP.	N/A	The impacts of water pollution are contained within the mine's EIA/EMP. The mine implements Spill handling procedure (AAM-EP-02) and an Environmental Emergency Response Plan to ensure no water resources are impacted.
Water management and pollution control: GN 704 Regulations of 1999 i.t.o. NWA	No TDF shall be established on the bank of any stream, river, dam, pan, wetland or lake without written permission and upon such conditions as determined and as approved in the EMP. Toilet facilities shall be located in such a manner that no water or other pollution is caused. GN 704 Regulations of 1999 i.t.o. NWA place: restrictions on locality; restrictions on the use of material; capacity requirements of clean and dirty water systems; protection of water resources; and security and additional measures.		
Water management and pollution control Regulation 9 of GN 632 of 2015 (Regulations regarding the planning and management of residue stockpiles and residue deposits) under NEMWA, Regulation 68 of GN	A mine must ensure that preventative or remedial action is taken in respect of any sign of pollution.	N/A	The mine has an environmental emergency procedure.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
527 of 2004 (Mineral and Petroleum Resources Development Regulations) under MPRDA			
Dams with safety risks Sections 117-123 of NWA	All residue stockpiles and deposits must be classified into one or a combination of the following categories: (1) the safety classification to differentiate between residue stockpiles and deposits of high, medium and low hazard based on their potential to cause harm to life or property; and (2) the environmental classification to differentiate between residue stockpiles and deposits. A mine must within the period specified, provide the Minister with any information, drawings, specifications, design assumptions, calculations, documents and test results requested by the Minister, pertaining to dams with a safety risk.	N/A	The mine does not have an environmental classification for the mine residue.
Hazardous chemical substances management			
Use, storage, and handling: Regulation 14 of GN1179 of 1995 under OHSAS, GN 1381 of 1994, GN 247 of 1993, and GN 690 of 1989 under the Hazardous Substances Act No 15 of 1973 (as amended) (HSA)	A Hazardous chemical substance (HCS) in storage or distributed must be properly identified, classified and handled in accordance with SABS 072 and SABS 0228. A container or a vehicle in which an HCS is transported must be clearly identified, classified and packed in accordance with SABS 0228 and SABS 0229. Any container into which an HCS is decanted must be clearly labeled with regard	N/A	This will form part of the mine's management measures. The mine follows their Waste Management Procedure: AAM-EP-01

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	to the contents thereof. Hazardous substances must also be classified according to the Hazardous Substances Regulations (GN 453 of 1977) i.t.o the Hazardous Substances Act No 15 of 1973.		
Transportation: Section 54 of National Road Traffic Act No 93 0f 1996 (NRTA), regulation 277 of GN 255 of 2000 under NRTA	No person shall except as prescribed, accept after transportation, any prescribed dangerous goods. The NRTA and regulations place strict obligations on the "consignee", "consignor, "driver" and "operator" during transportation. Imerys is in the position of the "consignee" due to the off-loading.	N/A	Due to the number of requirements as set out in these regulations, it is unclear whether this is in place.
Polychlorinated biphenyl (PCB): GN 549 of 2014 I.t.o. NEMA	PCBs must be phased out.	N/A	There is no phasing-out plan yet in place.
Radioactive sources: Section 3A of the HAS, GN 246 & 247 of 1993 i.t.o HSA	The possession and use of Group IV hazardous substances require a written authority in terms of the HSA.	N/A	There are no such sources on the mine.
Air quality management			
Ambient air quality management Regulation 64 of GN 527 of 2004 (Mineral and Petroleum Resources Development Regulations) under MPRDA, GN 1210 of 2009 (National Ambient Air Quality Standards) & GN 486 of 2012 (National Ambient Air Quality Standard for PM Less than 2.5 Micron Metres) under NEMAQA	Limits and compliance for SO2, NO2, PM10, O3, C6H6, Pb, CO, PM2.5	N/A	There are none necessary as the remining of the slimes dam will not affect ambient air quality standards.

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Ambient air quality management GN 351 of 2014 (Regulations Regarding the Phasing-out and Management of Ozone- Depleting Substances) under NEMAQA	Hydrochlorofluorocarbons are phased-out.	N/A	Annesley is not yet phasing out old air conditioners
Dust control Regulations 9(f) & 11 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits) under NEMWA	A mine must ensure that adequate measures are implemented to control dust pollution and erosion of the slopes at all residues.	N/A	This will form part of the mine's management measures. Long-term erosion and dust control will be achieved by the re-vegetation of spoil and bare areas with a combination of creeping and tufted grass species.
Atmospheric impact report and air dispersion modeling GN 747 of 2013 (Regulations Prescribing the Format of the Atmospheric Impact Report) & GN 533 of 2014 (Regulations Regarding Air Dispersion Modelling) under NEMAQA	Atmospheric impact report and air dispersion modeling only if required from officer or if applying for Air emissions license (AEL).	N/A	The mine has an atmospheric impact report and air dispersion modeling in place.
Environmental noise control and management: Regulation 66 of GN 572 of 2004 i.t.o. MPRDA, section 34 of NEMAQA, Sections 25 & 26 of ECA, and GN 154 of 1992 i.t.o. ECA	The mine must comply with the provisions of the MHSA. The assessment of impacts relating to noise pollution management and control, where appropriate, must form part of the EMP No person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any	N/A	This will form part of the mine's management measures. Some structures that have been damaged due to mining activities (blasting and shock) will be identified and appropriate action initiated prior to the mining operations closing.

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	person, animal, machine, device or apparatus or any combination thereof. No person shall drive a vehicle on a public road in such a manner that it may cause a noise nuisance.		
Noxious or offensive gases: Section 35 of NEMAQA, GN 1651 of 1974 i.t.o. APPA	No vehicle may be driven on a public road if the noxious gases emitted have a density or content as to produce a mean reading of 70 or more.	N/A	This is very old legislation, there is no new such legislation – technology also old?
Blasting, vibration and shock management, and control: Regulation 67 of GN 572 of 2004 i.t.o. MPRDA	The mine must comply with the provisions of the MHSA. An assessment of impacts relating to blasting, vibration and shock management and control, where applicable, must form part of the EMP.	N/A	No blasting takes place.
Biodiversity management			
Alien and invasive species GN598 of 2014 (Alien and Invasive Species Regulations) & GN864 of 2016 (Alien and Invasive Species Lists) under NEMBA	Category 1a Listed Invasive Species must be combatted or eradicated. Category 1b Listed Invasive Species must be controlled. Category 2 Listed Invasive Species require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit. Category 3 Listed Invasive Species are subject to exemption.	N/A	The mine needs an alien eradication plan. A specialist will go out to site on the 23rd July 2018 to identify alien invasive and identify the controls needed for the appropriate eradication.
Fire breaks and firefighting: Sections 12, 13, 17, 18 & 34 of National Veld and Forest Fire Act No 101 of 1998 (NVFFA)	Every owner on whose land a veldfire may start or burn or from whose land it may spread, must prepare and maintain a firebreak on his/her side of the boundary between his/her land and any adjoining land. Every owner must have the	N/A	All vehicles and equipment at the mine are regularly inspected and maintained. The emergency plan includes the prevention and control of veld fires.

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	appropriate equipment and measures in place to be ready to be able to combat veld fires and must be in a position to report the occurrence of fires and to take such measures as may be necessary to combat such fires.		
Acquisition, disposal, sale or use of fertilizers, farm feeds, agricultural remedies and stock remedies: Section 7*bis* of Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act No 36 of 1947 (FFFARSRA)	Prohibition of certain pesticides and herbicides.	N/A	This will form part of the mine's management measures. A specialist will go out to site on the 23rd July 2018 to identify alien invasive species and identify the controls applicable to the species and those allowed in the area.
Soil management			
Contaminated land: GN 527 of 2004 i.t.o. MPRDA, and sections 35-41 of NEMWA	The assessment of impacts relating to soil pollution and erosion control must form part of both the EMP. The acidification, salination and mineralisation of soils through seepage of polluted water must take place as approved in the EMP. The spillage of hazardous chemicals onto soils or its escape or migration into surrounding soils from the approved deposition area must be prevented. Oils, grease, and hydraulic fluids must be disposed of. Oils, grease, and hydraulic fluid spills must be cleaned up by removing all contaminated soil and disposing such soil in a waste disposal receptacle or at a	N/A	This will form part of the mine's management measures. The mine will dispose of contaminated material as hazardous waste (see Waste Management Procedure: AAM-EP-01) to ensure spillage into the soil does not occur and will, as soon as reasonably practicable after knowledge of the incident take all reasonable measures to contain and minimise the effects of the incident, including its effects on the environment and any risks posed by the incident to the health, safety and property of persons.

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	licensed facility. The chemical and physical properties of topsoil to be used for the purposes of rehabilitation must not be changed by introducing foreign material, gravel, rock, rubble or mine residue to such soil. An owner of land that is significantly contaminated, or a person who undertakes an activity that caused the land to be significantly contaminated, must notify the department of that contamination as soon as that person becomes aware, of that contamination		
Heritage resources management			
Section 52 of MPRDA, and Sections 34 & 35 of National Heritage Resources Act No 25 of 1999 (NHRA)	An EMP must include impacts on heritage aspects. No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority. Any person who discovers archaeological or palaeontological objects or material or a meteorite must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.	N/A	Already existing infrastructure to be used therefore no impact on Archaeological, historical and cultural aspects.
Emergency incidents			
Section 30 of NEMA, section 20 of NWA S20, and Section 18 of NVFFA	In the event of an emergency, the mine must: report through the most effective means reasonably	N/A	The mine has an environmental emergency procedure. This procedure will be

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	available; take all reasonable measures to contain and minimise the effects of the incident, including its effects on the environment and any risks posed by the incident to the health, safety and property of persons; undertake clean-up procedures; remedy the effects of the incident; and assess the immediate and long-term effects of the incident on the environment and public health. Any owner who has reason to believe that a fire on his or her land or the land of an adjoining owner may endanger life, property or the environment, must immediately notify the fire protection officer or, any member of the executive committee of the fire protection association, if one exists for the area; and the owners of adjoining land; and do everything in his or her power to stop the spread of the fire.		implemented, and this will be audited as part of the legal compliance audit.
Sustainable development			
Sustainable development principles: Section 2(3 & 4), of NEMA, section 2, 2(a)(ii), 22(2)(d) of NWA, GN 527 of 2004 i.t.o. MPRDA, section 37 of MPRDA, section 2(a)(ii) of Section 2(3 & 4) of NEMA, section 2 of NWA, section of, and section of NWA	Any mining operation must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into the planning and implementation of mining in order to ensure that exploitation of mineral resources serves present and future generations. The mine shall	N/A	The mine has recently updated their environmental procedures. The mine also has an amended Social and Labour Plan (SLP) in place for the year 2018-2022. The LoM is more than 5 years, however, the mine is compiles annual rehabilitation plans and update the financial provision annually as part of the new

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	investigate new and emerging technologies and put into practice water efficient devices or applied technique for the re-use of water containing waste. The Closure Plan must include agreed standard or land use which conforms with the concept of sustainable development.		NEMA requirements. This plan will include end land use.
International conventions/treaties	Convention on Biological Diversity, ratified by RSA on 2 November 1995: Conservation of biological diversity, the sustainable use of its components. UN Framework on Climate Change and Kyoto Protocol, ratified by RSA on 29 August 1997: The NDEA has published a report on 'A national climate change response strategy" in response to the Kyoto Protocol'. Greenhouse gas emissions and inventories will be specifically dealt with in the NEMAQA. Climate change is referred to explicitly in the White Paper on Integrated Pollution and Waste Management in 2000 and referenced in the White Paper on a National Water Policy for South Africa, 1997. It is also specifically addressed in the Government's imminent National Water Resource Strategy.' Greenhouse gases are only included under AEL requirements in the NEMAQA.	N/A	The mine must make a list of these chemicals if there are any on the mine. If there are no such chemicals on the mine, keep proof of this.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	Stockholm Convention on Persistent Organic Pollutants, ratified by RSA on 4 September 2002: Persistent organic pollutants (POPs) include various insecticides as well as PCBs. South Africa published a report 'National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants' in 2012. According to this report, the duty of care covers the responsibility of Imerys to avoid the use, storage, generation, or uncontrolled disposal thereof. Vienna Convention on the Protection of the Ozone Layer, and the Montreal Protocol, ratified by RSA on 15 January 1990: The Montreal Protocol includes ozone depleting substances as well as a list of products containing these substances. On 18 September 2015, the NDEA published a notice (GN 703 of 2015), requesting all companies to submit information regarding the listed chemicals as per Annex A within 60 days from the publication. 17 November 2015. The Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971 (Ramsar Convention). South Africa ratified Ramsar		

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report (reference and description)	Reference where applied	How does this development comply with and respond to the policy and legislative context (significance)
	in March 1975. The objectives of the Convention are: • to stem the progressive encroachment on and loss of wetlands now and in the future, recognising the fundamental ecological functions of wetlands and their economic, cultural, scientific and recreational value; • to encourage the 'wise use' of the world's wetland resources; and • to co-ordinate international efforts for this purpose.		

f) Need and desirability of the proposed activities

As per the Guideline on Needs and Desirability in terms of the EIA Regulations (published 20 October 2014), the following table has been compiled:

Table 5: Need and Desirability of the proposed project

Guideline requirement	Comments on requirement
1. How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?	
1.1 How were the following ecological integrity considerations taken into account?	
1.1.1 Threatened Ecosystems.	The mine falls within the Sekhukune Norite Bushveld which is classed as an endangered ecosystem. The mine has rehabilitation plan in place to mitigate any impacts that are caused. The reclamation of mine residue will not impact on this threatened ecosystem.
1.1.2 Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.	An aquatic ecosystem delineation was conducted for a river diversion on site. No other delineations have been conducted.
1.1.3 Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs").	The activities taking place are not within any CBAs or ESAs.
1.1.4 Conservation targets.	The spatial development framework guides and informs all decision of the municipality relating to land use development and land planning. It guides and informs the direction of growth, major movement routes, special development areas and conservation of areas. Areas of specific conservational importance are identified and are targeted in the SDF for management. Water conservation is also of particular concern in the SDF. Similarly, to the conservation targets, the mine has a rehabilitation plan that will ensure the land is remediated for use by the community, flora and fauna and water management is ensured.
1.1.5 Ecological drivers of the ecosystem.	The ecological driver focused on in the SDF are grasses. Many grasses in the area have good grazing value and others perform a multitude of useful ecological functions, for example to bind soil. Grass species composition is also an indicator of vegetation condition. The mine has further identified ecological drivers through specialist

Guideline requirement	Comments on requirement
	studies. As part of rehabilitation, re-vegetation is to take place which will ensure the establishment of grasses.
1.1.6 Environmental Management Framework.	The Sekhukhune Municipality District has developed an Integrated Environmental Management Plan (DIEMP) that needs to be approved by Council. The district still needs to have Environmental Inspectors in its territory to preserve the biodiversity and its natural resources. The mine has developed its own management measures in line with the project based on specialist studies to ensure combability with the ecological integrity of the surrounding environment.
1.1.7 Spatial Development Framework (SDF),.	The Sekhukhune Municipality District has an existing Spatial Development Framework which allocates a budget to ensure the environment stays clean. The mine also has a budget for rehabilitation for the project. This resonates with the objective of the SDF.
1.1.8 Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.).	The mine ensures compliance to environmental legislation which often encompasses objectives of environmental treaties.
1.2 How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	There will be no loss of ecosystems or biological diversity as the project involves the remining of an already existing mine. The remining of mine residue may have a final positive impact on the area if these areas can then be completely removed and rehabilitated.
1.3 How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	The remining of mine residue may lead to pollution of nearby areas if management measures are not put into place. The impacts and management on the biophysical environment are found in Section A(v) of this EMP.
1.4 What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or	No additional non-mining waste than that already generated by the mine. The mine has a waste procedure in place for non-mining waste.

Guideline requirement	Comments on requirement
recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	
1.5 How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	All proposed activities are on the already existing mining area. It is not envisaged that any cultural heritage resources will be disturbed.
1.6 How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	Resources include diesel for vehicles to transport the mine residue to the plant. All resources used in the plant to add the reworking of the mine residue to the current operation has been included in the MWP.
1.7 How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?	
1.7.1 Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy	The mine aim to reduce this resource consumption as part of the reduction in operational costs.

Guideline requirement	Comments on requirement
demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life)	
1.7.2 Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources this the proposed development alternative?)	The remining of mine waste will aid in rehabilitation and prevent the impacts associated with progressive development of a new pit or the impact of prospecting.
1.7.3 Do the proposed location, type and scale of development promote a reduced dependency on resources?	Yes. The location is an already existing mine and will not significantly increase dependency on the resource
1.8 How were a risk-averse and cautious approach applied in terms of ecological impacts?	The impact assessment is based on previous studies done in the area.
1.8.1 What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	No specialist studies are included in this assessment.
1.8.2 What is the level of risk associated with the limits of current knowledge?	All risks, significance thereof as well as management are based on the EAP's knowledge and not on specialist recommendations.
1.8.3 Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	The impact assessment is based on previous studies done in the area.
1.9 How will the ecological impacts resulting from this development impact on people's environmental right in terms following	Refer to impact assessment for an in-depth description of each environmental component and the associated impact of the project.
1.9.1 Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	
1.9.2 Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	

Guideline requirement	Comments on requirement
1.10 Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	
1.11 Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?	
1.12 Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	There is no alternative to this project. The reclamation of mine residue will have a nett positive impact on the area and therefore no alternative is assessed.
1.13 Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Refer to the cumulative impact assessment.
2.1 What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?	Part A(g)(iv)(15). The impact of the project does not affect spatial patterns.
2.1.1 The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area,	
2.1.2 Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),	
2.1.3 Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	
2.1.4 Municipal Economic Development Strategy ("LED Strategy").	
2.2 Considering the socio-economic context, what will the socio-economic impacts be of the development (and	Refer to impact assessment. Employment to be discussed between mine management and community.

Guideline requirement	Comments on requirement
its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	
2.2.1 Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	The project ensures that those who are already employed remain employed which reduces unemployment in the area and transfers skills to employees.
2.3 How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	The project ensures the community is consulted and their needs are addressed through meetings.
2.4 Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?	The impacts associated with the project will remain the same as the mine is already existing.
2.5 (Not applicable)	
2.6 How were a risk-averse and cautious approach applied in terms of socio-economic impacts?	See above.
2.6.1 What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	
2.6.2 What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	
2.6.3 Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	
2.7 How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:	
2.7.1 Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	Refer to impact assessment. The project will not impact the socio-economic component negatively.
2.7.2 Positive impacts. What measures were taken to enhance positive impacts?	Consultation with I&APs ensured the mine considers the needs of the socio-economic component.
2.8 Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to	Refer to impact assessment. There is no alternative to this project.

Guideline requirement	Comments on requirement
the area in question and how the development's socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	
2.9 What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	The reclamation of mine residue will aid in rehabilitation which is ultimately the best practicable environmental option.
2.10 What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	All affected persons were consulted during the PPP. They have adequate time to comment if needed on the impacts associated with the project.
2.11 What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	
2.12 What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	The mine has a health and safety system in place which will also be implemented for this project.
2.13 What measures were taken to:	Refer to Part A(g)(iii) for public participation
2.13.1 ensure the participation of all interested and affected parties,	
2.13.2 provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,	
2.13.3 ensure participation by vulnerable and disadvantaged persons	
2.13.4 promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means	

Guideline requirement	Comments on requirement
2.13.5 ensure openness and transparency, and access to information in terms of the process	
2.13.6 ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge, and	
2.13.7 ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein were being promoted	
2.14 Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	
2.15 What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	All contractors, sub-contractors and workers will continue to attend compulsory environmental awareness training and inductions. This training will highlight the dangers associated with the workplace. Procedures relating to environmental risks will also be put in place and will be regularly updated.
2.16 Describe how the development will impact on job creation in terms of, amongst other aspects:	Employment to be discussed between mine management and community. The mine ensure employment is endured by using the workers already at the mine.
2.16.1 the number of temporary versus permanent jobs that will be created,	
2.16.2 whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),	
2.16.3 the distance from where labourers will have to travel,	
2.16.4 the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and	

Guideline requirement	Comments on requirement
2.16.5 the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).	
2.17 What measures were taken to ensure:	Refer to Part A(g)(iii). I&APs are consulted to ensure their input is included for the project development.
2.17.1 that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment, and	
2.17.2 that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?	
2.18 What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	
2.19 Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	Refer to impact assessment. The management measures are realistic.
2.20 What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	The mine has an updated financial provision which includes rehabilitation costs.
2.21 Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	There is no alternative to this project.
2.22 Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	Refer to the cumulative impact assessment.

g) Motivation for the preferred development footprint within the approved site including a full description of the process followed to reach the proposed development footprint within the approved site

There were no specialist studies conducted for the development as the mine is an already existing mine and the same environmental context applies. The only activity to be considered for this application is the remining of already existing mine residue. No new areas will be disturbed.

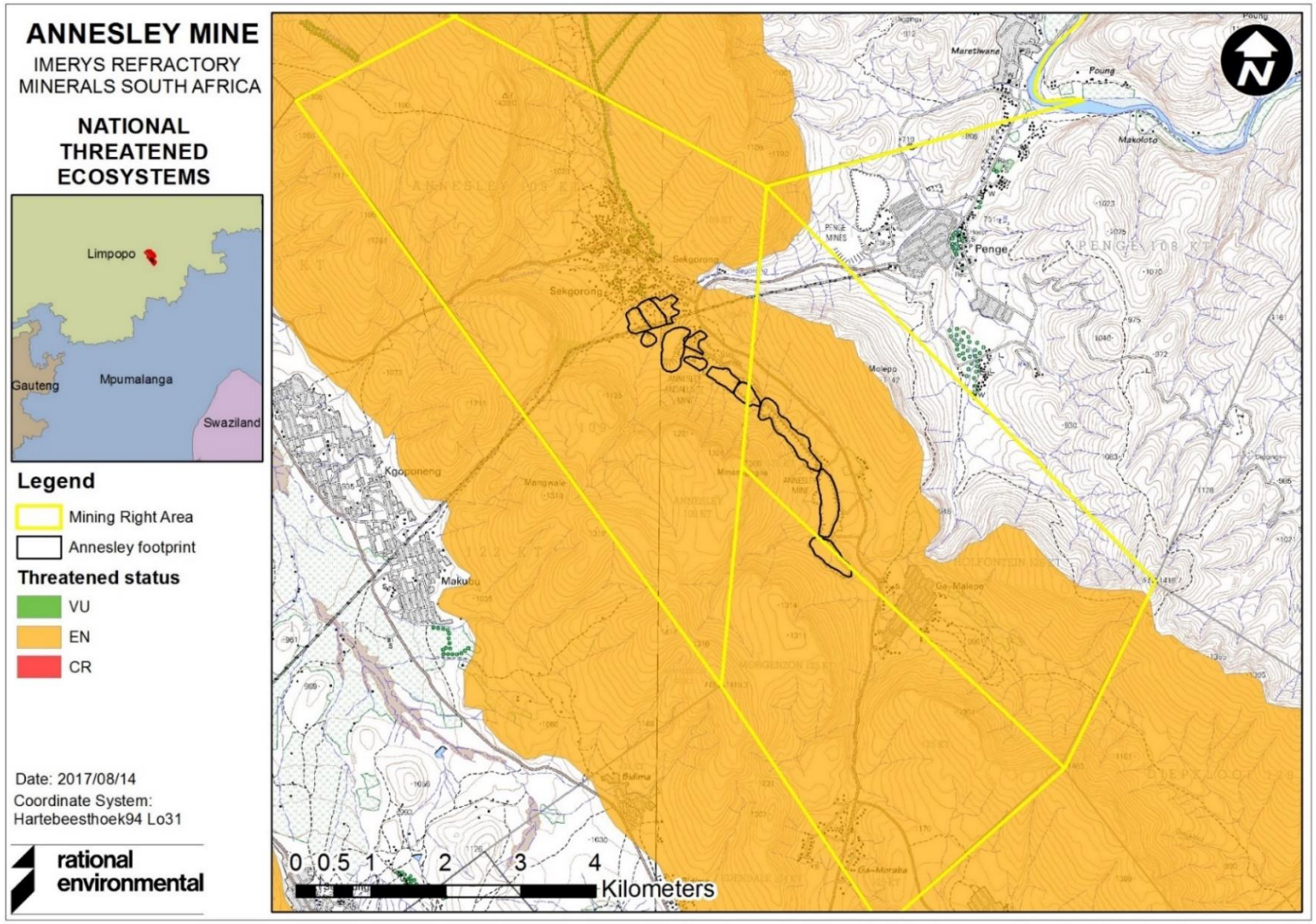


Figure 4: Layout plan which includes the national list of threatened ecosystems

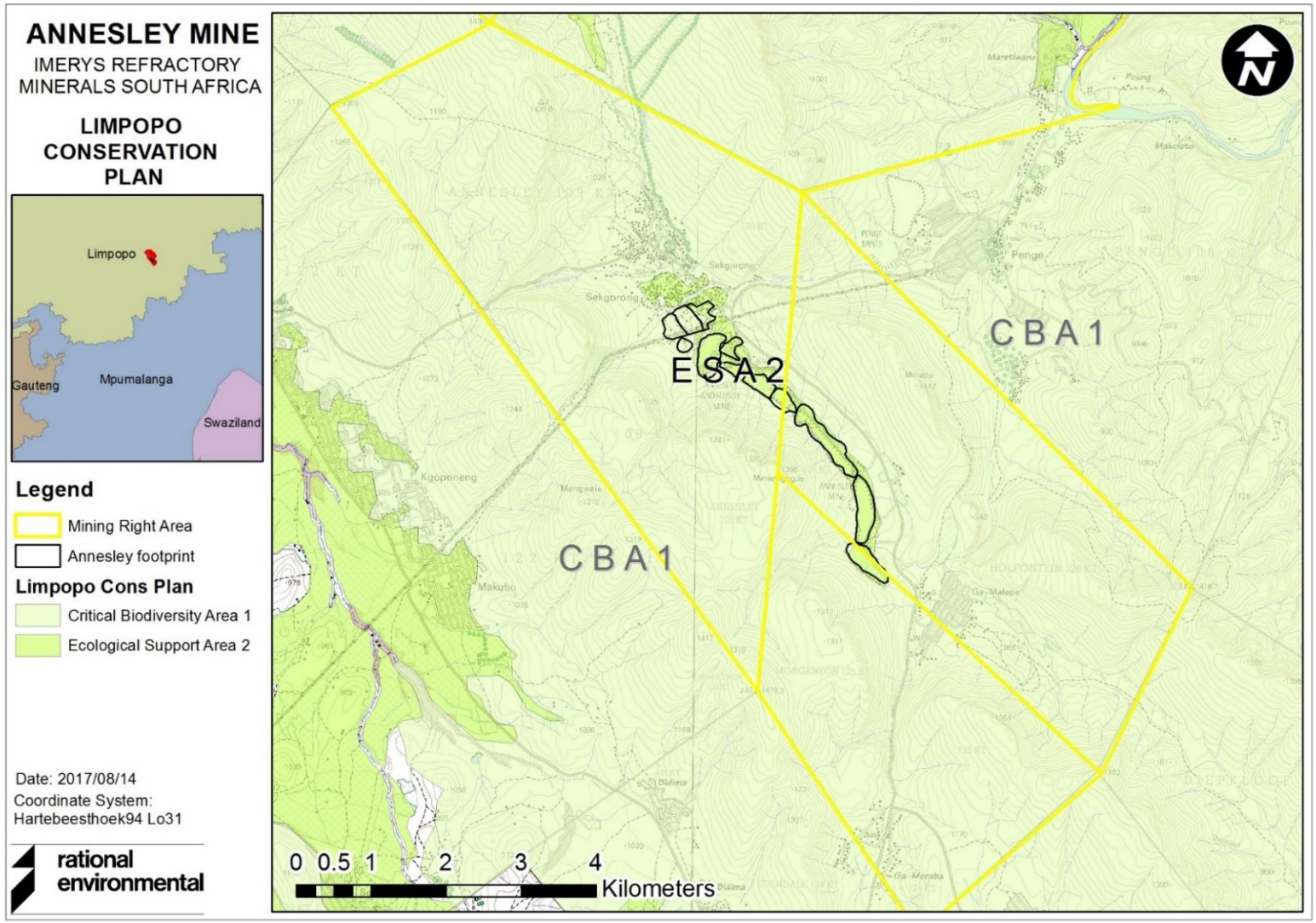


Figure 5: Layout plan indicating the Limpopo Critical Biodiversity Areas

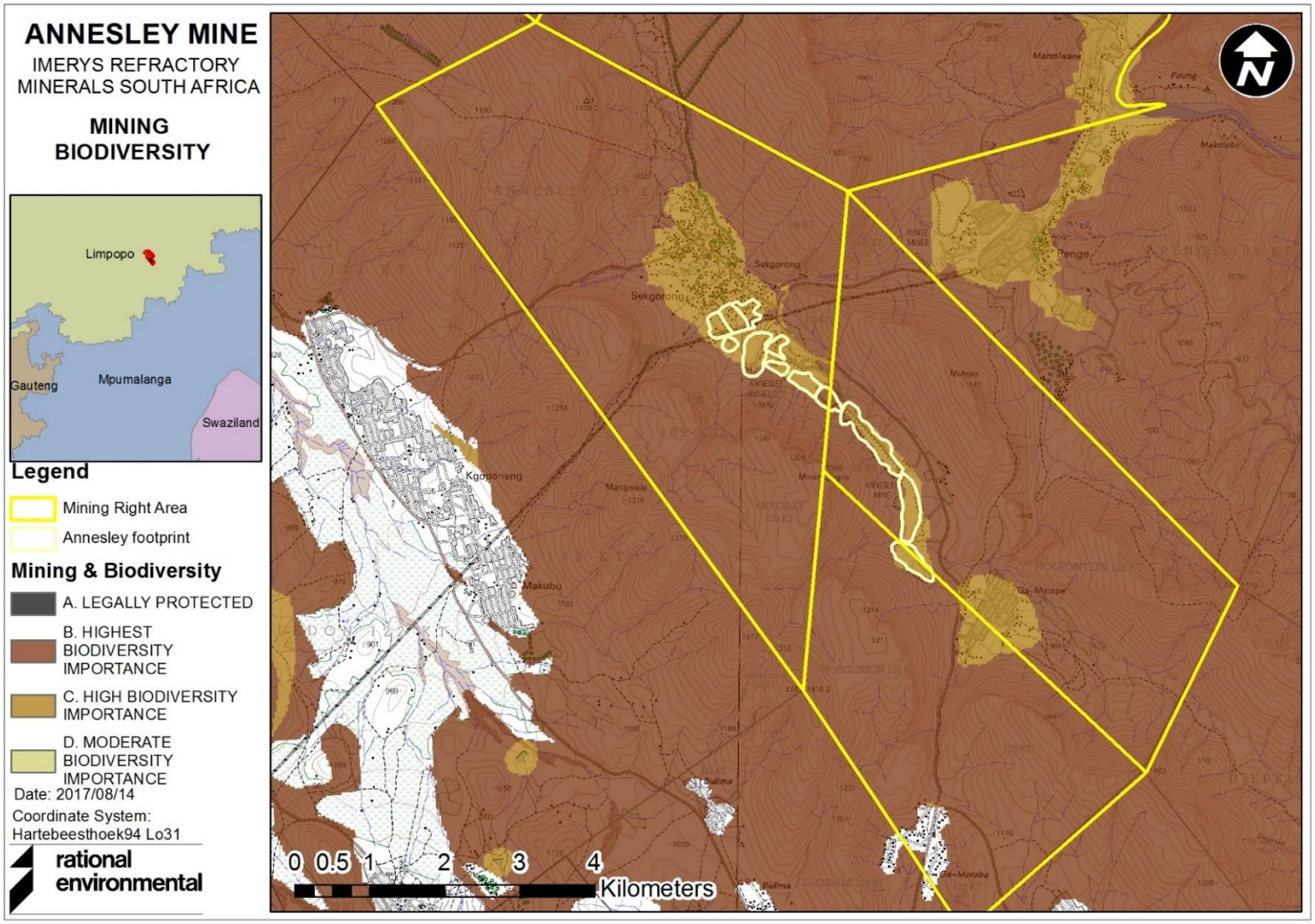


Figure 6: Layout plan indicating the Mining Biodiversity area

h) Description of the process followed to reach the proposed preferred site

The only activity to be considered for this application is the remining of already existing mine residue. No new areas will be disturbed.

i) Details of the development footprint alternatives considered

The following definition of "alternatives" is given in the EIA Regulations: *"alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to the -*

(a) property on which or location where the activity is proposed to be undertaken;

(b) type of activity to be undertaken;

(c) design or layout of the activity;

(d) technology to be used in the activity; or

(e) operational aspects of the activity; and

(f) includes the option of not implementing the activity;"

Please note the term preferred alternative is the preferred activity whereby the second alternative is the alternative to the preferred alternative.

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

As above, no alternatives are applied for.

(b) The type of activity to be undertaken

As above, no alternatives are applied for.

(c) The design or layout of the activity

As above, no alternatives are applied for.

(d) The technology to be used in the activity

As above, no alternatives are applied for.

(e) The operational aspects of the activity

As above, no alternatives are applied for.

(f) The option of not implementing the activity

In the case of the no go option being implemented, the mine residue area cannot be rehabilitated to an adequate final land use.

ii) Details of the public participation process followed

According to the Publication of Participation Guideline (NEMA), and I&AP is:

"(a) any person, group or persons or organisations interested in or affected by an activity, and (b) any organ of state that may have jurisdiction over any aspect of the activity".

This definition is more detailed in the Guideline for consultation with communities and I&APs (MPRDA):

"Interested and affected' parties include, but are not limited to; (i) Host Communities, (ii) Landowners (Traditional and Title Deed owners), (iii) Traditional Authority, (iv) Land Claimants, (v) Lawful land occupier, (vi) The Department of Land Affairs, (vii) Any other person (including on adjacent and non-adjacent properties) whose socio-economic conditions may be directly affected by the proposed prospecting or mining operation (viii) The Local Municipality, (ix) The relevant Government Departments, agencies and institutions responsible for the various aspects of the environment and for infrastructure which may be affected by the proposed project."

The process followed adheres to the National Environmental Management Act 107-1998 - National guideline on minimum information (20180209-GGN-41432-00086) and the 2012, IEM Guideline Series 7, Public participation, GN 807.

(a) Identification of interested and affected parties

No comments were received on the ESR. Refer to Table 6 below for all I&APs and stakeholders identified. All of these I&APs and stakeholders were in fact consulted. Refer to Section 2(h)(iii)(2) below for process that was followed. This will be added when comments are received.

Table 6: I&APs and stakeholders identified

Interested and Affected Parties	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this ESR where issues and or response were incorporated
Affected parties				
Landowner/s				
According to the title deeds, the National Government of South Africa is the landowner, however, Roka Malepe Traditional Council is the traditional landowner of the farm	None	None	N/A	N/A

Interested and Affected Parties	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this ESR where issues and or response were incorporated
Annesley and Babina Tlou is the Traditional Council is the traditional landowner of the farm Havercroft.				
Lawful occupier/s of the land				
The land is currently occupied by the mine.	N/A	N/A	N/A	N/A
Landowners or lawful occupiers on adjacent properties				
Roka Malepe Traditional Council	29/10/2018	Mr Malepe stated that the mine has disturbed the area, chased and moved around the people a lot. He says nothing has happened since they exhumed the graves and stated that he has various health issues due to the mine.	Mr Hendrik Jones is in direct contact with the families that have graves on the mine. These graves are managed by Mr Hendrik Jones, Xolisa Mvinjelwa and the community Liaison Officer (CLO), Mathebo.	Addendum 4G
		In 2015 a meeting was held regarding concerns. In this meeting compensation was agreed	The death of any miners will be further investigated to see if compensation	Addendum 4G

Interested and Affected Parties	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this ESR where issues and or response were incorporated
		for someone who died at the mine. The process of remining is not rejected nonetheless	has indeed been provided.	
Babina Tlou Traditional Council	14/01/2019	Modubeng Development Committee (MDC): The waste rock dump and slimes dam of Havercroft is combined with quarry 1 of Annesley. How will the employment work as two different communities are involved?	A plan of activity will be compiled to ensure that the correct community is involved in the employment.	Addendum 4I
Babina Tlou Traditional Council	14/01/2019	There is a general concern regarding the issue of the Social and Labour Plan (SLP)	The SLP will be discussed between Imerys and the Community and notes will be taken to finalise the SLP as necessary.	Addendum 4I

Interested and Affected Parties	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this ESR where issues and or response were incorporated
Babina Tlou Traditional Council	14/01/2019	MDC: A request was made regarding the trucking/piping for the transportation of product to employ a company from Havercroft to take the product from Havercroft to Annesley.	The local community will be involved as much as possible. Once the authorisation is obtained the local community will be communicated with.	Addendum 4I
Babina Tlou Traditional Council	14/01/2019	The issue of graves on the mining site was taken to the DMR. The DMR had stated that no mining should take place in the vicinity of the graves.	BECS Services is aware that this is a sensitive issue. The mining method will be done correctly and will ensure that the graves are dealt with correctly.	Addendum 4I
		How will the quarries be filled if the material is removed from	the quarries will be sloped so the cattle do not fall in.	Addendum 4I

Interested and Affected Parties	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this ESR where issues and or response were incorporated
		Havercroft Operation to Annesley?		
Babina Tlou Traditional Council	14/01/2019	How long will the process of consultation take before remining commences?	The DMR will communicate with BECS Services and notify them of the progress.	Addendum 4I
Babina Tlou Traditional Council	14/01/2019	Clarity was requested on the impact of animal and vegetation life.	The impact on vegetation and animal life will remain the same as the remining will not disturb any new areas	Addendum 4I
Babina Tlou Traditional Council	14/01/2019	MDC: We will communicate the events of the meeting with the rest of The community.	BECS Services will finalise the EMP and hand it in to DMR.	Addendum 4I
Municipal councillor – ward 9 and 16				
Cllr. OA Malakane (ward 9)	None	None	N/A	N/A
Cllr. R Khoza (ward 16)	None	None	N/A	N/A
GTLM - Municipal manager				
Cllr R.S Mamekoa	None	None	N/A	N/A
SDM - Municipal manager				
Mr. Seporo Masemola	None	None	N/A	N/A
Mr Philemon Mphahlele	17 May 2018	Requested to be registered as an I&AP	Added Mr Mphahlele to the register of I&APs	N/A

Interested and Affected Parties	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this ESR where issues and or response were incorporated
Organs of state				
DWS Mpumalanga – Lydenburg/Mashishing Office	None	None	N/A	N/A
Communities				
Roka Malepe Traditional Council - Manawe Malepe	None	None	N/A	N/A
Babina Tlou Community – Mphofelo Kgaogelo	None	None	N/A	N/A
DRDLR				
Ms Makhanana Senwana	None	None	N/A	N/A
Traditional Leaders				
Roka Malepe Traditional Council - Manawe Malepe	None	None	N/A	N/A
Babina Tlou Community – Mphofelo Kgaogelo	None	None	N/A	N/A
Limpopo Department of Economic Development, Environment and Tourism				
Juliet Mukhari	None	None	N/A	N/A
Other Competent Authorities affected				
Limpopo Heritage Resources Agency (LHRA)	None	None	N/A	N/A
Limpopo Department of Agriculture, Forestry and Fisheries (DAFF)	None	None	N/A	N/A
Lebalelo Water User Association B. Bierman P. De Wek A.J Collier	19th May 2018	Requested to be registered as an I&AP	Added LWUA to the register of I&APs	N/A
Other affected parties				
Historical disadvantaged communities				
None identified	N/A	N/A	N/A	N/A
Land claimants				
None	N/A	N/A	N/A	N/A
Interested parties				

Interested and Affected Parties	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this ESR where issues and or response were incorporated
None identified	N/A	N/A	N/A	N/A

(b) Formal announcement of the project

An advertisement was published in the local newspaper "Platinum Gazette" on 18 May 2018. Refer to Addendum 4C for a copy and proof of this advertisement. Four site notices were placed at and around the site on 17 May 2018. Two site notices were placed at the Havercroft Operation and two site notices were placed at the Annesley Mine. Refer to Addendum 4D for a copy and proof of the site notices placed. Letters were sent to all stakeholders as well as the Babina Tlou and Roka Malepe Community on 15 May 2018.

Details of the application were included in the notices placed in the designated areas mentioned above. The nature and the location of the activity, where further information can be obtained was added to the site notice. The applicant's intention to submit an application is clearly stated on the notice and comments in response to the site notices and advertisements are acknowledged. The competent authority will receive a copy of the newspaper advertisement which indicates the name of the newspaper and the date of publication. A picture of the site notice along with the coordinates of the site notice will also be sent to the competent authority and lastly copies of the written notices that were submitted by email or hand delivered will also be sent to the competent authority.

A community meeting was held on the 29th of October 2018 at 13h00 at Gamalepe with the Roko Malepe community. Various issues were raised regarding previous problems that the community has experienced. See Addendum 4G for the minutes of the meeting with the Roko Malepe Community and Addendum 4H for the attendance register of the Roko Malepe Community meeting.

Another community meeting was held on the 14th of January 2019 at 11h00 with the Babina Tlou community. The Madibeng Development Committee were present and various issues were raised regarding the application. See Addendum 4I for minutes of the meeting with the Babina Tlou community and their concerns addressed. Refer to Addendum 4J for the attendance register.

(c) Environmental Scoping Report and Environmental Impact Assessment Report and EMP

The ESR was sent to all registered stakeholders, the Babina Tlou and Roka Malepe Community. No comments were received.

The EIAR/EMP will be sent to all registered stakeholders, the Babina Tlou and Roka Malepe Community.

All I&APs are given the opportunity to comment on the final report if they are registered. This includes any issues that they have with the proposed activity and that they believe may be of significance in the consideration of the application. These comments need to be submitted within the specified timeframe.

The submission of the comments is received by the EAP. The organs of state have 40 days to comment (failing to do so will be taken as no comment) The DWS has 60 days in which to comment. If there are no comments within this time, then it will be regarded as no comments given to the CA.

Comments and responses are included in a separate report what is submitted with the EMP. Within 12 days of the date of decision taken by the department, all I&APs should be notified. They should also be notified that an appeal may be lodged.

All comments are included in Part A(h)(iii) below.

(d) Decision making announcement to stakeholders and I&APs

To be provided once received.

iii) Summary of issues raised by interested and affected parties

The main concerns that were raised regarding the project was the issue of the graves on the mining site. This issue is being solved by the mine manager and the Community Liaison Officer (CLO). Families are also concerned regarding the deaths of miners during occupation. The mine has put in place various safety protocol and measures to ensure that this does not occur. The issue of employment in terms of each community involved was raised and a working plan was suggested to ensure that the correct community is involved in the correct part of the project. The mined-out quarries at Havercroft were brought up and it was said that they will be sloped.

iv) The Environmental attributes associated with the sites – baseline environment

The environmental attributes described below include socioeconomic, social, heritage, cultural, geographical, physical and biological aspects. Refer below for the following:

a. Type of environment affected by the proposed activity - its current geographical, physical, biological, socio- economic, and cultural character;
b. Description of the current land uses;
c. Description of specific environmental features and infrastructure on the site; and

d. Environmental and current land use map - which shows all environmental, and current land use features.

1 Geology

Information for this section was extracted from the Integrated water and waste management plan (IWWMP) (Shangoni Management Services, 2012), and the Geohydrological impact assessment as input to the Section24G Rectification (Shangoni AquaScience, 2017):

The 2628 East Rand 1:250 000 geological map indicates that Annesley Mine is directly underlain by rocks of the Timeball Formation belonging to the Pretoria Group and the Transvaal Sequence of rocks believed to be of Vaalian age.

The Timeball Hill Formation consists of one or more beds of quartzite sandwiched between shale at the base and at the top of the unit. The entire Pretoria Group is widely intruded by dolerite dykes and sills. A minimum of four distinct diabase sills, irregularly weathered and probably of Bushveld lgneous Complex origin are intrusive along bedding planes near and within the ore body.

The intrusive bodies vary in thickness from 0.5 m to 5 m and appear to upwardly transgress through the ore body from east to west. The ore above and below these sills displays alteration through contact metamorphism (EMPR, 2003).

A minimum of six, often very irregular, sub-vertical dolerite dykes of Karoo age transect the ore body along strike, from south-west to north-east. They are usually deeply weathered and deep gullies mark their position on the surface. Their effect on the ore appears to be minimal. Only minor faulting and other structural deformation have been observed. Any water compartments that may exist lie below the mining operations at depths more than 50 m (EMPR, 2003).

The Bushveld Igneous Complex covers some 15,000km² of the old Transvaal Province and in the north-east its thermal metamorphic effects were most penetrative. Argillaceous zones within the Pretoria group underlying the Bushveld intrusion were most conducive to the formation of high grade Andalusite. The greater purity and relatively large crystal size of andalusite in the Limpopo Province as compared to the North-West Province is probably due to metamorphic conditions prevailing for a longer period of time. The Pretoria group is a cyclic sedimentary sequence deposited in a deeply subsiding basin, and shows remarkable consistency in its continuity, width and chemical composition. Marker zones within individual formations of the group have been traced for many kilometres along the strike.

1.1 Geology at the site

The ore zone comprises principally of quartz, feldspar, biotite and andalusite bearing hornfels. Accessory minerals of chlorite and staurolite occur. No sulphide mineralisation occurs in the ore body.
The orthorhombic andalusite crystals occur speckled throughout the hornfels, and vary in size between >0.5mm-12mm in cross -section.

The andalusite crystals release readily from the host rock due to the retrogressive formation of sericite along the crystals boundaries. This sericite is formed as a result of weathering. The staurolite hornfels hanging wall bands approximately defines the limit of weathering, which is also the mining limit for suitable ore having readily liberated crystals.

The entire ore body is underlain by a diabase sill approximately 40m below the footwall. The ore body is also intersected at intervals along the strike by dolerite dykes, the extent of which is not known.

2 Climate

Information for this section was extracted from the IWWMP (Shangoni Management Services, 2012):

2.1 Regional climate

The climate is moderate to hot, with occasional, very hot conditions in the low-lying valleys. The average daily temperature variation is 15°C. The area is part of a major mountain range and the winds blow consistently from the northeast. The rainy season lasts from late October until April with a maximum in November, mainly in the form of thunderstorms from the south west, but also light to moderate precipitation blown in from the east. The rainfall is fairly low and in 12% of all years there are severe drought conditions. There is no frost.

2.2 Rainfall and evaporation

The mean monthly rainfall of the area is 559mm, which is higher than that of the surrounding area as a result of the microclimate (topography and aspect).

Table 7: Rainfall statistics

Month	Average (mm)	Days with more than 1 mm rain
January	95	9,8
February	84	6,8
March	70	6,8
April	20	2,6
May	8	2,2

Month	Average (mm)	Days with more than 1 mm rain
June	4	1,3
July	4	1,3
August	8	1,7
September	19	1,8
October	59	6,3
November	102	10,1
December	86	8,4
Annual	559	59

Table 8: Evaporation

Month	Evaporation (mm)
January	212
February	174
March	174
April	139
May	121
June	102
July	119
August	167
September	228
October	259
November	228
December	217
Average	2140

2.3 Temperature

Table 9: Temperature for Annesley

Month	Temperature	
	Max	Min
January	30,1	17,3
February	29,7	17,4
March	28,2	16,2
April	27,4	12,1
May	24,5	8,1
June	21,7	3,9
July	21,6	4,0
August	24,0	6,9

Month	Temperature	
	Max	Min
September	27,5	11,3
October	30,4	14,6
November	30,2	16,4
December	30,1	17,4
Annual	27,1	12,2

2.4 Extreme events

The area experiences several extreme events on a regular basis, including frost, hail, drought, and high winds.

3 Topography

Information for this section was extracted from the Geohydrological impact assessment as input to the Section24G Rectification (Shangoni AquaScience, 2017):

The elevation of the mining area varies between 780 meters above mean sea level (mamsl) in the north to over 1070 mamsl in the south. The mining area is located on the north-eastern slope of the Radingwane Mountain. The ore body outcrops along the lower slopes of the mountain range, close to the valley floor. The quarry area starts at an elevation of 780 mamsl rising up the northern slope of the Radingwane Mountain range to a maximum elevation of 987 mamsl. Although the slope is intersected by many well-defined gullies, no major ravines are present on-site.

4 Soil

Information for this section was extracted from the Approved EMP (Shangoni Management Services, 2006):

The mining area is dominated by rock with limited soils. Red-massive or weak structured soils with high base status. The soils on the mountain slopes overlying the ore body are skeletal and only developed in localised potholes and as a component of the scree made up of metamorphic (hornfels) schists, diabase still material and quartzite rocks.

The major components of the topsoil are weathered silica and clay materials, chiefly loamy biotite and rich in porphyroblasts of staurolite and or garnets and cordierite. The topsoil is generally friable, politic, with an abundance of gravel and pebbles of all sizes. The terrain and types of soil in the area make it prone to erosion.

5 Pre-mining land capability, land use and existing infrastructure

Information for this section was extracted from the Approved EMP (Shangoni Management Services, 2006):

The area is disturbed by the existing mining excavation. The area is classified as Wilderness land as defined by the Chamber of Mines Rehabilitation Guideline. The slope of the majority of the site is considered steep, with soils being less than 250mm in depth and the volume of rocks larger than 100mm being more than 50%. The land was classified to be arable land and suitable grazing land. The entire mining area roughly comprises: Wilderness land: 50% Arable Land: 0% Grazing Land: 50% Wetland: 0%

6 Vegetation

Certain information for this section was extracted from the Approved EMP (Shangoni Management Services, 2006):

The mine is located in the Savanna Biome and within the Mixed Bushveld and Sourish Mixed Bushveld veld type (According to Acocks 1975). According to Mucina and Rutherford this area is classified as the Ohrigstad Mountain Bushveld vegetation unit (SVcb 26). This vegetation unit is characterised by open to dense woody layer, with associated woody and herbaceous shrubs and closed to open grass layer. Moderate to steep slopes on mountainsides and sometimes deeply incised valleys; also fairly flat terrain in a few places.

The quarry and plant areas are significantly disturbed. Heaps of overburden occur near the quarries and these heaps are heavily infested with *Xanthium spinosum* (Spiny cocklebur) and *X strumarium* (Large cocklebur). Of particular concern is the invasion of *Nicotiana glauca* (Wild tobacco) and *Opuntia* spp (Common prickly pear).

No red data species were noted.

Table 10: Invader plant species found on Annesley Andalusite Mine

Scientific name	Common name
Nicotiana glauca	Wild tobacco
Xanthium spinosum	Spiny cocklebur
Xanthium strumarium	Large cocklebur

7 Animal life

Information for this section was extracted from the Approved EMP (Shangoni Management Services, 2006):

7.1 Mammals

The following larger mammals (amongst many more) are found in the general area: Kudu (*Tragelaphus strepiceros*), Klipspringer (*Oreotragus oreotrachus*), Grey Rhebok (*Pelea capreolus*) which is classed as Endangered, Common Duiker (*Sylvicapra grimmia*), Grey buck (*Raphicerus malanotis*), Bushpig (*Potamochoerus porcus*), Caracal (*Felis caracal*), Jackal (*Canis mesomelas*), African Wild Cat (*Felis lydic*)a, Leopard (*Panthera pardus*) which is classed as Endangered, Porcupine (*Hystrix africaeaustralis*), Dassie (*Procavia capensis*), Brown Hyaena (*Hyaena brunnea*), Slender Mongoose (*Galerella sanguinea*), Scrub Hare, (*Lepus saxatilis*), Chacma Baboon (*Papio ursinus*).

7.2 Birds

Birds that were recorded on the site were identified visually and with aid of audio recognition. Only a small fraction of the bird population was encountered. One of the species on the list White backed vulture is labelled by the IUCN (2000) as "vulnerable to extinction with an estimated continuing decline of at least 10% within the next 10 years. A pair of Black Eagles nest less than 1km from the current mining site.

8 Surface water

Information for this section was extracted from the IWWMP (Shangoni Management Services, 2012), the Aquatic Ecosystem Delineation Report (Galago Environmental, 2016), and the Geohydrological impact assessment as input to the Section24G Rectification (Shangoni AquaScience, 2017):

The mine lies in the Primary Catchment of the Olifants River and the Quaternary Catchment referred to as the B71F draining region as defined by the DWS. The applicable water management area is the Olifants and the responsibility of the Mpumalanga Regional DWS. The quaternary catchment B71F has a mean annual precipitation of 799.91mm and mean annual runoff of 101.3%.

The area in which the mine is located shows an abundance of non-perennial streams flowing down the escarpment. There is no permanent natural surface water on the mining site. The area is drained by several non-perennial water courses. The most southern section of the mine area is drained by several intermittent streams flowing into a larger northern flowing stream which eventually confluences with the Olifants River. The northern section of the mine is drained by a number of NW flowing intermittent streams which flows to the Sekgorong River, forming part of the greater Olifants River catchment.

Water quality monitoring was done in March 2016 (Chemical and Microbiological Analysis Report: Letaba Environmental Services, 2018). Refer to Table 11 below for the results.

Table 11: Surface water quality

Variable	Unit	Limit	Sample number		
			ANN1	ANN3	ANN6
pH		6.0-9.0	7.84	7.36	7.81
Conductivity*	mS/m	≤70	15.9	363.0	414.0
Total dissolved solids	mg/l	≤450	116	2106	2474
Fluoride	mg/l	≤1.0	<0.05	<0.05	<0.05
Chloride	mg/l	≤100	27.0	397.9	479.3
Nitrate: N	mg/l	≤6	<0.02	<0.02	1.35
Phosphate: P	mg/l		<0.02	<0.02	<0.02
Sulphate	mg/l	≤200	19.3	389.0	511.0
p-Alkalinity			0.0	0.0	0.0
m-Alkalinity			12.3	137.5	278.1
Carbonate			0.0	0.0	0.0
Bicarbonate			15.0	167.7	339.1
Total hardness		≤50	72.7	941.0	1097.7
Calcium hardness			48.1	302.0	341.2
Magnesium hardness			24.5	639.1	756.6
Calcium	mg/l	≤32	19.3	120.9	136.6
Magnesium	mg/l	≤30	6.0	155.2	183.7
Sodium dissolved	mg/l	≤100	5.3	161.7	326.0
Potassium dissolved	mg/l	≤50	0.87	9.11	5.02
Iron dissolved	mg/l	≤0.1	<0.002	<0.002	<0.002
Manganese dissolved	mg/l	≤0.05	<0.005	<0.005	<0.005
Sum Cation	me/l		1.70	26.07	36.25
Sum Anion	me/l		1.72	26.09	36.28
Turbidity	Ntu		20.11	8.21	47.99
Suspended solids	mg/l		29	11	58
Total viable organisms*	per 100ml	≤75	53	278	307
Total coliform Org	per ml	≤5	<1	89	111
Faecal coliform Org	per ml	0	<1	3	53

ANN1 - Upstream of the Segorong Spruit

ANN3 - Penge Dam

ANN6- Pollution control dam

9 Groundwater

Information for this section was extracted from the Geohydrological evaluation for the IWULA report (Aurecon, 2010)) (from the IWWMP, 2012 (Shangoni Management Services)), and the Geohydrological impact assessment as input to the Section24G Rectification (Shangoni AquaScience, 2017):

According to the published 1:250 000 geological map (2430 Pelgrims Rest), the area under investigation is underlain by the Timeball Hill Formation that forms part of the Pretoria Group and mainly comprises of andesitic lava, shale and quartzite. Diabase dykes and sills of the Upper Vaalium age have intruded the Pretoria Group.

The ore zone principally comprises of quartz, feldspar, biotite and Andalusite bearing hornfels. The ore body outcrops/sub-outcrops against the north-eastern slopes of the Radingwane Mountain, which is capped by Daspoort Quartzite of the Daspoort Formation. The surface of the ore body is covered by a layer of rubble, between 0.5m to 6m thick, consisting primarily of quartzite boulders, occasional lava boulders and very little soil.

The ore body is a metamorphically altered alumina-rich shale horizon. It is essentially a quartzbiotite-andalusite hornfels with minor amounts of garnet and staurolite. The ore body varies between 40m and 50m in thickness, strikes NW and dips on average 15° to the SW.

The geological map indicates the presence of several regional linear structures, comprising of NESW striking dolerite dykes and NW-SE striking diabase dykes. The drainage line through the mine area runs parallel to the regional orientation of the diabase dykes.

They are usually deeply weathered and deep gullies mark their position on the surface. Their effect on the ore appears to be minimal.

A minimum of four distinct diabase sills, irregularly weathered and probably of Bushveld Igneous Complex origin, are intrusive along bedding planes in the vicinity of and within the ore body. They vary in thickness from 0.5m to 5m and appear to upwardly transgress through the ore body from east to west. The ore above and below these sills, display alteration through contact metamorphism. Only minor faulting and other structural deformation have been observed.

Groundwater occurrence favours weathered shale, brecciated or jointed zones and especially the contact zone between intrusive diabase sheets and shale. These contact zones would usually act as targets for groundwater exploration. To the contrary it must be stated that little groundwater seepage from the contact

zones between shales and diabase/dolerite dykes intercepted in the mining area occur. During the site visit, a small volume of water accumulated at the base of the open quarries was observed. No active dewatering takes place in the open casts. The contact between the diabase and shale where fracturing usually takes place and act as preferential flow paths for groundwater may have been metamorphosed with no distinct contact and consequently, little fracturing. Future exploratory drilling on these contact zones will shed more light on this issue.

9.1 Groundwater use

There is only one existing borehole (ANBH Mine) within the Annesley mining area, which deliver a yield of approximately 10 000 l/d (0.12 l/s). Water from this borehole is used as domestic water (cleaning and personal hygiene purposes only). Some boreholes outside the mining area exist, most of which are being used by the local community.

Table 12: Summary of boreholes identified during the hydrocensus

BH number	Owner	Static water level (mbgl)	User application
ANBH Mine	Annesley Mine	BH Sealed	Domestic use
ANBH Penge	Annesley Mine	78.8	Process Water
ANBH Chief	Segorong chief	BH Sealed	Domestic use
H12-2270	DWS	BH Sealed	Domestic use
BH School	Ga Malepe school	BH Sealed	Domestic use
ANW 1 (well)	Ga Malepe community	0.5	Domestic use

From the hydrocensus data it can be concluded that groundwater is being used as source of potable water in the area. Based on the acquired data, the average yield of a successful borehole in the study area is in the region of 1ℓ/s (3,600ℓ/hour). Based on the investigation and data acquired from the mine, a volume of ~1350m³/day of groundwater are being abstracted from the mine and adjacent properties. The majority hereof is being abstracted from the "Old Penge Shaft" which amounts to an average daily abstraction of 1,333m³/day. The mine further abstracts less than 10,000ℓ/day from a borehole ("ANBH Mine") located close to the Annesley plant. The neighbouring communities utilise groundwater for domestic purposes from 4 identified boreholes and 1 hand dug well.

It must be stated that it was not always practical possible to measure the yields of the boreholes and as no records for the boreholes, exist, a qualified guess was made. This was done in conjunction with information provided by mine personnel. The same applies for the volume of water being abstracted from boreholes.

9.2 Groundwater levels

The mining area is underlain by a diabase sill of approximately 100m thick, and is concordant with the sedimentary rock in which it intrudes. This sill is approximately 40m below the footfall of the ore body. Several dolerite dykes intersect the ore body, but none of these will be mined, leaving the water compartments locally intact. Due to the highly undulating nature of the topography, varied geology and localised presence of dykes and sills, the depth to water table in the B71F quaternary catchment varies significantly. This could be less than 10mbgl in some places and more than 40mbgl at others.

It was not possible to obtain measured water levels from the hydrocensus boreholes due to the fact that all the boreholes identified were sealed to prevent equipment theft and contamination. The water level of the "Old Penge Shaft" was measured to be 78.8 mbgl. This is however not representative of the static regional groundwater level as it is deeper than the surrounding boreholes and major pumping from this shaft takes place. The water level in the hand dug well was measured to be at 0.5mbgl. A NGA hydrocensus of registered boreholes in the B71F Quaternary Catchment was therefore undertaken to establish regional groundwater levels for the area.

A total of eight boreholes in the B71F catchment are registered with the Department of Water Affairs (DWA) with only five (5) boreholes located in relatively close proximity to Annesley or within similar geology. The water levels for these boreholes range between 12.93mbgl and 36mbgl.

9.3 Aquifer parameters

Falling head tests ("Slug Tests")

No boreholes were accessible to conduct falling head tests ("slug tests"). The test involves continuous measuring of the water level response in a borehole to the rapid displacement of water therein. This displacement or rise in water level is caused as a result from the introduction of a slug below the rest water level. Data acquired from the "slug tests" are used to calculate the hydraulic conductivity of the substrata in the immediate vicinity of the borehole in order to get an idea of the groundwater flow velocity. Theoretical K-values are presented in Table 13 in order to compare groundwater flow velocities in different rock types.

Table 13: Comparison of the hydraulic conductivity in different rock types

Rock Type	**K (m/day)**
Shale	1×10^{-8} - 1×10^{-6}
Sandstone	10^{-3} - 1
Limestone	10-5 - 1
Basalt	3×10^{-4} - 3
Granite	1×10^{-4} - 3×10^{-2}

Rock Type	K (m/day)
Slate	$10^{-8} – 10^{-5}$
Schist	$10^{-7} – 10^{-4}$
Groundwater movement	
Extremely slow	1×10^{-6}
Very slow	1×10^{-4}
Slow	1×10^{-2}
Moderate	1
Fast	10
Very fast	100

Keeping the (1) relatively low yielding boreholes, (2) little/no groundwater seepage into the open quarries and (3) occurring geological formations in mind, it can be concluded that groundwater movement at the mine will be very to extremely slow. The rock will have a typical hydraulic conductivity of 10^{-6} to 10^{-4}. The advantage of a low hydraulic conductivity is that any pollutants that might accidently leak to the aquifer will migrate at very slow pace.

9.4 Aquifer classification

The DWS have characterised South African aquifers based on the rock formations in which it occurs together with its capacity to transmit water to boreholes drilled into specific formations. The water bearing properties of rock formations in South Africa can be classified into four classes defined as:

1. **Class A - Intergranular**
    - Aquifers associated either with loose and unconsolidated formations such as sands and gravels or with rock that has weathered to only partially consolidated material.
2. **Class B - Fractured**
    - Aquifers associated with hard and compact rock formations in which fractures, fissures and/or joints occur that are capable of both storing and transmitting water in useful quantities.
3. **Class C - Karst**
    - Aquifers associated with carbonate rocks such as limestone and dolomite in which groundwater is predominantly stored in and transmitted through cavities that can develop in these rocks.
4. **Intergranular and fractured**
    - Aquifers that represent a combination of Class A and B aquifer types. This is a common characteristic of South African aquifers. Substantial quantities of water are stored in the

intergranular voids of weathered rock but can only be tapped via fractures penetrated by boreholes drilled into the fractured aquifer.

Each of these classes is further subdivided into groups relating to the capacity of an aquifer to transmit water to boreholes, typically measured in l/s. The groups therefore represent various ranges of borehole yields.

The water-bearing properties of the shale formations are generally more favourable than those of the quartzites due to their greater susceptibility to weathering. The quartzites do, however, constitute productive aquifers where these rocks are fractured and especially in the presence of ferruginization. Lesser and/ or more isolated groundwater occurrences are associated with fault and associated shear zones and with contact zones between diabase sills, dykes, shale and quartzite. Water may also occur in occasional joints and fractures in fresh diabase.

Annesley Andalusite Mine is located in a **d3 aquifer class** region. The groundwater yield potential is classed as low to medium on the basis that most of the boreholes on record in vicinity of the study area produce between 0.5 and 2.0l/s. Higher yields do sporadically occur where groundwater is tapped from good water yielding fractures.

9.5 Regional aquifer classification

According to the regional aquifer classification map of South Africa, the Timeball Hill aquifer has been identified as a minor aquifer with relatively good groundwater quality (average = <300mg/l TDS). Based on the underlying hydrogeology of the project area the aquifer can be classified according to the Parsons classification system as follows:

i. Intergranular and fractured shale/quartzites/diamictite of the Timeball Hill Formation
   a. Minor-aquifer

9.6 Aquifer vulnerability

Tables 14 - 17 summarizes the aquifer classification vulnerability scores for the aquifer/s in vicinity of Annesley Andalusite Mine. The final DRASTIC score of 101 indicates that the aquifer/s in the region has a medium susceptibility to pollution and a medium level of aquifer protection is therefore required.

Table 14: DRASTIC vulnerability scores

Factor	Range/Type	Weight	Rating	Total
D	15 - 30 m	5	3	15
R	10 - 50 mm	4	6	24

Factor	Range/Type	Weight	Rating	Total
A	Fractured	3	6	18
S	Loamy sand	2	7	14
T	0-2%	1	10	10
I	Pretoria	5	4	20
C	-	3	-	-
DRASTIC SCORE = 101				

In order to achieve the Groundwater Quality Management (GQM) Index a point scoring system as presented in Table 15 and Table 16 was used.

Table 15: Ratings for the Aquifer System Management and Second Variable Classifications

Aquifer System Management Classification		
Class	Points	Study Area
Sole Source Aquifer System	6	
Major Aquifer System	4	
Minor Aquifer System	2	2
Non-Aquifer System	0	
Special Aquifer System	0-6	
Second Variable Classification (weathered/fractured)		
High	3	
Medium	2	2
Low	1	

Table 16: Ratings for the GQM Classification System

Aquifer System Management Classification		
Class	Points	Study Area
Sole Source Aquifer System	6	
Major Aquifer System	4	
Minor Aquifer System	2	2
Non-Aquifer System	0	
Special Aquifer System	0-6	
Second Variable Classification (weathered/fractured)		
High	3	
Medium	2	2
Low	1	

The occurring aquifer(s), in terms of the above definitions, is classified as a minor aquifer system. The vulnerability, or the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer, in terms of the above, is classified as medium.

The level of groundwater protection based on the GQM Classification (Table 17):

GQM Index = Aquifer System Management x Aquifer Vulnerability

= 2 X 2 = 4

Table 17: GQM index for the study area

GQM Index	Level of Protection	Study Area
<1	Limited	
1-3	Low level	
3-6	Medium level	4
6-10	High level	
>10	Strictly non-degradation	

The ratings for the Aquifer System Management Classification and Aquifer Vulnerability Classification yield a GQM Index of 4 for the study area, indicating that a **medium level groundwater protection** may be required.

Due to the medium/high GQM index calculated for this area, a medium/high level of protection is needed to adhere to DWS's water quality objectives. Reasonable and sound groundwater protection measures are required to ensure that no further cumulative pollution affects the aquifer, even in the long term.

In terms of DWS's overarching water quality management objectives which is i) protection of human health and ii) the protection of the environment, the significance of this aquifer classification is that if any potential risk exist, measures must be triggered to limit the risk to the environment, which in this case is the i) protection of the secondary underlying aquifers and ii)) the non-perennial streams draining the project area.

9.7 Geochemical characterisation

Shangoni (2014) performed a geochemical study on four (4) mine residue deposit (MRD) samples to identify contaminants of concern and risks pertaining to day to day operation of the mine. Stormwater/leachate emanating from these MRDs are directed towards the pollution control and other water management infrastructure. A summary of the geochemical assessment is discussed below.

The waste locations sampled were:

- Overburden
- HMS Waste
- Primary Waste
- Slimes Slurry (tailings)

The following tests were included in their assessment:

- Aqueous extraction. This procedure indicates which chemical constituents may be solubilised by deionised water.
- Static acid base accounting (ABA). Static tests are the analytical tests used as a screening criterion of the samples, used to determine the difference between the acid-generating capability and the acid-neutralising potential of the samples. Originally developed for the coal mining industry, this procedure provides information on potential of solids to generate or neutralise acid formation and is correlated to the concentration of sulphides and neutralising minerals.

9.7.1 Acid Base Accounting

The results of the ABA analyses are displayed in Table 18 and rock classification guideline in Table 19. According to these results all of the samples are classified as a Type III rock, which according to the guidelines imply that they are non-acid forming. This is largely due to the low almost absent sulphur content. Although the *HMS waste* calculated a Neutralising Potential Ratio (NPR), of 1:1.60, the very low sulphur content of the waste resulted in a Type III classification.

Table 18: Results of acid-base accounting

Acid – Base Accounting Modified Sobek (EPA-600)	**Sample Identification**			
	Primary Waste	**Overburden**	**Slimes**	**HMS Waste**
Paste pH	7.5	8.0	7.9	8.0
Total Sulphur (%) (LECO)	0.02	0.01	0.02	0.01
Acid Potential (AP) (kg/t)	0.625	0.313	0.625	0.313
Neutralization Potential (NP)	7.00	2.50	5.50	0.500
Nett Neutralization Potential (NNP)	6.38	2.19	4.88	0.187
NPR (NP: AP)	11.20	8.00	8.80	1.60
Rock Type	III	III	III	III

Table 19: Rock Classification

TYPE I	Potentially Acid Forming	Total S(%) > 0.25% and NP:AP ratio 1:1 or less

TYPE II	Intermediate (uncertain)	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

9.7.2 Leachate analysis

The results of the aqueous extraction test are displayed in Table 20. The results were evaluated according to the SANS 241: 2011 water quality standards. Where no standard is proposed in the SANS guideline or where relevant, health-based water quality standards as proposed by the DWS (DWAF, 1996) were sourced.

Note *that the solid-to-liquid ratio of 1:4 used in the aqueous laboratory extractions can be considered relatively similar to reality but it must be stressed that in-situ conditions can never be 100% simulated under laboratory conditions. Therefore, any exceedance of the water quality standards should be treated as an indication of potential contaminants only.*

The results in Table 20 indicate that the waste is chemically inactive/inert.

Table 20: Leach results evaluated according to the SANS 241: 2015 water quality guidelines

Parameter	SANS 241: 2015	Primary Waste	Overburden	Slimes	HMS Waste
pH	5.0 - 9.7	7.5	8.0	7.9	8.1
TDS	1200.0	156.0	94.0	176.0	140.0
Alkalinity ($CaCO_3$)	-	64.0	44.0	20.0	16.0
Chloride (Cl)	300.0	27.0	11.0	25.0	21.0
Sulphate (SO_4)	500.0	21.0	9.0	55.0	44.0
Nitrate (NO_3-N)	11.0	0.20	1.80	<0.2	<0.2
Fluoride (F)	1.5	1.30	1.00	0.40	0.40
Silver (Ag)	na	<0.025	<0.025	<0.025	<0.025
Aluminium (Al)	0.3	0.282	0.537	0.687	0.471
Arsenic (As)	0.05	0.013	<0.010	<0.010	<0.010
Boron (B)	na	<0.025	<0.025	<0.025	<0.025
Barium (Ba)	na	<0.025	<0.025	<0.025	<0.025
Beryllium (Be)	na	<0.025	<0.025	<0.025	<0.025
Bismuth (Bi)	na	<0.025	<0.025	<0.025	<0.025
Calcium (Ca)	-	<2	2	4	3
Cadmium (Cd)	0.003	<0.005	<0.005	<0.005	<0.005
Cobalt (Co)	0.5	<0.025	<0.025	<0.025	<0.025
Chromium (Cr)	0.05	<0.025	<0.025	<0.025	<0.025

Parameter	SANS 241: 2015	Primary Waste	Overburden	Slimes	HMS Waste
Copper (Cu)	2	<0.025	<0.025	<0.025	<0.025
Iron (Fe)	2	0.137	0.290	0.633	0.511
Potassium (K)	-	<1.00	<1.00	1.0	1.0
Lithium (Li)	na	<0.025	<0.025	<0.025	<0.025
Magnesium (Mg)	-	<2	<2	4	3
Manganese (Mn)	0.5	<0.025	<0.025	<0.025	<0.025
Molybdenum (Mo)	na	<0.025	<0.025	<0.025	<0.025
Sodium (Na)	200	46	28	33	27
Nickel (Ni)	0.07	<0.025	<0.025	<0.025	<0.025
Phosphorous (P)	-	0.028	0.032	<0.025	<0.025
Lead (Pb)	0.01	<0.020	<0.020	<0.020	<0.020
Antimony (Sb)	0.02	<0.010	<0.010	<0.010	<0.010
Selenium (Se)	0.01	<0.020	<0.020	<0.020	<0.020
Tin (Sn)	-	<0.025	<0.025	<0.025	<0.025
Strontium (Sr)	-	<0.025	<0.025	<0.025	<0.025
Titanium (Ti)	-	<0.025	<0.025	<0.025	<0.025
Vanadium (V)	0.2	<0.025	<0.025	<0.025	<0.025
Wolfram (W)	-	<0.025	<0.025	<0.025	<0.025
Zinc (Zn)	5	<0.025	<0.025	<0.025	<0.025
Zirconium (Zr)	-	<0.025	<0.025	<0.025	<0.025

Results are given in mg/l, except for pH

Solid to liquid ratio – 1: 4

The salinity (TDS) is low with results ranging between 94 mg/l and 176 mg/l, which is mostly contributed by chloride (Cl), sulphate (SO_4) and sodium (Na), while the pH is neutral to slightly alkaline ranging between 7.9 and 8.1. The primary waste recorded an arsenic (As) concentration of 0.013 mg/l which slightly exceeds the SANS guideline but is still within DWS health based guideline of <0.05 mg/l. None of the remaining parameters exceed the SANS guideline and is overall of good quality and of fairly low/inert chemical reactivity.

9.8 Water quality

9.81 Sampling sites

Water quality data was sourced from (Letaba Environmental Services, 2018), report. Information pertaining to the available water quality datasets are shown in Table 21.

Table 21: Water sampling points for chemical constituents

Location name	Comments
ANW1	
ANBH Penge	ANN3 – Penge Dam. This water is abstracted from the shaft next to the borehole.
ANBH Chief	Correct description is: H12-2270. DWS borehole
ANBH Mine	ANN4
ANQ6	
H12-2270	Additional borehole to be drilled. Must be renamed to ANBH Chief

9.8.2 Water quality

9.8.2.1 Interpretation according to relevant standards

Standards & guidelines applicable to the geohydrological investigation were the South African water quality guidelines namely i) the domestic colour coded classification system and; ii) the South African National Standard for drinking water. The hydrochemical results for the water samples taken at Annesley Andalusite Mine, interpreted according to the South African drinking water guidelines, are displayed in Table 22.

Table 22: Hydrochemical data

Variable	Unit	Limit	Sample number
			ANN 4
pH		7.84-8.62	7.72
Conductivity*	mS/m	152.40	447.0
Total dissolved solids	mg/l	450	2836
Fluoride	mg/l	0.43	<0.05
Chloride	mg/l	302.40	414.6
Nitrate: N	mg/l	0.40	<0.02
Phosphate: P	mg/l		<0.02
Sulphate	mg/l	57.27	407.0
p-Alkalinity			0.0
m-Alkalinity			341.3
Carbonate			0.0
Bicarbonate			416.1
Total hardness*		<200.0	1004.7
Calcium hardness			199.0
Magnesium hardness			805.7
Calcium	mg/l	74.13	79.7
Magnesium	mg/l	58.85	316.2
Sodium dissolved*	mg/l	≤100	6.97

Variable	Unit	Limit	Sample number
			ANN 4
Potassium dissolved*	mg/l	≤250	0.87
Iron dissolved*	mg/l	≤0.200	<0.002
Manganese dissolved*	mg/l	≤0.05	<0.005
Sum Cation	me/l		34.01
Sum Anion	me/l		34.03
Turbidity	Ntu		4.93
Suspended solids	mg/l		8
Total viable organisms*	per 100ml	≤100	162
Total coliform Org*	per ml	≤1	22
Faecal coliform Org	per ml	0	<1

ANN4- Plant Borehole

From Table 22, the following can be concluded:

Of concern are the high microbiological results in ANN4. These results are possibly from the settlements in the area.

TDS and EC for ANN4 were above the IWUL limit. The total dissolved solids (**TDS**) is a measure of the amount of various inorganic salts dissolved in water. The TDS concentration is directly proportional to the electrical conductivity (EC) of water. Since EC is much easier to measure than TDS, it is routinely used as an estimate of the TDS concentration. TDS are likely to accumulate in water moving downstream because salts are continuously being added through natural and manmade processes while very little of it is removed by precipitation or natural processes. Domestic and industrial effluent discharges and surface runoff from urban, industrial and cultivated areas are examples of the types of return flows that may contribute to increased TDS concentrations. High TDS concentrations in surface water are also caused by evaporation in water bodies which are isolated from natural drainage systems. The saline pans in the central parts of South Africa are such water bodies. Health effects related to TDS are minimal at concentrations below 2, 000 – 3,000 mg/l TDS.

Chloride for ANN4 was above the IWUL limit. Chloride inputs to surface waters can arise from irrigation return flows, sewage effluent discharges and various industrial processes. Chloride is only detectable by taste at concentrations exceeding approximately 200 mg/l. At chloride concentrations greater than 200 mg/l, there is likely to be a significant shortening of the lifetime of domestic appliances as a result of corrosion.

Magnesium for ANN4 was above the IWUL limit. Magnesium has a bitter taste. This property serves as a natural protection against the ingestion of potentially harmful concentrations. As excess magnesium is readily excreted by the kidney, adverse effects such as the suppression of the central nervous system and heart function are rarely seen. Excess magnesium intake, particularly as the sulphate, results in diarrhoea. Magnesium, together with calcium, is responsible for scaling problems caused by deposits of carbonates in appliances using heating elements and plumbing which transports hot water, and for inhibiting the lathering of soap which results in scum formation.

Calcium for ANN4 was above the IWUL limit. Mineral deposits of **calcium** are common, usually as calcium carbonate, phosphate or sulphate. Calcium bicarbonate, chloride and nitrate are very soluble in water, calcium sulphate is moderately soluble and calcium carbonate and phosphate are insoluble. There is no conclusive evidence to support claims for the increased incidence of human kidney and urinary tract stones (urolithiasis) resulting from the long-term consumption of water with high concentrations of calcium. Calcium is known to mitigate against the toxicity of certain heavy metals. High concentrations of calcium impair the lathering of soap by the formation of insoluble calcium salts of long chain fatty acids that precipitate as scums. This results in excessive soap consumption used in personal hygiene and, in rare cases, household cleaning operations. In addition, the scums are not aesthetically pleasing and lead to, in the long-term, the marking of enamelled surfaces such as baths and hand basins (Department of Water Affairs and Forestry, 1996).

Sulphate for ANN4 was above the IWUL limit. Sulphate is a common constituent of water and arises from the dissolution of mineral sulphates in soil and rock, particularly calcium sulphate (gypsum) and other partially soluble sulphate minerals. Since most sulphates are soluble in water, and calcium sulphate relatively soluble, sulphates when added to water tend to accumulate to progressively increasing concentrations. High concentrations of sulphate exert predominantly acute health effects (diarrhoea). These are temporary and reversible since sulphate is rapidly excreted in the urine. Individuals exposed to elevated sulphate concentrations in their drinking water for long periods, usually become adapted and cease to experience these effects. Sulphate concentrations of 600 mg/R and more cause diarrhoea in most individuals and adaptation may not occur (Department of Water Affairs and Forestry, 1996).

Total hardness for ANN4 was above the IWUL limit. Total hardness for ANN1 was above the Domestic use: Target Water Quality Guidelines limit. The natural **hardness** of water is influenced by the geology of the catchment and the presence of soluble calcium and magnesium minerals. Excessive hardness in water used for domestic purposes causes two main problems. It forms scale on heat exchange surfaces such as cooking utensils, hot water pipes, kettles and geysers. It results in an increase in soap required to produce a lather when bathing and in household cleaning.

9.8.2.1 Groundwater Composition

Major ion composition of the water is used to classify it into various chemical types. Piper (Figure 7), Stiffs (Figure 8) and a Schoeller diagram (Figure 9) were used to present this classification graphically.

The Piper and Stiffs in Figure 7 and 8, respectively indicate that:

- Groundwater from *ANBH Chief* is typical of fresh recently recharged groundwater with a distinct Mg/Ca-HCO_3^- character.
- Quarry 6 (*ANQ6*) displays a water type characteristic of rainwater subjected to evaporation mixed with water of a Mg-SO_4 type character. This water type may also be an indication of ion exchange with the host rock.
- The hand dug well displays a signature of a Na-HCO_3^- type water that is typical of shallow and 'open' groundwater systems in close contact with igneous types of rock or that has an evaporative signature.
- Groundwater from the Penge Shaft (*ANBH Penge*), the on-mine borehole (*ANBH Mine*), including the process water and *PCD* group together and display **similar signatures** based on their respective Stiff diagrams. All four hydrochemical sets display distinct Na/Mg-SO_4(Cl) characters.

A Schoeller diagram displaying the ion ratios for the sampling localities was constructed and shown in Figure 9. The diagram indicates similar ion compositions for the *process water*, *ANBH Mine*, and *ANBH Penge*, the process water sample and water within the PCD. Background groundwater sources display unrelated *signatures* compared to groundwater from the on-mine borehole – *ANBH Mine*, located downgradient from the PCD.

Water abstracted from the Penge Shaft and used in the plant is polluted most probably due to historical mining activities at the old Asbestos Penge Mine and/ or due to the depth of the shaft. The fact that the groundwater from the Penge Shaft, the on-mine borehole, the process water and the PCD share very distinct similarities in ion composition, point towards a process related groundwater contamination effect as measured in the groundwater at *ANBH Mine*. The greatest contributing factor to the poor water quality of *ANBH Mine* is most probably related to the use of process water sourced from the Penge Shaft since the nature of the ore and mine residue deposits is chemically unreactive or inert. The pathway for pollution is either from leaching of the process water storage facilities such as the PCD or from process water spillages.

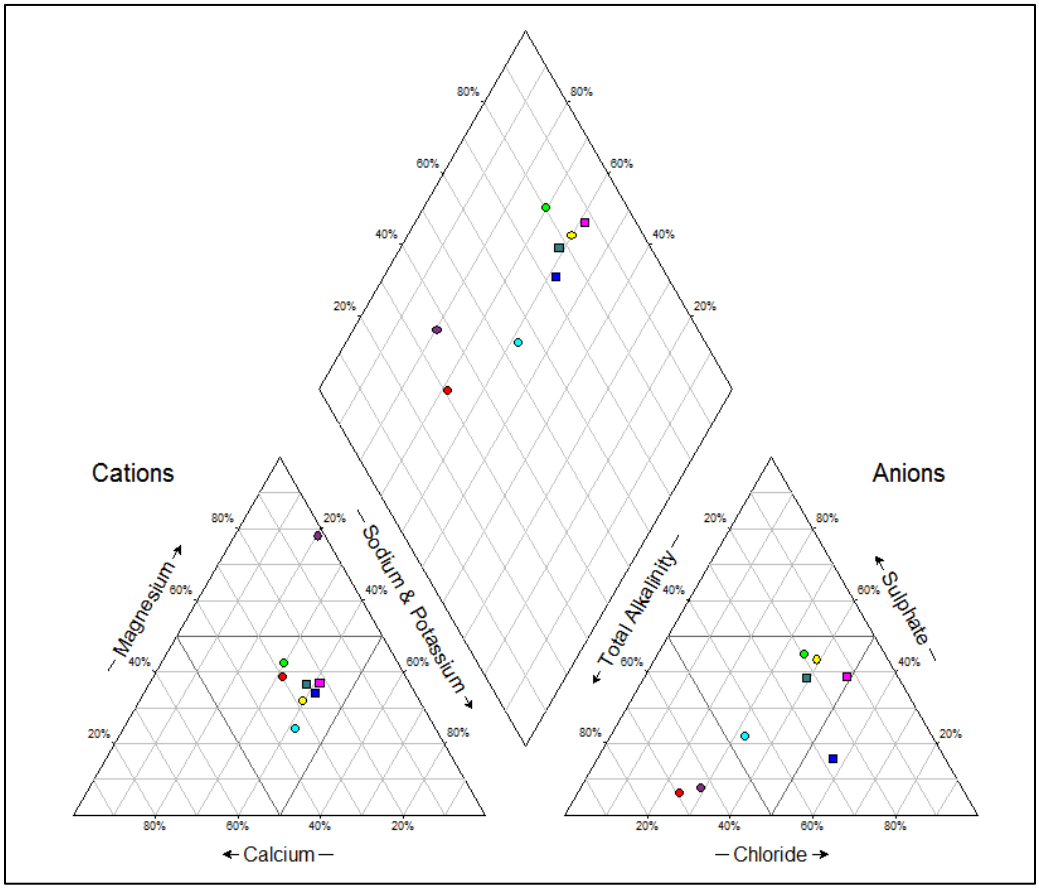


Figure 7: Piper diagram indicating the relative distribution of major cations and anions

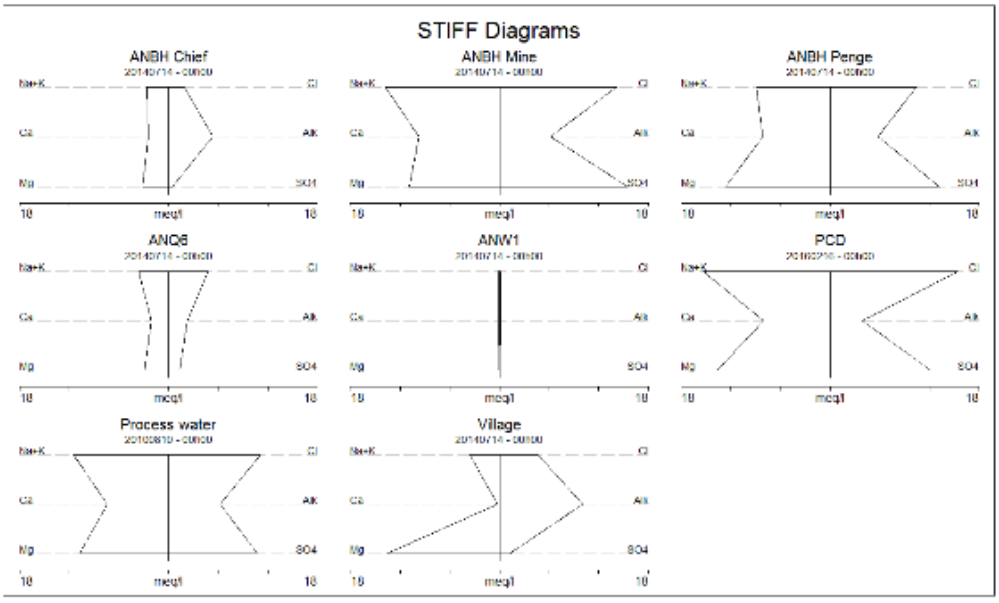


Figure 8: Stiff diagrams indicating the relative distribution of major cations and anions

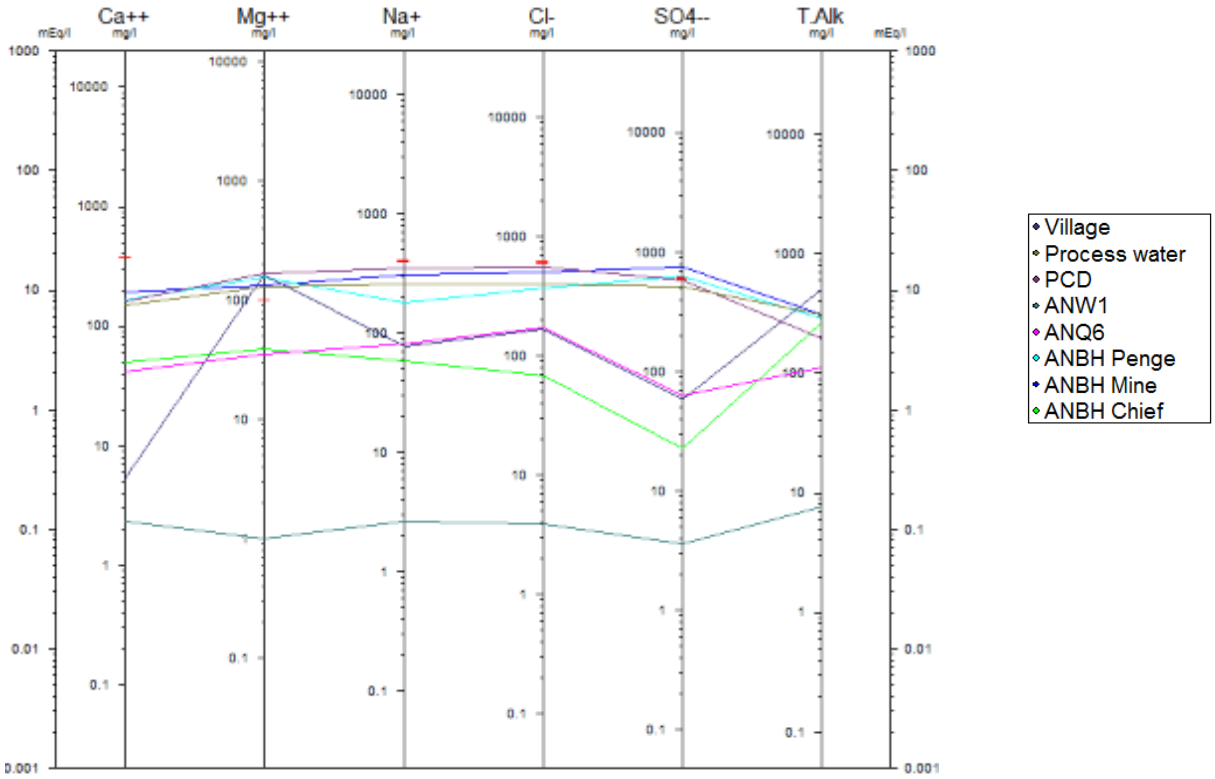


Figure 9: Schoeller diagram indicating the relative distribution of major cations and anions

9.9. Conceptual model

In a typical geohydrological setting, groundwater flow and aquifer development are closely linked to the geology of an area, which is no different for the aquifers underlying Annesley Andalusite Mine.

The area under investigation is underlain by the Timeball Hill Formation that forms part of the Pretoria Group and mainly comprises of andesitic lava, shale and quartzite. Sills and dykes do occur widespread within the study area and groundwater occurrence generally favours these contact zones between intrusive diabase sheets/dykes and the host shale. These contact zones would usually act as targets for groundwater exploration as they may create preferential flow pathways for the movement of groundwater. However, a study by Aurecon (2010) revealed that that little/no favourable groundwater was intercepted on the contact zones between shales and diabase/dolerite dykes. It is expected that contact between the diabase and shale, where fracturing usually takes place and where preferential flow paths may exist, may have been metamorphosed with no distinct contact and consequently little fracturing. In addition, very small volumes of groundwater seepage into the mining pits occur. This emphasizes the impervious nature of the rock and an assumption can be made that groundwater flow in the occurring aquifers will be very slow. However,

groundwater quality data suggest that the on-mine borehole is of poor quality displaying similar signatures to the upgradient PCD (emergency dam) and process water, and seepage is therefore expected to occur from the dam/s. The ore and mine residue deposits are chemically inert, and therefore the abstraction and use of process water from the old Penge Shaft is believed to be the major contributor to the substandard water quality measured.

Based on hydrocensus information, it can be concluded that aquifer system in the study area is classified as a “Minor Aquifer System”. The local population are not solely dependent on groundwater and borehole yields are generally low.

A geochemical study on waste material and mine residue conducted by Shangoni Management Services in 2014 (Shangoni, 2014) revealed that the ore and the waste material generated on site are chemically inert. The leachate tests revealed that none of the parameters exceeded the SANS guideline, is overall of good quality and of fairly low chemical reactivity. A 1:4 (solid:leachate) ratio was used in the extraction tests and although this is unlikely to be replicated *in-situ*, it is sometimes regarded as a more representative ratio to use compared to the general 1:20.

10 Air quality

Information for this section was extracted from the “Air Quality Impact Assessment” (Shangoni Management Services, 2018):

The proposed remining project will involve material handling by excavators and front-end loaders, hauling, material transfer, conveying, crushing, screening and dumping. These remining activities have the potential to become major sources of dust and fine particulates (PM10 and PM2.5) and to lesser extent combustion emissions from vehicles and mobile equipment. This air quality impact assessment, therefore, focused on the emissions of dust and fine particulates (particularly PM10) and considered the combustion emissions qualitatively.

10.1 Remining Air Pollutants

The proposed remining project will involve material handling by excavators and front-end loaders, hauling, material transfer, conveying, crushing, screening and dumping. These remining activities are major sources of dust and fine particulates (PM10 and PM2.5) and to lesser extent other criteria pollutants from vehicle and mobile equipment.

10.2 Effects of Air Pollutants

10.2.1 Dust

Total Suspended Particulates (TSP) constitutes the fraction of atmospheric dust less than or equal to 75µm in aerodynamic diameter. The aerodynamic diameter is the diameter of a spherical particle that has a density of 1g/cm3 and which has the same terminal settling velocity as the particle of interest. TSP is used to estimate dustfall rates (mg/m2/day) and to evaluate the risk of nuisance posed by the dustfall.

10.2.2 Particulate Matter

PM10 and PM2.5 constitutes the atmospheric dust where the aerodynamic d50 diameter is 10µm and 2.5µm, respectively. In a sample of dust, the d50 diameter is the diameter above which fifty percent of the particles are larger, and below which fifty percent of the particles are smaller. PM10 and PM2.5 can harm to the human respiratory- and cardiovascular system and depending on the chemical composition of the small particles, they can also damage plants and contribute to acid rain.

10.2.3 Other criteria pollutants

10.2.3.1 Sulphur dioxide (SO2)

Power plants and industries are the largest contributors of SO2 in the atmosphere. Other smaller anthropogenic sources of SO2 include vehicles and heavy equipment that burn fuel with a high sulphur content. The effects of SO2 include:

- Harm to the human respiratory system;
- The formation of secondary atmospheric particulates- adding to the particulate matter pollution in an area;
- Damage to plants and decreasing their growth (at high concentrations of SO2); and
- The formation of acid rain which can harm sensitive ecosystems.

10.2.3.2 Oxides of Nitrogen (NOx)

Power plants, kilns, vehicles and other machinery that combust fossil fuels are major sources of NOx. The effects of NOx include:

- Harm to the human respiratory system;
- The formation of secondary atmospheric particulates- adding to the particulate matter pollution in an area;
- The formation of ozone; and
- The formation of acid rain which can harm sensitive ecosystems.

10.2.3.3 Carbon Monoxide (CO)

Vehicles and other machinery that combust fossil fuels are major sources of outdoor CO pollution. CO reduces the amount of oxygen transported in the blood and may, therefore, affect the human heart and brain.

10.2.3.4 Benzene

Sources of Benzene include the burning coal and oil, evaporation from fuel service stations, and vehicle exhaust emissions. Benzene is carcinogenic and can cause disorders affecting human blood.

10.2.3.5 Lead

Lead is released from industrial sources (mining, smelting, and refining activities) and vehicles. It can affect almost every organ and system in the human body. The effects of lead include:

- Cardiovascular effects, increased blood pressure and incidence of hypertension;
- Decreased kidney function;
- Reproductive problems (in both men and women); and
- Behaviour and learning problems, lower IQ and hyperactivity, slowed growth, hearing issues and anemia in children.

10.3 Emission Inventory

An emission inventory is a database of emission sources, and their contribution to the amount of pollution entering the atmosphere within a given time and geographic boundary. The development of a complete emission inventory is an important step in air quality management as it not only identifies emission sources but can aid in establishing emission trends over time and identifies areas that require mitigation.

Different methods for calculating an emission inventory depend on the availability of data, time, staff and finances and include, but are not limited to:

- Continuous monitoring to measure actual emissions;
- Extrapolating of short term emissions tests results;
- Mass balance;
- Engineering calculations; and
- The combination of published emission factors.

The emission inventory for the proposed remining project was developed using default emission factors for TSP and PM10. These default emission factors were taken from the Australian Government's National Pollutant Inventory Emission Estimation Technique Manual for Mining and Processing of Non-Metallic 1999 (Refer to Table 23 below).

The emission inventory was set up to assess a routine operational day for a remining scenario at each of the two sites:

- Remining at Segorong - simulates the dust and PM10 where the remined material (waste rock and/or tailings) is hauled from Segorong to Annesley's crushing and screening plant; and
- Remining at Havercroft - simulates the dust and PM10 where the remined material (waste rock and/or slimes) is hauled from Havercroft to Annesley's crushing and screening plant.

The emission inventory found hauling and crushing to be the most significant sources of dust and PM10. Refer to Figure 10 below for source apportionment.

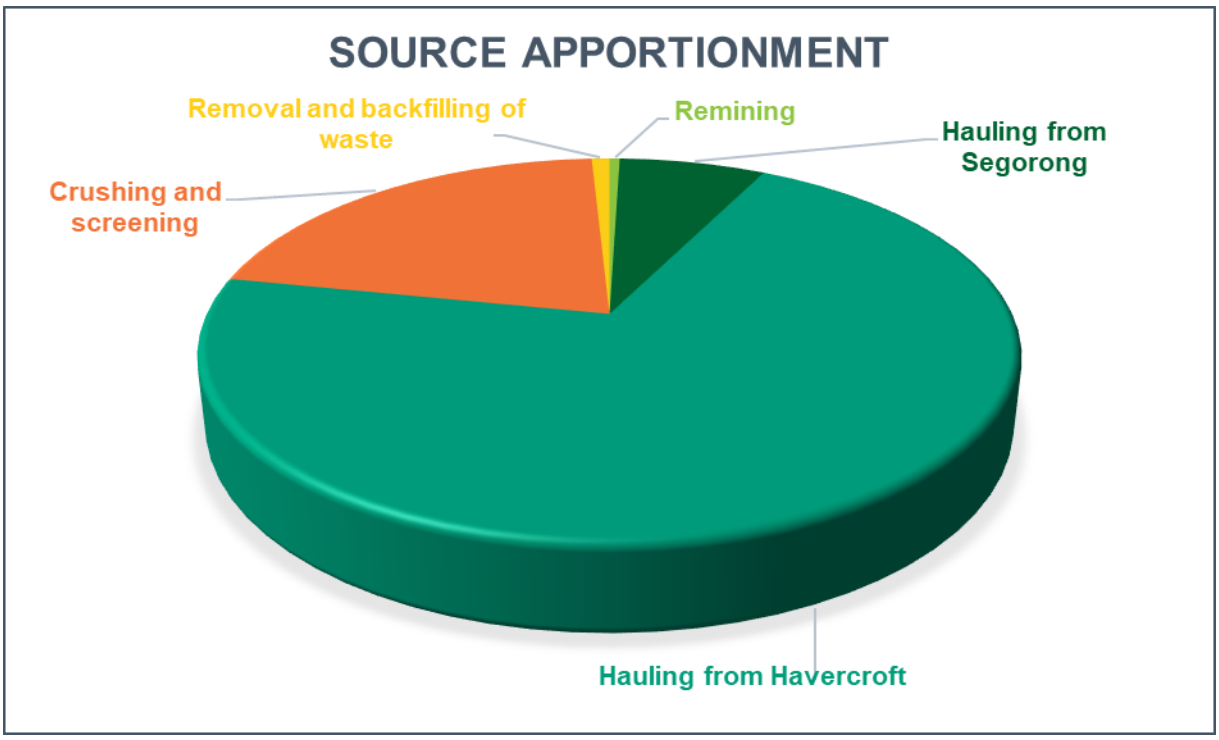


Figure 10: Source apportionment.

Table 23: Emission Inventory

Source	Activity	TSP EF	Unit	PM10 EF	Unit	Activity data	Unit	TSP (g/s)	PM10 (g/s)
Remining	Material handling by excavators & front-end loaders (waste rock)	0.025	kg/tonne	0.012	kg/tonne	61	tonne/day	0.02	0.01

Source	Activity	TSP EF	Unit	PM10 EF	Unit	Activity data	Unit	TSP (g/s)	PM10 (g/s)
	Material handling by excavators & front-end loaders (slimes)	0.025	kg/tonne	0.012	kg/tonne	61	tonne/day	0.02	0.01
	Material handling by excavators & front-end loaders (tailings)	0.025	kg/tonne	0.012	kg/tonne	61	tonne/day	0.02	0.01
Hauling and delivery of material	Hauling at Segorong	4.23	kg/VKT	1.25	kg/VKT	5	VKT/day	0.25	0.07
	Hauling from Havercroft	4.23	kg/VKT	1.25	kg/VKT	53	VKT/day	2.59	0.76
Unloading & material handling at Plant	Trucks (dumping material)	0.012	kg/tonne	0.0043	kg/tonne	61	tonne/day	0.01	0.00
	Handling, transferring and conveying at Plant	0.06	kg/tonne	0.03	kg/tonne	61	tonne/day	0.04	0.02
Plant	Primary crushing	0.2	kg/tonne	0.02	kg/tonne	61	tonne/day	0.14	0.01
	Secondary crushing	0.6	kg/tonne	0.06	kg/tonne	61	tonne/day	0.42	0.04
	Screen 1	0.08	kg/tonne	0.06	kg/tonne	61	tonne/day	0.06	0.04
	Screen 2	0.08	kg/tonne	0.06	kg/tonne	61	tonne/day	0.06	0.04
Handling of waste	Handling, transferring and conveying at Plant	0.06	kg/tonne	0.03	kg/tonne	58	tonne/day	0.04	0.02

Source	Activity	TSP EF	Unit	PM10 EF	Unit	Activity data	Unit	TSP (g/s)	PM10 (g/s)
Removal of waste with trucks	Hauling waste rock to plant	4.23	kg/VKT	1.25	kg/VKT	0	VKT/day	0.02	0.01
Backfilling of waste	Trucks (dumping waste)	0.012	kg/tonne	0.0043	kg/tonne	58	tonne/day	0.01	0.00

10.4 Dispersion Model

10.4.1 Setup

For this assessment a tier two gaussian-plume dispersion model, AERMODview, was used. AERMODview makes use of a terrain pre-processor (AERMAP) and a meteorological pre-processor (AERMETview). Pre-processed MM5 meteorological data was used in the setup of AERMETview.

AERMETview's land use creator tool was used to create a Land Use File using different Land Use Code Selections based on the United states 1992 National Land Cover Data ("NLCD92"). Once the Land Use File was created, the number and period of the different surface sectors were selected and processed by AERMETview's AERSURFACE Utility. This utility generates the albedo, Bowen ratio and surface roughness of the area.

The model domains in AERMODview, for both Havercroft and Segorong, were setup for a distance of 10 km from the centre of the respective sites and plotted on a Cartesian receptor grid matrix with a spacing of 100m. The Universal Transverse Mercator ("UTM") coordinate system (horizontal datum: World Geodetic System 84, WGS-84 system) was used for the model domain base map. The terrain data used in AERMODview was obtained from the Shuttle Radar Topography Mission (SRTM1, version 3, 30 m resolution).

Refer to below for the model source parameters.

Table 24: Model source parameters

Source	Parameters
Remining	Volume source Height – 3 m

Source	Parameters
	Area – Approximately 8000 m^2 Working hours: 24 hours, 365 days per year.
Crushing	Volume source Height – 2 m Area – 7500 m^2 Working hours: 13 hours/day, 365 days per year.
Hauling	Line source Vehicle height – 3.75 m Vehicle width – 3.5 m Length of haul road – Approximately 13 km. Working hours: 24 hours, 365 days per year.

10.4.2 Results

The emissions from the two scenarios were simulated and compared to the National Ambient Air Quality Standards (NAAQS) and the National Dust Control Regulations (NDCR) standards. The evaluation found the following for both remining at Segorong and remining at Havercroft:

- The projected average daily PM10 concentrations exceed the average daily NAAQS (75 µg/m3) for PM10 in proximity to the crushing and screening plant (Refer to Figure 11 and Figure 14);
- The projected annual average PM10 concentrations fall below the annual average NAAQS (40 µg/m3) for PM10 (Refer to Figure 12 and Figure 15);
- The projected average daily dustfall rates exceed the NDCR standard for non-residential areas (1200 mg/m2/day) in proximity to the crushing and screening plant (Refer to Figure 13 and Figure 16).

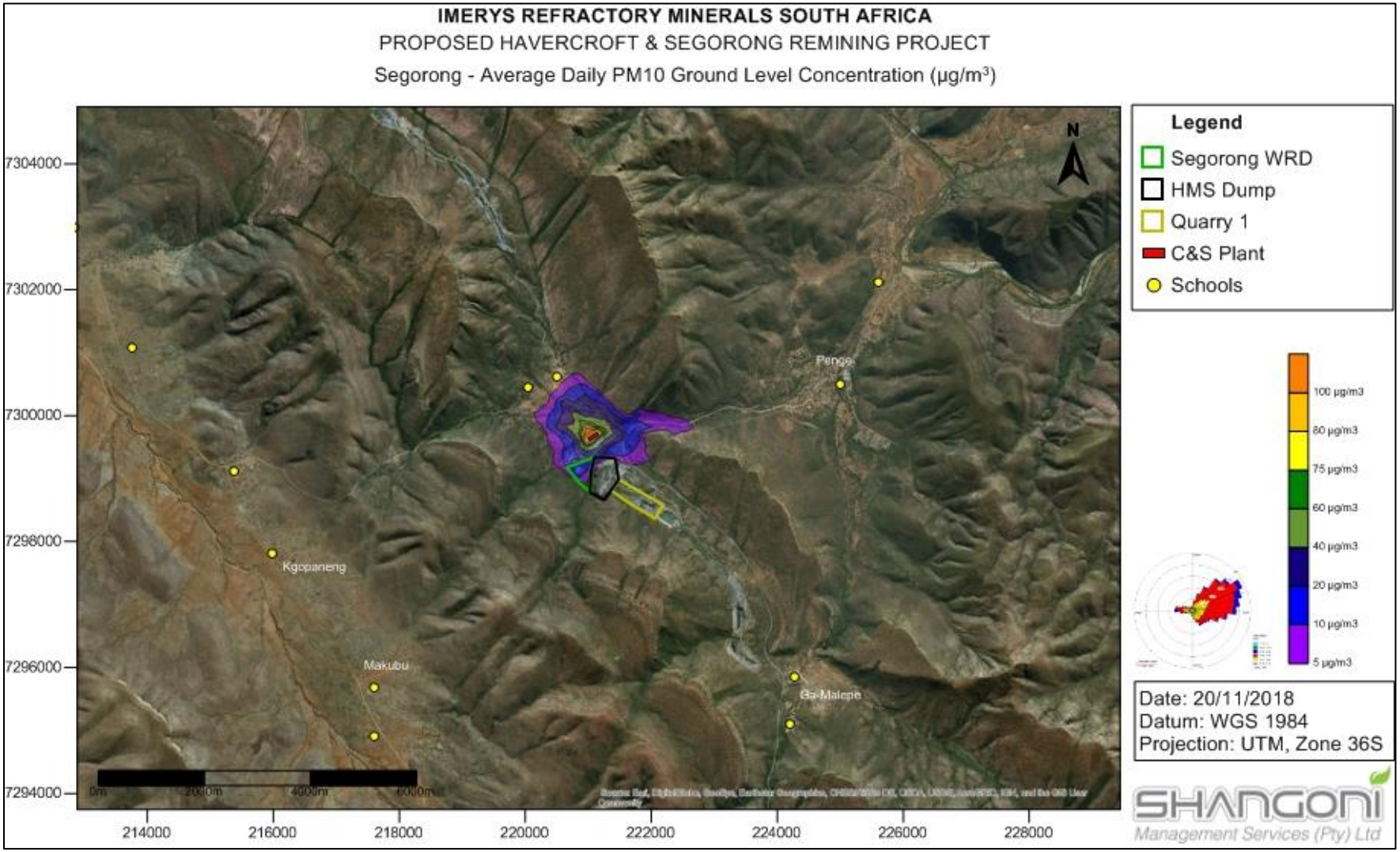


Figure 11: Segorong: Average daily PM10 ground level concentration.

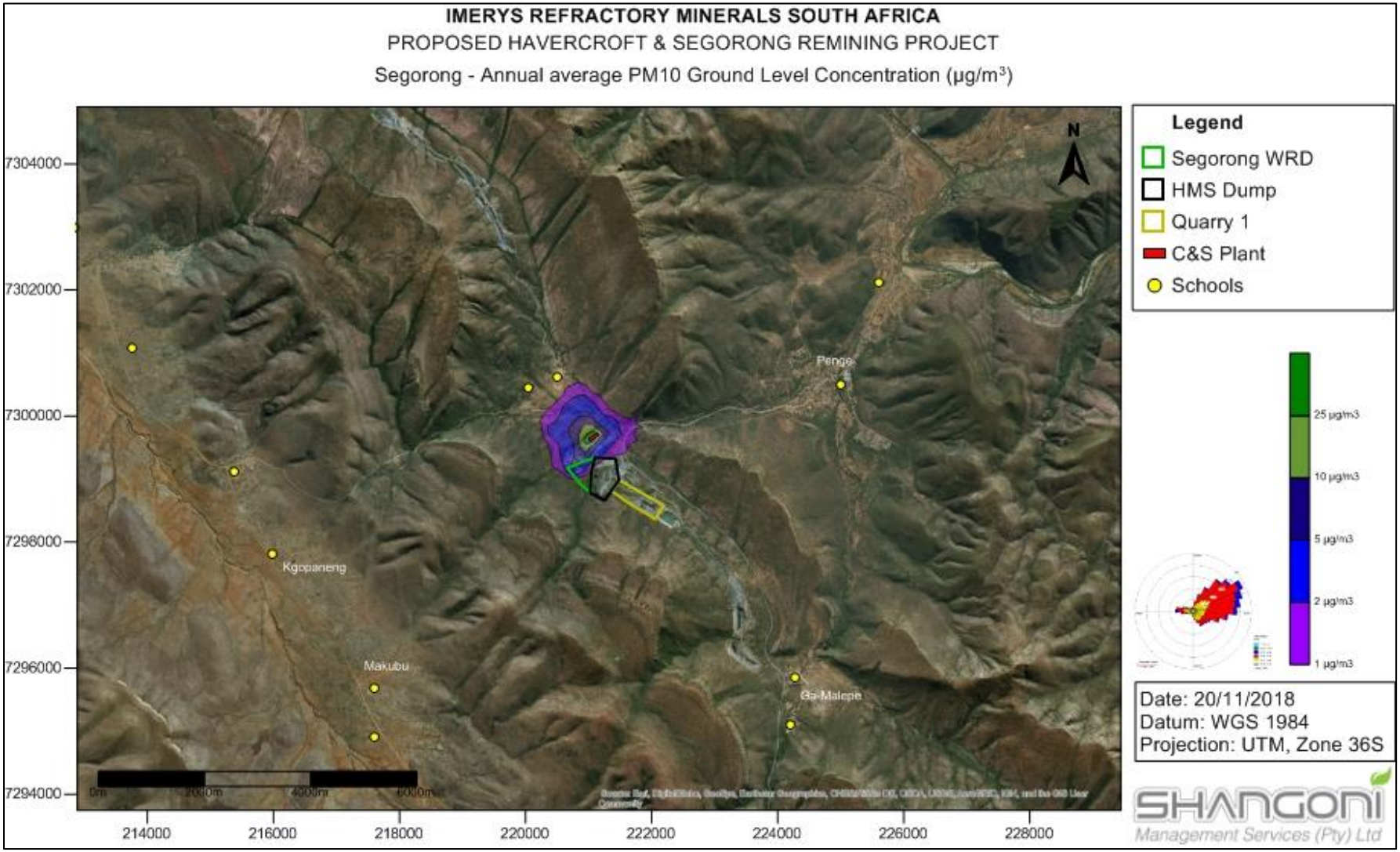


Figure 12: Segorong: Annual average PM10 ground level concentration.

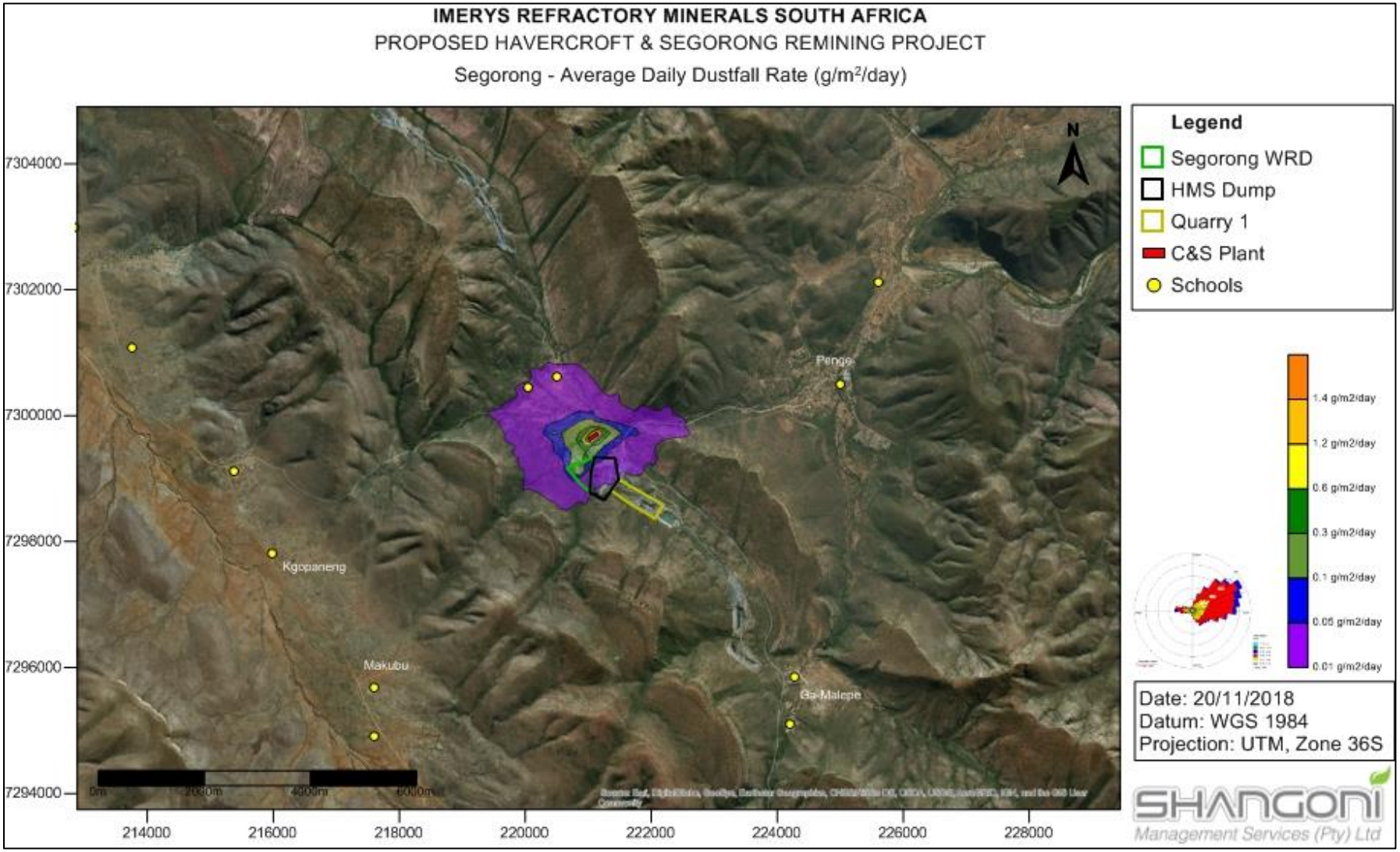


Figure 13: Segorong: Average daily dustfall rate.

Figure 14: Havercroft: Average daily PM10 ground level concentration.

Figure 15: Havercroft: Annual average PM10 ground level concentration.

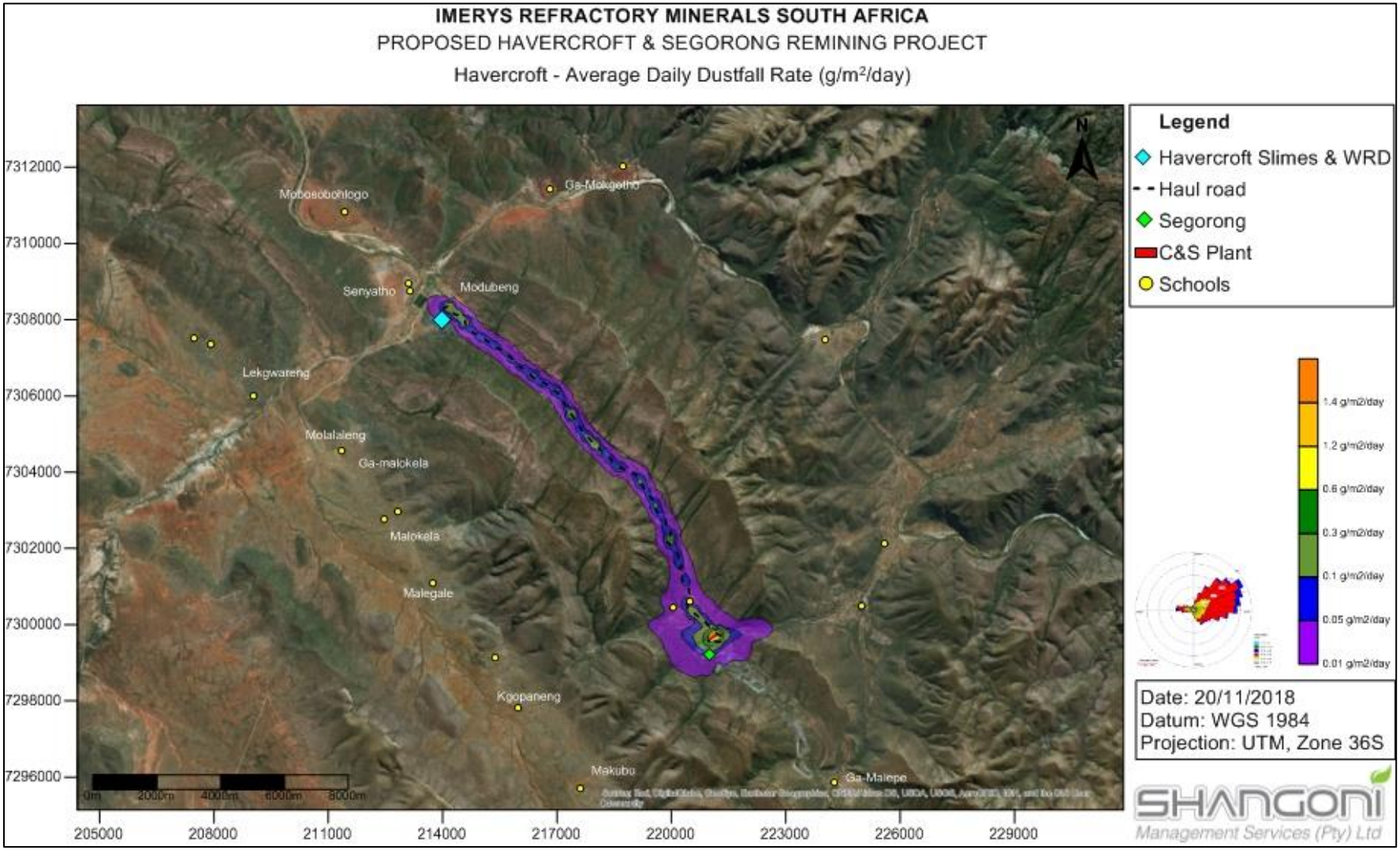


Figure 16: Havercroft: Average daily dustfall rate.

The main conclusion of the air quality impact assessment is that the proposed remining project is likely to result in high to moderate impacts without mitigation. Its anticipated that the application of the mitigation measures as per section 4 will reduce the significance of the impacts to moderate and low.

It is Shangoni's opinion that the proposed remining project may continue if the applicant commits to implementing the mitigation measures recommended in section 4 of this report. These mitigation measures should be improved on, should dustfall- or any ambient air quality monitoring results during the construction, operational and/or the closure phase show exceedances of dustfall or the ambient air quality standards.

11 Environmental noise

Information for this section was extracted from the 'Approved EMP (nd, nd):

No baseline values were determined as the area is classified as rural and the statutory requirement for such areas is known to be 45dB. The only source of noise beyond the boundaries of the mine is expected to be low volume traffic noise from public roads.

12 Visual aspects

There is no specialist study done for visual aspects. The comment below is based on assumptions made during site visits.

Annesley Mine Operation is only visible from the Penge access road, adjacent to the mine. Annesley Andalusite Mine (Havercroft Operation) is visible from the scattered residential areas of the local inhabitants and from the access roads.

13 Cultural and heritage resources

Information for this section was extracted from the Approved EMP (Shangoni Management Services, 2006), and the EMP PAR (BECS Environmental, 2015):

Malepe Tribal Authority grave sites are situated in the proposed mining area. According to the Cultural Resources Survey done by the National Cultural History Museum in August 2001 there are a total of 353 graves. These graves are not yet removed.

Some tools dating to the Early and Middle Stone Age were found within the boundaries of Segorong village but are of low archaeological significance.

No archaeological site dating to the Iron Age was identified in the area of the mining area.

14 Sensitive landscapes

The proposed activities are as follow:

- The remining of the Havercroft Operation slimes dam and waste rock dump, located on the farm Havercroft 99 KT.
- The remining of the Segorong waste rock dump and HMS waste rock dump, located on the farm Annesley 109 KT
- The remining of backfilled tailings in Quarry 1, located on farm Annesley 109 KT.
- The extension of the mining right area to include the Penge Shaft and associated tanks on the farm Penge 108 KT (no environmental authorisation necessary for this step).

There were no specialist studies conducted for the development as the mine is an already existing mine and the same environmental context applies. The only activity to be considered for this application is the remining of already existing mine residue. No new areas will be disturbed.

Three upper tributaries of the Segorong River pass through the farm Annesley 109 KT where the remining of the Segorong waste rock dump and HMS waste rock dump occurs. There is a wetland present on this site. With exception of the topographic location of the systems, the wetland indicators necessary for the classification as wetlands were not observed on site. The wetland found within the extended study area can be considered to be of moderate ecological management class. The REMC was calculated to be in Low/ Marginal condition “Aquatic ecosystems that is not ecologically important and sensitive at any scale. The biodiversity of these floodplains is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers”. The Ephemeral hydrology of the system combined with the impact of the open cast mining somewhat isolates the system from the larger hydrological drainage network.

The 353 graves (Approved EMP, Shangoni Management Services, 2006) were never removed and are still sensitive resources on the area.

Havercroft Operation falls within the Sekhukhune Norite Bushveld which is an endangered threatened ecosystem. The area surrounding the quarries are classified as Critical Biodiversity Area 1.

15 Regional socio-economic aspects

Information for this section was extracted from the IWWMP (Shangoni Management Services, 2012):

The mining site is situated within the SDM and GTLM. The statistics indicated in the table below was collected for the Integrated Development Plan and is valid for 2017-2018.

Table 25: Households in the district

Municipalities	**Population**			**Number of households**			**Average household size**		
	1996	2001	2011	1996	2001	2011	1996	2001	2011
Ephraim Mogale	97 597	115 682	115 682	19 666	24 189	32 284	5,0	4,8	3,8
Elias Motsoaledi	218 622	213 218	213 218	42 641	45 478	60 251	5,1	4,7	4,1
Makhuduthamaga	266 845	258 246	258 246	49 789	52 978	65 217	5,4	4,9	4,2
Fetakgomo	96 945	91 589	91 589	17 376	18 883	22 851	5,6	4,9	4,1
Greater Tubatse	227 127	264 258	264 258	42 427	53 756	83 199	5,4	4,9	4,0
Sekhukhune	**907 137**	**942 993**	**1076 840**	**171 908**	**195 285**	**263 802**	**5,3**	**4,8**	**4,1**

Source: Census (2011)

Since 1996, the number of households in the district has been on an upward trend. In 2011, there are 263 802 households in the district. The average household size is 4.1 in 2011 and was 5,3 in 1996. This means that the extended family set up is beginning to change on a daily basis with modern life styles. The provincial household average size is 3.8 which mean Sekhukhune household average size is still relatively high by comparison.

Table 26: Gender Profile: Males and Females

Municipality	**2011**		**2016**	
	Males	**Females**	**Males**	**Females**
Fetakgomo/ Greater Tubatse	202 656	227 814	238 458	251 923
Makhuduthamaga	121 282	153 075	124 963	158 993
Ephraim Mogale	58 207	65 442	59 908	67 260
Elias Motsoaledi	115 503	133 860	125 133	143 123
Sekhukhune	**497 648**	**579 191**	**548 463**	**621 299**

Source: Census (2011), Community Survey (2016)

Since 1996, sex ratios have not changed much. In 2011, there are 497 428 males compared to 579 191 females. The imbalance can be attributed to large numbers of males who migrate to other provinces to look for work opportunities. As a result of the rural nature of the district of Sekhukhune, there are still persons who work in other provinces such as Gauteng and only come back home monthly or bi-monthly to see their families. This scenario also tells a picture that there might high presence of female headed households in the district.

The implication for the district is that there is a need to develop programmes that target women in particular to create self-employment and educational opportunities where possible.

Table 27: Population growth by race

Race	1996	2001	2011
Africans	898 129	958 594	1 061 550
Coloured	579	727	1 232
Indian/Asian	377	508	1 721
Whites	8 876	7 356	11 015

Source: Census (2011)

The figure below indicates that 99% of the population in Sekhukhune District Municipality is made up of Africans. The remainder 1% comprises Whites, Indians and Coloureds. It is not a surprising trend because a large part of Sekhukhune District Municipality comprises villages under tribal authorities. The 1% of the Whites, Indians and Coloureds are confined to the main towns in the district and mining areas.

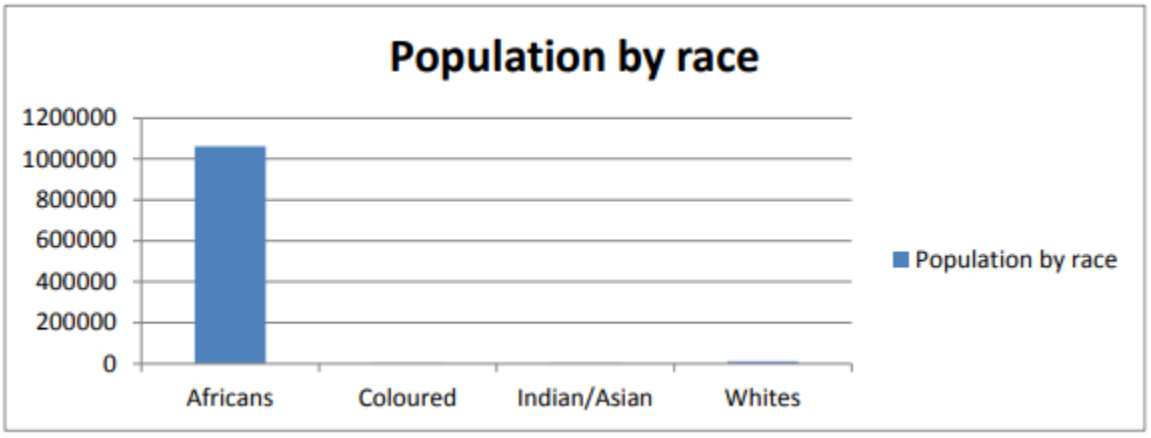


Figure 17: Population by race

Table 28: Age profile

Municipality	Age group	Total
Fetakgomo/Greater Tubatse (LIM476)	0-14	149 186
	15-64	255 695
	65+	24 590

Source (Census 2011)

The male-female ratios are almost equal in the age group below 18 years, but females are almost 60% of the population in the working age group and more than 68% in the senior age group for the Sekhukhune district as a whole. It is obvious then that a significant number of Sekhukhune males have alternative residence away from the district

15.1 Major economic activities and sources of employment

- Annesley Andalusite Mine;
- Local shops;
- Schools and
- Farmers in the Burgersfort/Steelpoort areas.

15.2 Unemployment estimate for the region

There has been a rapid improvement in the household income distribution profile in Limpopo during the past ten years, mainly as a result of social grants. Households living in poverty, with annual incomes ranging from 0 to R19.600 per year, shrank as a proportion of total households from 86% in 2001 to 56.5% in 2011. This group is unable to afford any contribution towards the cost of municipal services. The corresponding proportion of households in this income group for Limpopo Province in 2011 was 55.6%, which is only slightly better than the situation in Sekhukhune District.

The intermediate group, with incomes ranging from R19.601 per year to R153.800 per year, used to comprise 13% of all households in 2011, but has increased to 38%. This group can afford to make meaningful contributions to the cost of municipal services. The high-income group, who can afford to pay the full cost of municipal services, has increased from less than 1% of all households in 2011, to 5.5% in 2011. The income distribution profile is unlikely to keep improving at the same pace as the last ten years, because the social grant programme is already fully taken up. Further improvements will depend on new job creation (GSA 2014).

The SDM like any other District in South Africa is experiencing a decline in formal job opportunities because of the general global economic meltdown. This has led to an escalating unemployment particularly among

the economically active population of 18 years and above. Unemployment rate has encouraged the fast growth of informal sector in the district.

Table 29: Household Income Distribution for Sekhukhune District: 2001 and 2011

Income Group	2001	2011	2001 (%)	2011(%)
No income	80 525	38 450	39.3	14.58
R 1 - R 4800	19 985	17 064	9.76	6.47
R 4801 - R 9600	50 857	32 375	24.8	12.28
R 9601 - R 19 600	25 954	61 827	12.6	23.44
R 19 601 - R 38 200	14 580	56 078	7.12	21.26
R 38 201 - R 76 400	9 307	27 100	4.55	10.28
R 76 401 - R 153 800	3 765	16 313	1.84	6.19
R 153 801 - R 307 600	1 082	9 454	0.53	3.58
R 307 601 - R 614 400	286	3 748	0.14	1.42
R 614 001 - R 1 228 800	113	720	0.06	0.27
R 1 228 801 - R 2 457 600	171	333	0.08	0.13
R 2 457 601 or more	81	274	0.04	0.10
Total	**204 706**	**263 737**	**100.00**	**100.00**

Source: Statistics South Africa (Census 2001 and 2011)

15.3 Housing demand, and availability

The mine is in the Malepe Tribal Area and land allocation is informal. The land is administrated as communal land where small plots are allocated on a “Permission to Occupy” (PTO) basis. A number of formal townships have been established in the region, or is in the construction phase, and stands are readily available.

15.4 Social infrastructure - schools, hospitals, sporting and recreating facilities, shops, police, civil administration

- Churches at Segorong: 4 churches namely; Baptist Church, Segorong RCC, Apostolic Church, St Engenas ZCC.
- Schools in Segorong: Segorong Primary School: (260 pupils, 8 teachers) and Madikoloshe Secondary School (126 pupils, 9 teachers); Sekhukhune District Municipality has 263 000 households. This means there is a need for 263 secondary schools and 526 primary schools. There

exists 536 primary schools and the need is 526 compared to existing 327 secondary schools where the need is 263 secondary schools. Although the average scenario indicates that enough schools have been provided, there is still a challenge due to long walking distances to these educational facilities.

- Businesses in Segorong: Magana Gokatwa (bottle store, not in use), Hygienic Butchery (not in use), Matikwene Eating house (active), Majestic Café, Super Saving Store (active);
- Health Services: Hospital at Penge;
- Recreation Facilities: None;
- Police: Burgersfort;
- Civil Administration: The authority in the area is the Malepe Tribal Authority and is in the jurisdiction of the SDM. The Administrative Centre is at Praktiseer, some 24km to the south.

15.5 Bulk services

There are no Gross Geographic Product (GGP) estimates available for SDM, in which the Annesley Andalusite Mine – Segorong Project resides, since the demarcation was done in December 2000. The closest proxy is to consider sectoral employment. However, there is not a strict correlation between employment and GGP, because a sector such as agriculture has a considerably higher employment co-efficient than a sector such as mining, which is more capital intensive. Sectoral employment figures for SDM are reflected below, because these are the best available at present.

Table 30: Socio-Economic statistics for the area

Sector	Employment number
Agriculture, hunting; forestry and fishing	11357
Mining and quarrying	5618
Manufacturing	3315
Electricity; gas and water supply	707
Construction	3299
Wholesale and retail trade	9180
Transport; storage and communication	2668
Financial, insurance, real estate and business services	2736
Community, social and personal services	17250
Other and not adequately defined	6
Private Households	7642
Undetermined	6844
Total	70622

Community services, which are mostly government, is the largest employer by far, accounting for 25% of employment. It is probably also the largest contributor to GGP. It is evident that government is far more dominant in the Limpopo portion of SDM than in Mpumalanga.

The second biggest employer is agriculture and hunting, with 16% of total employment. In this case, Mpumalanga is the dominant contributor. Trading activities are in third place (13%) and this time the relative contributions from Limpopo and Mpumalanga are more balance, but with Limpopo ahead. This is a reflection of the larger number of people living in the Limpopo part of SDM.

Private household activities are in fourth place at 11%. This time Mpumalanga is well ahead, reflecting the domestic work opportunities that are available at Groblersdal, Marble Hall and Burgersfort. Mining is only the fifth largest employer, but probably the largest or second largest contributor to GGP. Limpopo, with its platinum mines in Tubatse and Fetakgomo, is the dominant area.

All the other sectors, including manufacturing and construction, are relatively small, accounting for less than five percent of total employment each. In-migration is likely to be less than 3000 of the total employment of almost 71,000, which is less than 5%. However, in addition to the total number of locally employed persons, there are probably at least 42,000 men who have families in SDM, but who work elsewhere.

16 Ecosystem Services

The following information was extracted from Walter et al (2005):

16.1 Provisioning services

These are the products obtained from ecosystems, including:

1. Food. This includes the vast range of food products derived from plants, animals, and microbes.
    - No food products are associated with the area of the proposed project.

2. Fiber. Materials included here are wood, jute, cotton, hemp, silk, and wool.
    - No fibre products are associated with the area of the proposed project.

3. Fuel. Wood, dung, and other biological materials serve as sources of energy.
    - No fuel products are associated with the area of the proposed project.

4. Genetic resources. This includes the genes and genetic information used for animal and plant breeding and biotechnology.
    - No genetic resources are associated with the area of the proposed project.

5. Biochemicals, natural medicines, and pharmaceuticals. Many medicines, biocides, food additives such as alginates, and biological materials are derived from ecosystems.
    - No biochemicals, natural medicines, and pharmaceuticals are associated with the area of the proposed project.

6. Ornamental resources. Animal and plant products, such as skins, shells, and flowers, are used as ornaments, and whole plants are used for landscaping and ornaments.
    - No ornamental resources are associated with the area of the proposed project.

7. Fresh water. People obtain fresh water from ecosystems and thus the supply of fresh water can be considered a provisioning service. Fresh water in rivers is also a source of energy. Because water is required for other life to exist, however, it could also be considered a supporting service.
    - Refer to Part A(g)(iv)(6.1) for the river diversion as part of the project. The impacts associated with this river diversion is also included in Part A(g)(v)(1.4).

16.2 Regulating services

These are the benefits obtained from the regulation of ecosystem processes, including:

1. Air quality regulation. Ecosystems both contribute chemicals to and extract chemicals from the atmosphere, influencing many aspects of air quality.
    - No air quality regulation will be influenced by the proposed project.

2. Climate regulation. Ecosystems influence climate both locally and globally. At a local scale, for example, changes in land cover can affect both temperature and precipitation. At the global scale, ecosystems play an important role in climate by either sequestering or emitting greenhouse gases.
    - The land cover in the area has already been changed for mining. No additional land cover will be changed for the proposed project.

3. Water regulation. The timing and magnitude of runoff, flooding, and aquifer recharge can be strongly influenced by changes in land cover, including, in particular, alterations that change the water storage potential of the system, such as the conversion of wetlands or the replacement of forests with croplands or croplands with urban areas.
    - Refer to Part A(g)(iv)(6.1) for the river diversion as part of the project. The impacts associated with this river diversion is also included in Part A(g)(v)(1.4).
    - The mine is currently applying for a water use licence for the diversion of the tributary.

4. Erosion regulation. Vegetative cover plays an important role in soil retention and the prevention of landslides.
    - No additional vegetation cover will be lost.

5. Water purification and waste treatment. Ecosystems can be a source of impurities (for instance, in fresh water) but also can help filter out and decompose organic wastes introduced into inland waters and coastal and marine ecosystems and can assimilate and detoxify compounds through soil and subsoil processes.
    - Refer to Part A(g)(v) for a description of the impact of backfilling with waste on the environment.

6. Disease regulation. Changes in ecosystems can directly change the abundance of human pathogens, such as cholera, and can alter the abundance of disease vectors, such as mosquitoes.
    - No disease regulation will be influenced by the proposed project.

7. Pest regulation. Ecosystem changes affect the prevalence of crop and livestock pests and diseases.
    - No pest regulation will be influenced by the proposed project.

8. Pollination. Ecosystem changes affect the distribution, abundance, and effectiveness of pollinators.
    - No pollination will be influenced by the proposed project.

9. Natural hazard regulation. The presence of coastal ecosystems such as mangroves and coral reefs can reduce the damage caused by hurricanes or large waves.
    - This is not applicable for this project.

16.3 Cultural services

These are the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences, including:

1. Cultural diversity. The diversity of ecosystems is one factor influencing the diversity of cultures.

2. Spiritual and religious values. Many religions attach spiritual and religious values to ecosystems or their components.

3. Knowledge systems (traditional and formal). Ecosystems influence the types of knowledge systems developed by different cultures.

4. Educational values. Ecosystems and their components and processes provide the basis for both formal and informal education in many societies.

5. Inspiration. Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising.

6. Aesthetic values. Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, scenic drives, and the selection of housing locations.

7. Social relations. Ecosystems influence the types of social relations that are established in particular cultures. Fishing societies, for example, differ in many respects in their social relations from nomadic herding or agricultural societies.

8. Sense of place. Many people value the “sense of place” that is associated with recognized features of their environment, including aspects of the ecosystem.

9. Cultural heritage values. Many societies place high value on the maintenance of either historically important landscapes (“cultural landscapes”) or culturally significant species.

10. Recreation and ecotourism. People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area.

    - The proposed project is on an already existing mining area. A heritage study was conducted for the mine. No such ecosystems are deemed to exist on the area which form part of the proposed project.

16.4 Supporting services

Supporting services are those that are necessary for the production of all other ecosystem services. They differ from provisioning, regulating, and cultural services in that their impacts on people are often indirect or occur over a very long time, whereas changes in the other categories have relatively direct and short-term impacts on people. (Some services, like erosion regulation, can be categorized as both a supporting and a regulating service, depending on the time scale and immediacy of their impact on people.) These services include:

1. Soil Formation. Because many provisioning services depend on soil fertility, the rate of soil formation influences human well-being in many ways.

2. Photosynthesis. Photosynthesis produces oxygen necessary for most living organisms.

3. Primary production. The assimilation or accumulation of energy and nutrients by organisms.

4. Nutrient cycling. Approximately 20 nutrients essential for life, including nitrogen and phosphorus, cycle through ecosystems and are maintained at different concentrations in different parts of ecosystems.

5. Water cycling. Water cycles through ecosystems and is essential for living organisms.

- The proposed project includes two already existing quarries. No supporting services can be associated with these quarries.
- The settling point will be constructed on an already disturbed area; therefore, no supporting services can be associated with this area.

The river diversion is the only area that can be associated with supporting services. Adequate management as per this EIA/EMP will prevent loss of these services.

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

The impact assessment and management measures are only based on the remining activities, and the transportation of the residue to the plant for re-mining. The impacts and management associated with the plant activities as well as the disposal of the final mine residue after processing, form part of the mine-wide EMP as well as the EIAR submitted for the backfilling of Quarries 6 & 7.

1 Geology and the mineral resource

There will be no impact on the geology.

2 Topography including drainage patterns and visual aspects

2.1 Restoration of topography

Activity: Sloping and remining of the slimes dam, waste rock dumps and the pits.

Aspect and impact description: The topography of the mine residue areas will be changed to a more natural topography. This will further also have a positive impact on the drainage patterns as well as the visual aspects. There will be no impact from the roads, as there are already existing roads from all areas to Annesley Plant. There will also be no impact from the pipelines as the pipelines will be on already existing routes.

Method for assessing risks: Havercroft Operation Annual Rehabilitation Plan (BECS Environmental, 2018). Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. This EMP is for a new application, therefore changes of impact are not included.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
The impact on the topography will be **positive**. Topography is not a resource, however, other resources such as drainage patterns and visual aspects are affected.	4	5
Spatial extent of Impact	**Before management**	**With management**
Impact occurs on-site at the point where the pits and mine residue will be sloped.	1	1

Duration of Impact	**Before management**	**With management**
Once sloping is finished, this will remain as a permanent land pattern.	4	4
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
The impact will occur regardless of any prevention measures	4	4
Frequency of potential occurrence of the Impact	**Before management**	**With management**
This is a once-off impact.	1	1
SIGNIFICANCE	**Before management**	**With management**
The impact before and after mitigation will be a positive impact and will aid rehabilitation.	14	15

Cumulative impacts

Further sloping and rehabilitation on Havercroft Operation is planned for the near future. The remining of the mine residue will therefore have a positive cumulative impact on the topography.

Environmental objective

To ensure end land-use that has been achieved which is grazing and game farming.

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Management timeframe and schedule**	**Monitoring programmes**	**Responsibilities for implementation and long-term maintenance**	**Financial provision for long-term maintenance and/or environmental costs**	**Mitigation hierarchy**
Sloping as per rehabilitation plan must be implemented. In short, sloping of most of the material to the north in the direction of the tailings facility and to the east towards the plant area.	Operational until closure.	The rehabilitation plan for both Annesley and Havercroft Operations.	Correct sloping must be ongoing. Monitoring of sloping once after reshaping.	Topographical reshaping.	Mine surveyor and mine manager.		Rehabilitation.

Stakeholder expectations and / or comments

None received.
Legal compliance and standards Regulation 4 of GN 632 of 2015 under NEMWA (Regulations Regarding the Planning and Management of Mine Residue) under NEMWA. NEMA and the Environmental Conservation Act 73 of 1989 as amended (ECA)
Residual and latent risks The sloping will lessen this residual impact. No additional latent impacts are envisaged.

3 Soils, land capability, surrounding land use and landscape character

3.1 Pollution of soil due to use of road

Activity: Removal of all topsoil at the quarry footprint in order to mine the underlying geological strata

Aspect and impact description: Soil pollution from spillages of mine residue or hydrocarbons.

Method for assessing risks: General accepted standards and procedures on mine (BECS Environmental, 2015)

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the soil will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
The risks on soil pollution will not be severe and reversible. The resources are not sensitive.	1	1
Spatial extent of Impact	**Before management**	**With management**
The risk will be site specific	1	1
Duration of Impact	**Before management**	**With management**
Soil pollution will be temporary.	1	1
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Soil pollution impact will be probable without management measures.	2	1
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Soil pollution impact can occur weekly without proper management.	4	1
SIGNIFICANCE	**Before management**	**With management**
The impact before and after mitigation will be a low negative impact.	9	5

Cumulative impacts

Farming, residential and mining activities in the area can lead to soil pollution.

Environmental objective

To prevent soil pollution.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
All vehicles and machinery must be maintained to prevent soil pollution.	Operation and decommissioning phase.	Spill handling procedure and waste management procedure.	Maintenance as per maintenance register.	As per schedule of maintenance register.	Mine manager.		Minimise.
All pipelines must be maintained to prevent spillages of mine residue.	Operation and decommissioning phase.	Spill handling procedure and waste management procedure.	Inspections of routes for any pollution.	Weekly basis.	Mine manager.		Minimise.
Any leakages or mine residue spillages must be removed as hazardous waste.	Operation and decommissioning phase.	Spill handling procedure and waste management procedure.	Inspections of routes for any pollution.	Weekly basis.	Mine manager.		Minimise.

Stakeholder expectations and / or comments

None received.

Legal compliance and standards

Contaminated land: GN 527 of 2004 i.t.o. MPRDA, and sections 35-41 of NEMWA

Residual and latent risks

No residual risks from soil pollution.

3.2 Change of land capability

Activity: Sloping and remining of the slimes dam, waste rock dumps and the pits.

Aspect and impact description: Changing land capability and land use back to non-mining.

Method for assessing risks: Havercroft Operation Annual Rehabilitation Plan (BECS Environmental, 2018). Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the soil will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
The impact on the land capability, surrounding land use and landscape character will be positive medium to high.	4	5
Spatial extent of Impact	**Before management**	**With management**
The risk will be site specific.	1	1
Duration of Impact	**Before management**	**With management**
Once sloping is finished, this will remain as a permanent land pattern.	4	4
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
The impact will occur regardless of any other activity.	4	4
Frequency of potential occurrence of the Impact	**Before management**	**With management**
This is a once-off impact.	1	1
SIGNIFICANCE	**Before management**	**With management**
The impact before and after mitigation will be a positive impact and will aid rehabilitation.	14	15
Cumulative impacts Further sloping and rehabilitation on Havercroft Operation is planned for the near future. The remining of the mine residue will therefore have a positive cumulative impact on the land capability and land use.		
Environmental objective To ensure end land-use that has been achieved which is grazing and game farming.		

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
All pipelines must be removed.	Decommissioning phase.	Rehabilitation plan.	Inspections of pipeline routes.	Monthly until all pipes are removed.	Mine manager		Rehabilitation.
The plant area and associated infrastructure must be removed.	Decommissioning phase.	Rehabilitation plan.	Inspections of plant and infrastructure area.	Monthly until all infrastructure is removed.	Mine manager		Rehabilitation.
All unused roads must be removed.	Decommissioning phase.	Rehabilitation plan.	Inspection of road routes.	Monthly until all roads are removed.	Mine manager		Rehabilitation.
Sloping as per rehabilitation plan must be implemented.	Operational until closure.	Rehabilitation plan.	Topographical reshaping.	Correct sloping must be ongoing. Monitoring of sloping once after reshaping.	Mine surveyor and mine manager.		Rehabilitation.
Revegetation as per the rehabilitation plan must be implemented. Mine residue characteristics with respect to plant growth (soil quality) to be done only if necessary.	Operational until 5 years after closure.	Rehabilitation plan.	Vegetation monitoring.	Revegetation and vegetation monitoring as per the rehabilitation plan. Mine residue characteristics will be once-off	Mine manager.		Rehabilitation.

				only if necessary.			
Erosion to be removed if necessary.	Operational until 5 years after closure.	Rehabilitation plan.	Erosion monitoring.	Erosion removal as necessary. Erosion monitoring monthly	Mine manager.		Rehabilitation.
Overall clean-up of area.	Operational until 5 years after closure.	Rehabilitation plan and spill handling procedures if spills occur.	Surface water quality monitoring; groundwater quality monitoring; and monitoring of surface water drainage systems.	Surface water quality monitoring monthly; groundwater quality monitoring quarterly; and monitoring of surface water drainage systems during rainy seasons.	Mine manager.		Rehabilitation.
Stakeholder expectations and / or comments None received.							
Legal compliance and standards GN 527 of 2004 i.t.o. MPRDA, and sections 35-41 of NEMWA							
Residual and latent risks The sloping will lessen this residual impact. No additional latent impacts are envisaged.							

4 Vegetation and animal life

There will be no additional impact on vegetation. Refer to Part A(h)(v)(3.2) for correct revegetation.

4.1 Impact on livestock

Activity: Transportation of mine residue.

Aspect and impact description: Transportation of mine residue leading to the accidental collision with livestock.

Method for assessing risks: General accepted standards. Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on animal life and vegetation has been updated due to issues raised from the Babina Tlou Community.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
The risks on the livestock can be severe as it also impacts the community	3	1
Spatial extent of Impact	**Before management**	**With management**
Receptors will be in the area.	2	2
Duration of Impact	**Before management**	**With management**
Traffic potential will be short-term	1	1
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Safety risks will be improbable.	1	1
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Impact once annually or rarely if management measure is in place.	1	1
SIGNIFICANCE	**Before management**	**With management**
The impact before mitigation will be low and will be reduced further once mitigation is in place.	8	6
Cumulative impacts All roads in the area contribute to traffic.		
Environmental objective Ensure traffic does not affect the safety of livestock.		

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
All vehicles will drive within the speed limits of the mine and avoid knocking livestock.	Operational until closure.	Generally accepted standards, social and labour plan.	Compliance with social and labour plan and adhering to speed limits.	Ongoing.	Mine manager.	None.	Minimise.
Stakeholder expectations and / or comments Issue raised by Babina Tlou Community.							
Legal compliance and standards NRTA							
Residual and latent risks No residual or latent risks.							

5 Surface water

5.1 Impact on surface water quality

Activity: Sloping and remining of the slimes dam, waste rock dumps and the pits.

Aspect and impact description: Surface water pollution due to run-off from already existing mine residue.

Method for assessing risks: Information for this risk was extracted from the Quarterly Water Quality Monitoring Report (BECS Environmental, 2018). Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the surface water will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
Sloping of mine residue may have a low severity.	1	1
Spatial extent of Impact	**Before management**	**With management**

Receptors which may be influenced by the mining activities include the users in the Mogomotsi River (aquatic species, livestock, wildlife).	2	2
Duration of Impact	**Before management**	**With management**
Pollution potential will be permanent, depending on new monitoring results	3	3
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Sedimentation from mine residue will be probable.	2	1
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Impact occurs at least once in a year or less frequently	1	1
SIGNIFICANCE	**Before management**	**With management**
The impact will be low prior to mitigation but will be reduced further with mitigation, the impact will be negative.	9	8
Cumulative impact There are various activities in the area that can also impact on the water resources in the area. This includes the community.		
Environmental objective To prevent the contamination and sedimentation of surface water resources.		

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Financial provision for long-term maintenance and/or environmental costs**	**Mitigation hierarchy**
All quarries will be sloped to reduce erosion and subsequent sedimentation.	Operational until 5 years after closure.	Rehabilitation plan.	Erosion monitoring.	Erosion removal as necessary. Erosion monitoring monthly.	Mine manager.	None.	Minimise.
The slimes dam will be revegetated. This will help to reduce any	Operational until 5 years after closure.	Rehabilitation plan.	Vegetation monitoring.	Revegetation and vegetation monitoring as per the rehabilitation plan. Mine residue	Mine manager.	None.	Minimise.

form of sedimentation from the dam.				characteristics will be once-off only if necessary.			
Overall clean-up of area.	Operational until 5 years after closure.	Approved water monitoring programme.	Surface water quality monitoring; and monitoring of surface water drainage systems.	Surface water quality monitoring monthly; and monitoring of surface water drainage systems during rainy seasons.	Mine manager		Minimise.
Stakeholder expectations and / or comments None							
Legal compliance and standards Section 21 of the NWA sets out the water uses for which an IWUL is required.							
Residual and latent risks Depending on the results of further monitoring, the risk of potential pollution and sedimentation will not be a latent risk.							

6. Groundwater

6.1 Impact on ground water quality

Activity: Sloping and remining of the slimes dam, waste rock dumps and the pits.

Aspect and impact description: Seepage from already existing mine residue leading to groundwater pollution and/or AMD.

Method for assessing risks: Information for this risk was extracted from the Hydrogeological Report (Shangoni Management Services, 2013) conducted for Krugerspost Mine. These mines are not close to each other, however, the mineral mined are both Andalusite. Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the ground water will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**

Groundwater pollution: The pH is likely to be neutral to slightly alkaline and heavy metal solubilisation will, therefore, be minimal. Further, it can be determined that the waste present a slight/ low risk to the environment posed by the sloping of mine residue.	3	3
AMD: The pH is likely to be neutral to slightly alkaline, therefore the severity of acid mine drainage will be negligible.	0	0
Spatial extent of Impact	**Before management**	**With management**
Vertical seepage will dominate during the operational phase due to the high hydraulic conductivity of fines thereby reducing horizontal seepage risks towards the matrix and receiving environment. Seepage loads from the slimes and tailings wastes will, therefore, most probably remain isolated during the operational phases.	2	2
Duration of Impact	**Before management**	**With management**
Pollution potential will be permanent, depending on new monitoring results.	4	4
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Groundwater pollution: Although it is expected that vertical seepage will dominate over horizontal seepage, it may nevertheless remain a potential risk towards the receiving environment. This would be especially true if large-scale fracturing and/ weathering are present in the host matrix.	2	2
AMD: It is unlikely that significant acid (if any) will be generated from the mine residue.	0	0
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Impact occurs at least once in a year or less frequently.	1	14
SIGNIFICANCE	**Before management**	**With management**
Groundwater pollution: The impact prior to mitigation will be medium and will be reduced to low with mitigation. The impact will have a negative effect.	14	9
AMD: There is no AMD taking place, therefore there is no impact significance.	0	0
Cumulative impacts Groundwater can be polluted from the mining of Andalusite or the pollution from the nearby township. There are villages in the area which can contribute largely to groundwater pollution.		
Environmental objective To reduce any groundwater pollution that may occur.		

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
All residue will be sloped. This will help to reduce any form of seepage from the mine residue.	Operational until closure.	Water monitoring programme.	Topographical reshaping.	Correct sloping must be ongoing. Monitoring of sloping once after reshaping.	Mine surveyor and mine manager.	None.	Minimise.
All residue will be adequately vegetated. This will help to reduce any form of seepage from the mine residue.	Operational until 5 years after closure.	Water monitoring programme.	Vegetation monitoring.	Revegetation and vegetation monitoring as per the rehabilitation plan. Mine residue characteristics will be once-off only if necessary.	Mine manager.	None.	Minimise.
Boreholes must be drilled as per the IWUL to monitor the groundwater quality.	Operational until 5 years after closure.	Water monitoring programme.	Groundwater quality monitoring.	Groundwater quality monitoring quarterly; and drilling once-off	Mine manager.	None.	Minimise.
Stakeholder expectations and / or comments None.							
Legal compliance and standards Section 21 of the National Water Act sets out the water uses for which an IWUL is required. Regulation 4 of GN 632 of 2015 under NEMWA (Regulations Regarding the Planning and Management of Mine Residue) under NEMWA’							
Residual and latent risks Depending on the results of further monitoring, the risk of potential pollution (excluding acid mine drainage) will be a residual risk. The potential for acid mine drainage becoming a latent impact is not probable.							

7. Air quality

The following information has been extracted from the Annesley Air Impact Assessment (Shangoni Management Services, 2018)

7.1 Construction phase (Havercroft & Segorong)

7.1.1 Impact on air quality through small particulate air pollution

Activity: Remining and transportation of mine residue. Upgrade of the Heavy Medium Separation ("HMS") plant.

Aspect and impact description: Health impacts on susceptible groups due to small particulate (PM10 & PM2.5) air pollution.

Method for assessing risks: Qualitative assessment. Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the air quality will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
Medium, considering other PM10 and PM2.5 sources in the area (mining operations in the Steelpoort area, Annesley's mining operations and Annesley's dryer) and their cumulative effect.	3	1
Spatial extent of Impact	**Before management**	**With management**
Local, as the atmosphere and valley exit provide a pathway for air pollution to reach surrounding communities.	2	1
Duration of Impact	**Before management**	**With management**
Pollution potential will be short-term for the duration of the installation of the HMS plant.	1	1
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Dust generation will be probable considering the cumulative effect of other sources, the possibility of polluted air becoming trapped and/or recirculated in a mountain valley system, the presence of communities within a 5 km radius from the site and the valley exits and atmospheric pathway.	2	1
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Daily (An impact is expected when the daily and annual average NAAQS for PM10 and PM2.5 is exceeded. Due to the qualitative nature of this risk assessment a conservative approach was taken to select the highest frequency of occurrence).	5	5
SIGNIFICANCE	**Before management**	**With management**
Medium before mitigation to low after mitigation.	13	9

Cumulative impacts

Mining operations in the Steelpoort area, Annesley's mining operations and emissions from Annesley's coal-fired dryer.

Environmental objective

To minimise the generation of small particulate emissions by vehicles and mobile equipment traveling on unpaved roads.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
All residue will be adequately vegetated. This will help to reduce dust generation. Dust suppression will take place.	Operational until 5 years after closure.	Rehabilitation plan.	Vegetation monitoring.	Revegetation and vegetation monitoring as per the rehabilitation plan. Mine residue characteristics will be once-off only if necessary.	Mine manager	None.	Rehabilitation.
All vehicles will drive within the speed limits of the mine ≤40 km/hr.	Operational until closure.	Signage.	Fall-out dust monitoring.	Fall-out dust monitoring monthly.	Mine manager.	None.	Minimise.
A dust management plan, in line with the National Dust Control Regulations.	Construction Operational Closure	Dust management plan.					
Ensure the Annesley maintains compliance with its Atmospheric Emission Licence (SK17/1/8/5/AEL/ANNANDA/MINE).	Operational	Dust management plan.					

Stakeholder expectations and / or comments

None

Legal compliance and standards GN 351 of 2014 (Regulations Regarding the Phasing-out and Management of Ozone- Depleting Substances) under NEMAQA. Regulations 9(f) & 11 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits) under NEMWA
Residual and latent risks No residual or latent risks.

7.1.2 Dustfall

Activity: Remining and transportation of mine residue and upgrading of the HMS plant.

Aspect and impact description: Air pollution due to dust from remining of mine residue as well as transportation of mine residue. Nuisance impact of dust on the surrounding settlements.

Method for assessing risks: Qualitative assessment. Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the air quality will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
Medium, considering other dust sources in the area (Annesley's mining operations) and their cumulative effect.	3	1
Spatial extent of Impact	**Before management**	**With management**
On-site, considering the low intensity construction activities, communities are located >2 km away from the HMS plant and that Annesley's dustfall monitoring programmes shows the mine to be in compliance with the NDCR's standard for non-residential areas.	1	1
Duration of Impact	**Before management**	**With management**
Pollution potential will be short-term considering the short duration of the installation of the HMS plant.	1	1
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Probable/Possible, considering the cumulative effect of other sources, the low winter rainfall and average summer rainfall, the possibility of higher winds, the presence of communities within a 5 km radius from the site and the valley exits and atmospheric pathway.	2	1

Frequency of potential occurrence of the Impact	**Before management**	**With management**
Daily (An impact is expected when the NDCR's daily standard for non-residential areas is exceeded. Due to the qualitative nature of this risk assessment a conservative approach was taken to select the highest frequency of occurrence).	5	5
SIGNIFICANCE	**Before management**	**With management**
The impact prior to mitigation is low but with mitigation it can be lowered further. The impact will have a negative impact on the environment.	12	8
Cumulative impacts All dirt roads in the area contribute to dust.		
Environmental objective To minimise the generation of dust by vehicles and mobile equipment traveling on unpaved roads.		

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Financial provision for long-term maintenance and/or environmental costs**	**Mitigation hierarchy**
All residue will be adequately vegetated. This will help to reduce dust generation. Dust suppression will take place.	Operational until 5 years after closure.	Rehabilitation plan.	Vegetation monitoring.	Revegetation and vegetation monitoring as per the rehabilitation plan. Mine residue characteristics will be once-off only if necessary.	Mine manager	None.	Rehabilitation.
All vehicles will drive within the speed limits of the mine ≤40 km/hr.	Operational until closure.	Signage.	Fall-out dust monitoring.	Fall-out dust monitoring monthly.	Mine manager.	None.	Minimise.
A dust management plan, in line with the National Dust Control Regulations.	Construction Operational Closure	Dust management plan.					

Ensure the Annesley maintains compliance with its Atmospheric Emission Licence (SK17/1/8/5/AEL/ANNANDA/MINE).	Operational	Dust management plan.					
Stakeholder expectations and / or comments None							
Legal compliance and standards GN 351 of 2014 (Regulations Regarding the Phasing-out and Management of Ozone- Depleting Substances) under NEMAQA. Regulations 9(f) & 11 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits) under NEMWA							
Residual and latent risks No residual or latent risks.							

7.1.3 Impact on air quality by other criteria pollutants

Activity: Remining and transportation of mine residue and the upgrading pf the HMS plant.

Aspect and impact description: Health impacts on susceptible groups due to combustion gases from vehicle/equipment exhaust emissions.

Method for assessing risks: Qualitative assessment. Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the air quality will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
Medium, considering other sources in the area (mining operations in the Steelpoort area, Annesley's mining operations and Annesley's dryer) and their cumulative effect.	3	1
Spatial extent of Impact	**Before management**	**With management**
Receptors will be in the area as the atmosphere and valley exits provide a pathway for air pollution to reach surrounding communities.	2	1
Duration of Impact	**Before management**	**With management**

Pollution potential will be short-term considering the short duration of the installation of the HMS plant.	1	1
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Probable/Possible, considering the cumulative effect of other sources, the possibility of polluted air becoming trapped and/or recirculated in a mountain valley system, the presence of communities within a 5 km radius from the site and the valley exits and atmospheric pathway.	2	1
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Daily (An impact is expected when the NAAQS for pollutants are exceeded. Due to the qualitative nature of this risk assessment a conservative approach was taken to select the highest frequency of occurrence).	5	5
SIGNIFICANCE	**Before management**	**With management**
Medium before mitigation to low after mitigation.	13	9
Cumulative impacts Fuel combustion by vehicles and mobile equipment used in the mining operations in the Steelpoort area, Annesley's mining operations and emissions from Annesley's coal-fired dryer.		
Environmental objective To minimise the generation of combustion emissions by vehicles and mobile equipment.		

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Financial provision for long-term maintenance and/or environmental costs**	**Mitigation hierarchy**
All residue will be adequately vegetated. This will help to reduce dust generation. Dust suppression will take place.	Operational until 5 years after closure.	Rehabilitation plan.	Vegetation monitoring.	Revegetation and vegetation monitoring as per the rehabilitation plan. Mine residue characteristics will be once-off only if necessary.	Mine manager	None.	Rehabilitation.

All vehicles will drive within the speed limits of the mine ≤40 km/hr.	Operational until closure.	Signage.	Fall-out dust monitoring.	Fall-out dust monitoring monthly.	Mine manager.	None.	Minimise.
A dust management plan, in line with the National Dust Control Regulations.	Construction Operational Closure	Dust management plan.					
Ensure the Annesley maintains compliance with its Atmospheric Emission Licence (SK17/1/8/5/AEL/ANNANDA/MINE).	Operational	Dust management plan.					
Stakeholder expectations and / or comments None							
Legal compliance and standards GN 351 of 2014 (Regulations Regarding the Phasing-out and Management of Ozone- Depleting Substances) under NEMAQA. Regulations 9(f) & 11 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits) under NEMWA							
Residual and latent risks No residual or latent risks.							

7.2 Operational phase (Havercroft & Segorong)

7.2.1 Impact on air quality through small particulate air pollution

Activity: Remining: material handling by excavators and front-end loaders, hauling, material transfer, conveying, crushing, screening and dumping.

Aspect and impact description: Health impacts on susceptible groups due to small particulate (PM10 & PM2.5) air pollution.

Method for assessing risks: Emission inventory and dispersion modelling. Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the air quality will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
High, considering: the dispersion model results for the proposed remining project show exceedance of the daily PM10 standard is possible and the presence of other PM10 and PM2.5 sources in the area (mining operations in the Steelpoort area, Annesley's mining operations and Annesley's dryer) and their cumulative effect.	5	3
Spatial extent of Impact	**Before management**	**With management**
Local, as the atmosphere and valley exit provide a pathway for air pollution to reach surrounding communities.	2	1
Duration of Impact	**Before management**	**With management**
Long-term. The risk of the impact will remain for the duration of the life of the project.	3	3
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Highly probable, considering the cumulative effect of other sources, the possibility of polluted air becoming trapped and/or recirculated in a mountain valley system, the presence of communities within a 5 km radius from the site and the valley exits and atmospheric pathway.	3	2
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Daily (An impact is expected when the daily and annual average NAAQS for PM10 and PM2.5 is exceeded.)	5	1
SIGNIFICANCE	**Before management**	**With management**
High before mitigation to low after mitigation.	18	10
Cumulative impacts Mining operations in the Steelpoort area, Annesley's mining operations and emissions from Annesley's coal-fired dryer.		
Environmental objective To minimise the generation of small particulate emissions by hauling and vehicles traveling on unpaved roads and the crushing and screening of material.		

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Financial provision for long-term maintenance and/or environmental costs**	**Mitigation hierarchy**

All residue will be adequately vegetated. This will help to reduce dust generation. Dust suppression will take place.	Operational until 5 years after closure.	Rehabilitation plan.	Vegetation monitoring.	Revegetation and vegetation monitoring as per the rehabilitation plan. Mine residue characteristics will be once-off only if necessary.	Mine manager	None.	Rehabilitation.
All vehicles will drive within the speed limits of the mine ≤40 km/hr.	Operational until closure.	Signage.	Fall-out dust monitoring.	Fall-out dust monitoring monthly.	Mine manager.	None.	Minimise.
A dust management plan, in line with the National Dust Control Regulations.	Construction Operational Closure	Dust management plan.					
Ensure the Annesley maintains compliance with its Atmospheric Emission Licence (SK17/1/8/5/AEL/ANNANDA/MINE).	Operational	Dust management plan.					
Stakeholder expectations and / or comments None							
Legal compliance and standards GN 351 of 2014 (Regulations Regarding the Phasing-out and Management of Ozone- Depleting Substances) under NEMAQA. Regulations 9(f) & 11 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits) under NEMWA							
Residual and latent risks No residual or latent risks.							

7.2.2 Dustfall

Activity: Remining: material handling by excavators and front-end loaders, hauling, material transfer, conveying, crushing, screening and dumping.

Aspect and impact description: Nuisance impact of dust on the surrounding settlements.

Method for assessing risks: Emission inventory and dispersion modelling. Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the air quality will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
Medium, considering the presence of other dustfall sources in the area (mining operations in the Steelpoort area and Annesley's mining operations) and their cumulative effect.	3	1
Spatial extent of Impact	**Before management**	**With management**
Local, considering the proximity of communities to Havercroft.	2	1
Duration of Impact	**Before management**	**With management**
Long-term. The risk of the impact will remain for the duration of the life of the project.	3	3
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Probable/Possible, considering the cumulative effect of other sources, the low winter rainfall and average summer rainfall, the possibility of higher winds, the presence of communities within a 5 km radius from the site and the valley exits and atmospheric pathway.	2	1
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Daily (An impact is expected when the NDCR's daily standard for non-residential areas is exceeded).	5	1
SIGNIFICANCE	**Before management**	**With management**
Medium before mitigation to low after mitigation.	15	7
Cumulative impacts Mining operations in the Steelpoort area and Annesley's mining operations.		
Environmental objective To minimise the generation of dust by hauling and vehicles traveling on unpaved roads and the crushing and screening of material.		

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
All residue will be adequately vegetated. This will help to reduce dust generation. Dust suppression will take place.	Operational until 5 years after closure.	Rehabilitation plan.	Vegetation monitoring.	Revegetation and vegetation monitoring as per the rehabilitation plan. Mine residue characteristics will be once-off only if necessary.	Mine manager	None.	Rehabilitation.
All vehicles will drive within the speed limits of the mine ≤40 km/hr.	Operational until closure.	Signage.	Fall-out dust monitoring.	Fall-out dust monitoring monthly.	Mine manager.	None.	Minimise.
A dust management plan, in line with the National Dust Control Regulations.	Construction Operational Closure	Dust management plan.					
Ensure the Annesley maintains compliance with its Atmospheric Emission Licence (SK17/1/8/5/AEL/ANNANDA/MINE).	Operational	Dust management plan.					
Stakeholder expectations and / or comments None							
Legal compliance and standards GN 351 of 2014 (Regulations Regarding the Phasing-out and Management of Ozone- Depleting Substances) under NEMAQA. Regulations 9(f) & 11 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits) under NEMWA							
Residual and latent risks							

No residual or latent risks.

7.2.3 Impact on air quality by other criteria pollutants

Activity: Remining: material handling by excavators and front-end loaders, hauling, material transfer, conveying, crushing, screening and dumping.

Aspect and impact description: Health impacts on susceptible groups due to combustion gases from vehicle/equipment exhaust emissions.

Method for assessing risks: Qualitative assessment. Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the air quality will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
Medium, considering other sources in the area (mining operations in the Steelpoort area, Annesley's mining operations and Annesley's dryer) and their cumulative effect.	3	1
Spatial extent of Impact	**Before management**	**With management**
Local, as the atmosphere and valley exits provide a pathway for air pollution to reach surrounding communities.	2	1
Duration of Impact	**Before management**	**With management**
Long-term. The risk of the impact will remain for the duration of the life of the project.	3	3
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Probable/Possible, considering the cumulative effect of other sources, the possibility of polluted air becoming trapped and/or recirculated in a mountain valley system, the presence of communities within a 5 km radius from the site and the valley exits and atmospheric pathway.	2	1
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Daily (An impact is expected when the NAAQS for pollutants are exceeded. Due to the qualitative nature of this risk assessment a conservative approach was taken to select the highest frequency of occurrence).	5	5
SIGNIFICANCE	**Before management**	**With management**
Medium before mitigation to low after mitigation.	15	11
Cumulative impacts		

Fuel combustion by vehicles and mobile equipment used in the mining operations in the Steelpoort area, Annesley's mining operations and emissions from Annesley's coal-fired dryer.

Environmental objective

To minimise the generation of combustion emissions by vehicles and mobile equipment.

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Financial provision for long-term maintenance and/or environmental costs**	**Mitigation hierarchy**
All residue will be adequately vegetated. This will help to reduce dust generation. Dust suppression will take place.	Operational until 5 years after closure.	Rehabilitation plan.	Vegetation monitoring.	Revegetation and vegetation monitoring as per the rehabilitation plan. Mine residue characteristics will be once-off only if necessary.	Mine manager	None.	Rehabilitation.
All vehicles will drive within the speed limits of the mine ≤40 km/hr.	Operational until closure.	Signage.	Fall-out dust monitoring.	Fall-out dust monitoring monthly.	Mine manager.	None.	Minimise.
A dust management plan, in line with the National Dust Control Regulations.	Construction Operational Closure	Dust management plan.					
Ensure the Annesley maintains compliance with its Atmospheric Emission Licence (SK17/1/8/5/AEL/ANNANDA/MINE).	Operational	Dust management plan.					

Stakeholder expectations and / or comments

None

Legal compliance and standards GN 351 of 2014 (Regulations Regarding the Phasing-out and Management of Ozone- Depleting Substances) under NEMAQA. Regulations 9(f) & 11 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits) under NEMWA
Residual and latent risks No residual or latent risks.

7.3 Closure phase (Havercroft & Segorong)

7.3.1 Impact on air quality through small particulate air pollution

Activity: Remining: material handling by excavators and front-end loaders, hauling, material transfer, conveying, crushing, screening and dumping.

Aspect and impact description: Health impacts on susceptible groups due to small particulate (PM10 & PM2.5) air pollution.

Method for assessing risks: Qualitative assessment. Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the air quality will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
Medium, considering the presence of other PM10 and PM2.5 sources in the area (mining operations in the Steelpoort area, Annesley's mining operations and Annesley's dryer) and their cumulative effect.	3	1
Spatial extent of Impact	**Before management**	**With management**
Local, as the atmosphere and valley exit provide a pathway for air pollution to reach surrounding communities.	2	1
Duration of Impact	**Before management**	**With management**
Long-term. The risk of the impact will remain for the duration of the decommissioning and rehabilitation activities.	3	3
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Probable/Possible, considering the cumulative effect of other sources, the possibility of polluted air becoming trapped and/or recirculated in a mountain valley system, the presence of communities within a 5 km radius from the site and the valley exits and atmospheric pathway.	2	1
Frequency of potential occurrence of the Impact	**Before management**	**With management**

Daily (An impact is expected when the daily and annual average NAAQS for PM10 and PM2.5 is exceeded. Due to the qualitative nature of this risk assessment a conservative approach was taken to select the highest frequency of occurrence).	5	5
SIGNIFICANCE	**Before management**	**With management**
Medium before mitigation to low after mitigation	15	11
Cumulative impacts Mining operations in the Steelpoort area, Annesley's mining operations and emissions from Annesley's coal-fired dryer.		
Environmental objective To minimise the generation of small particulate emissions by vehicles traveling on unpaved roads and other decommissioning and rehabilitation activities.		

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Financial provision for long-term maintenance and/or environmental costs**	**Mitigation hierarchy**
All residue will be adequately vegetated. This will help to reduce dust generation. Dust suppression will take place.	Operational until 5 years after closure.	Rehabilitation plan.	Vegetation monitoring.	Revegetation and vegetation monitoring as per the rehabilitation plan. Mine residue characteristics will be once-off only if necessary.	Mine manager	None.	Rehabilitation.
All vehicles will drive within the speed limits of the mine ≤40 km/hr.	Operational until closure.	Signage.	Fall-out dust monitoring.	Fall-out dust monitoring monthly.	Mine manager.	None.	Minimise.
A dust management plan, in line with the National Dust Control Regulations.	Construction Operational Closure	Dust management plan.					
Ensure the Annesley maintains compliance with its Atmospheric	Operational	Dust management plan.					

Emission Licence (SK17/1/8/5/AEL/ANNANDA/MINE).							
Stakeholder expectations and / or comments None							
Legal compliance and standards GN 351 of 2014 (Regulations Regarding the Phasing-out and Management of Ozone- Depleting Substances) under NEMAQA. Regulations 9(f) & 11 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits) under NEMWA							
Residual and latent risks No residual or latent risks.							

7.3.2 Dustfall

Activity: Material handling, movement of vehicles and mobile equipment on unpaved roads and other decommissioning and rehabilitation activities.

Aspect and impact description: Nuisance impact of dust on the surrounding settlements.

Method for assessing risks: Qualitative assessment. Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the air quality will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
Medium, considering the presence of other dustfall sources in the area (mining operations in the Steelpoort area and Annesley's mining operations) and their cumulative effect.	3	1
Spatial extent of Impact	**Before management**	**With management**
Local, considering the proximity of communities to Havercroft.	2	1
Duration of Impact	**Before management**	**With management**
Long-term. The risk of the impact will remain for the duration of the decommissioning and rehabilitation activities.	3	3
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**

Probable/Possible, considering the cumulative effect of other sources, the low winter rainfall and average summer rainfall, the possibility of higher winds, the presence of communities within a 5 km radius from the site and the valley exits and atmospheric pathway.	2	1
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Daily (An impact is expected when the NDCR's daily standard for non-residential areas is exceeded. Due to the qualitative nature of this risk assessment a conservative approach was taken to select the highest frequency of occurrence).	5	5
SIGNIFICANCE	**Before management**	**With management**
Medium before mitigation to low after mitigation.	15	11
Cumulative impacts Mining operations in the Steelpoort area and Annesley's mining operations.		
Environmental objective To minimise the generation of dust by hauling and vehicles traveling on unpaved roads and the crushing and screening of material.		

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Financial provision for long-term maintenance and/or environmental costs**	**Mitigation hierarchy**
All residue will be adequately vegetated. This will help to reduce dust generation. Dust suppression will take place.	Operational until 5 years after closure.	Rehabilitation plan.	Vegetation monitoring.	Revegetation and vegetation monitoring as per the rehabilitation plan. Mine residue characteristics will be once-off only if necessary.	Mine manager	None.	Rehabilitation.
All vehicles will drive within the speed limits of the mine ≤40 km/hr.	Operational until closure.	Signage.	Fall-out dust monitoring.	Fall-out dust monitoring monthly.	Mine manager.	None.	Minimise.
A dust management plan, in line with the	Construction Operational	Dust management plan.					

National Dust Control Regulations.	Closure						
Ensure the Annesley maintains compliance with its Atmospheric Emission Licence (SK17/1/8/5/AEL/ANNANDA/MINE).	Operational	Dust management plan.					
Stakeholder expectations and / or comments None							
Legal compliance and standards GN 351 of 2014 (Regulations Regarding the Phasing-out and Management of Ozone- Depleting Substances) under NEMAQA. Regulations 9(f) & 11 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits) under NEMWA							
Residual and latent risks No residual or latent risks.							

7.3.3 Impact on air quality by other criteria pollutants

Activity: Material handling, movement of vehicles and mobile equipment on unpaved roads and other decommissioning and rehabilitation activities.

Aspect and impact description: Health impacts on susceptible groups due to combustion gases from vehicle/equipment exhaust emissions.

Method for assessing risks: Qualitative assessment. Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the air quality will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
Medium, considering other sources in the area (mining operations in the Steelpoort area, Annesley's mining operations and Annesley's dryer) and their cumulative effect.	3	1
Spatial extent of Impact	**Before management**	**With management**
Local, as the atmosphere and valley exits provide a pathway for air pollution to reach surrounding communities.	2	1

Duration of Impact	**Before management**	**With management**
Long-term. The risk of the impact will remain for the duration of the decommissioning and rehabilitation activities.	3	3
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Probable/Possible, considering the cumulative effect of other sources, the possibility of polluted air becoming trapped and/or recirculated in a mountain valley system, the presence of communities within a 5 km radius from the site and the valley exits and atmospheric pathway.	2	1
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Daily (An impact is expected when the NAAQS for pollutants are exceeded. Due to the qualitative nature of this risk assessment a conservative approach was taken to select the highest frequency of occurrence).	5	5
SIGNIFICANCE	**Before management**	**With management**
Medium before mitigation to low after mitigation.	15	11
Cumulative impacts Fuel combustion by vehicles and mobile equipment used in the mining operations in the Steelpoort area, Annesley's mining operations and emissions from Annesley's coal-fired dryer.		
Environmental objective To minimise the generation of combustion emissions by vehicles and mobile equipment.		

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Financial provision for long-term maintenance and/or environmental costs**	**Mitigation hierarchy**
All residue will be adequately vegetated. This will help to reduce dust generation. Dust suppression will take place.	Operational until 5 years after closure.	Rehabilitation plan.	Vegetation monitoring.	Revegetation and vegetation monitoring as per the rehabilitation plan. Mine residue characteristics will be once-off only if necessary.	Mine manager	None.	Rehabilitation.

All vehicles will drive within the speed limits of the mine ≤40 km/hr.	Operational until closure.	Signage.	Fall-out dust monitoring.	Fall-out dust monitoring monthly.	Mine manager.	None.	Minimise.
A dust management plan, in line with the National Dust Control Regulations.	Construction Operational Closure	Dust management plan.					
Ensure the Annesley maintains compliance with its Atmospheric Emission Licence (SK17/1/8/5/AEL/ANNANDA/MINE).	Operational	Dust management plan.					
Stakeholder expectations and / or comments None							
Legal compliance and standards GN 351 of 2014 (Regulations Regarding the Phasing-out and Management of Ozone- Depleting Substances) under NEMAQA. Regulations 9(f) & 11 of GN 632 of 2015 (Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits) under NEMWA							
Residual and latent risks No residual or latent risks.							

8. Environmental noise

8.1 Environmental noise generation

Activity: Remining and transportation of mine residue.

Aspect and impact description: Environmental noise from remining of mine residue as well as transportation of mine residue.

Method for assessing risks: General accepted standards. Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the environmental noise will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
The risks on noise pollution will not be severe and reversible.	2	1
Spatial extent of Impact	**Before management**	**With management**
Receptors will be in the area.	2	2
Duration of Impact	**Before management**	**With management**
Pollution potential will be short-term	1	1
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Noise generation will be probable.	2	1
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Impact occurs frequently.	3	3
SIGNIFICANCE	**Before management**	**With management**
The impact prior to mitigation is low but with mitigation can be lowered further. The impact will have a negative impact on the environment.	10	8
Cumulative impacts The villages and other activities in the area contribute to noise generation.		

Environmental objective

Ensure environmental noise is not severely affected.

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Financial provision for long-term maintenance and/or environmental costs**	**Mitigation hierarchy**
All vehicles and machinery must be maintained.	Operation and decommissioning phase.	Maintenance register.	Maintenance as per maintenance register.	As per schedule of maintenance register.	Mine manager.	No additional costs. This forms part of the operating costs.	Minimise.
Put a complaint register in place which includes	Operation and decommissioning phase.	Complaint register.	Maintenance as per complaint register.	As per schedule of maintenance register.	Mine manager.	No additional costs. This forms part of the operating costs.	Minimise.

environmental noise.							
Stakeholder expectations and / or comments None							
Legal compliance and standards NEMAQA and Ambient air quality management							
Residual and latent risks No residual or latent risks.							

9. Archaeological, historical and cultural aspects

Already existing infrastructure to be used therefore no impact on Archaeological, historical and cultural aspects.

10. Socio-economic

10.1 Impact on community safety and livestock

Activity: Transportation of mine residue.

Aspect and impact description: Safety of community due to traffic from mine. Livestock may get knocked which will cost the community.

Method for assessing risks: General accepted standards. Refer to Part B(1)(d) for a complete discussion on rehabilitation and Part B(1)(h)(i) for a complete discussion on monitoring. Refer to Part A(d) for a detailed discussion on legal compliance and standards. Refer to the Addendums 4G and 4I for the minutes of the meeting with the community and the actions taken moving forward.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on the community safety will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
The risks on the community can be severe	3	1
Spatial extent of Impact	**Before management**	**With management**
Receptors will be in the area.	2	2

Duration of Impact	**Before management**	**With management**
Traffic potential will be short-term	1	1
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Safety risks will be improbable.	1	1
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Impact occurs frequently.	3	3
SIGNIFICANCE	**Before management**	**With management**
The impact prior to mitigation is low but with mitigation it can be lowered further. The impact will have a negative impact on the environment.	10	8
Cumulative impacts All roads in the area contribute to traffic.		
Environmental objective Ensure traffic does not affect the safety of the community.		

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Financial provision for long-term maintenance and/or environmental costs**	**Mitigation hierarchy**
All vehicles will drive within the speed limits of the mine and avoid knocking livestock.	Operational until closure.	Generally accepted standards, social and labour plan.	Compliance with social and labour plan.	Ongoing.	Mine manager.	None	Minimise.

Stakeholder expectations and / or comments Issue raised by Babina Tlou Community.
Legal compliance and standards NRTA
Residual and latent risks

No residual or latent risks.

10.2 Impact on land use and land capability

Activity: Final remining of mine residue

Aspect and impact description: Returning the land to grazing for the community

Refer to Part A(h)(v)(3.2) for correct returning land capability and land use.

10.3 Impact on job creation

Activity: Sloping and remining of the slimes dam, waste rock dumps and the pits.

Aspect and impact description: Job creation involving the Babina Tlou and Roko Malepe community in the transportation of the material between the Havercroft Operation and Annesley.

Method for assessing risks: General accepted principles.

Changes to previous EMP: The impact and risk methodology have been updated to a new format. The impact on job creation will remain the same.

CONSEQUENCE		
Nature / Intensity / Severity of Impact	**Before management**	**With management**
Unemployment is a significant problem in the area. Job creation will therefore have a medium to high and positive nature on the area.	4	5
Spatial extent of Impact	**Before management**	**With management**
Impact occurs on-site	1	1
Duration of Impact	**Before management**	**With management**
Job opportunities for rehabilitation will only be short-term.	1	1
LIKELIHOOD		
Probability of potential occurrence of the Impact	**Before management**	**With management**
Job opportunities will be created. Using local people will ensure definite job opportunities.	3	4
Frequency of potential occurrence of the Impact	**Before management**	**With management**
Once-off impacts	1	1
SIGNIFICANCE	**Before management**	**With management**

The impact will be low prior to mitigation but will increase with the remining and sloping. This will result in the overall positive impact of the project.	10	12

Cumulative impacts

Mining activities in the area already provide jobs.

Environmental objective

To ensure local job opportunities.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation hierarchy
The community must be employed for decommissioning and rehabilitation activities, as far as possible.	Operational until closure.	Social and Labour Plan.	Compliance with social and labour plan.	Ongoing.	Human resources.	None	

Stakeholder expectations and / or comments

Issue raised by Babina Tlou community.

Legal compliance and standards

None

Residual and latent risks

Job loss once closure is obtained.

vi) Methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks

Impact assessment

The methodology used to assess the significance of an impact is based on the requirements as set out in EIA Regulations, (GN 982) of 2014 i.t.o. the NEMA as well as the Proposed National Guideline on Minimum Information Requirements for Preparing EIA for Mining Activities that Require EA, of 2018, GN 86 in terms of NEMA. The impact significance methodology described below also complies to Appendix B of the Operational Guideline to Integrated Water and Waste Management of 2010 in terms of the NWA. In the event of any Section 21c&i water uses in terms of the NWA being assessed, Appendix A of the General Authorisations of 2016, GN 509 in terms of the NWA will be used to construct a risk matrix. Regulation 3(b) of the General Authorisations of 2016, GN 509 in terms of the NWA states that a suitably qualified SACNASP professional member must determine risks associated with this risk matrix.

Impact identification and prediction means forecasting the change of environmental parameters due to developmental patterns. These parameters may also be changing due to climate change and should be included.

Method of assessment: Impact identification and prediction is a stepwise procedure to identify the direct, indirect and cumulative impacts (relating to both positive and negative impacts) for which a proposed activity and its alternatives will have on the environment as well as the community. This should be undertaken by determining the geographical, physical, biological, social, economic, heritage and cultural sensitivity aspects of sites and locations as well as the risk of impact of the proposed activity. Refer to part A(h)(iv) for a complete description of these environmental attributes. Sources of data to be used for gathering data on the environmental attributes as well as the impacts include; monitoring / sampling data collected and stored, assumptions and actual measurements, published data available from the departments or other stakeholders in the area as well as specialist studies. Likely impacts should be described qualitatively and then studied separately in detail. This provides consistent and systematic basis for the comparison and application of judgements.

Significance rating: Ratings should then be assigned to each criterion. Significance of impacts should be determined for each phase of the mining lifecycle this includes; preconstruction, construction, operational, closure (including decommissioning) and post closure phases. The significance of impacts should further be assessed both with and without mitigation action. The description of significance is largely judgemental, subjective and variable. However, generic criteria can be used systematically to identify, predict, evaluate

and determine the significance of impacts resulting from project construction, operation and decommissioning. The process of determining impact magnitude and significance should never become mechanistic. Impact magnitude is determined by empirical prediction, while impact significance should ideally involve a process of determining the acceptability of a predicted impact to society. Making the process of determining the significance of impacts more explicit, open to comment and public input would be an improvement of environmental assessment practice. Impact magnitude and significance should as far as possible be determined by reference to either legal requirements (accepted scientific standards) or social acceptability. If no legislation or scientific standards are available, the EAP can evaluate impact magnitude based on clearly described criteria. A matrix selection process is the most common methodology used in determining and ranking the site sensitivities:

- The consequence: includes the nature / intensity / severity of the impact, spatial extent of the impact, and duration of the impact.
    - The nature / intensity / severity of the impact: An evaluation of the effect of the impact related to the proposed development on the receiving environment. The impact can be either positive or negative. A description should be provided as to whether the intensity of the impact is high, medium or low or has no impact in terms of its potential for causing negative or positive effects. Cognisance should be given to climate change which may intensify impacts.
    - The spatial extent of the impact: Indication of the zone of influence of the impact: A description should be provided as to whether impacts are either limited in extent or affect a wide area or group of people. Cumulative impacts must also be considered as the extent of the impact as may increase over time.
    - The duration of the impact: It should be determined whether the duration of an impact will be short-term, medium term, long term or permanent. Cumulative impacts must also be considered as the duration of the impact as it may increase over time.
- The likelihood: includes the probability of the potential occurrence of the impact, and frequency of the potential occurrence of the impact
    - The probability of the impact: The probability is the quality or condition of being probable or likely. The probability must include the degree to which these impacts can be reversed; may cause irreplaceable loss of resources; and can be avoided, managed or mitigated
    - The frequency of the potential occurrence of the impact.
- The significance: This is worst case scenario without any management measures. See below how significance is determined: Impact that may have a notable effect on one or more aspects of the environment or may result in noncompliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact

on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence. Mitigation measures should be provided with evidence or motivation of its effectiveness

Example of significance rating:

			Before management	With management
CONSEQUENCE	**Nature / Intensity / Severity of Impact**			
	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.	1	
	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are altered	3	
	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	5	
	Spatial extent of Impact			
	On-site	Impact occurs on-site	1	
	Local	Impact occurs within 5km radius of the site	2	
	Regional	Regional Impact occurs within a 100km radius of the site	3	
	National	National Impact occurs within South Africa	4	
	International	Impact occurs internationally	5	
	Duration of Impact			
	Short-term	Through dilution and dispersion, the impact reduces to insignificant within 1 week.	1	
	Medium-term	Through dilution and dispersion, the impact reduces to insignificant within the life of the mine.	2	
	Long-term	The impact will cease after the operational life of the mine either because of natural process or by human intervention	3	
	Permanent	Where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.	4	
LIKELIHOOD	**Probability of potential occurrence of the Impact**			
	Improbable	The possibility of the impact materializing is very low either because of design or historic experience	**1**	
	Probable	There is a distinct possibility that the impact will occur	**2**	

	Highly probable	It is most likely that the impact will occur	**3**	
	Definite	The impact will occur regardless of any prevention measures	**4**	
	Frequency of potential occurrence of the Impact			
	Annually or less	Impact occurs at least once in a year or less frequently	1	
	6 months	Impact occurs at least once in 6 months	2	
	Monthly	Impact occurs at least once a month	3	
	Weekly	Impact occurs at least once a week.	4	
	Daily	Impact occurs daily	5	

CONSEQUENCE

LIKELIHOOD													
	3	4	5	6	7	8	9	10	11	12	13	14
2	5	6	7	8	9	10	11	12	13	14	15	16
3	6	7	8	9	10	11	12	13	14	15	16	17
4	7	8	9	10	11	12	13	14	15	16	17	18
5	8	9	10	11	12	13	14	15	16	17	18	19
6	9	10	11	12	13	14	15	16	17	18	19	20
7	10	11	12	13	14	15	16	17	18	19	20	21
8	11	12	13	14	15	16	17	18	19	20	21	22
9	12	13	14	15	16	17	18	19	20	21	22	23

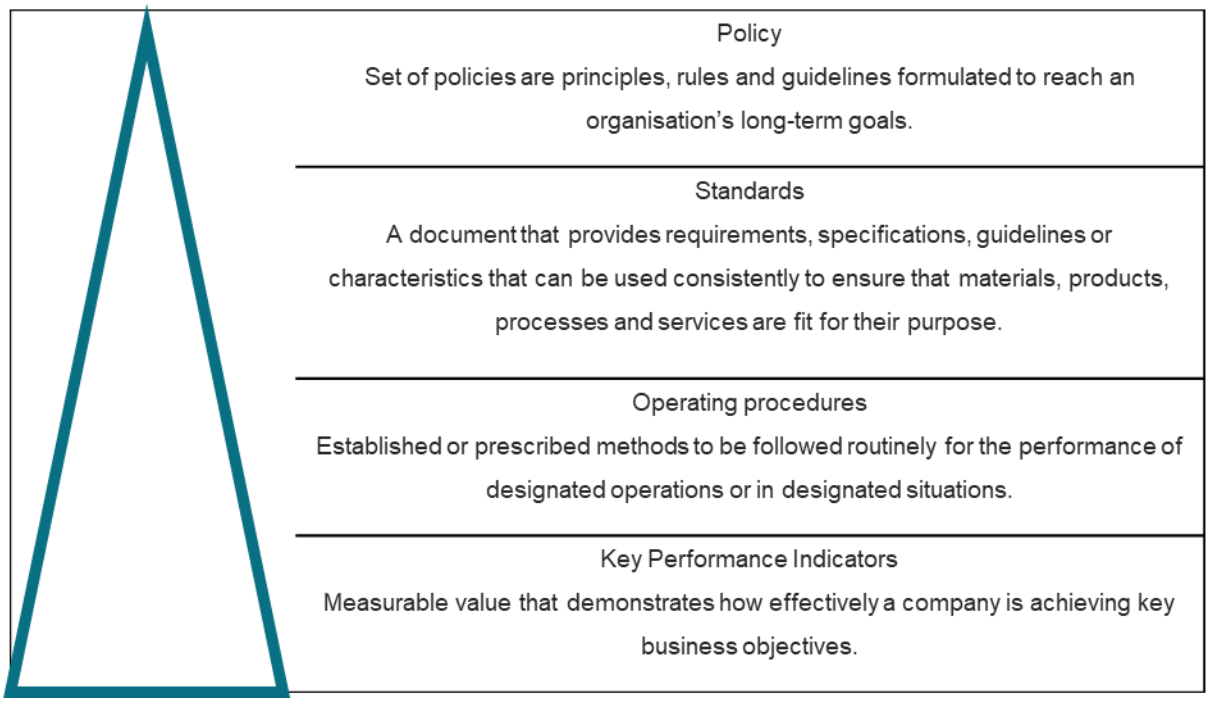
Low	Where it will not have a significant influence on the environment. Management measures can be proposed to ensure that significance does not increase	5- 11
Medium	Where it could have a significant influence on the environment unless it is mitigated or managed	12- 17
High	Where it would have a significant influence on the environment regardless of any possible mitigation and hence must be either avoided or managed	18- 23
Medium positive	In the case of an impact having a positive outcome.	High positive

Mitigation and management

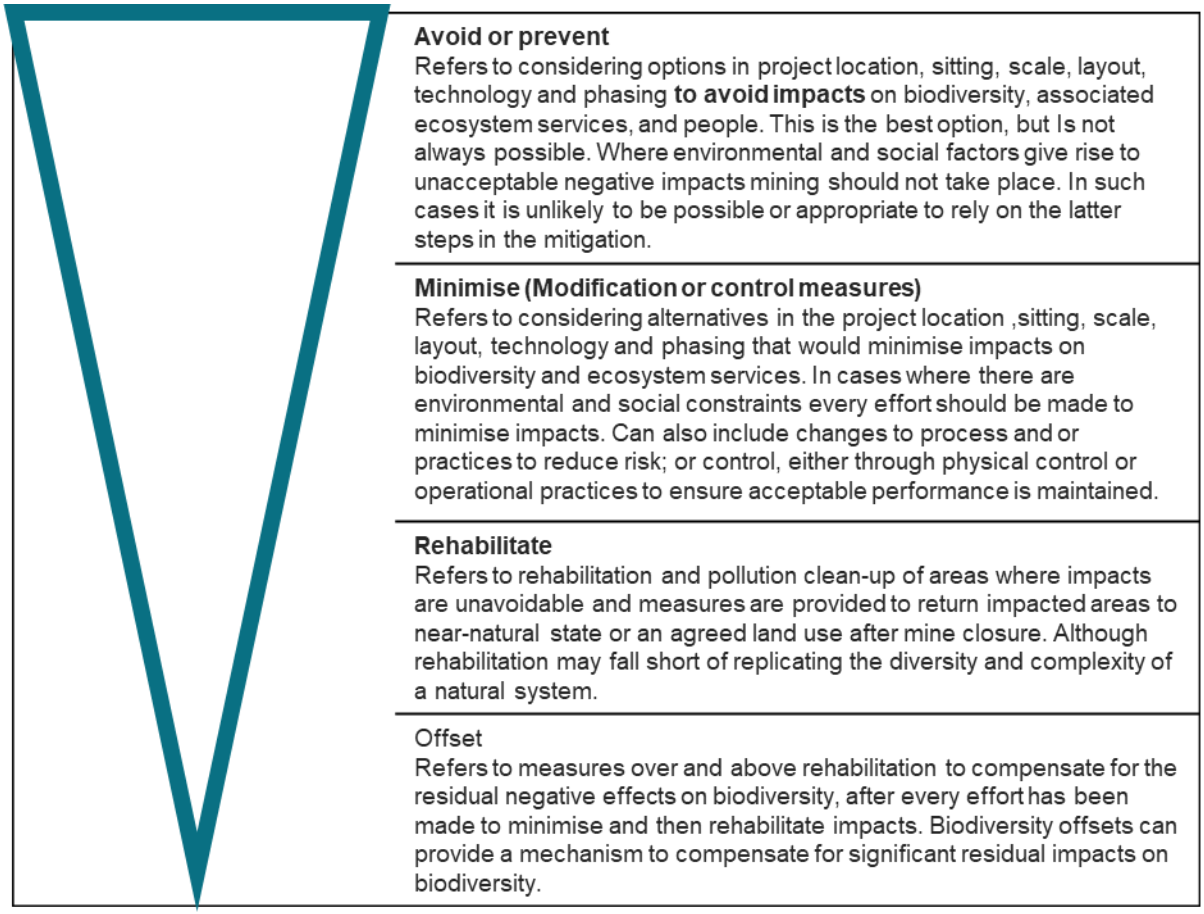
Management methodology is based on the requirements as set out in EIA Regulations, (GN 982) of 2014 i.t.o. the NEMA as well as the Proposed National Guideline on Minimum Information Requirements for Preparing EIA for Mining Activities that Require EA, of 2018, GN 86 in terms of NEMA; and the Mining and

Biodiversity Guideline (Mainstreaming Biodiversity into the Mining Sector) IDB of 2013 in terms of the MPRDA.

Management statements detail the processes, procedures and practices required to achieve an impact management outcome. A hierarchy of management tools used can also be used as seen below.



Mitigation should include measures in the following order of priority. The aim is to prevent adverse impacts from happening or, where this is unavoidable, to limit their significance to an acceptable level.



Avoiding or preventing impacts

If the biodiversity (an ecosystem, habitat for threatened species, ecological corridor or area that provides essential ecosystem services) is of conservation value or importance, it is best to plan to avoid or prevent impacts altogether by changing the location, siting, method or processes of the mining activities and related infrastructure.

Minimising impacts

Minimising impacts of mining is a mitigation measure that deals with the environment in general. In areas where the biodiversity is to be affected is of conservational value or importance, then every effort should be made to minimise those impacts that cannot be avoided or prevented. Mining companies should strive to minimise impacts on biodiversity to ensure environmental protection. Section 2 of NEMA contains environmental management principles that resonates with minimising the impact rather than stopping at mitigation, this is imperative in the mining sector.

Rehabilitating impacted areas

Rehabilitation is the measures that are undertaken to "as far as it is reasonably practicable, rehabilitate the environment affected by the prospecting or mining operations to its natural or predetermined state or to a land use which aligns to the generally accepted principle of sustainable development. A closure plan is an essential part of rehabilitation and must be developed based on the establishment of the closure objectives and criteria.

Biodiversity offsets

Biodiversity offsets are measurable conservation gains that help to balance any significant biodiversity losses that remain after actions to avoid, minimise and restore negative impacts have been taken. They are the last stage of mitigation and should be considered after appropriate avoidance, minimisation, and rehabilitation/restoration measures have been applied already.

When dealing with management, impact management outcomes must:

- be set for the expected activity-based impacts;
- describe the desired outcome of the management measure/s prescribed or the standard to be achieved (environmental objective);
- be clearly documented and identified per project phase as in the impact identification and significance rating process (this must be aligned to the mines closure objectives, and must therefore include predicted long-term result of the applied management measures);
- be measurable to determine compliance, which includes time frames and schedule for the implementation of the management measures; responsibilities for implementation and long-term maintenance of the management measures; financial provision for long-term maintenance; and monitoring programmes to be implemented;
- be informed by stakeholder expectations; and
- ensure legal compliance;

Finally, the impact assessment must refer to the residual and latent impact after successful implementation of the management measures.

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

No alternatives are applied for.

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

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

ix) Motivation where no alternative sites were considered

There is no alternative to the remining of mine residue. The activities in this Section 102 report is the most effective way to rehabilitate the area.

x) Statement motivating the preferred site

Not applicable. No alterative considered.

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

Refer to Part A(g)(v & vi) above for a full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (In respect of the final site layout plan) through the life of the activity.

i) Assessment of each identified potentially significant impact and risk

Groundwater pollution is the only significant risk identified in this study. This is however, an already existing risk.

j) Summary of specialist reports

- An air quality impact assessment was conducted in 2018 and the following aspects were noted. Steelpoort is considered an air quality hotspot. Of particular concern in the Steelpoort hotspot area is the ambient concentration of PM10. Annesley and the proposed remining project are located approximately 18 km east of the Steelpoort hotspot area;
- Annesley's existing mining and processing operation was identified as the primary source of air pollution in the area of the proposed remining project;
- The proposed remining project will involve material handling by excavators and front-end loaders, hauling, material transfer, conveying, crushing, screening and dumping;

- These remining activities have the potential to become major sources of dust and fine particulates (PM10 and PM2.5) and to lesser extent combustion emissions from vehicles and mobile equipment;
- The dispersion modelling results found both remining at Segorong and remining at Havercroft to:
  - Exceed the average daily NAAQS (75 µg/m3) for PM10 in proximity to the crushing and screening plant;
  - Fall below the annual average NAAQS (40 µg/m3) for PM10; and
  - Exceed the NDCR standard for non-residential areas (1200 mg/m2/day) in proximity to the crushing and screening plant.

The main conclusion of the air quality impact assessment is that the proposed remining project is likely to result in high to moderate impacts without mitigation. Its anticipated that the application of the mitigation measures as per section 4 will reduce the significance of the impacts to moderate and low.

It is Shangoni's opinion that the proposed remining project may continue if the applicant commits to implementing the mitigation measures recommended in section 4 of this report. These mitigation measures should be improved on, should dustfall- or any ambient air quality monitoring results during the construction, operational and/or the closure phase show exceedances of dustfall or the ambient air quality standards.

k) Environmental impact statement

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

The geology of the surrounding environment will not be altered as the project involves the remining of mine residue. The surrounding faunal and floral habitat will not be impacted by the project. Already existing infrastructure will be used therefore no impact on archaeological, historical and cultural aspects.

The topography of the area will be impacted in a positive manner as further sloping and rehabilitation on Havercroft Operation is planned for the near future. The remining of the mine residue will therefore reduce the residual impact after closure and rehabilitation.

Soils, land capability, surrounding land use and landscape character will be impacted by further by the project as it prolongs the start date of rehabilitation. If soil pollution does occur, it will be mitigated through the various management measures set out in the impact assessment. Once rehabilitation is complete, the end land-use will be grazing and game farming.

Surface water pollution due to run-off from already existing mine residue will have a negative impact on the environment. This will impact receptors which may be influenced by the mining activities include the users in the Mogomotsi River (aquatic species, livestock, wildlife). However, the approved water monitoring programme will ensure that this does not occur, and the adequate operational measures are taken.

Seepage from already existing mine residue can potentially lead to groundwater pollution. Vertical seepage will dominate during the operational phase and will most probably remain isolated during the operational phases. Management measures will ensure that the impact after management is reduced and groundwater monitoring takes place.

Short term air pollution due to dust from remining of mine residue as well as transportation of mine residue will occur but can be remediated through re-vegetation to prevent surface erosion and vehicles sticking to the correct speed limits.

Environmental noise may affect the community within the vicinity, the mine will mitigate this through the maintenance of vehicles and machinery to ensure they are functioning optimally.

The project will create temporary jobs for rehabilitation activities by using locals. However, once the mine closes the risk of unemployment arises. However, the increased traffic in the area can negatively impact receptors. This will be mitigated through speed limits.

(ii) Final Site Map

Refer to Addendum 1 for all the maps.

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

Environmental component	Negative implications	Positive implications
Geology	There will be no negative impact	There will be no positive impact
Topography	There will be no negative impact	The project will have a positive impact on topography as the topography of the mine residue areas will be changed to a more natural topography. This will further also have a positive impact on the drainage patterns as well as the

Environmental component	Negative implications	Positive implications
		visual aspects. There will be no impact from the roads, as there are already existing roads from all areas to Annesley Plant. There will also be no impact from the pipelines as the pipelines will be on already existing routes.
Soils	The project will have a negative impact on the soil as soil pollution from spillages of mine residue or hydrocarbons may occur.	There will be no positive impact
Land capability, surrounding land use and landscape character	There will be no negative impact	The project will have a positive impact on land capability and land use as they will be restored to non - mining conditions with the appropriate sloping and rehabilitation to take place in the near future.
Vegetation and animal life	There will be no negative impact	There will be no positive impact
Surface water	The project may have negative implications on surface water resources as receptors may be influenced by the mining activities and include the users in the Mogomotsi River (aquatic species, livestock, wildlife).	There will be no positive impact
Groundwater	The project will negatively impact groundwater resources as vertical seepage from the already existing mine residue during the operational phase may occur.	There will be no positive impact
Air quality	Air pollution due to dust from remining of mine residue as well as transportation of mine residue has the negative potential to reduce the air quality without proper air quality management measures as per the air emissions license.	There will be no positive impact

Environmental component	Negative implications	Positive implications
Environmental noise	Environmental noise from remining of mine residue as well as transportation of mine residue has the potential to negatively impact receptors within the area.	There will be no positive impact
Archaeological, historical and cultural aspects	There will be no negative impact as already existing infrastructure to be used therefore no impact on archaeological, historical and cultural aspects.	There will be no positive impact as already existing infrastructure to be used therefore no impact on archaeological, historical and cultural aspects.
Socioeconomic	The project will have a negative impact on the mine as increased traffic leading to the area will endanger the people walking in the vicinity.	The project will have a positive impact on the community as locals will be employed by the mine.

l) Proposed impact management objectives and the impact management outcomes for inclusion in the environmental management programme

Refer to Part A(g)(v) for all Proposed impact management objectives and the impact management outcomes for inclusion in the EIA/EMP Part B.

m) Final proposed alternatives

There are no alternatives.

n) Aspects for inclusion as conditions of Authorisation

All management measures set out in this EIA/EMP must be complied to. The mine must further comply with any conditions set out under other authorisations.

o) Description of any assumptions, uncertainties and gaps in knowledge

1. No specialist studies were conducted. All impact assessments and management measures are based on either previous studies or on acceptable general standards.

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

i) Reasons why the activity should be authorised or not

The proposed activity should be authorised as it will contribute largely to the production of Andalusite which is a refractory mineral that can contribute largely to South Africa's Gross Domestic Product (GDP) as South Africa has one of the highest Andalusite reserves in the world. Through the allowance remining of the mineral, the environmental impact is significantly less than starting a new project in a new vicinity which is why the project should be authorised. The project will also ensure that locals are involved and will create opportunities for skill transfer between the mine and locals.

ii) Conditions that must be included in the authorisation

The mine must update the water monitoring requirements as soon as DWS has issued a WUL.

q) Period for which the Environmental Authorisation is required

The period for which the authorisation will be required until 2051, the mining right will expire after 30 years where after it will be renewed.

r) Undertaking

The undertaking required to meet the requirements of this section is provided at the end of the EMP and is applicable to both the EIA report and the EMP.

s) Financial Provision

The financial provisioning must include:

1. Annual forecasted financial provision calculation;
2. Confirmation of the amount that will be provided should the right be granted (in this case, the mine already has a right, therefore the amount updated annually);
3. Method of providing financial provision contemplated in Regulation 53; and
4. Capacity to manage and rehabilitate the environment.

1 Annual forecasted financial provision calculation

The financial provision for the mine is updated on an annual basis. The update will include any changes due to this project.

2 Confirmation of the amount that will be provided should the right be granted

The mine has financial provision in place for the mine residue. This EIA (WL) is to remove the mine residue and place in other authorised areas. No new mine residue areas will be created. The costs as per the MWP is included. This is costs to rehabilitate the area where remining has taken place.

Table 31: Estimated environmental and rehabilitation cost (in kZAR)

CATEGORY	
a) Progressive total for rehabilitation	Annesley: 22,464.4 (2018 to 2037 = 19 years) Havercroft: 17,718.14 (2018 to 2021 = 3 years)
b) Cost to mitigate socio-economic conditions of directly affected persons	0
Total costs (19 years)	**40,182.54**
Total costs year 1	**7,088.38**
Total costs year 2	**7,088.38**
Total costs year 3	**7,088.38**
Total costs year 4	**118,2.34**
Total costs year 5	**118,2.34**
Total costs year 6	**118,2.34**
Total costs year 7	**118,2.34**
Total costs year 8	**118,2.34**
Total costs year 9	**118,2.34**
Total costs year 10	**118,2.34**

3 Method of providing financial provision contemplated in regulation 53

This amount will be provided using a bank guarantee.

4 Capacity to manage and rehabilitate the environment

Refer to the tables in Part A(g)(v) for a description of the environmental budget.

t) Deviations from the approved scoping report and plan of study

The impact and management methodology has been updated.

u) Other Information required by the competent Authority

i) Compliance with the provisions of sections 24(4)(a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act (Act 107 of 1998)

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

Refer to Part A(g)(v) above.

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

Refer to Part A(g)(v) above.

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

24 (4) Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment-	
(a) must ensure, with respect to every application for an EA-	
i. Coordination and cooperation between organs of state in the consideration of assessments where an activity falls under the jurisdiction of more than one organ of state;	DMR is the only applicable authority for the proposed integrated EA and thus the only organ of state. DWS is, however the competent authority for the IWULA. All other organs of state and stakeholders will receive the ESR as well as the EIA/EMP for review.
ii. That the findings and recommendations flowing from an investigation, the general objectives of integrated environmental management laid down in this Act and the principles of environmental management set out in section 2 are taken into account in any decision made by an organ of state in relation to any proposed policy, programme, process, plan or project;	All the findings from investigations have been included in this ESR.
iii. That a description of the environment likely to be significantly affected by the proposed activity is contained in such application;	Environmental baseline information, based in specialist studies, has been included in this ESR.
iv. Investigation of the potential consequences for or impacts on the environment of the activity and assessment of the significance of those potential consequences or impacts; and	Investigation of impact on the environment and assessment of the significance of the potential impacts have been done by specialists previously. However, for the intended project, no specialist studies were conducted.
v. Public information and participation procedures which provide all I&APs, including all organs of state in all	Refer to Part A(h)(iii) for the PPP.

spheres of government that may have jurisdiction over any aspect of the activity, with a reasonable opportunity to participate in those information and participation procedures; and	
(b) must include, with respect to every application for an EA and where applicable-	
i. Investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity;	Investigation of impact on the environment and assessment of the significance of the potential impacts have been done by specialists. However, for the intended project, no specialist studies were conducted.
ii. Investigation of mitigation measures to keep adverse consequences or impacts to a minimum;	There were no specialist studies conducted as the project involves the remining and transportation of the mineral. Therefore, already existing management measures will be applied.
iii. Investigation, assessment and evaluation of the impact of any proposed listed or specified activity on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999), excluding the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act;	Refer to Part A(h)(v)(9)
iv. Reporting on gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information;	All gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information will be included in the EIA/EMP.
v. Investigation and formulation of arrangements for the monitoring and management of consequences for or impacts on the environment, and the assessment of the effectiveness of such arrangements after their implementation;	A monitoring plan will be included in the EIA/EMP. Refer to Part B(h)(i)
vi. Consideration of environmental attributes identified in the compilation of information and maps contemplated in subsection (3); and	Environmental attributes identified were taken into consideration during the process.
vii. Provision for the adherence to requirements that are prescribed in a specific environmental management Act relevant to the listed or specified activity in question.	Refer to Part B(k) for adherence to requirements that are prescribed in a specific environmental management Act relevant to the listed or specified activity in question and the financial provision

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

a) Details of the Environmental Assessment Practitioner

Refer to Part A(a) for the requirement for the provision of the details and expertise of the EAP.

b) Description of the Aspects of the activity

The requirement to describe the aspects of the activity that are covered by the draft EMP is already included in Part A(1)(h), and (g)(v) herein as required.

c) Composite map

Refer to Addendum 1 for all the maps.

d) Description of impact management objectives including management statements

i) Determination of closure objectives

1 End 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.

2 Residual impacts

There will be no residual impact for geology, the surrounding faunal and floral habitat, archaeological, historical and cultural aspects as the project does not affect these environmental components. The sloping will lessen this residual impact felt on topography by the project. There will be no residual impact from soil pollution as soil pollution will be mitigated as soon as the spillage occurs. There residual risk of groundwater and surface water pollution depends on the results of water monitoring. There will be no residual impacts on air quality, environmental noise and the socio-economic component.

3 Closure objectives

The closure objective is to restore the land to a self-sustaining, aesthetically pleasing landform and planted to pasture that could be used for grazing by the surrounding communities.

- Demolition or disposal of structures and buildings, removal of foundations and debris and rehabilitation of the surface, subject to Section 40 of the Minerals Act
- Disposal facilities (pipes, solution trenches, return water dams etc.).
    - The tailings delivery and return water pipes will be removed, as will the conveyor belt feeding the tailings dumps
- On-going seepage, control of rainwater.
    - Minimise seepage through control of rainwater on residue.
- Long-term stability.
    - Long-term stability will be enhanced by the relatively flat slope of spoil areas and the re-vegetation of bare areas with a combination of creeping and tufted grass species.
- Final rehabilitation in respect of erosion and dust control.
    - Long-term erosion and dust control will be achieved by the re-vegetation of spoil and bare areas with a combination of creeping and tufted grass species.

4 Rehabilitation process

- Firstly, all steel pipes will be removed to other mines within the Imerys Group. These pipes will then be reused as part of their operations. The pipes will be removed in accordance with all environmental principles as well as the requirements of the MHSA
- It is proposed to slope most of the material to the north in the direction of the tailings facility and to the east towards the plant area. Once the sloping is finalised it is also recommended to add contour paddocks along the side slopes of the waste rock dump no more than 20m apart. Previous contours of 50m apart have shown erosion to form along the slope
- The removal of unwanted roads will prevent erosion of these areas. Some roads will still be used by farmers and cannot be removed
- It is proposed to plant a thick row of euphorbias on the top of the high walls. This will be done to prevent access of people and animals to these high walls

ii) The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity

Refer to Part A(d)(i).

iii) Potential risk of acid mine drainage

According to the Geohydrological Evaluation (Aurecon, 2010):

'It was proven at the Havercroft Andalusite Mine that the stable & inert nature of the andalusite and gangue increases the water quality by absorbing certain elements'.

It can therefore be assumed that the risk of AMD or potential groundwater contamination associated with the mineral to be mined is therefore minimal to zero.

iv) Steps taken to investigate, assess, and evaluate the impact of acid mine drainage

Refer above, not necessary.

v) Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage

Refer above, not necessary.

vi) Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage

Refer above, not necessary.

vii) Volumes and rate of water use required for the mining, trenching or bulk sampling operation

This is not applicable for the proposed activities.

viii) Has a water use licence has been applied for?

Havercroft Operation has and IWUL; however, it has elapsed. DWS will advise whether an IWULA is necessary for the decommissioning and rehabilitation. Annesley Operation has an IWUL. A pre-application meeting is set to take place on the 19th of July 2018 where the IWUL will be discussed to make the necessary amendments to the IWUL to ensure it is up to date.

ix) Impacts to be mitigated in their respective phases

Refer to Part A(g)(v) as well as Part A(i) of this report.

e) Impact management outcomes

Refer to Part A(g)(v) as well as Part A(i) of this report.

f) Impact management actions

Refer to Part A(g)(v) as well as Part A(i) of this report.

g) Financial provision

(a) Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under Regulation 22 (2) (d) as described in 2.4 herein

Refer to Part B(1)(d) for closure objectives.

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

All comments are included in this EIA/EMP.

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

The Annesley Andalusite Mine Closure Liability Update were submitted to DMR. These plans include rehabilitation of the area. The Annesley Andalusite Mine (Havercroft Operation) Annual Rehabilitation Plan was also submitted to DMR and includes the anticipated mining activities at anticipated time of closure.

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

The closure objectives in this EMP were taken from the Annesley Andalusite Mine Closure Liability Update as discussed above. The Annesley Andalusite Mine (Havercroft Operation) Annual Rehabilitation Plan includes the latest closure objectives which are in line with the rehabilitation plan. The rehabilitation plans outline how the closure objectives are to be achieved and they work simultaneously.

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

Refer to Part A(s).

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

Refer to Part A(s).

h) Mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon

Baseline monitoring is required to establish existing conditions that will help to define the requirements for site restoration and provide a basis for comparison of effects during the operation. Compliance monitoring should be carried out during the operation to ensure that the specified target limits are being met. The following environmental monitoring will be conducted at Annesley.

Only monitoring applicable to this project is included, all additional monitoring is found in prior environmental documents.

i) Monitoring of impact management actions

All impacts identified in the impact assessment must be monitored to ensure the correct management thereof takes place.

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.

2 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.

3 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 32 and 33 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, 2018).

Parameters to be monitored

Table 32: Surface water monitoring parameters for Section 21c&i and Section 21g water uses

<table>
<tr><th colspan="4">ASWM0, ASWM1, ASWM2, ASWM3, ASWM4, ASWM5, ASWM6</th></tr>
<tr><th>Variables to be sampled</th><th>Unit</th><th>Limits</th><th>Frequency</th></tr>
<tr><td rowspan="2">Heavy metals</td><td>Aluminium</td><td>
<table>
<tr><th>TWQR and Criteria</th><th colspan="2">Aluminium concentration (µg/•)</th></tr>
<tr><th></th><th>pH< 6.5</th><th>pH > 6.5</th></tr>
<tr><td>Target Water Quality Range (TWQR)</td><td>• 5</td><td>• 10</td></tr>
<tr><td>Chronic Effect Value (CEV)</td><td>10</td><td>20</td></tr>
<tr><td>Acute Effect Value (AEV)</td><td>100</td><td>150</td></tr>
</table>
</td><td rowspan="2">Every 6 months (January and July)</td></tr>
<tr><td>Iron</td><td>The iron concentration should not be allowed to vary by more than 10 % of the background dissolved iron concentration for a particular site or case, at a specific time.</td></tr>
</table>

<table>
<tr><th colspan="4">ASWM0, ASWM1, ASWM2, ASWM3, ASWM4, ASWM5, ASWM6</th></tr>
<tr><th>Variables to be sampled</th><th>Unit</th><th>Limits</th><th>Frequency</th></tr>
<tr><td></td><td>Magnesium (Mg)</td><td>58.85 mg/l (from WUL)</td><td></td></tr>
<tr><td></td><td>Nickel</td><td>No clear guide for aquatic ecosystems. Sample results used to compare to previous results</td><td></td></tr>
<tr><td></td><td>Chromium (vi)</td><td>>7 µg</td><td></td></tr>
<tr><td></td><td>Chromium (iii)</td><td>>12 µg</td><td></td></tr>
<tr><td></td><td>Copper (Cu)</td><td><table><tr><th rowspan="2">TWQR and Criteria</th><th colspan="4">Copper concentration (µg/•)</th></tr><tr><th>< 60 (Soft)</th><th>60-119 (Medium)</th><th>120-180 (Hard)</th><th>> 180 (Very hard)</th></tr><tr><td>Target Water Quality Range (TWQR)</td><td>• 0.3</td><td>• 0.8</td><td>• 1.2</td><td>• 1.4</td></tr></table></td><td></td></tr>
<tr><td></td><td>Manganese (Mn)</td><td>>180 µg</td><td></td></tr>
<tr><td></td><td>Total Iron</td><td>The total iron concentration should not be allowed to vary by more than 10 % of the background dissolved iron concentration for a particular site or case, at a specific time.</td><td></td></tr>
<tr><td>Total hardness</td><td>Total hardness (CaCO) in (mg/l) used for Copper interpretation</td><td></td><td></td></tr>
<tr><td>Hydrocarbons</td><td></td><td>Any and all results must be 0.</td><td></td></tr>
<tr><td>Rough estimate of flow</td><td>Basic flow speed calculated distance covered in time. Two stakes on banks of system, exactly two meters apart.</td><td>To be compared to previous results.</td><td>Monthly</td></tr>
</table>

ASWM0, ASWM1, ASWM2, ASWM3, ASWM4, ASWM5, ASWM6			
Variables to be sampled	**Unit**	**Limits**	**Frequency**
	Using stopwatch, determine flow speed.		
pH[1]		6.0-9.0	Monthly
Total Dissolved Solids[1]	mg/l	≤450	Monthly
Electrical Conductivity[2]	mS/m	≤70	Monthly
Suspended Solids[1]	mg/l	Background TSS concentrations are < 100 mg/R. Any increase in TSS concentrations must be limited to < 10 % of the background TSS concentrations at a specific site and time.	Monthly
Nitrate (NO_3)[3]	mg/l	<0.5	Monthly
Oxido nitrate (NO_4)[3]	mg/l	<0.5	Monthly
Phosphate (PO_4)[3]	mg/l	<0.005	Monthly
Temperature[4]	Degrees Celsius	16-20ºC	Monthly

[1]All parameters, units and limits were taken from the Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines (first edition). Volume 8: Field Guide.

[2]General limits for general authorisations

[3]Department of Water Affairs and Forestry, 1996

[4]Limnology, 2018

3.1 Return water dam

Table 33: Quarry 3 RWD water monitoring parameters for Section 21g water uses

ARWD			
Variables to be sampled	**Unit**	**Leachable Concentration Threshold (LCT) Limits**	**Frequency**
Arsenic	(mg/l)	0.01	Annually
Boron	(mg/l)	0.5	Annually
Barium	(mg/l)	0.7	Annually

ARWD			
Variables to be sampled	**Unit**	**Leachable Concentration Threshold (LCT) Limits**	**Frequency**
Cadmium	(mg/l)	0.003	Annually
Cobalt	(mg/l)	0.5	Annually
Chromium Total	(mg/l)	0.1	Annually
Chromium (VI)	(mg/l)	0.05	Annually
Copper	(mg/l)	2.0	Annually
Mercury	(mg/l)	0.006	Annually
Manganese	(mg/l)	0.5	Annually
Molybdenum	(mg/l)	0.07	Annually
Nickel	(mg/l)	0.07	Annually
Lead	(mg/l)	0.01	Annually
Antimony	(mg/l)	0.02	Annually
Selenium	(mg/l)	0.01	Annually
Vanadium	(mg/l)	0.2	Annually
Zinc	(mg/l)	5.0	Annually
TDS	(mg/l)	1000	Annually
Chloride	(mg/l)	300	Annually
Sulphate	(mg/l)	250	Annually
Nitrate-N	(mg/l)	11	Annually
Fluoride	(mg/l)	1.5	Annually
Cyanide Total	(mg/l)	0.07	Annually

All parameters, units and limits were taken from the National norms and standards for the assessment of waste for landfill disposal, GN635 of 2013 in terms of the National Environmental Management Waste Act, no 59 of 2008 as amended.

3 Ground water 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 34 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, 2018).

Parameters to be monitored

Table 34: Groundwater monitoring parameters for Section 21g water uses

ANW1, ANBH Penge, ANBH Chief, ANBH Mine, ANQ6, upstream of the BH School borehole, and downstream of boreholes ANBH, CHIEF and H12-2270.			
Variables to be sampled	**Units**	**Groundwater target water quality range as per the IWUL**	**Frequency**
Heavy metals	See table above		
Hydrocarbons	See table above		
pH		7.84 - 8.62	Quarterly
Electrical Conductivity	(mS/m)	152.40	Quarterly
Chlorides	(mg/l)	302.40	Quarterly
Sulphates	(mg/l)	57.27	Quarterly
Orthophosphate			Quarterly
Fluoride	(mg/l)	0.43	Quarterly
Sodium	(mg/l)	138.60	Quarterly
Potassium			Quarterly
Calcium	(mg/l)	74.13	Quarterly
Magnesium	(mg/l)	58.85	Quarterly
Aluminium			Quarterly
Iron			Quarterly
Manganese			Quarterly
Nitrate	(mg/l)	0.40	Quarterly
Nickel			Quarterly
Copper			Quarterly
Total chromium			Quarterly
Total hardness			Quarterly
Iron			Quarterly
Total dissolved solids	(mg/l)	450	Quarterly
Total suspended solids			Quarterly
Zinc			Quarterly
Silica			Quarterly
Faecal coliforms	(100ml)	0	Quarterly
Total alkalinity			Quarterly
Total Petroleum hydrocarbon			Quarterly

All parameters, units and limits were taken from the IWUL limits (Groundwater Target Water Quality Range).

4 Fall out dust

Mechanism for monitoring compliance:

Method:

ASTM D1739 1998 (Reapproved 2017) and compliance with Atmospheric Emission Licence (SK17/1/8/5/AEL/ANN ANDA/MINE).

• Determine the contribution of dustfall in residential and non-residential areas in the vicinity of the mine; and

• To establish the baseline dustfall at the mine

• Maintain a complaint register

- The complaints register should be kept with security at the entrance to the site;
- The complaints register should provide space for the following information: complainant name, complaint, physical address, telephone number, date and the time when the complaint was registered; and
- All air quality related complaints should be investigated, and remedial steps taken.

The monthly dustfall monitoring reports will comply with Regulation 5(a) of the National Dustfall Control Regulations. Regulation 5 (a) requires a dustfall monitoring report to provide:

a) Information on the location of sampling sites, including latitudinal and longitudinal coordinates, and a position indicator on a topographic map;

b) Classification of the area where samplers are located, in terms of residential and non-residential, and identification of sensitive receptors;

c) Reference to the standard methods used for site selection, sampling and analysis, and any methods/laboratory accreditation, if applicable;

d) The dustfall monitoring results including a comparison of current year and historical results (if any) for each site, and including a tabular summary of compliance with the dustfall standard set out in regulation 3; and

e) Meteorological data (wind speed and direction, rainfall) for the sampling area; and any other relevant data that might influence the results.

Environmental component affected and impact	**Monitoring and reporting frequency**	**Responsible persons**
• Dust generation on air quality	Monthly monitoring.	Mine manager / site geologist.

5 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.

ii) Monitoring and reporting frequency

Refer to Part B, section (i) above.

iii) Responsible persons

Refer to Part B, section (i) above.

iv) Time period for implementing impact management actions

Refer to Part B, section (i) above.

v) Mechanism for monitoring compliance

Refer to Part B, section (i) above.

i) Indicate the frequency of the submission of the performance assessment report

The performance of the EIA/EMP will be assessed every two years. A financial provision will accompany the EIA/EMP which will be updated on an annual basis. This financial provision update will be accompanied by a report on rehabilitation that has taken place. An audit on the Integrated Water Use License (IWUL) was also done to ensure compliance in all water uses and activities taking place on the mine.

j) Environmental awareness plan

This section includes:

1. Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work; and
2. Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment.

The following was extracted from the Environmental training procedure (BECS Environmental, 2016).

i) Induction training

1. Induction training is relevant to all new employees and contractors (including any employee and/or contractor that has not yet been trained on the environmental induction material) as well as all visitors to Annesley Andalusite Mine.
2. Training will be repeated every 18 months.

3. Induction training will include the following:
   a. Relevant impacts and management as per the approved and operational EMP of Annesley Andalusite Mine (these will be site- and job specific);
   b. Environmental procedures; and
   c. Environmental emergency procedure.
4. The trainee will after completion of induction:
   a. Sign the necessary induction form/book; and
   b. Have all relevant PPE necessary for the specific job.

ii) General environmental awareness training

1. Management will identify environmental awareness needs and related environmental topics.
2. The environmental awareness will include:
   a. The significant environmental impacts, actual or potential, of their work activities and the benefits of improved personal performance; and
   b. The potential consequences of departure from specified operating procedures.
3. Environmental awareness training will form part of the safety talks prior to each shift.
4. Visual aids will be used, where applicable to help with awareness training. These could be in the form of posters displayed at specific work areas after training was done.

iii) Competency training

1. Management will identify job-related training needs for all employees who have or can have a significant impact on the environment.
2. A training needs matrix will be completed for Annesley Andalusite Mine.
3. Job specific training will convey the importance of conformance with the environmental procedures. Simplified summaries of these procedures may be used to ensure better understanding at lower levels of the organisation.

4. Management will identify specialised training needs. for personnel performing tasks, which can cause significant environmental impacts, or personnel who needs specialised environmental knowledge for areas of responsibility. These courses will be sourced externally.

5. Management will undergo legal training from time to time. A summary of this training wil also be given to employees of Annesley Andalusite Mine.

iv) Development of training material

1. The Health and Safety Officer will develop and maintain training material for induction training, general environmental awareness and competency training. This excludes specialised competency training which wil be externally sourced.
2. This training material will be based on the approved and operational EMP as well as environmental procedures. Additional topics will also be included for general environmental awareness.
3. Training material will be reviewed using results from audits, changes to plant/operation, competency assessments and new significant aspects.

v) Scheduling of training

1. Once training topics and material have been compiled, the Health and Safety Officer will ensure employees are scheduled according to the needs identified.

vi) Training records

1. Upon completion of training, a training record will be completed. This may be in the following formats:
   a. Attendance registers;
   b. Sign off on procedure to demonstrate understanding of procedure; and/or
   c. Certificates of attendance / completion.

2. All training records will be kept for the period of employment plus an additional 5 years.

vii) Reconciliation to determine gaps in attendance

1. All employees and contractors must undergo all training as identified (as per training needs analysis). Reconciliation will be done on all training attendance registers, against the training schedules, to identify any shortcomings in training performed and reschedule if necessary.

viii) Competency assessment

1. An evaluation will be conducted on all employees and contractors. The aim is to identify both the effectiveness of training as well as the competence in performing the job.
2. Competency evaluation records will be completed by the approved training assessor and will be included with the attendance records.

k) Specific information required by the Competent Authority

1 Financial provision

The financial provision will be reviewed on an annual basis.

2 Procedures for environmentally related emergencies and remediation

The following was extracted from the Environmental emergency's procedure (BECS Environmental, 2016).

2.1 List of environmental incidents

Description or activity	Aspect	Impact	Associated procedure and other records
Diesel tank	Burst of pipe, leakage from tank	Major spillage causing soil pollution	Spill handling procedure (AAM-EP-02), Environmental Emergency Response Plan, diesel MSDS,
		Any spillage into a water resource	
Diesel tanker	Off-loading and loading spillages	Major spillage causing soil pollution	Spill handling procedure (AAM-EP-02), Environmental Emergency Response Plan, diesel MSDS
		Any spillage into a water resource	
TBE or acetone (at stores in quantity of 210l)	Spillage of TBE or acetone during off-loading, loading, handling, or storage	Major spillage causing soil pollution	Spill handling procedure (AAM-EP-02), Environmental Emergency Response Plan, TBE MSDS, acetone MSDS
		Any spillage into a water resource	
Acetone at mine stores (210l)	Uncontrolled fire	Damage to the surrounding environment, soil & air pollution	Environmental Emergency Response Plan, acetone MSDS
TDF and WRDs	Failure of side walls or overtopping	Major spillage causing soil pollution	Spill handling procedure (AAM-EP-02), Environmental Emergency Response Plan, MRDs CoP
		Any spillage into a water resource	
		Safety of community	

Description or activity	Aspect	Impact	Associated procedure and other records
Process water and fine tailings pipelines	Burst or leakages of pipelines	Major spillage causing soil pollution	Spill handling procedure (AAM-EP-02), Environmental Emergency Response Plan
		Any spillage into a water resource	
Abnormal rainfall/floods	Overflow of dirty water infrastructure or mine residue	Major spillage causing soil pollution	Environmental Emergency Response Plan
		Any spillage into a water resource	
Veld fires	Veld fire through mining area	Destruction of fauna and flora, hazard to community	Environmental Emergency Response Plan, smoke detectors and fire-hose inspection checklists
RWD (quarry 3) and emergency dam	RWD (quarry 3) failure or emergency dam failure	Major spillage causing soil pollution	Spill handling procedure (AAM-EP-02), Environmental Emergency Response Plan
		Any spillage into a water resource	

2.2 Major spillages onto soil or spillages into water resources

1. Annesley Andalusite Mine will as soon as reasonably practicable after obtaining knowledge of the incident, report through the most effective means reasonably available:
   a. the nature of the incident;
   b. any risks posed by the incident to public health, safety and property;
   c. the toxicity of substances or by-products released by the incident; and
   d. any steps that should be taken in order to avoid or minimise the effects of the incident on public health and the environment to:
      i. the DWS and/or the Limpopo Department of Economic Development, Environment, and Tourism;
      ii. the South African Police Services and the relevant fire prevention service;
      iii. the relevant head of municipality; and
      iv. all persons whose health may be affected by the incident.

2. Annesley Andalusite Mine will, as soon as reasonably practicable after knowledge of the incident:
   a. take all reasonable measures to contain and minimise the effects of the incident, including its effects on the environment and any risks posed by the incident to the health, safety and property of persons;
   b. undertake clean-up procedures;

c. remedy the effects of the incident;
d. assess the immediate and long-term effects of the incident on the environment and public health; and
e. and take such measures as the catchment management agency may either verbally or in writing direct within the time specified by such institution.

3. Steps to be taken to contain, minimise and clean-up are as follow:
   a. Isolate and evacuate the affected area to prevent unauthorised access;
   b. If safe to do so, isolate source of leak or spillage to prevent further losses;
   c. Use appropriate PPE;
   d. Protect stormwater drains around the affected area by sealing them off:
   - Construct berm walls cross-stream using soil if pollution has escaped into drainage ditches; and
   - If possible construct temporary retention dams across stream using soil, and divert flow into them.
   e. Transfer any residual contents and contaminated absorbents to suitable temporary storage containers;
   f. Obtain specialist advice on decontamination of surfaces, drains and interceptors;
   g. Remove any retention berms/temporary retention dams only when authorised; and
   h. Dispose of contaminated material as hazardous waste (see Waste Management Procedure: AAM-EP-01).

4. Annesley Andalusite Mine will, within 14 days of the incident, report to the DWS, and/or the Limpopo Department of Economic Development, Environment, and Tourism, and relevant head of municipality such information as is available to enable an initial evaluation of the incident, including:
   a. the nature of the incident;
   b. the substances involved and an estimation of the quantity released and their possible acute effect on persons and the environment and data needed to assess these effects;
   c. initial measures taken to minimise impacts;
   d. causes of the incident, whether direct or indirect, including equipment, technology, system, or management failure; and
   e. measures taken and to be taken to avoid a recurrence of such incident.

2.3 Fire emergencies

1. Refer to Type B Emergencies of the Environmental Emergency Response Plan.
2. In addition to the Environmental Emergency Response Plan, Annesley Mine will inspect and maintain the smoke detectors at the sub-stations, the fire hose at the plant and workshop, and fire-proofing and sealers in the electrical cables.

2.4 Flooding emergencies

Refer to Type C Emergencies of the Environmental Emergency Response Plan

2.5 Drills

1. Emergency drills of above incidents will be held at least biannually.
2. The emergency drill should be a practical exercise where practicable or as a minimum, a desktop exercise.
3. A realistic scenario will be created, e.g. water can be spilled from an oil drum in order to test the reaction of personnel in line with the emergency procedure.
4. The emergency drill report should be completed.
5. It is advisable that photographs or videos should be taken for review after the drill has been conducted.
6. A debriefing session should be held after each drill to discuss any non-conformances or areas for improvement identified during the drill.

2.6 Tailings disposal facility

The tailings disposal facility design, operational controls, monitoring and management systems are designed to prevent the potential hazards developing into unacceptable risks. However, in the event that the systems fail and / or an unforeseen event occurs that manifest into a risk, emergency procedures are appropriate to avoid the loss of life and minimisation of damage.

The occurrences of emergency situations generally arise as a result of an uncontrollable event, i.e. a heavy rain storm, coinciding with a set of sub-standard conditions. To avoid an emergency, the prevailing conditions need to be managed such that irrespective of the uncontrollable event, an emergency situation would not prevail. Prevailing conditions are managed through daily functions. If everything is maintained and operated according to the appropriate standard, the status of the facility could be designated Code Green. If something falls out of specification that can be rectified by the on-dam resources, which occurs on a regular basis in keeping with the nature of a TDF operation, a Code Blue could be assigned. If the situation is beyond the capability or capacity of the on-dam resources to resolve, the status is elevated to a Code Yellow, which should prompt external management intervention. If the situation threatens beyond the confines of the TDF, an emergency state or Code Orange status is initiated. The Code Orange status is an emergency standby mode. This status triggers the emergency response plan. If the situation is beyond control and a significant risk or fault is about to occur, then a Code Red status is invoked, which would prompt immediate evacuation.

There are two major risks or faults associated with the TDF, both of which could lead to the same result or events. The faults are;

- slope failure and
- over-topping

The significant event that could occur should either of these faults occur is the escape of tailings in the form of a heavy fluid that flows downstream engulfing everything in its path. The potential reach of the escaped tailings is called the zone of influence. Anything or anyone within the zone of influence is at risk.

The procedures must be in keeping with the identified risks and possible consequences. All personnel working on the TDF must be briefed and familiar with the emergency logic and procedures. An emergency awareness discussion must be conducted with all TDF personnel at least once a month.

3 Groundwater

The mine needs to implement the necessary investigations during the operational phase and prior to commencement with any final rehabilitation projects, to investigate the applicable groundwater aspects such as the pollution plume movement, the anticipated quality and quantity of seepage. The mine should declare the waste rock save for backfilling (by implementing the necessary studies), to demonstrate that such activities are not likely to cause pollution of a water resource. Waste classification will be done.

2) Undertaking

The EAP herewith confirms

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

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

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

d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed ☒

The EIA/EMP will, should it comply with the provisions of section 24N of NEMA as well as the applicable EIA Regulations i.t.o. NEMA, be approved, become an obligation in terms of the approved EIA/EMP and mining right issued.

Herewith I, the person whose name and identity number is stated below, confirm that I am the person authorised to act as representative of the, and confirm that the above EIA & EMP compiled in accordance with Appendices 3 & 4 of the EIA Regulations.

Full Names and Surname	Salome Beeslaar
Identity Number	8310190032081
Designation	EAP
Signature	

-END-

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Regulations Relating to Group III Hazardous Substances, GN 697 of 1989 i.t.o. The Hazardous Substances Act No 15 of 1973

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Regulations Relating to Surveying, Mapping and Mine Plans, GN 447 of 2011 2011 i.t.o. the Mine Health and Safety Act No 29 of 1996 (as amended)

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Convention on Biological Diversity, ratified by RSA on 2 November 1995

UN Framework on Climate Change and Kyoto Protocol, ratified by RSA on 29 August 1997

Stockholm Convention on Persistent Organic Pollutants, ratified by RSA on 4 September 2002

Vienna Convention on the Protection of the Ozone Layer, and the Montreal Protocol, ratified by RSA on 15 January 1990

SABS 072 - Code of Practice for the Safe Handling of Pesticides

SABS 0228 - Code of Practice for the Identification and Classification of Dangerous Substances and Goods

SABS 0229 - Code of Practice for Packaging of Dangerous Goods for Road and Rail Transportation in South Africa

SANS 241:2006 - Drinking Water Quality Requirements, Edition 6.1

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