ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME AMENDMENT REPORT FOR THE TSHIPI BORWA MINE

AUGUST 2017

SUBMITTED FOR AN APPLICATION TO AMEND AN ENVIRONMENTAL MANAGEMENT PROGRAMME IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT NO 107 OF 1998, READ WITH THE NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 59 OF 2008 AND THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 28 OF 2002

NAME OF APPLICANT: TSHIPI É NTLE MANGANESE MINING (PTY) LTD)

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FILE REFERENCE NUMBER SAMRAD: NC/30/5/1/2/2/206MR

FILE RECORD NUMBER SAMRAD: NC-00083-MR/102

DOCUMENT INFORMATION

Title	ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME AMENDMENT REPORT FOR THE TSHIPI BORWA MINE
Status	Final
Applicant	Tshipi é Ntle Manganese Mining (Pty) Ltd
Consultant	SLR Consulting (Africa) (Pty) Ltd
Project Number	710.20029.00008
Project Manager	Natasha Smyth
Report Author	Natasha Smyth
Reviewer	Alex Pheiffer
Report Number	1
Date last printed	2017/06/05 03:39 PM
Date last saved	2017/06/05 03:45 PM
Issue Date	August 2017

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME AMENDMENT REPORT FOR THE TSHIPI BORWA MINE

EXECUTIVE SUMMARY

INTRODUCTION TO THE PROJECT

Tshipi é Ntle Manganese Mining (Tshipi) operates the open pit manganese Tshipi Borwa Mine located on the farms Mamatwan 331 (mining right and surface use areas) and Moab 700 (surface use area), in the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality in the Northern Cape Province.

The mine holds a mining right (NC/30/5/1/2/2/0206MR) and an environmental management programme report (EMPr) issued and approved by the erstwhile Department of Minerals and Energy (currently the Department of Mineral Resources (DMR)), an Environmental Authorisation (EA) (NC/KGA/KATHU/37/2008) issued by the erstwhile Department of Tourism, Environment and Conservation (currently the Department of Environment and Nature Conservation (DENC)) and an Integrated Water Use Licence (IWUL) (10/D41K/AGJ/1735) issued by the erstwhile Department of Water Affairs (currently the Department of Water and Sanitation (DWS)). In terms of environmental law, the approved EMPr is now deemed to be an EA issued in terms of the National Environmental Management Act No 107 of 1998 (NEMA).

Changes to Tshipi’s approved layout include:

- an increase in the number, position, volume and layout of waste rock dumps;
- a change to the design, capacity and position of the sewage treatment plant;
- a change to the stormwater management system position, including additional storage;
- a change to the potable water storage facilities capacity and position;
- a change to the position of the office, plant, workshop and related infrastructure;
- a change to the number, position, volume and layout (footprint) of the ore stockpiles;
- a change to the design of the railway line and an increase in length;
- the establishment of an additional temporary run-of-mine (ROM) stockpile area;
- the establishment of tyre bays;
- the establishment of additional weighbridges;
- the establishment of an additional topsoil stockpile area (No. 2); and
- a change in position of the secondary crushing and screening plant.

This EMPr makes provision for the changes listed above including the addition of proposed facilities. Additional proposed facilities include the expansion of the approved topsoil stockpile area (No.1), expansion of topsoil stockpile No.2, the change in the position of the approved 78Ml stormwater dam and establishment of a clean and dirty water separation system. In addition to this, Tshipi is proposing on mining the barrier pillar between the Tshipi Borwa Mine and the South 32 (Mamatwan Mine). The proposed project also caters for the crushing and loading of trains at night.

SLR Consulting (Africa) (Pty) Ltd (SLR), an independent firm of environmental consultants, has been appointed to manage the environmental authorisation processes.

LEGAL FRAMEWORK

Prior to the commencement of the project, environmental authorisation is required from various government departments. This list does not cover occupational health and safety legislation requirements. These include:

- an amendment of the environmental management programme in terms of section 102 of the Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA) which is regulated by the DMR;
- an environmental authorisation from the DMR in terms of the NEMA for the amendment of an environmental authorisation. The EIA Regulations being followed for this project are Government Notice Regulation (GNR) 982 of 4 December 2014 (EIA Regulations), as amended to cater for 2017 changes, which is regulated by the DMR; and
- an amendment of the existing IWUL and related management plans to cater for additional water uses in terms of section 21 of the National Water Act (No. 36 of 1998) (NWA). The water uses that need to be authorised as part of the proposed project include:
  - section 21 a – taking water from a water resource;
  - section 21 b – storing of water;
  - section 21 g – disposal of waste that may detrimentally impact a water resource; and
  - section 21 j – removal of underground water to allow for the continuation of an activity or the safety of people.

STAKEHOLDER ENGAGEMENT

The stakeholder engagement process commenced prior to the submission of the EMPr and has continued throughout the environmental assessment process. As part of this process, commenting authorities and interested and affected parties (IAPs) were given the opportunity to attend public meetings, submit questions and comments to the project team, and review the background information document and now the EMPr. All comments submitted to date by the commenting authorities and IAPs have been included and addressed in this EMPr. Further comments arising during the review of the EMPr report will be handled in a similar manner.

IMPACTS AND MANAGEMENT ACTIONS

This section provides a summary of the assessment of the potential impacts of the project and provides measures to prevent or mitigate the impacts. The potential impacts associated with the mine activities and infrastructure can be categorised into those that have low, medium and high significance in the unmitigated scenario. All three categories of impacts require a measure of management actions which, if successfully implemented will reduce the significance of the impacts and the related residual risk. All identified impacts are considered both incrementally and cumulatively in the context of the existing Tshipi mining infrastructure and activities.

The table below provides a summary of the potential impacts in no particular order of importance.

Table A – Potential impact summary

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance without management actions	Significance with management actions
Geology	Loss and sterilization of mineral resources	Mineral resources can be sterilised and/or lost through the placement of infrastructure and activities in close proximity to mineral resources, by preventing access to potential mining areas, and through the disposal of mineral resources onto mineralised waste facilities (waste rock dumps and tailings dam). Related mitigation measures include best mining practises to ensure that mineral sterilisation is minimised as far as possible.	High	Low
Topography	Hazardous excavations and infrastructure resulting in safety risks to third parties and animals	Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. Included in this category is facilities that can fail such as the approved tailings dam. Related mitigation measures focus on infrastructure safety and design and limiting access to third parties and animals.	High	Low
Soil and land capability	Loss of soil resources and land capability through contamination	Soil is a valuable resource that supports a variety of ecological functions and is the key to re-establishing post closure land capability. Soil and related land capability can be compromised through pollution and through physical disturbance through compaction, removal and erosion. Related mitigation measures focus on pollution prevention, implementing soil conservation procedures and limiting site clearance to what is absolutely necessary.	High	Low
	Loss of soil resources and land capability through physical disturbance		High	Low (Medium for approved tailings dam)
Biodiversity	Physical destruction of biodiversity	Areas of high sensitivity are functioning biodiversity areas with species diversity and associated intrinsic value. In addition, some of these areas host protected species. The linking areas have value because of the role they play in allowing the migration or movement of flora and fauna between the areas which is a key function for the broader ecosystem. The project has the potential to impact on biodiversity both through physical destruction (mainly during infrastructure establishment) and on-going physical disturbance during all mine phases. Related mitigation measures focus on limiting the project footprint area, biodiversity action plans and operation controls to limit on-going disturbance.	High	Medium
	General disturbance of biodiversity		High	Medium
Surface water	Alteration of surface water drainage patterns	Rainfall and surface water run-off are collected in all areas that have been designed with water containment infrastructure. The collected run-off will therefore be lost to the catchment and can result in the alteration of drainage patterns. Related mitigation measures focus on minimising the footprint areas associated with containing rainfall and runoff and diverting clean run-off away from the mine site.	Medium	Low
	Contamination of	The project has the potential to contaminate surface water resources (ephemeral	Medium	Low

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance without management actions	Significance with management actions
	surface water resources	Vlermuisleegte approximately 2km, west of the site). Related mitigation measures focus on pollution prevention and monitoring.		
Groundwater	Contamination of groundwater resources	There are a number of sources in all mine phases that have the potential to pollute groundwater. Some sources are permanent (approved tailings dam) and some sources are transient (starting later and at different time-steps) and becoming permanent (pit backfilling). Even though some sources are temporary in nature, related potential pollution can be long term. Modelled results indicate that low concentrations for a small area will extend outside of the mining right area, however no known third party boreholes are within the pollution plume. Related mitigation measures focus on monitoring, compensation for third part loss of water supply and basic infrastructure design.	Low	Low
	Lowering of groundwater levels and reducing availability	Dewatering of the open pit has the potential to lower groundwater levels in the operational phase. The simulated cone of depression extends 5.5 km to the east and 8.3 km to the west of the Tshipi Borwa Mine at the end of mining (Year 25). Third party boreholes (if present within the simulated cone of depression) may therefore experience a drop in water levels. The simulation shows that as mining operations stop and backfilling takes place, the water levels recover by the end of life of mine. It remains a possibility that dewatering at Tshipi and the surrounding mining operations could reduce the contribution of groundwater to the sub surface flow of the Vlermuisleegte during the operational phase, until groundwater levels recover after mining ceases. Related mitigation measures focus on monitoring and compensation for third party loss of water.	Medium	Low
Air	Air pollution	The main contaminants associated with the project includes: inhalable particulate matter less than 10 microns in size (PM10), larger total suspended particulates (TSP) that relate to dust fallout, Mn concentrations, SO_2, NO_2 and gaseous emissions mainly from vehicles and generators. A change in ambient air quality can have health and/or nuisance impacts. Related mitigation measures focus on pollution prevention and monitoring. It is important to note that even with management measures, Mn concentrations are predicted to exceed World Health Organisation guidelines at a number of residence.	High	Medium (High for Mn)
Noise	Increase in disturbing noise levels	Two types of noise are distinguished: noise disturbance and noise nuisance. The former is noise that can be registered as a discernible reading on a sound level meter and the latter, although it may not register as a discernible reading on a sound level meter, may cause nuisance because of its tonal character (e.g. distant humming noises). Related mitigation measures focus on noise pollution prevention and monitoring when required.	Medium	Low (day-time) Medium (night-time)
Visual	Negative visual views	Visual impacts are assessed by considering changes to the visual landscape. Mine infrastructure and activities will change this landscape and the changes will have different impacts that will vary between the different viewpoints and the associated visual receptors.	Medium	Low

Aspect	Potential impact	Impact discussion and reference to mitigation measures	Significance without management actions	Significance with management actions
		Related mitigation measures focus on landscaping interventions particularly during the decommissioning and rehabilitation stages.		
Traffic	Road disturbance and related safety	Existing traffic volumes comprise public traffic and traffic from nearby mines that utilise the R380 and D3457. Safety risks associated with mining traffic making use of public road infrastructure include pedestrian accidents and vehicle accidents. Related mitigation measures focus on road maintenance in conjunction with other role players and the relevant road authorities.	Medium	Low
Blasting	Ground vibration, air blasts and fly rock	Blasting activities have the potential to impact on people, animals and structures located in the vicinity of the mining area through ground vibration, air blast and fly rock. Related mitigation measures focus on blast design and compensation due to blast related damage.	High	Medium
Heritage, cultural and paleontological resources	Loss of heritage, cultural and paleontological resources	In the event of a chance find where undisturbed areas will be cleared as part of the establishment of additional facilities and activities (barrier pillar) there is a potential to damage heritage/cultural and palaeontological resources (if present), either directly or indirectly, and result in the loss of the resource for future generations. Related mitigation measures focus on notifying heritage/cultural and palaeontological specialists in the event of a chance fine.	N/A	N/A
Socio-economic	Inward migration	Mining operations tend to bring with them an expectation of employment in all phases prior to closure. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. Related mitigation measures focus on recruitment processes, communication and health awareness training.	High	Low
	Economic impact	Mining has a positive net economic impact on the national, local and regional economy. Direct benefits are derived from wages, taxes and profits. Indirect benefits are derived through the procurement of goods and services, and the increased spending power of employees. Related mitigation focusses on clear communication, recruitment and procurement processes.	Medium-high	Medium-high
Land use	Change in land use	Land uses within the Tshipi Borwa Mine area include mining activities and infrastructure associated with the mine. Land use surrounding the Tshipi Borwa Mine area includes existing mining operations, agriculture, infrastructure (road, rail network, powerlines, water pipeline, sewage works), solar plant and isolated farmsteads. There are mine related activities and infrastructure that may have an impact on other land uses in all mine phases. Related mitigation measures include communication with neighbouring communities, land users, and land owners to facilitate information sharing.	Medium	Low

ENVIRONMENTAL STATEMENT

The assessment of the project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the bio-physical, cultural and socio-economic environments both on the project site and in the surrounding area. With management actions these potential impacts can be prevented or reduced to acceptable levels.

It follows that provided the EMP is effectively implemented there is no environmental, social or economic reason why the project should not proceed.

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME AMENDMENT REPORT FOR THE TSHIPI BORWA MINE

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ACRONYMS AND ABBREVIATIONS

Acronyms / Abbreviations	Definition
BID	Background Information Document
DEA	Department of Environmental Affairs
DENC	Department of Environment and Nature Conservation
DAFF	Department of Agriculture, Forestry and Fisheries
DMR	Department of Mineral Resources
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme Report
HDSA	Historically Disadvantaged South African
IAP	Interested and Affected Party
IUCN	International Union for Conservation of Nature
MPRDA	Mineral and Petroleum Resources Development Act, No. 28 of 2002
NPAES	National Protected Areas Expansion Strategy 2008
NEM:BA	National Environmental Management: Biodiversity Act No. 10 of 2004
NFEPA	National Freshwater Ecosystem Priority Areas 2011
NEMA	National Environmental Management Act, 1998 No. 107 of 1998
NEM:WA	National Environmental Management: Waste Act, 2008 No 59 of 2008
NWA	National Water Act, 1998 NWA, No. 36 of 1998
NPR	Neutralising Potential Ratio
PRECIS	Pretoria Computer Information Systems
TDS	Total Dissolved Solids
SAHRA	South African Heritage Resource Agency
SANBI	South African National Botanical Institute
SLR	SLR Consulting (Africa) (Pty) Ltd
SLP	Social and Labour Plan
NDCR	South African National Dust Control Regulations
NAAQS	South African daily National Ambient Air Quality Standards
ROM	Run of Mine
WHO	World Health Organisation

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME AMENDMENT REPORT FOR THE TSHIPI BORWA MINE

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The mine holds a mining right (NC/30/5/1/2/2/0206MR) and an EMPr issued and approved by the Department of Minerals and Energy (currently the DMR), an EA (NC/KGA/KATHU/37/2008) issued by the Department of Tourism, Environment and Conservation (currently the DENC) and an IWUL (10/D41K/AGJ/1735) issued by the Department of Water Affairs (currently the DWS). In terms of environmental law, the approved EMPr is now deemed to be an EA. Refer to Appendix A for a copy of the existing environmental authorisations.

Changes to Tshipi’s approved layout to include:

- an increase in the number, position, volume and layout of waste rock dumps;
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  - section 21 a – taking water from a water resource;
  - section 21 b – storing of water;
  - section 21 g – disposal of waste that may detrimentally impact a water resource; and
  - section 21 j – removal of underground water to allow for the continuation of an activity or the safety of people.

OTHER APPROVALS / PERMITS

Other approvals/permits needed for the project are listed below. In this regard, there are other approvals that are required where new areas will be disturbed by mining related activities. These are as follows:

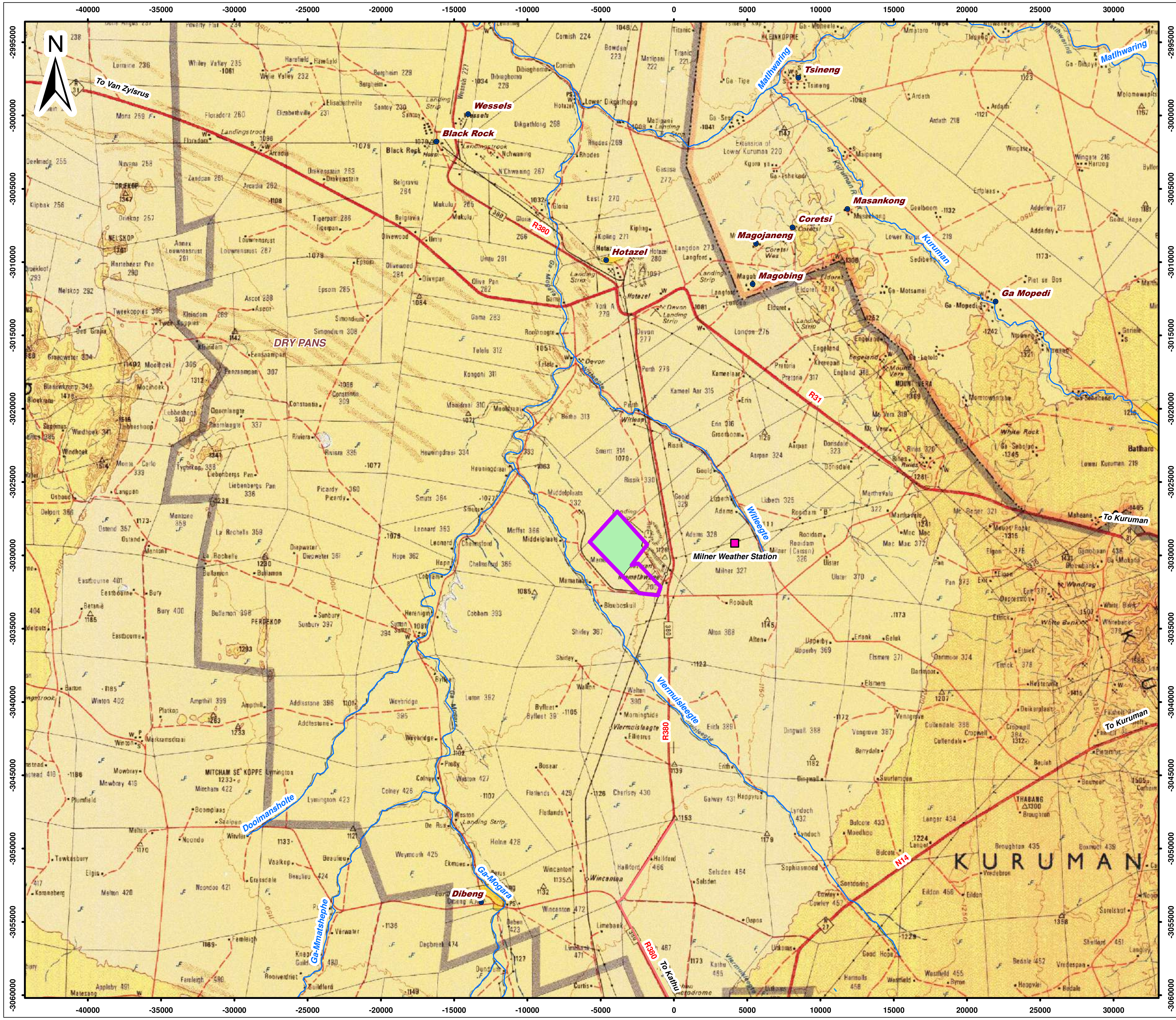
- where new areas will be disturbed, prior to removing or damaging any protected plant species, the necessary permits will be obtained from the Department of Agriculture Forestry and Fisheries (DAFF) and the DENC in terms of the National Forests Act (No. 84 of 1998); and
- the expansion of the sewage treatment plant will be registered with the DWS in terms of the NWA.

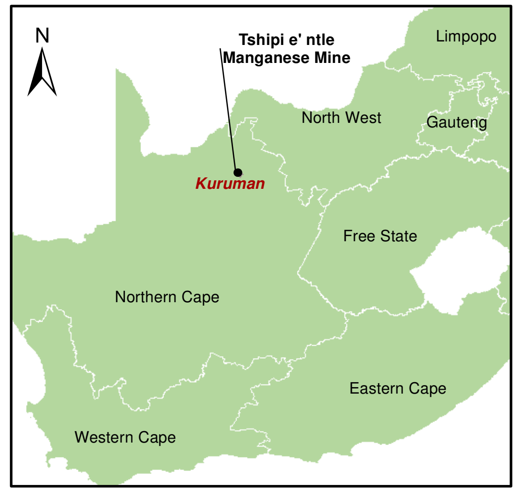
This report does not cover occupational health and safety legislation requirements.

EMPR PHASE OBJECTIVES

The objectives of the environmental assessment process are as follows:

- to identify policies and legislation that is relevant to the project;
- to describe the need and desirability of the project;
- to describe the project;
- to provide an assessment of the environmental and social impacts taking into account issues and concerns raised by IAPs; and
- to identify measures to avoid, manage or mitigate identified impacts including the residual risks that need to be managed and monitored.





Legend

- Approved Mining Right Area
- Surface Use Area
- Main Roads
- Rivers

0 4 8 Kilometers

Scale: 1:20 000 000 @ A3

Projection:Transverse Mercator
Datum: Hartebeeshoek, Lo 23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 1

Regional Setting

SLR Consulting (Africa) (Pty) Ltd
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Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

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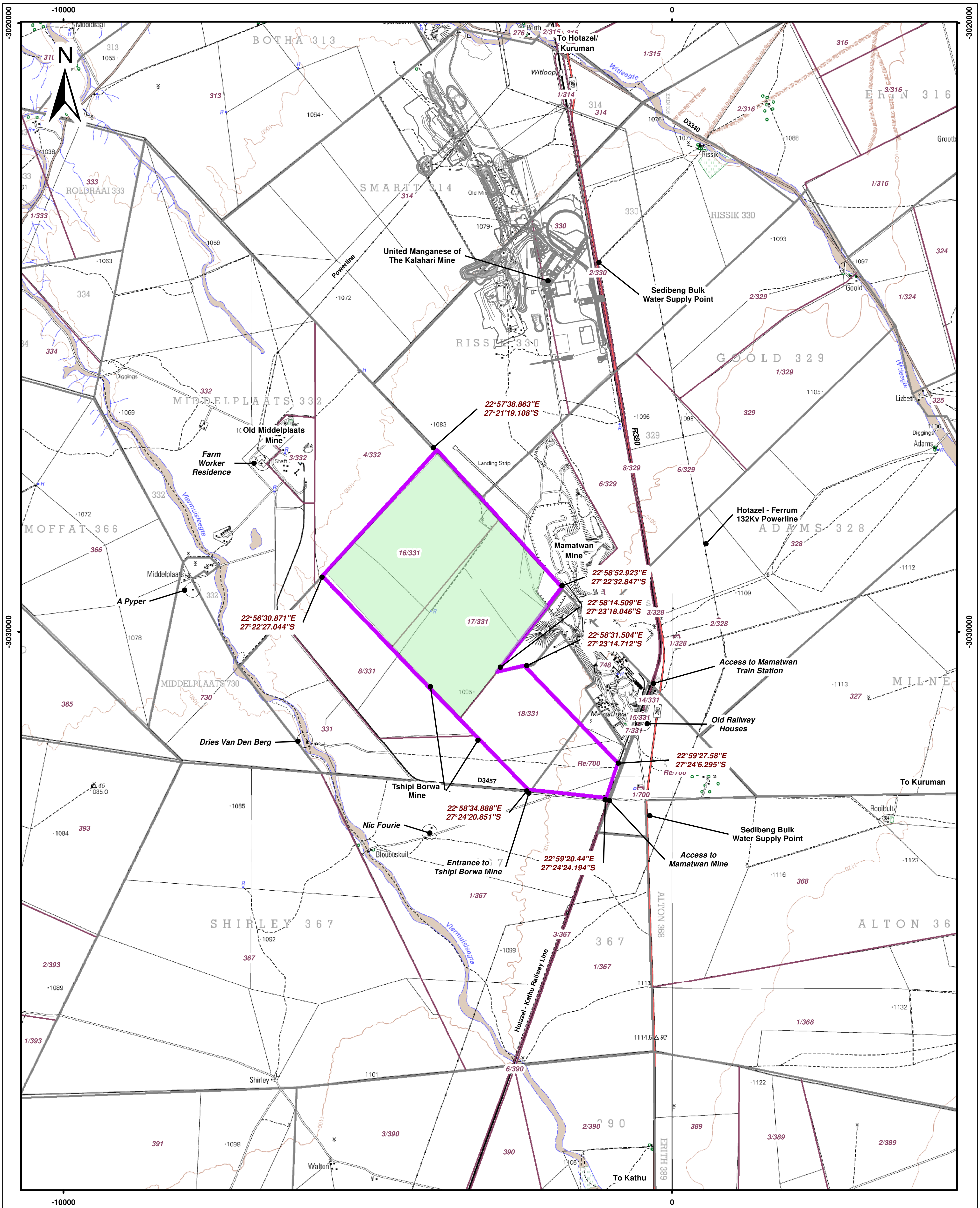

Legend

- Approved Mining Right Area
- Surface Use Area
- Main Roads
- Power Line
- Rivers and Streams
- 20m Contour Lines
- Farm Boundaries
- Farm Portions

0 1 000 2 000 Meters

Scale: 1:60 000 @ A3

Projection: Transverse Mercator

Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 2

Local Setting

SLR

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710.20029.00008

2017/07/12

PART A – SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1 DETAILS OF THE EAP

1.1 DETAILS OF THE EAP WHO PREPARED THE REPORT

The details of the EAPs that were involved in the preparation of this report are provided in Table 1 below.

TABLE 1: DETAILS OF THE EAPS

Details	Project manager and author	Reviewer
Name of the practitioner	Natasha Smyth	Alex Pheiffer
Tel No.:	011 467 0945	011 467 0945
Fax No.:	011 467 0978	011 467 0978
E-mail address	nsmyth@slrconsulting.com	-

Neither SLR nor any of the specialists involved in the environmental assessment process have any interest in the project other than fair payment for consulting services rendered as part of the environmental assessment process.

1.2 EXPERTISE OF THE EAP

Natasha Smyth holds a BSc Honours degree in Geography and Environmental Management and has approximately eight years of relevant experience (curriculum vitae attached in Appendix B). Alex Pheiffer holds an MSc degree in Environmental Management and is registered as a professional natural scientist (Environmental Science) with the South African Council for Natural Scientific Professions (SACNSP) (Appendix B). Alex Pheiffer has over 15 years of relevant experience (curriculum vitae attached in Appendix B). Both Natasha Smyth and Alex Pheiffer have been involved in several impact assessments for large scale mining developments in southern Africa.

2 PROPERTY DESCRIPTION

2.1 PROPERTY DESCRIPTION

A description of the property on which the project is located is provided in Table 2 below.

TABLE 2: DESCRIPTION OF THE PROPERTY

Description	Detail
Farm Name	• Mamatwan 331 portion 16 (previously a portion of portion 1), 17 (previously a portion of portion 2) and 18 (previously a portion of portion 3); and • Moab 700 (remaining extent).
Application area (Ha)	The project footprint is 229 ha comprising already disturbed and proposed changes. The approved EMPr (Metago, May 2009) caters for an overall disturbance area of 950 ha. The changes to the project form part of the approved 950 ha. The changes to the infrastructure layout do not result in an increase in the approved disturbance area.
Magisterial district	Located within the Kuruman Magisterial District and in the John Taolo Gaetsewe District Municipality
Distance and direction from nearest town (Figure 2)	The closest towns are Hotazel and Black Rock, located approximately 18 km north and 26 km north west of the Tshipi Borwa Mine, respectively.
21 digit Surveyor General Code for each farm portion (Figure 2)	Remaining extent of the farm Mamatwan 331: CO4100000000033100000 Portion 16 of the farm Mamatwan 331: CO4100000000033100016 Portion 17 of the farm Mamatwan 331: CO4100000000033100017 Portion 18 of the farm Mamatwan 331: CO4100000000033100018 Remaining extent of the farm Moab 700: CO4100000000070000000
Co-ordinates (Figure 2)	The four main corner points of the mine include: • the northern corner: 22° 57’ 38.863 E and 27° 21’ 19.108 S; • the western corner: 22° 56’ 30.871 E and 27° 22’ 27.044 S; • the wastern corner: 22° 58’ 52.923 E and 27° 22’ 32.847 S; and • the southern corner (near mine entrance): 22° 58’ 34.888 E and 27° 24’ 20.851 S.

2.2 LOCALITY MAP

The regional and local setting of the project site is illustrated in Figure 1 and Figure 2.

3 DESCRIPTION OF THE SCOPE OF THE ACTIVITY

An infrastructure plan of the project, showing the location of activities that form part of the EMPr amendment process is illustrated in Figure 3.

3.1 LISTED AND SPECIFIED ACTIVITIES

The Tshipi Borwa Mine operates in accordance with EA (NC/KGA/KATHU/37/2008) issued by the Department of Tourism, Environment and Conservation (currently the DENC). Activities that were authorised as part of the approved EMPr (Metago, May 2009) were in accordance with the NEMA Regulation 386 and 387 of July 2006. Refer to Appendix H for the list of the activities authorised in terms of the EA for the project. Refer to Appendix A for a copy of the environmental authorisation.

The purpose of this application is to apply for an amendment to the approved EMPr. Given that none of the amendments to the EMPr trigger any listed activities under NEMA, the EMPr amendment process is being undertaken in accordance with regulation 31 of the Government Notice Regulation (GNR) 982 of 4December 2014 (EIA Regulations), as amended to cater for 2017 changes, and NEMA (substantive amendment process), as read with the National Environmental Management: Waste Act (No. 59 of 2008) (NEM:WA) and section 102 of the MPRDA. The amendments to the EMPr (which is regarded as a valid EA issued in terms of NEMA) are considered to be a change to the scope of the EMPr where such change will result in a change in nature of impact where such level or change was not assessed and included in the initial application for environmental authorisation.

3.2 DESCRIPTION OF THE ACTIVITIES

The information in this section draws from the approved EMPr (Metago, May 2009) and has been updated where relevant using information provided to SLR, by the Tshipi project team. For completeness purposes, the section below will also make reference to existing approved infrastructure.

3.2.1 OVERVIEW OF CHANGES TO THE APPROVED LAYOUT

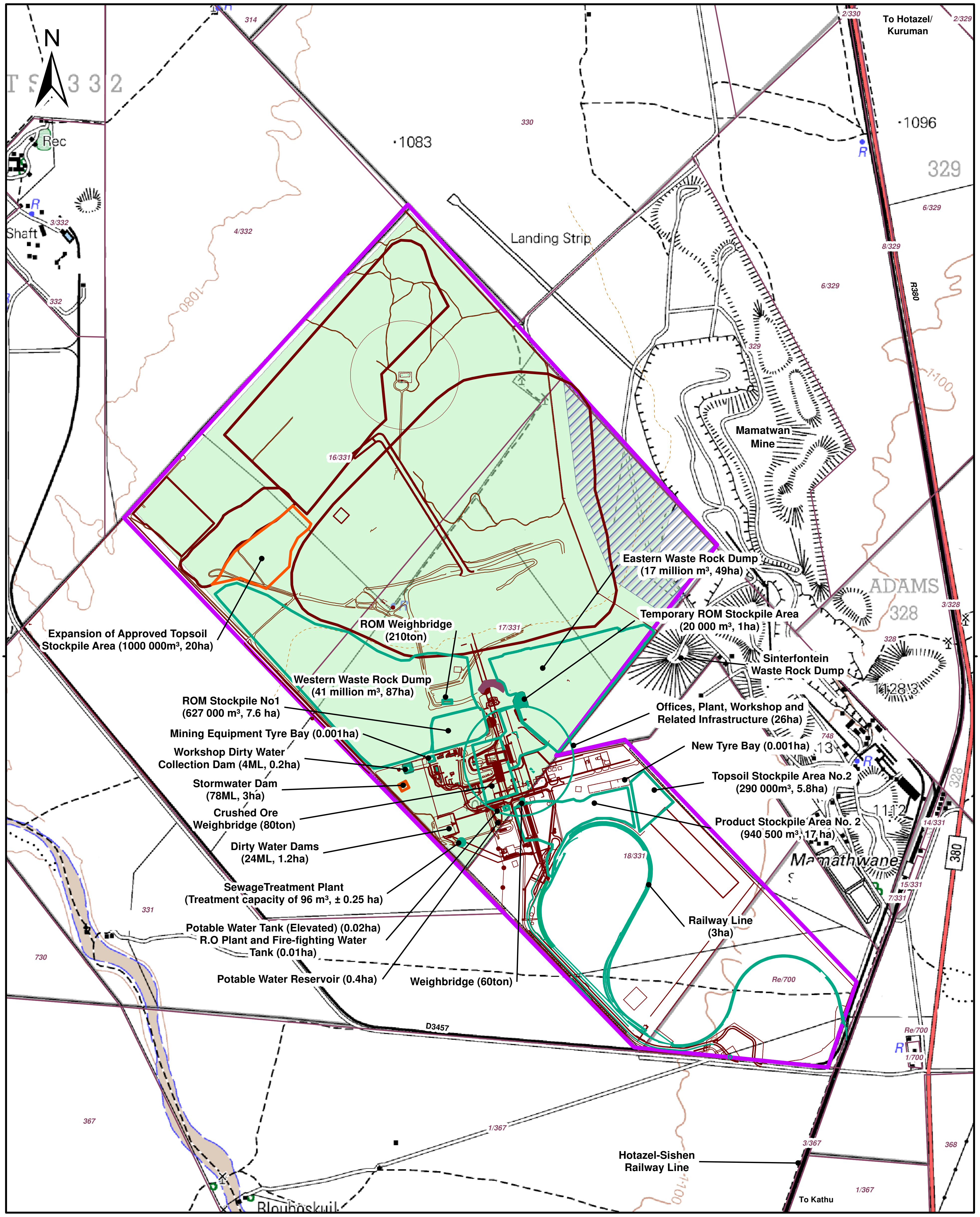
An overview of the activities and infrastructure associated with the project are listed in Table 3 below and are illustrated in Figure 3. Further information pertaining to the changes to the approved layout is discussed in Section 3.2.4 and Section 3.2.5.

TABLE 3: LIST OF ACTIVITIES/INFRASTRUCTURE ASSOCIATED WITH THE PROJECT

Main activity/ infrastructure	Detail			Aerial extent of the activity (ha) and capacity (m^3) where applicable
	Changes to the approved infrastructure layout already implemented	Changes to approved infrastructure layout to be implemented	Proposed changes to the infrastructure layout	
Earthworks	Establishment of an additional topsoil stockpile area (Stockpile No. 2)	-	Expansion of topsoil stockpile area No. 2	Total of approximately 5.8 ha Capacity of approximately 290 000m^3
	-	-	The proposed expansion of the approved topsoil stockpile area No. 1	Approximately 15.7 ha Total capacity of approximately 780 000 m^3
Mineralised ore and waste	Establishment of the eastern waste rock dump	-	-	Approximately 49 ha Total capacity of approximately 17 million m^3
	Shift in the position of the western waste rock dump	-	-	Approximately 87 ha Total capacity of 41 million m^3
	Change in the number and position of product stockpiles: • ROM stockpile; • product stockpile No. 1; and • product stockpile No. 2.	-	-	• ROM stockpile No. 1 (7.6 ha and 627 000m^3); • product stockpile No. 1 (7.9 ha and 434 500m^3); and • product stockpile No. 2 (17 ha and 940 500m^3).
	The establishment of a temporary ROM stockpile area at the ROM pad.	-	-	Approximately 1 ha Total capacity of approximately 20 000 m^3
Open pit mining	-	-	Mining of the barrier pillar	Total of approximately 7 ha
Non-mineralised waste	Increase in the capacity and design change of the sewage treatment plant and change in the position of the facility	-	-	Approximately 0.25 ha Treatment capacity of 96 m^3
Water use and management	Establishment of a dirty water dams and change in position	-	-	Approximately 1.2 ha Total capacity of 24 Ml
	Establishment of a workshop dirty water collection dam	-	-	Approximately 0.2 ha Total capacity of 4 Ml (4 000 m^3)
	-	Establishment of a clean and	-	Approximately 2 ha

Main activity/ infrastructure	Detail			Aerial extent of the activity (ha) and capacity (m^3) where applicable
	Changes to the approved infrastructure layout already implemented	Changes to approved infrastructure layout to be implemented	Proposed changes to the infrastructure layout	
		dirty water separation system		
	-	Change in the position of the approved 78ML stormwater dam	-	Approximately 3 ha Total capacity of 78 Ml
	Increase in the capacity of potable water storage facilities: • a potable water reservoir; • a fire water tank; • an elevated potable water storage tank; and • a temporary construction dam.	-	-	• a potable water reservoir (Approximately 0.01 ha and 2 000m^3); • a fire water tank (Approximately 0.01 ha and 653 m^3); • an elevated potable water storage tank (Approximately 0.02 ha and 75 m^3); and • a potable waste temporary construction dam (Approximately 0.24 ha and 9 000m^3).
Support services	Change in the position of the offices, plant, workshop and related infrastructure area	-	-	Approximately 26 ha
	Establishment of tyre bays (tyre bay and mining equipment tyre bay)	-	-	Approximately 0.001 ha (tyre bay) Approximately 0.001 ha (mining equipment tyre bay)
	Establishment of additional weighbridges (ROM weighbridge and crushed ore weighbridge)	-	-	Approximately 0.03 total ha 210 tons and 80 tons
	Change in the position of the secondary crushing and screening plant	-	-	Approximately 2 ha
Transportation system	Change to the design of the railway line and an increase in length	-	-	Approximately 3 ha
Continued use of approved	Not applicable	-	Not applicable	Not applicable.

Main activity/ infrastructure	**Detail**			**Aerial extent of the activity (ha) and capacity (m^3) where applicable**
	Changes to the approved infrastructure layout already implemented	**Changes to approved infrastructure layout to be implemented**	**Proposed changes to the infrastructure layout**	
facilities and services				



Legend

- Surface Use Area
- Approved Mining Right Area
- Changes to Approved Layout (already implemented)
- Mine Infrastructure (no changes to approved infrastructure layout)
- Proposed Changes to Approved Layout
- Barrier Pillar

0 500 1 000 Meters

Scale: 1:25 000 @ A3

Projection: Transverse Mercator

Datum: WGS1984, Lo23

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Figure 3

New Surface Infrastructure Layout

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June 2017

3.2.2 OPEN PIT MINING METHOD

The operations comprise conventional truck and shovel open pit mining methods. Further detail is provided below.

The mining of the open pit commenced in the south east section and is progressing to the north. The depth of the manganese seam at the start of mining was approximately 70m below the surface and the deepest point will be approximately 330m below surface. In the longer term underground mining methods may be required to access the deeper ore. Further detail pertaining to the mining method is provided in Table 4 below.

TABLE 4: MINING METHOD DESCRIPTION

Activity	Description
Site preparation	Site preparation includes the clearing of vegetation and topsoil stripping. Topsoil is stockpiled, for later use in rehabilitation.
Earthworks	Following site preparation all topsoil and some waste rock is dozed and stockpiled separately for re-use for rehabilitation activities.
Drilling and blasting	Once the topsoil and some of the waste rock has been removed by dozing, the waste rock is drilled and blasted in benches until the economic ore horizon is exposed. Similarly drill and blast methods are used to break the ore with careful attention being paid to avoiding contamination of the ore with waste. Blasting occurs on a daily basis during the week in the afternoon. Blasting does not take place on weekends in the normal course. Access to the open pit is by means of boxcuts and ramps. Access to the underground workings will be by means of decline portals from the base of the open pit footwall.
Removal of waste rock	Broken waste rock is loaded by excavator and hauled by mining dump trucks to the waste dumps where it is tipped.
Removal of run-of-mine ore	Broken ore is also loaded by excavator and hauled by mining dump truck either directly to the Run-of-Mine (ROM) pad or to various stockpile area. The ROM is transported to the primary crushing and screening plant where it is sent for further crushing and screening at the secondary and tertiary plant by means of conveyors. Further detail regarding the mineral processing method is provided in Table 5. Prior to being fed into the primary crushing and screening plant, ROM is stockpiled at either the designated ROM. The ROM stockpile is only utilised when the designated ROM pad is unable to accommodate for the ROM tonnages at that time. In addition to this, a temporary ROM stockpile area near the ROM pad is utilised in the event that there is a shortfall in capacity at the ROM stockpile. Low grade ore that cannot be sent for crushing and screening is stockpiled at one of the product stockpile areas (No. 1 and No. 2). Low grade ore is sent off-site for sale via truck and/or train.
Rehabilitation	Once the open pit reaches a steady state, on-going rehabilitation of the mined out areas will occur as mining advances. In this regard, waste rock will be used to backfill the pit voids (once there is sufficient space to dump safely) and then topsoil will be placed over the waste rock and vegetation will be re-established.

The project will not result in any changes to the mining method. However, as part of the project, Tshipi is proposing to mine the 18m wide (on surface) boundary pillar between the Tshipi Borwa Mine and the South 32, Mamatwan Mine. The boundary pillar is illustrated in Figure 3. The DMR has granted permission to Tshipi to mine the boundary pillar, based upon an application and a comprehensive risk assessment. It is anticipated that one of the two parties will be responsible for stripping waste drilling and blasting the ore on behalf of the other party. Waste rock will be deposited onto each party's waste rock dumps or into the pit void. Ore will be loaded by each party and delivered to their respective stockpile and/or tip. This EMPr caters for the activities associated with the mining of the boundary pillar and the additional capacities needed for waste rock.

In terms of the mining pillar, it is important to note that this area is currently included in the Tshipi mining right.

The approved EMPr (Metago, May 2009), makes provision for the production ranging between 2.5 and 4.5 million tonnes of manganese per annum. The mining of the boundary pillar will be inclusive in the above production rates.

3.2.3 MINERAL PROCESSING METHOD

The mineral processing method is described in Table 5 below. The project will not result in any changes to the mineral processing methodology. The conceptual process flow diagram is illustrated in Figure 4.

TABLE 5: MINERAL PROCESSING METHOD

Activity	Description
Primary crushing and screening	ROM is delivered to the primary crushing and screening plant via haul trucks. The primary crushing and screening plant is used to reduce the size of the ore to fractions required by the downstream plant processes. ROM that has been subjected to the primary crushing and screening plant is stockpiled prior to being sent to the secondary crushing and screening plant via conveyor for further re-sizing. Dust suppression by means of water sprays is installed at both the primary and secondary crushing and screening plants.
Secondary crushing and screening	The secondary crushing and screening plant is used to size the ore according to product specifications. The final product from the secondary crushing and screening plant is stockpiled at one of the product stockpile areas or the crushed ROM stockpile. Material that will be stockpiled will vary between -6+1 MM and -75 + 6 MM and will be stockpiled separately via conveyor. The final product is loaded onto trains or trucks at the loadout area and is exported for further processing. Product is sent off-site via road trucks and trains. Front end loaders are used to load product onto trucks, while conveyors are used to send the product to a load-out silo from where it is loaded onto trains.
Thickener and tailings dam (not established yet)	Secondary screening fines waste (<1 MM) material will be sent to the thickener plant via conveyor. Water removed from the secondary screening fines waste during the thickener process will be re-used within the mining system as process water for dust suppression at the primary and secondary screening plants. The fines waste processed at the thickener will be disposed as tailings.
Tertiary crushing and screening (not established yet)	The tertiary crushing and screening section (– 40, +6 MM material) will be used to prepare the ore for sinter plant feed. High grade product will be stockpiled at the tertiary product stockpile prior to being sent to the sinter plant. Manganese that is below the required grade from the tertiary crushing and screening plant will be stockpiled at a low grade stockpile prior to being sent to the Dense Medium Separator (DMS) for further processing. Any fines material (-1 MM) produced at the tertiary crushing and screening plant will be sent to the thickener for disposal to the tailings dam.
Sintering (not established yet)	In the sinter plant, ore will be sintered by the application of heat, to agglomerate it and to increase the manganese content (by burning off the carbonaceous material). Raw materials will be mixed with the manganese ore in a rotating mixing pan prior to agglomeration in a rotary drum. The agglomerated material will be fed into the sinter furnace on a steel belt. The sinter furnace is a multi-compartment oven that is ignited with gas or heavy fuel oil. The front compartments will be used for drying, ignition and sintering. The back compartments will be for cooling. Gas emissions will be scrubbed in cascade scrubbers to remove most of the

Activity	Description
	particulates and pollutants. The dirty scrubber water will be re-cycled in the thickener plant. Dust emissions will be captured in bag filters and recycled into the sinter feed. The final product will be stockpiled on the product stockpile prior to being loaded onto trains for sale to third parties.
Dense medium separation (not established yet)	Prior to the sintering stage, manganese ore that is below the required grade (– 6 + 1 MM) can be beneficiated using dense medium separation, effectively upgrading the ore. Using density differential between manganese and waste; the material will be sent to the sinter feed stockpile prior to being sent to the sinter plant while the waste will be disposed onto the temporary discard dump.

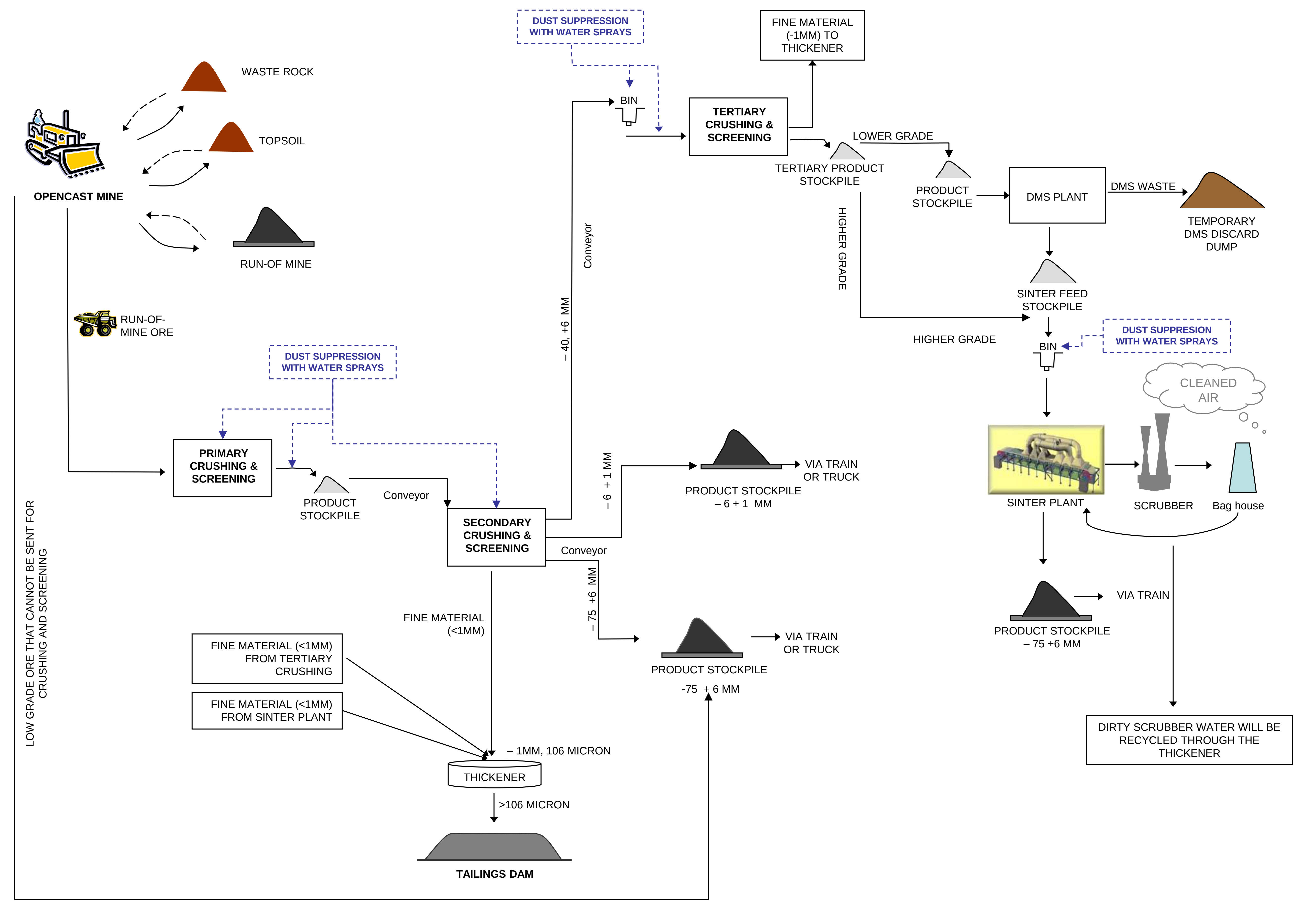


FIGURE 4: CONCEPTUAL PROCESS FLOW DIAGRAM

3.2.4 CONSTRUCTION PHASE

The Tshipi Borwa Mine has reached the operational stage. Where changes to the layout have already taken place, these were done during the main construction phase of the project. It is, however important to note that some of the project changes will require construction related activities. Proposed changes to the infrastructure layout requiring construction related activities include:

- the expansion of the topsoil stockpile areas No. 1 and No.2;
- the establishment of a clean and dirty water separation system on-site; and
- the establishment of the 78 Ml stormwater dam.

Refer to Figure 28 for a close up of the proposed new surface infrastructure layout.

Construction related activities may include:

- selective clearing of vegetation (expansion of the topsoil stockpile area, establishment of the dirty water separation system and 78 Ml stormwater dam);
- stripping and stockpiling soil (establishment of the dirty water separation system and 78 Ml stormwater dam);
- preparing (compacting) foundations and building trenches (establishment of the dirty water separation system and 78 Ml stormwater dam); and
- delivery of materials (establishment of the dirty water separation system and 78 Ml stormwater dam).

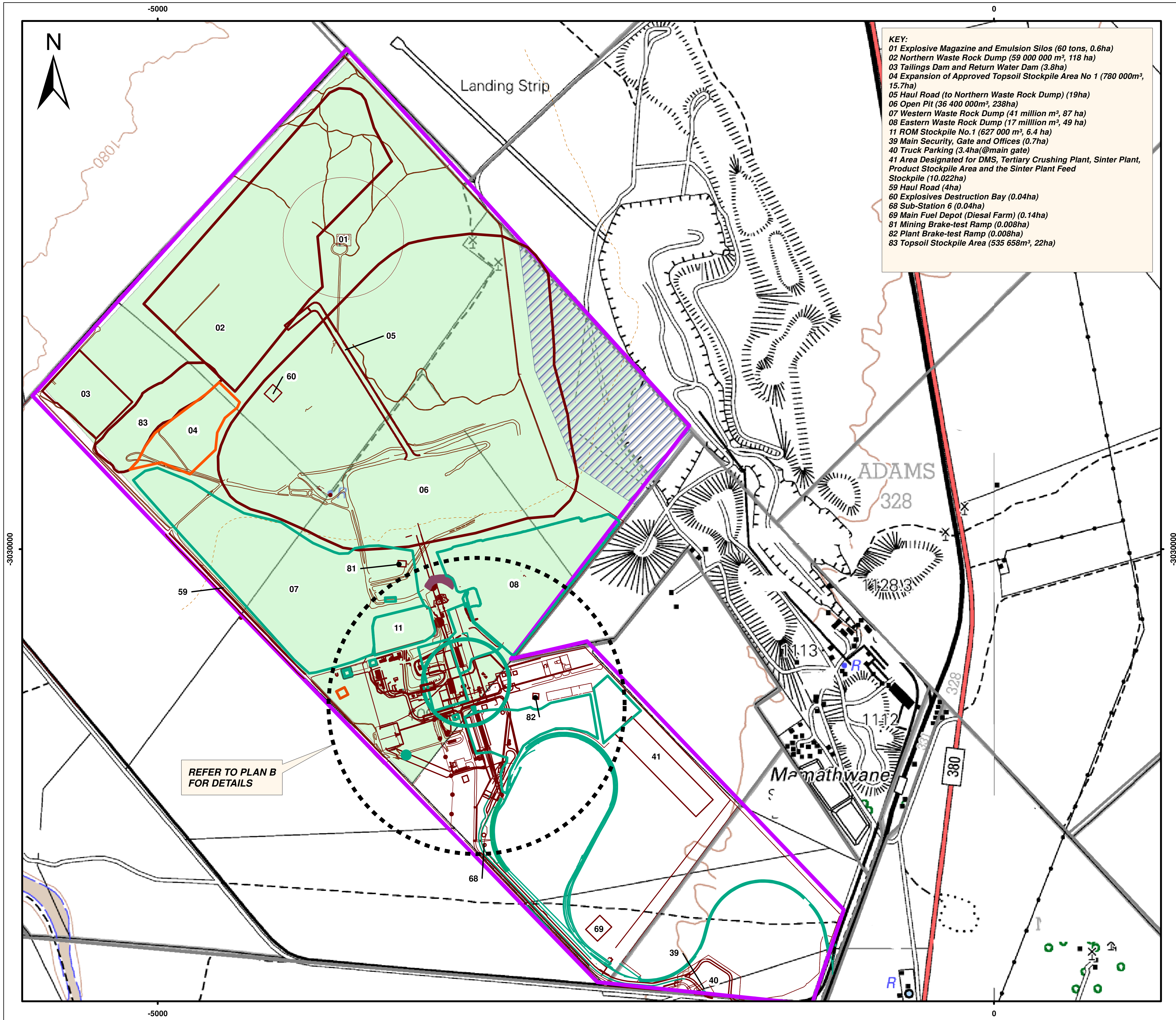
3.2.5 OPERATIONAL PHASE

The surface infrastructure layout that was approved as part of the EMPr process undertaken in 2009 (Metago, May 2009) is illustrated provided in Appendix I. The new infrastructure layout that caters for changes to the layout is illustrated in Figure 5 and Figure 6. The key infrastructure components include:

- Explosive Magazine and Emulsion Silos;
- Northern Waste Rock Dump;
- Western Waste Rock Dump;
- Eastern Waste Rock Dump;
- Tailings Dam and Return Water Dam;
- Haul Road (to Northern Waste Rock Dump);
- Open Pit;
- ROM Stockpile No.1 and temporary ROM stockpile area;
- Main Security, Gate and Offices;
- Truck Parking;
- Area Designated for DMS, Tertiary Crushing Plant, Sinter Plant, Product Stockpile Area and the Sinter Plant Feed Stockpile;
- Haul Road;
- Explosives Destruction Bay;

- Sub-Stations (No. 1 to No. 6);
- Main Fuel Depot (Diesel Farm);
- Mining Brake-test Ramps;
- Plant Brake-test Ramp;
- ROM Pad and Crushed ROM Stockpile;
- Primary Crushing and secondary crushing and screening;
- ROM Stockpile No1;
- Workshop Dirty Water Collection Dam;
- Spares Yard;
- Mining Equipment Tyre Bay;
- Boiler Shop;
- Mining Equipment Service Bay;
- Conveyors (Crushed ROM Conveyor);
- Mining Shift Change Building;
- Mining Equipment Workshop and Satellite Workshop, LDV Workshop and Engineering Workshop;
- Wash Bay;
- Offices (Mining Office No.1 and No. 2, Main Admin Offices, Engineering and Projects Offices, Ancillary Equipment Workshop, Plant Production Offices, Engineering Offices);
- Mining Training Rooms;
- Parking (Mining Mobile Equipment Hardpark, Ancillary Mobile Equipment Hardpark, ambulance bay, Road Truck, Vehicle Parking Bay and General Parking Area);
- Stormwater management facilities (Dirty Water Dams, Workshop dirty water collection dam, Stormwater Dam);
- Potable water facilities (Potable Water Tank (elevated), Potable Water Reservoir, fire water tank and the Temporary Construction Dam);
- Reverse osmois plant;
- Change House and Laundry;
- Clinic;
- Laboratory;
- Railway line;
- Product Stockpile Area No. 1 and No. 2;
- Topsoil Stockpile No.1 and No.2;
- Salvage Yard and Waste Storing/Sorting/Reclaim Area;
- Ancillary Equipment Diesel Storage and Refuelling Area ;
- Mine General Store, Core Stores, Rigging Store and Hazardous Store;
- Generator Powerhouse Diesel Tanks;
- Plant MCC, Control Room and Offices;

- Sewage Treatment Plant;
- Temporary Mobile Crushing Plant;
- Thickener;
- Weighbridges and control room (Weighbridge and Crushed Ore Weighbridge);
- Train Load-Out Station;
- Tyre Bays (Tyre bay and mining equipment tyre bay);
- Truck Road;
- Heli-pad (Still to be established); and
- Overhead Power line.



Legend

- Surface Use Area
- Approved Mining Right Area
- Mine Infrastructure (no changes to approved infrastructure layout)
- Changes to Approved Layout (already implemented)
- Proposed Changes to Approved Layout
- Barrier Pillar

0 500 1 000 Meters

Scale: 1:22 000 @ A3

Projection: Transverse Mercator

Datum: WGS1984, Lo23

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Figure 5

Close Up A of New Surface Infrastructure Layout

SLR

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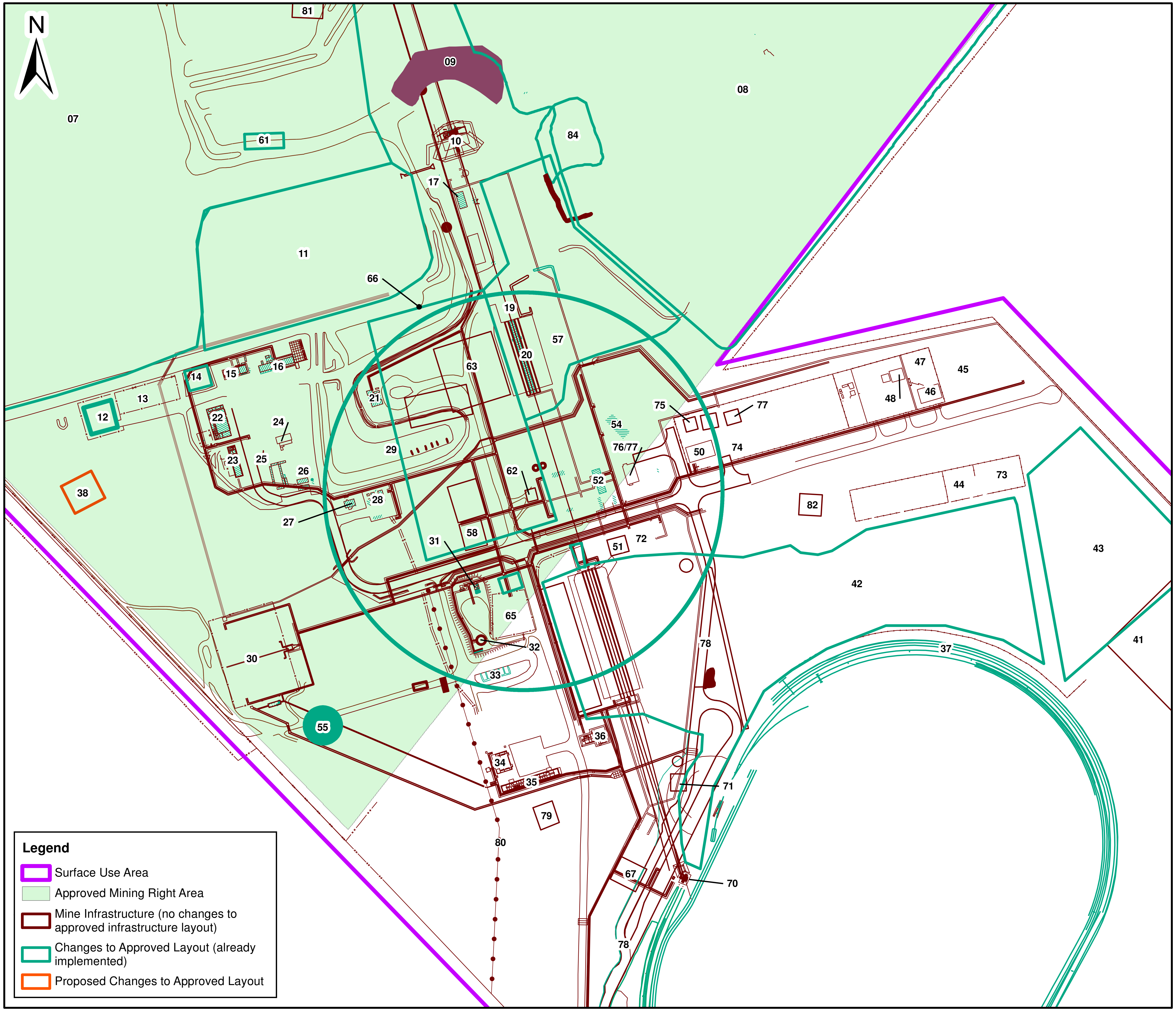

KEY:

07 Western Waste Rock Dump (41 milllion m³, 87 ha)
08 Eastern Waste Rock Dump (17 million m³, 49 ha)
09 ROM Pad (73 000 m³,16 ha)
10 Primary Crusher (±.0.7ha)
11ROM Stockpile No1 (627 000 m³, 7.6 ha)
12 Workshop Dirty Water Collection Dam (4Ml, 0.2 ha)
13 Spares Yard (0.4ha)
14 Mining Equipment Tyre Bay (0.001ha)
15 Boiler Shop (0.06ha)
16 Mining Equipment Service Bay (0.07ha)
17 Sub-station No. 4 (0.08ha))
19 Crushed ROM Conveyor (2.1ha)
20 Crushed ROM Stockpile (1.7ha)
21 Mining Shift Change Building (0.05ha)
22 Mining Equipment Workshop (0.14ha)
23 LDV Workshop (0.06ha)
24 Wash Bay (0.04ha)
25 Mining Office No.1 (0.1ha)
26 Mining Training Rooms (0.04ha)
27 Sub-station No.3 (0.04ha)
28 Mining Office No.2 (0.3ha)
29 Mining Mobile Equipment Hardpark (1ha)
30 Dirty Water Dams (24Ml, 1.2 ha)
31 Fire Water Tank (Approximately 0.01 ha and 653 m³), Elevated Potable Water Storage Tank (Approximately 0.02 ha and 75 m³), Sedibeng meter and RO plant
32 Potable Water Reservoir (2 000m³, 0.01ha)
33 Ancillary Mobile Equipment Hardpark (0.06ha)
34 Change House and Laundry (0.06ha)
35 Main Admin Offices and Clinic (0.12ha) and Ambulance Bay
36 Laboratory (0.08ha)
37 Railway Line (3ha)
38 Stormwater Dam (78ML,3ha)
40 Road Truck and Vehicle Parking Bay(3.4ha)
41 Sinter Plant, Including Feed and Product Stockpiles (future) (10ha)
42 Product Stockpile Area No. 2 (940 500 m³, 17 ha)
43 Topsoil Stockpile Area No.2 (290 000m³, 5.8ha)
44 Engineering and Projects Offices (1.7ha)
45 Salvage Yard and Waste Storing/Sorting/Reclaim Area (0.4ha)
46 Ancillary Equipment Workshop (0.05ha)
47 Ancillary Equipment Diesel Storage and Refueling Area (0.003ha)
48 Plant Production Offices (0.05ha)
50 Mine General Store (0.1ha)
51 Generator Powerhouse Diesel Tanks and Engineering Offices (0.2ha)
52 Plant MCC, Control Room and Offices (0.05ha)
54 General Parking Area (0.1ha)
55 Sewage Treatment Plant (Treatment capacity of 96 m³, ± 0.25 ha)
57 Temporary Mobile Crushing Plant (8.9ha)
58 Thickener (future)
61 ROM Weighbridge (210ton) and Control Room
62 Crushed Ore Weighbridge (80ton) and Control Room
63 Secondary Crushing and Screening Plant
65 Temporary Construction Dam (9 000 m³, 0.24ha)
66 Product Stockpile Area No.1 (434 500 m³ 7.9ha)
67 Satellite Workshop
70 Train Load-Out Station
71 Sub-Station No.5 (0.08ha)
72 Sub-station No.1 (0.04ha)
73 Tyre Bay (0.001ha)
74 Core Stores (0.0612ha)
75 Hazardous Store (0.02ha)
76 Engineering Workshop (0.054ha)
77 Rigging Store (0.05ha)
78 Truck Road
79 Heli-pad
80 11 kVA Overhead Power line
81 Mining Brake-test Ramp
82 Plant Brake-test Ramp
84 Temporary ROM Stockpile Area (20 000 m³, 1ha)

0 100 200 Meters

Scale: 1:6 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 6

Close Up B of New Surface Infrastructure Layout

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TRANSPORT SYSTEM

Access to the mine

As per of the approved EMPr (Metago, May 2009), the Tshipi Borwa Mine is located along the D3457 gravel road which is accessed via an intersection off the provincial R380 road (Figure 5 and Figure 6). The project will not result in any changes to the access to the mine.

Internal haul roads

As per of the approved EMPr (Metago, May 2009), internal haul roads are used for the mining operation to transport product, waste rock material and people to various sections within the mine area. The haul roads are constructed from suitably sized and compacted waste rock which varies in width up to a maximum width of 25 m. As part of the project no additional internal haul roads will be established.

Prior to the development of the Tshipi Borwa Mine, an 8m wide gravel farm road was located along the western boundary of the mine's surface use area. A section of this gravel road was widened to approximately 25m by Tshipi in 2013 (Figure 5 and Figure 6). These road widening works were not authorised in the approved EMPr (Metago, May 2009). Under the NEMA the unlawful commencement of activities may be authorised through an application for rectification made in terms of section 24G of the NEMA. In this regard, a separate process is being undertaken for the authorisation of the widening of this haul road, but is mentioned in this report for completeness purposes. It follows that this will not be assessed as part of the project.

Transportation of workers and supplies to site via existing road networks

During the operational phase there are employees and contractors travelling to and from site, vehicles transporting ROM, vehicles removing waste material and trucks transporting manganese product. Table 6 below provides a conceptual indication of the traffic volumes associated with the operational phase of the Tshipi Borwa Mine. As part of the project a traffic study was undertaken (Siyazi, June 2017). The result of this traffic study indicates that road infrastructure improvements are currently required from a road safety point of view. This includes providing a 60m dedicated right-turn lane on the northern approach and reflective road studs. Further details pertaining to the upgrade is included in Appendix O. It is proposed that these upgrades are discussed in collaboration with neighbouring mines and the relevant roads department.

TABLE 6: OPERATIONAL PHASE TRAFFIC

Items to be transported		Transport mechanism	Approximate trips per day	Most likely route
Group	Specific			
Staff and visitors	Skilled, semi-skilled and unskilled	Private vehicles / mini bus/ buses	220 / day	From Kathu, Hotazel and Kuruman via the R31 and/or R380
Raw materials	Plant raw materials	30-tonne trucks	5 / week	From Kuruman or Gauteng via the R31 and/or the R380.

Items to be transported		Transport mechanism	Approximate trips per day	Most likely route
Group	**Specific**			
and domestic waste	Explosives	30-tonne trucks	5/ week	
	Diesel	Tanker	2 / week	
	Spares truck	30-tonne trucks	2 / week	
	Other consumables	Trucks	1 / week	
	Domestic and industrial waste collection	Trucks	1 / week	
Within the mining operation	Ore	Haul trucks	Within the boundaries of the surface use area	From mining areas to processing and crushing areas.
Outside the mining operation	Manganese product	Either 30-tonne trucks or by rail.	300 / day - trucks or between 3 trains a day	Export manganese product to the coast using R31 to Kuruman and R380 to Kathu.

Conveyors

As per of the approved EMPr (Metago, May 2009), various surface conveyors are/will be used to move material from the primary, secondary and tertiary crushing and screening plants, onto the product stockpiles and ultimately through to the loading silo. Dust suppression at material transfer points include water sprays. The conveyors have a width of 1200, 1500 or 1800mm.

These (open) conveyors are located within the approved surface use area and are routed to support the operations at the Tshipi Borwa Mine.

Railway siding

As per of the approved EMPr (Metago, May 2009) a railway siding was planned between the regional Transnet railway line (adjacent to the R380) and the Tshipi silo/loading area (Figure 27). In this regard the design of the railway siding incorporated a loop, which eliminated the need for shunting and was approximately 3.1 km in length.

The design of the approved railway siding has been changed and the length of the railway siding has been increased to approximately 6 km. The current layout of the railway siding is illustrated in Figure 5.

Pipelines

As per the approved EMPr (Metago, May 2009) a pipeline connection has been established to the Sedibeng Vaal-Gamagara pipeline to supply the mine with potable and process water with a diameter of 100mm. Secondary pipelines are installed to move water within the mining areas with a diameter which range between 250mm to 300mm. Secondary pipelines will be installed to move water between the return water dam and processing plant area when the tailings dam is operational. These pipelines are located within the approved surface use area and are routed to support the operations at the Tshipi Borwa Mine.

WATER SUPPLY AND USE

Potable water

Potable water for the mine is sourced from the Sedibeng Vaal Gamagara Water Supply pipeline. This water is sent to the reverse osmosis treatment plant located on-site prior to use within the mine for potable use. Tshipi requires a maximaum of 27 387 m^3/month of water from the Sedibeng Vaal Gamagara Water Supply pipeline.

Process water

Process water from the mine is sourced from a combination of water from the Sedibeng Vaal Gamagara Water Supply pipeline, dewatering from the open pit and the collection of stormwater run-off. Tshipi requies a total of 9 432 m^3/month. When the tailings dam and sinter plant are in operation, the process water requirements will increase to 15 004 m^3/month.

Water storage facilities

As per the approved EMPr (Metago, May 2009), two steel tanks of 1.5 Ml (1 500 m^3) capacity each are positioned in the plant area for the storage and dispensing of process water. These tanks receive water from the stormwater dam and sewage plant, the pit dewatering and from a Vaal-Gamagara pipeline. In addition to this, provision is also made for a steel tank for the mining and primary crushing section stores and dispense process water, with a capacity of 1 Ml (1 500 m^3). Further to this, provision is made for various other water tanks to store and dispense potable water, each tank with a capacity of 1 Ml (1 500 m^3).

Potable water is currently stored in one of four water storage facilities (Figure 5 and Figure 6) including:

- a potable water reservoir with a capacity of 2000 m^3;
- a fire water tank with a capacity of 653 m^3;
- an elevated potable water storage tank with a capacity of 75 m^3; and
- a temporary construction dam with a capacity of 9000 m^3.

STORMWATER MANAGEMENT

As per the approved EMPr (Metago, May 2009) the separation of clean and dirty water systems at the mine will be designed, implemented, and managed in accordance with the provisions of Regulation 704, 4 June 1999 (Regulation 704) for water management on mines. In general, the footprint of all dirty areas will be minimised by isolating these areas from clean water runoff and dirty water will be contained in designated systems. Further detail pertaining to the management of clean and dirty water is discussed below. As part of the project, the stormwater management plan has been reviewed and updated. The revised plan is detailed below. Refer to Appendix L for the stormwater management plan for the Tshipi Borwa Mine.

Diversion of clean water runoff

As per the approved EMPr (Metago, May 2009), provision is made for the diversion of clean water around the mine through elevated roads, various stockpiles and dedicated diversion berms. The project will not alter the concept of the diversion of clean water runoff.

Containment of dirty runoff water

The approved EMPr (Metago, May 2009) made provision for the establishment of several stormwater dams within the vicinity of the plant and operational areas (Figure 27). These stormwater dams included:

- a 10 Ml stormwater dam for the collection of dirty water from the operational areas (mining workshop and primary crusher area);
- a 8 Ml stormwater dam for the collection of dirty water from around the plant area; and
- a 6.3 Ml settling dam that would receive dirty water from the pit dewatering and the various storm water dams described above.

The approved plan has been adjusted such that the above listed stormwater dams have been combined to form one 24.3 Ml dirty water dam (Figure 5 and Figure 6) which consists of four compartments. This facility is lined with an HDPE liner. In addition to this, the existing stormwater management system at the mine does not allow for the containment of dirty water run-off from the contractors area. In this regard, Tshipi has established an workshop dirty water collection dam near the contractors' areas to collect dirty run-off water (Figure 5 and Figure 6). The workshop dirty water collection dam has been designed for a capacity of 4 Ml and is lined with an HDPE liner. Dirty water stored within containment facilities will be re-cycled as process water.

The approved EMPr (Metago, May 2009) also makes provision for the establishment of two stormwater dams with a capacity of 78 Ml positioned to the north of the tailings dam (Figure 27). Stormwater from other dirty areas on site that is not contained within the approved 10 Ml, 8 Ml and 6.3 Ml stormwater dams (currently the 24.3 Ml stormwater dam), as listed above, would be captured in these two stormwater dams.

As part of the project, Tshipi is proposing re-positioning the 78 Ml stormwater dam closer to the plant area. Stormwater run-off not contained within the 24.3 Ml stormwater dam will be directed to the repositioned 78 Ml stormwater dam. The proposed new position is illustrated in Figure 5. The 78 Ml stormwater dam will be lined with an HDPE liner and will be built in compartments. The initial compartment will be sized to take the overflow from the workshop dirty water collection dam and the dirty water dam when these are full. The initial capcity required is 48Ml or 48 000m^3. A secondary compartment can be constructed later if more detailed analysis demonstrates that the additional capacity is required.

In addition to the above, return water and run-off from the tailings dam will drain into a return water dam. Further detail pertaining to the approved return water dam in provided in Table 7 below. The project will not alter the conceptual design parameters of the return water dam.

TABLE 7: CONCEPTUAL DESIGN PARAMETERS OF THE APPROVED RETURN WATER DAM (METAGO, MAY 2009)

Feature	Detail	
Physical Dimensions and Capacity	Wall height above NGL	2 m
	Surface area at FSL	14 884 m^2
	Total footprint area	25 600 m^2
	FSL Capacity	35 000 m^3
	Freeboard	1 m
	Avg water depth at FSL	3 m
	Depth of excavation (max)	2.50 m
	Return water dam is designed to not spill more than once in every 50 years (R704 of NWA 1998). Water located in the return water dam will be pumped back to the processing plant via return water pipelines for re-use in the system.	
Topsoil Stripping	Topsoil within the return water dam footprint will be stripped and stockpiled in accordance with the soil conservation procedure (Table 52). Stripping and stockpiling of topsoil will be done as part of the initial tailings dam and return water dam construction.	
Lining	The return water dam will be lined with an HDPE liner.	
Embankments	A compacted starter wall will be constructed as part of the initial civil engineering works for the return water dam. It will be constructed in 150mm layers which will be compacted to a 98% standard proctor density. The embankment walls of the return water dam will have an inner and outer slope of 1V: 3H	
Leakage Detection	A leakage detection system will be established	
Access and Access Control	An access road will be constructed around the perimeter of the return water dam to allow access to the return water pump station. This road will also be constructed of suitable gravel material. A 2 m high, 6 stranded barbed wire perimeter fence will be constructed around the return water dam to livestock and unauthorised people from entering.	
Drowning Prevention	The dam will be largely empty during its operations and only be full during periods of high rainfall. The dam side slopes are flat (1:3) and constructed from a granular material that would facilitate escape should a person fall in.	
Settling Facility	The dam collects runoff from the tailings dam. The material of the tailings dam is high in density and fairly coarse. Given these characteristics, the runoff is not expected to carry a significant amount of tailings in suspension. A settling facility is therefore not recommended.	
Emergency Spillway	In the event of a storm greater than the design storm event, an emergency spillway has been designed to control the discharge of excess water.	
Monitoring and Maintenance	Monitoring of the return water dam will include daily, monthly and quarterly inspections. These will consist of: Daily monitoring: 1) the water level in the dam will fluctuate over time. These levels need to be monitored to ensure that the return water dam will not exceed its limit; and 2) the operation of pumps and controls needs to be monitored to ensure that they are operating correctly and that there are no faults. This will ensure that the return water dam will be able to operate at its optimum potential and will allow any problems to be detected early. Monthly monitoring: 1) the sump needs to be monitored monthly to ensure that there is no damage to the HDPE liner, lining the sump. If leakage is detected then action needs to be taken in order to locate the problem and act appropriately; and 2) a physical inspection needs to be completed in order to find and locate any damage or potential problems to the liner. If any potential problem is found, then immediate	

Feature	Detail
	action can be taken to ensure that the problem will not progress. Quarterly monitoring: 1) the ground water needs to be monitored on a quarterly basis to ensure that there has been no contamination of ground water; and 2) inspection of the side slopes.
Contingency Plans	In the event that the downstream borehole monitoring indicates that possible pollution has occurred, the source needs to be identified and investigated by a specialist to determine the following: 1) possible leakage from the pipelines; 2) possible leakage from the dam; and 3) possible alternative sources of pollution. Once the source of pollution has been identified, appropriate action should be implemented to prevent further pollution and if necessary, clean up the existing plume. Initial geochemistry work indicates that the ore and tailings have an insignificant pollution potential. If any pollution is detected, tests should be conducted to confirm the initial test findings.
Closure	On completion of the mine the sump and pump station within the return water dam will be removed, including all pipes and plastic liners and the dam will remain for continued storm water attenuation.

The conceptual stormwater management plan for the Tshipi Borwa Mine is presented on Figure 7, whilst Figure 8 presents more detail on stormwater management around the plant area. The key features include:

- Dirty stormwater from the operational areas (crushers, ore stockpiles, load out stations, workshops, stores, contractor's area etc) will be collected by lined drainage channels and conveyed into dirty water containment facilities, either the dirty water dam or workshop dirty water collection dam;
- During significant storm events, the dirty water dam and workshop dirty water collection dam will spill via new channels into a stormwater dam, and this stormwater will be pumped back to the dirty water dam for re-use after the storm event;
- Dirty stormwater and any groundwater collecting within the pit will be collected and pumped to the dirty water dam;
- Runoff from the waste rock dumps will be managed by creating toe paddocks or perimeter berms, to collect runoff and allow it to evaporate;
- Dirty stormwater from the tailings storage facility will be collected within the return water dam and pumped back to the dirty water dam for re-use;
- The topsoil stockpile will be re-vegetated and any runoff from this will be classified as clean; and
- Dirty water within the dirty water containment facilities will be re-used at the site for dust suppression, wash down or other non-potable uses where water quality permits.

Legend

- Infrastructure
- Surface Use Area
- Dirty Stormwater Channels
- Stormwater Berms
- Dirty Catchments
- Dirty Water Dams
- Clean Catchments
- Non-Perennial Watercourses
- 0.5m Contours

0 250 500 1 000 Meters

Projection: Transverse Mecator
Datum: WGS 1984_UTM Zone 34S

Tshipi é Ntle Manganese Mining (Pty) Ltd

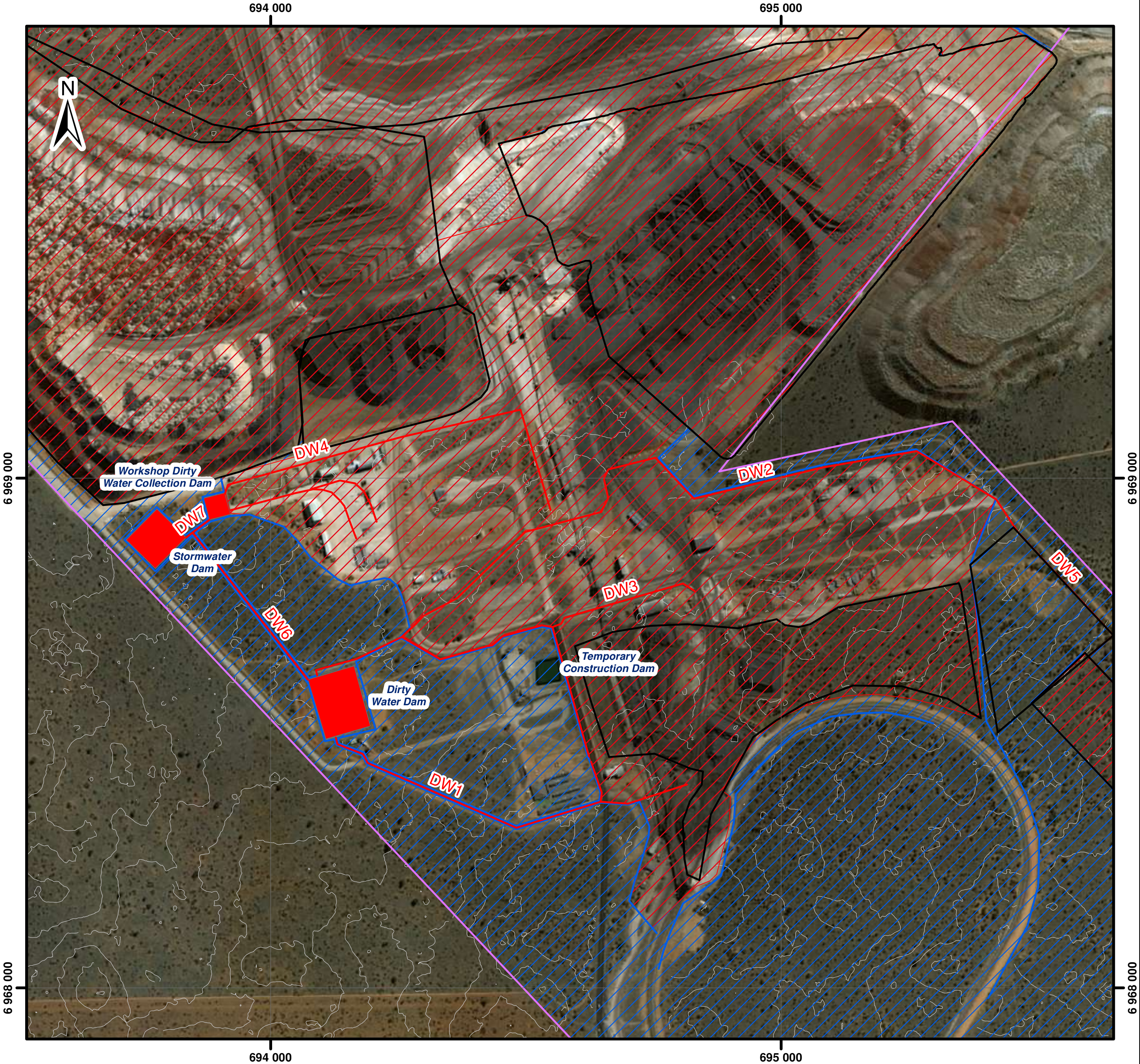
Figure 7

Site Wide Conceptual Stormwater Management Plan

SLR

SLR Consulting (Africa) (Pty) Ltd
P O Box 1596, Cramerview, 2060, South Africa
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.20029.00011	July 2017



Legend

- Infrastructure
- Surface Use Area
- Dirty Stormwater Channels
- Stormwater Berms
- Dirty Catchments
- Dirty Water Dams
- Clean Catchments
- Non-Perennial Watercourses
- 0.5m Contours

0 250 500

Projection: Transverse Mecator
Datum: WGS 1984_UTM Zone 34S

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 8

Plant Conceptual Stormwater Management Plan

SLR Consulting (Africa) (Pty) Ltd
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710.20029.00011	July 2017

DISTURBANCE OF WATERCOURSES

The Vlermuisleegte is the closest watercourse to the Tshipi Borwa Mine, which is located approximately 2 km from the mine (Figure 2). As per the approved EMPr (Metago, May 2009), no diversion of this watercourse is required.

Changes to the infrastructure layout all took place within the existing mining right and surface use areas, and as such, no watercourses will be physically disturbed as a result of the project.

WATER BALANCE

A site wide water balance model has been prepared to understand flows within the Tshipi Borwa Mine's operational water circuit during average dry seasons and average wet seasons during different phases of the mine. To demonstrate how variations in groundwater inflows and operational water requirements will impact upon the water balance, the following scenarios were modelled:

- year (current) average wet and dry seasons;
- year 10 of life of mine average wet and dry seasons; and
- life of mine average wet and dry seasons (with the tailings dam and sinter plant).

The wet season and dry season for the three scenarios is illustrated from Figure 9 to Figure 14. The water balance shows that during the current scenario, groundwater inflows are negligible and the mine is reliant on makeup water from Sedibeng with monthly demand estimated to be between 11 111 m^3 and 27 387 m^3.

Groundwater inflow and stormwater collecting within the open pit becomes a very significant source of water for the mine in future years and from year 10 of mining onwards the mine could be expected to be water positive during the wet season, although there is still expected to be a requirement for makeup water through the dry season. When the mine is water positive, the mine will store the water. If the mine is unable to store all the water, water will need to be discharged.

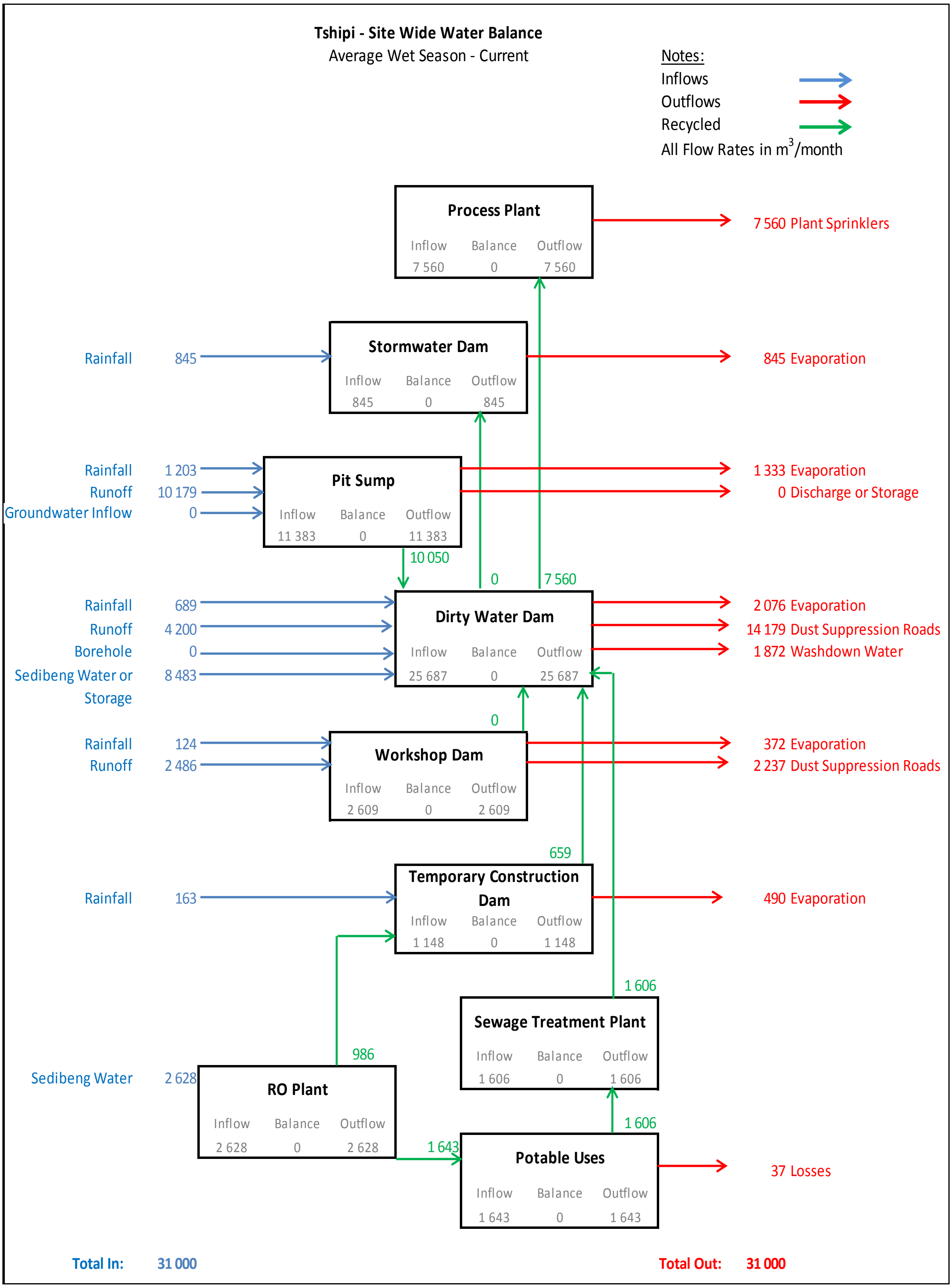


FIGURE 9: WATER BALANCE - CURRENT WET SEASON

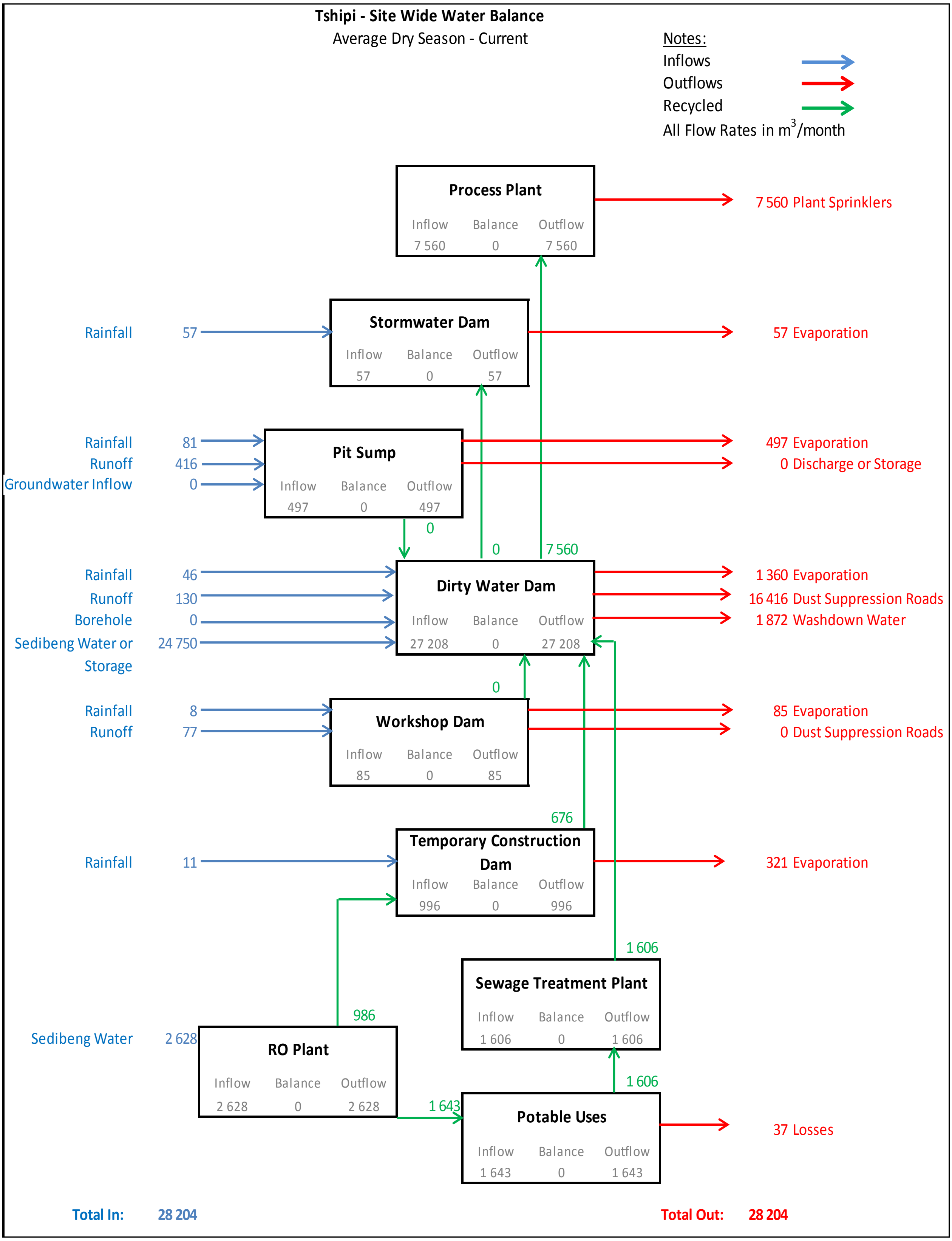


FIGURE 10: WATER BALANCE - CURRENT DRY SEASON

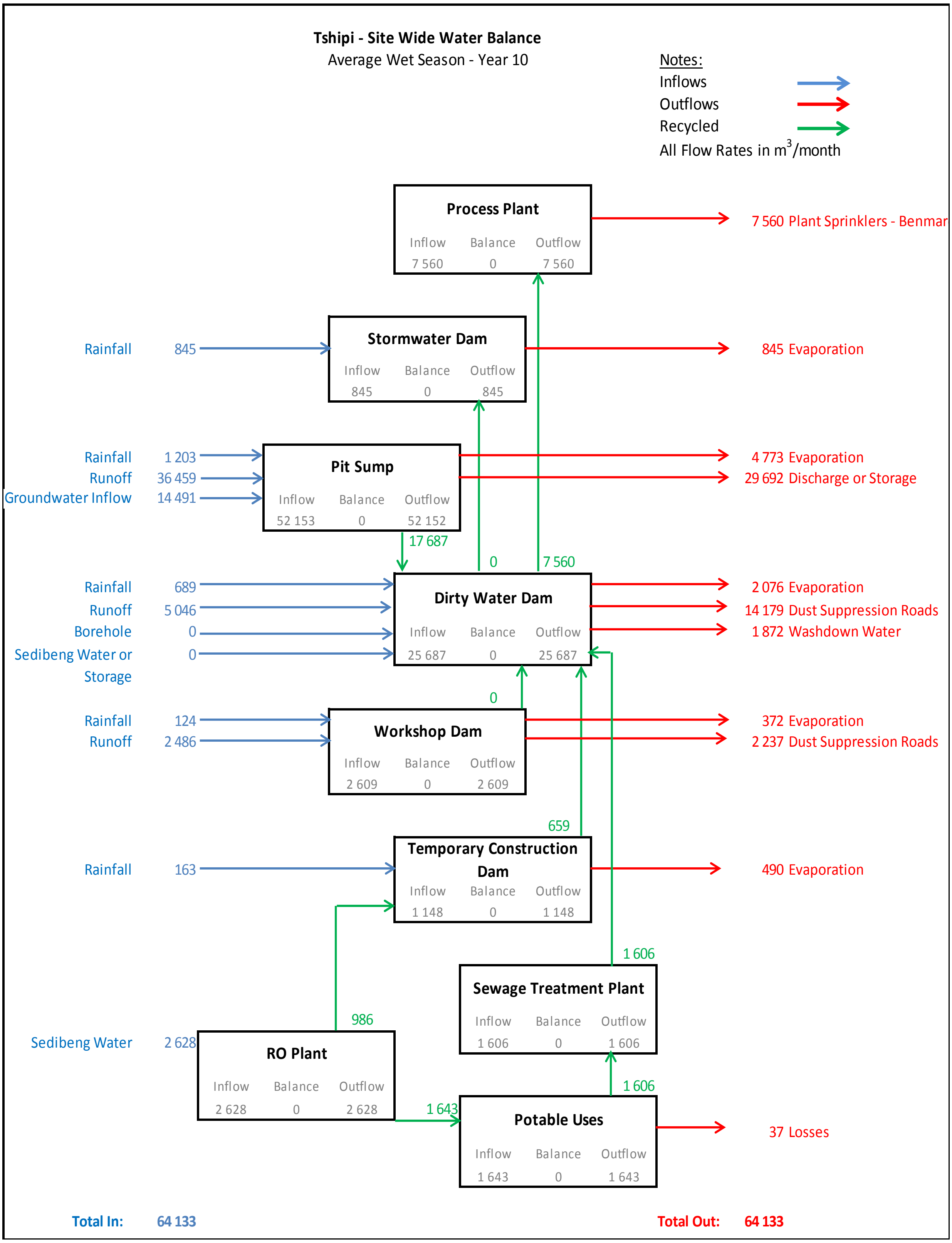


FIGURE 11: WATER BALANCE - YEAR 10 WET SEASON

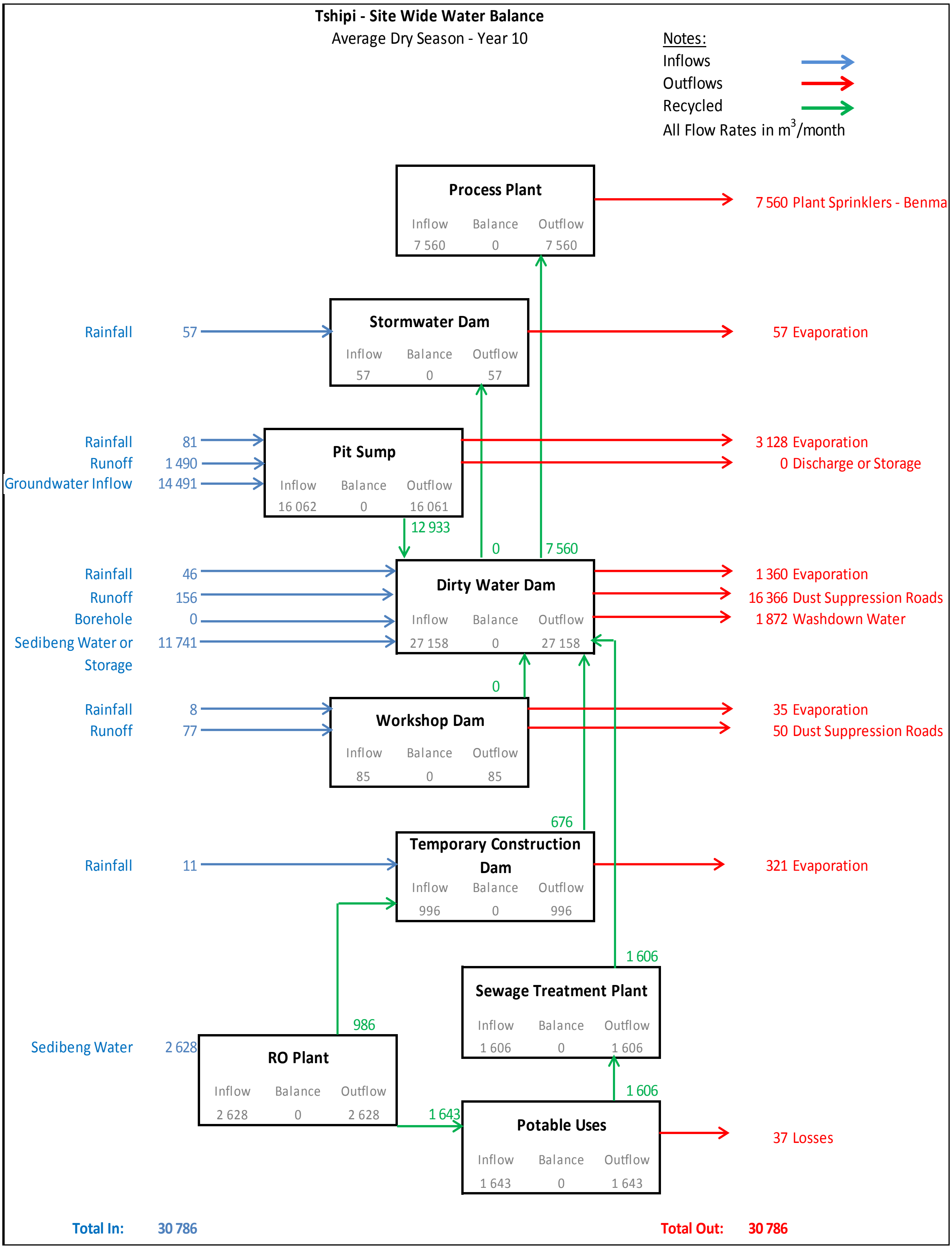


FIGURE 12: WATER BALANCE - YEAR 10 DRY SEASON

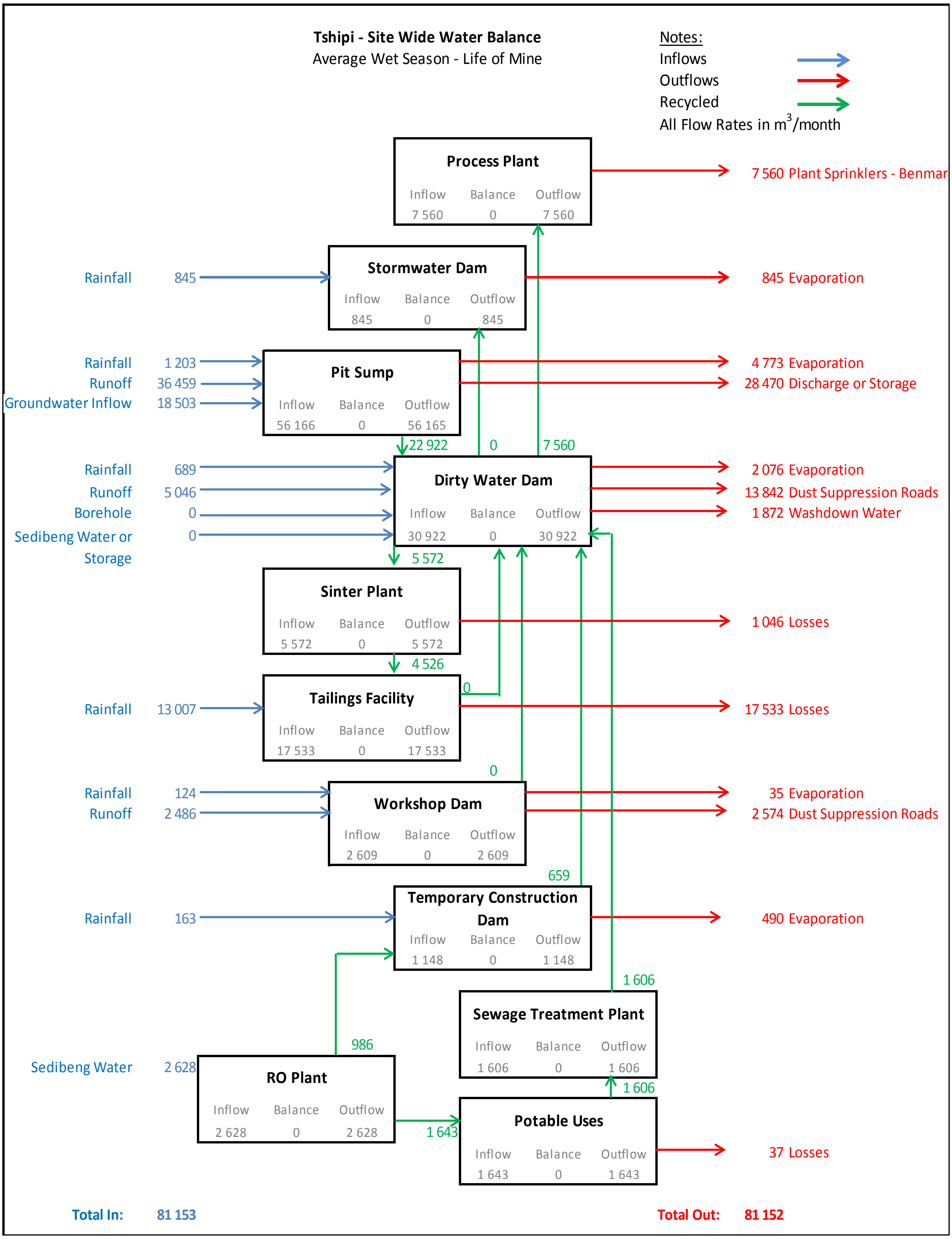


FIGURE 13: WATER BALANCE – LIFE OF MINE WET SEASON

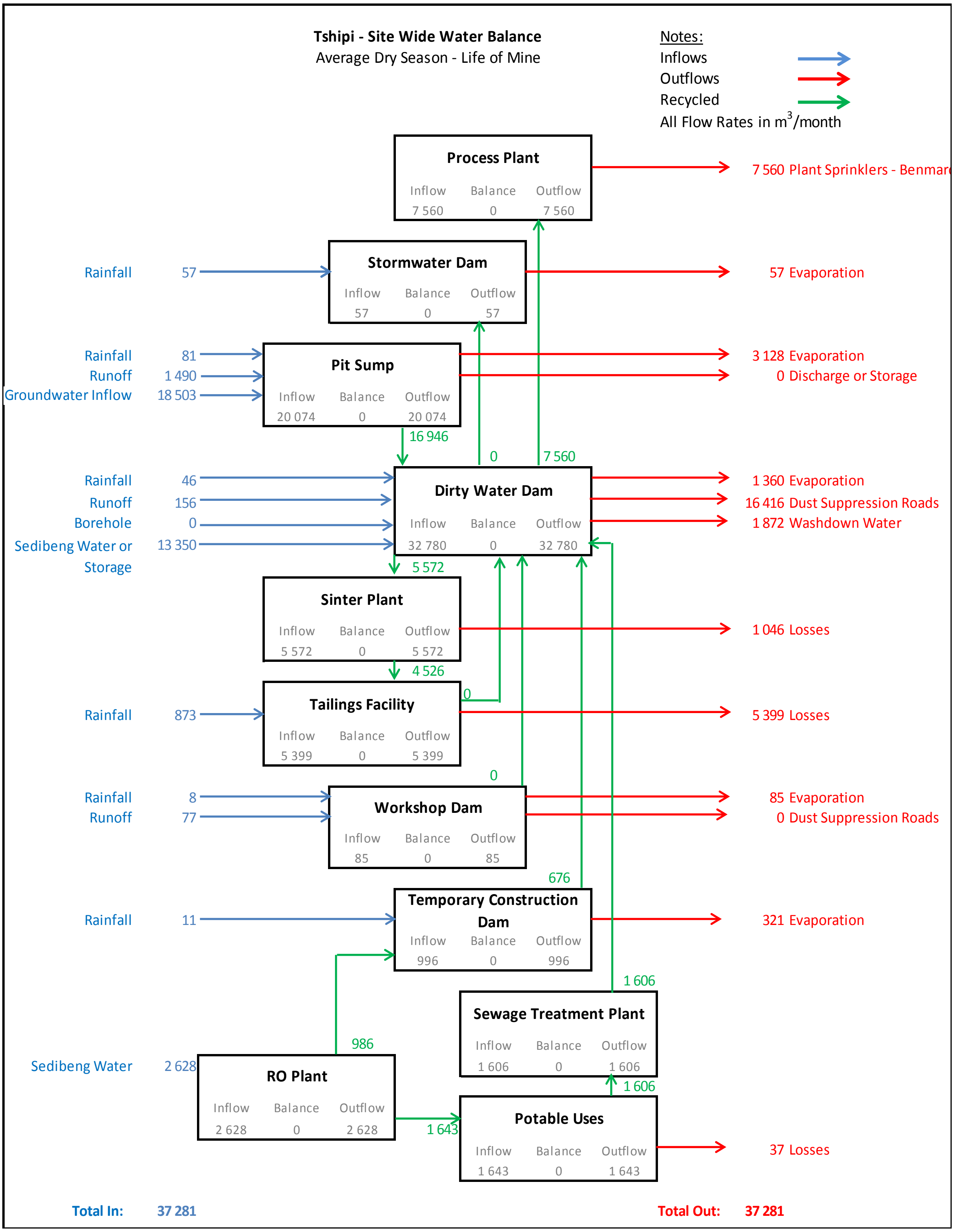


FIGURE 14: WATER BALANCE – LIFE OF MINE DRY SEASON

POWER SUPPLY AND USE

As per the approved EMPr (Metago, May 2009), operational power was planned to be sourced from Eskom via a dedicated powerline. The power requirements for the mine will be 4 MVA at full production. This power requirement will be increased to 9MVA once the sinter plant is constructed. It transpired that Eskom could not supply grid-power timeously and the planned backup diesel generators became the primary source of electrical power for the mine. At this time Eskom grid-power is being considered which will require the establishment (by Eskom or Tshipi) of a 132/11 kVA sub-station (on portion 8 of the farm Mamatwan 331) and a 11 kVA overhead power-line (also on portion 8 of the farm Mamatwan 331) to bring Eskom electricity onto the mine. It is important to note, that if any additional powerlines need to be established by Tshipi, this will be managed as part of a separate environmental assessment process. The substation is equipped with transformers and switchgear to enable the voltage from the regional line to be stepped down and internally distributed. Internal power reticulation (from the diesel generators and the substation) is by means of an 11 kV distribution network comprising powerlines and mini substations. The diesel generators, substation and mini substations are equipped with impermeable floors with bunds and collection traps for any spilled diesel and lubricants. These power supply infrastructure is located within the approved surface use area to support the operations at the Tshipi Borwa Mine. The position of the generators and substations is illustrated in Figure 5 and Figure 6.

MINERALISED WASTE MANAGEMENT

<u>Waste rock</u>

The approved EMPr (Metago, May 2009) made provision for two waste rock dumps, namely the northern and the western waste rock dumps, which were designed to comply with Section 73 of Regulation 527 of the MPRDA as outlined in Table 8 below. The position of the approved waste rock dumps (northern and western) is illustrated in Figure 27. The project also caters for waste rock being deposition on an eastern waste rock dump as illustrated in Figure 5. The eastern waste rock dump was established and is operated in accordance with the design features outlined in Table 8 below. It is anticipated that any waste generated as part of mining the barrier pillar will be deposited onto the eastern waste rock dump.

TABLE 8: DESIGN FEATURES FOR THE WASTE ROCK DUMPS

Feature	Detail
Physical Dimensions	The total area to be covered by waste rock dumps over the life of the mine is approximately 254 ha, with a total volume of 117 Million m^3 storage capacity.
	Eastern waste rock dump: Final volume of 17 million m^3 and a final footprint of 49 ha.
	Western waste rock dump: Final volume of 41 million m^3 and a final footprint of 87 ha.
	Northern waste rock dump: Final volume of 59 million m^3 and final footprint of 118 ha.
Physical characteristics	The material comprises waste rock. The water content is expected to be about 5%. The void ratio is approximately 0.5.
Management, transport,	Waste rock is loaded onto trucks and transported to the waste rock dumps. As part of ongoing rehabilitation and pollution control, the open pit will be backfilled with the aim of

Feature	Detail
placement and mine void backfilling	reinstating the original profile comprising topsoil on top, with soft subsoil (excavatable) material and the harder rock material in the layers below.
Diversion	Runoff from the waste rock dumps will be managed by creating toe paddocks or perimeter berms, to collect runoff and allow it to evaporate
Topsoil Stripping	Topsoil in the waste rock dump footprint areas is stripped and stockpiled in accordance with the soil conservation procedure (Table 52) and is stockpiled at the topsoil stockpile near the tailings dam area. Stripping and stockpiling of topsoil is done immediately in advance of dumping.
Lining	No lining is provided for the waste rock dumps.
Side slopes	The slopes of the waste rock dumps do not exceed 26 degrees.
Under Drains	No under drainage has been provided. Surface run-off will be directed around the waste rock dump and dump surfaces will provide positive drainage to prevent ponding and infiltration.
Access and Access Control	Mining haul roads have been constructed using waste rock. No perimeter fence has been provided around the individual waste rock dumps. Rather a perimeter fence has been installed around the perimeter of the mine.
Waste Minimisation	Waste rock is used to construct foundations and haul roads. It will also be used to backfill the open pit as part of the rehabilitation process.
Monitoring	A monitoring strategy will be developed to manage excessive surface cracking, bulging, foundation creep, and seepage at the waste rock dump.
Dust Control	Operational Phase: Roads are watered using water and/or chemical solutions for dust suppression. Post Operational Phase: No measures necessary due to rehabilitation. Monitoring will form part of the overall site monitoring.
Closure	Material from the waste rock dumps will be used during the backfill of the pit. Where waste rock remains after mining because of the bulking factor, these will be flattened to a maximum side slope of 1V:3H. Land use options for rehabilitation will be considered during the life of mine. On closure of any remaining waste rock dumps, access ramps and berms will be eliminated prior to rehabilitation to reduce erosion risks. No active groundwater protection measures are envisaged given the relatively low pollution potential of the residual waste rock material. In the event that water quality monitoring around any waste rock dump indicates that the waste rock dumps are causing pollution, catchment paddocks and soak-aways will be provided to minimise the risk of exposure to wildlife, livestock and humans. The footprint of temporary waste rock dumps will be rehabilitated by ripping the underlying subsoil, then replacing the topsoil, vegetating, applying fertilizer, and irrigating the new growth for a short period.
Rehabilitation Success Criteria	Rehabilitation success will be determined by monitoring trends in soil nutrient levels, soil microbial levels, vegetation cover and vegetation biodiversity levels and comparing data and temporal trends in the data to numerical targets.

Safety classification of waste rock dumps

The safety classification for the approved waste rock dumps was determined in accordance with the South African Code of Practice for Mine Residue Deposits (SANS 10286:1998) and the requirements of Mineral Regulation 527 of 23 April 2004. The summarised classifications are included in Table 9.

TABLE 9: SAFETY CLASSIFICATION CRITERIA FOR WASTE ROCK DUMPS

Criteria No.	Criteria		Comment	Safety Classification
1	No. of Residents in	0 (Low hazard)	There are no farmhouses or other structures within the zone of influence.	Low Hazard
		1 -10 (Medium hazard		

Criteria No.	Criteria		Comment	Safety Classification
	Zone of Influence	>10 (High hazard)		
2	No. of Workers in Zone of Influence	<10 (Low hazard)	The waste rock dumps are located near the open pit and as such mine workers may be located in the zone of influence, however majority of the main activities will take place in the pit area.	Medium Hazard
		11 – 100 (Medium hazard)		
		>100 (High hazard)		
3	Value of third party property in zone of influence	0 – R2 Million (Low hazard)	No formal assessment of the value of property has been done in the zone of influence. The characteristics of the waste rock dumps are such that catastrophic failures will be localised and no extended flow will be experienced.	Low Hazard
		R2 – R20 million (Medium hazard)		
		>R20 million (High hazard)		
4	Depth to underground mine workings	>200 m (Low hazard)	There are no known underground mine workings beneath the tailings dam site. Any future workings would be more than 270m below surface.	Low Hazard
		50 m – 200 m (Medium hazard)		
		<50 m (High hazard)		

With reference to Table 9 above, the waste rock dumps are classified as a low safety risk.

Environmental classification for the waste rock dumps

In accordance with Regulation 5 of GN R. 632 of the NEM:WA, waste rock stockpiles need to be classified taking into account Regulation 8 of GN R. 634 of 2013, which references the following associated National Norms and Standards:

- the National Norms and Standards for the assessment of waste for landfill disposal (GN R.635 of 2013); and
- the National Norms and Standards for disposal of waste to landfill (GN R. 636 of 2013).

A waste assessment of the waste rock generated at the Tshipi Borwa Mine was undertaken by Golder Associates (Golder, February 2016). The results of the waste assessment indicate that waste rock generated as part of the Tshipi Borwa Mine operations is classified as a Type 1 waste which requires a Class A liner. A Class A liner consists of a compacted clay liner, leach detection, geotextile membranes and geotextile filters. Refer to Appendix S for a copy of the waste assessment report.

In June 2016, the DWS accepted a proposal by the Chamber of Mines of South Africa to follow a risk based approach on a case-by-case basis to allow for representations on alternative barrier systems for Mine Residue Deposits and Stockpiles (29 June 2016). A copy of the letter is included in Appendix E. The risk assessment will enable an evaluation of the efficacy of the alternative barrier system to prevent pollution as required in terms of section 19 (1) and (2) of the NEM:WA (Singh, 2016).

Since the purpose of the Norms and Standards is to protect water resources it may be appropriate to consider the potential water quality risk associated with the waste rock dumps at the Tshipi Borwa Mine, rather than a formulaic application of the Norms and Standards for the following reasons:

- a Class A liner is impractical for a waste rock dump on the basis of geotechnical properties given that the liner is likely to fail;
- the leachable concentrations of all the constituents are below the LCT0 limit, indicating a low seepage risk;
- the waste rock material will be dry and does not contain waste water; and
- the waste rock material is non-hazardous and not acid generating (Section 6.4.1.1).

Taking the above into consideration it was recommended by Golder via a formal motivation letter (included in Appendix S), that a Class D liner (stripping topsoil and base preparation) is considered appropriate for the waste rock dumps at the Tshipi Borwa Mine. It is important to note that this motivation has been submitted to the DWS for consideration by Tshipi. A response from the DWS is still pending.

Tshipi is planning on discussing the possibility of merging the eastern waste rock dump with the Mamatwan waste rock dump located on the farm Sinterfontein 748 with South 32. The merging of these two dumps will need to be managed in a separate environmental assessment process, but has however been mentioned for completeness purposes.

<u>Tailings</u>

The approved EMPr (Metago, May 2009) made provision for a standalone tailings dam (Figure 27). The conceptual design features associated with the tailings dam, in compliance with section 73 of Regulation 527 of the MPRDA, are outlined in Table 10 below. The project will not alter the conceptual design parameters of the tailings dam.

TABLE 10: DESIGN FEATURES FOR THE APPROVED TAILINGS DAM (METAGO, MAY 2009)

Feature	Detail
Physical Dimensions	Footprint = 300 000 m^2; Max height = 24 m; Volume = 2 million m^3, deposition of solids per year = average of 177 845 t
Physical properties	Particle size = less than 1.5mm, Solids mass = 75%, liquid mass = 25%, particle specific gravity = 3.32, wet density = 2.1 t/m^3, dry density = 1.6 t/m^3 (1.8 after consolidation), average void ratio = 0.85.
Lining	The tailings dam is lined with an HDPE liner.
Delivery and Deposition	The proposed method of depositing the tailings will be the advancing cone method via a 100mm carbon steel pipeline. During commissioning and deposition behind the starter wall, the tailings will be directed to the base of the starter wall by means of flexible hosing. Once the cone-shaped tailings deposit has reached the elevation of the starter wall, the pipe will be moved horizontally along the length of the wall. Upon reaching the height of the starter wall along the full length of the wall the outlet pipe is to be moved forward, i.e. away from the starter wall, to achieve a 0,25m layer thickness. The pipe is then moved horizontally along the length of the wall to achieve the 0,25m layer thickness along its full length.

Feature	Detail
	The pipe is moved along following this pattern until the toe of the beached tailings reaches the designated toeline. Once this toeline is reached the perimeter walls are to be raised with waste rock from the mining operations. The raised walls will be 6m each and 3 lifts in total. No decanting will be required as the area is free draining towards the storm water dam. The storm water dam will need to be managed such that the dam has a capacity to absorb the storm water event arising from the 1:50 year storm event, over and above the normal operating conditions.
Rate of rise	The allowable rate of rise is the time it takes a layer to reach a moisture content at which shrinkage ceases.
Storm water diversion	A 1,0m deep storm water trench adjacent to the north-western and south-western slopes, i.e. immediately downstream of the dam lined spill way will collect water and direct it to the return water dam.
Topsoil Stripping	Topsoil will be stripped to a depth of between 0.3 m to 0.5m and stockpiled in accordance with the soil conservation procedure. Stripping and stockpiling of topsoil will be done as part of the initial tailings dam construction.
Embankments /slopes and walls	The overall side slopes of the tailings dam will be limited to a maximum of 1:4 for rehabilitation purposes. There will be no step ins and there will be 6m height increases between lifts at the prescribed 1:4 outer slope. The tailings dam will have placed waste rock starter walls with a crest width of 8 m and height of 6m constructed from waste rock stripped at the pit.
Under Drains	The tailings and underlying soils are free draining, but will have a relatively low water content and will produce a small amount of supernatant water. This negates the need for drains.
Decant System	No decant system is required because, as mentioned above, the area is free draining towards the return water dam. The return water dam will need to be managed such that the dam has a capacity not to spill more than once in 50 years, over and above the normal operating conditions.
Access and Access Control	A calcrete/waste rock gravel access road will be constructed around the perimeter of the tailings dam to enable access for inspection. A perimeter fence will be constructed around the property boundary to keep livestock and people out.
Waste Minimisation	No re-processing of the tailings is envisaged at this stage. Tshipi will investigate options once operations commence.
Rehabilitation	Rehabilitation will be conducted concurrently as the outer wall rises. The exposed face of the tailings dam, upon reaching the designated toeline, is to be covered with waste rock to reduce dust and assist with access. Waste rock and/or vegetation will be used for concurrent rehabilitation of the out walls.
Monitoring	The monitoring of the tailings dam will include monitoring closure activities to ensure that slope vegetation is successfully established, earthworks have not been impaired in any way and repairing areas where degradation has occurred since closure. For this project, the reasonable time frame for after care has been deemed 5 years.
Dust Control	The tailings dam access roads and ramps will be watered as necessary to ensure that dust pollution is kept to a minimum. In addition, concurrent rehabilitation through waste rock and/or vegetation of the tailings dam outside slopes will further reduce dust emission rates.
Closure	At the end of the dam’s life the tailings surfaces will be covered with waste rock and/or vegetation. It is envisaged that the remaining surfaces will be accessible within the first month following closure for the removal of pipelines, valves, etc.; minor earthworks to roads, trenches, etc.; and reshaping of the storm water dam and spillway

Safety classification of the approved tailings dam

The safety classification for the approved tailings dam was determined in accordance with the South African Code of Practice for Mine Residue Deposits (SANS 10286:1998) and the requirements of Mineral Regulation 527 of 23 April 2004. The summarised classifications are included in Table 11.

TABLE 11: SAFETY CLASSIFICATION CRITERIA FOR THE APPROVED TAILINGS DAM

Criteria No.	Criteria		Comment	Safety Classification
1	No. of Residents in Zone of Influence	0 (Low hazard) 1 -10 (Medium hazard >10 (High hazard)	There are no farmhouses or other structures within the zone of influence.	Low Hazard
2	No. of Workers in Zone of Influence	<10 (Low hazard) 11 – 100 (Medium hazard) >100 (High hazard)	The tailings dam is situated inside the surface use area with only mine employees accessing the area.	Medium Hazard
3	Value of 3rd party property in zone of influence	0 – R2 Million (Low hazard) R2 – R20 million (Medium hazard) >R20 million (High hazard)	No formal assessment of the value of property has been done in the zone of influence. The characteristics of the tailings dam are such that catastrophic failures will be localised and no extended flow will be experienced.	Low Hazard
4	Depth to underground mine workings	>200 m (Low hazard) 50 m – 200 m (Medium hazard) <50 m (High hazard)	There are no known underground mine workings beneath the tailings dam site. Any future workings would be more than 270m below surface.	Low Hazard

With reference to Table 11 the Tshipi Borwa Mine tailings dam therefore classifies as a Low hazard dam with a low risk of occurrence. In accordance with regulation 73 of the MPRDA Regulation 527 (April 2004), a risk analysis is required before project implementation as outlined in the approved EMPr (Metago, May 2009). It is important to note that while the approved EMPr (Metago, May 2009) refers to these regulations, they are no longer applicable. It follows that at the time of implementing the use of the tailings dam any similar listed requirements will need to be considered.

Environmental classification for the tailings dam

The tailings dam does not pose a potential threat to the contamination of groundwater resources from leachate given that the facility will be lined. Dust emissions however do pose a potential risk to the surrounding environment. In the mitigated scenario, the tailings dam impacts on air can all be mitigated to a lower significance. The tailings dam is therefore classified as a low to medium hazard facility because with management actions there is less potential for significant impact on the environment. More discussion on the impacts and management actions are included in Appendix F and section 27 of the EMPr report.

DMS temporary discard

As per the approved EMPr (Metago, May 2009), a temporary coarse discard dump will be developed adjacent to the sinter plant to accept dry temporary discard from the dense media separation plant (Figure 28). Depending on market requirements this material will be re-processed through the tertiary crushing and screening section. If it is not re-processed, some of the material can be used for backfilling the open pits but the rest will be disposed on and handled in accordance with the waste rock dumps. The project will not result in any changes to the DMS discard dump.

Low grade and fines stockpiles

The approved EMPr made provision for two low grade stockpiles (Appendix I). Tshipi has established two product stockpile areas (No. 1 and No.2) and the position has changed. Product stockpile No. 1 covers and area of approximately 7.9 ha and can cater for a capacity of 434 500m^3. Product stockpile No. 2 covers and area of 17 ha and caters for a capacity of 940 500m^3. There product stockpiles receive product from both the primary and secondary crushing and screening circuits prior to being sent-off site via road truck and trains for sale to third parties.

ROM stockpile

As per the approved EMPr (Metago, May 2009), provision is made for the generation of ROM. The ROM is loaded and hauled using truck and shovel methods and is transported to the primary crushing and screening plant from where it is sent for further crushing and screening at the secondary and tertiary plant (still to be established). ROM is stockpiled at the designated ROM pad prior to being fed into the primary crushing and screening process. The ROM stockpile is only utilised when the designated ROM pad is unable to accommodate for the ROM tonnages at that time. In addition to this, a temporary ROM stockpile area near the ROM pad is utilised in the event that there is a shortfall in capacity at the ROM stockpile. The ROM pad has a total capacity of 73 000 m^3 and covers an area of approximately 16 ha. The ROM stockpile has a total capacity of 627 000 m^3 and covers an area of approximately 7.6 ha. The temporary ROM stockpile has a total capacity of 20 000 m^3 and covers an area of approximately 1 ha. The location of the ROM pad, ROM stockpile and the temporary ROM stockpile is illustrated in Figure 5 and Figure 6.

NON-MINERALISED WASTE MANAGEMENT

Domestic and industrial waste

General and hazardous wastes as defined under the NEM:WA that are generated at the mine including the method of storage and disposal is included in Table 12 below. The project will not alter the types of waste generated at the mine.

TABLE 12: GENERAL AND HAZARDOUS WASTE ASSOCIATED WITH THE MINE

Type of waste	Description of waste	Method of storage	Disposal

Type of waste	Description of waste	Method of storage	Disposal
General waste	Office waste, building rubble, scrap metal and rubber, glass, plastic, wood, garden waste, air filters, food waste and uncontaminated PPE	General waste generated at the mine is collected and temporarily stored in skips on site at the salvage yard, scrap yard or the designated temporary waste storage area	All general waste on site is temporarily handled and stored before being removed by contractors for disposal at the licenced landfill site in Kuruman
Hazardous waste	Electrical/material off-cuts and scrap metal, paints, solvents, contaminated metals, oil filters, plastic rubber, wood and contaminated particles	Hazardous waste generated by the project is collected and stored in skips on site at the salvage yard and scrap yard.	All hazardous waste on site is temporarily handled and stored before being removed by contractors for disposal at the licenced Holfontein landfill site
	Plastic and used conveyor belts	Hazardous waste generated by the project is collected and stored in skips on site at the salvage yard and scrap yard	Plastic and used conveyor belts are recycled on-site
	Hydrocarbons (used oil, grease)	Used oil and grease will be stored in drums in bunded areas at the designated temporary waste storage area and will be able to accommodate 110 % of the container contents and include a sump and oil trap	Use oils and grease are recycled on-site
	Used chemicals (Anthracite/coke, FeSi and Benonite) and laboratory waste (hydrochloric acid)	Used chemicals will be stored in sealed containers at the designated temporary waste storage area and will be able to accommodate 110 % of the container contents	All hazardous waste on site is temporarily handled and stored before being removed by contractors (Enviroserve) for disposal at the licenced Holfontein landfill site
	Used explosive packaging	Collected and temporary stored in designated skips at the salvage yard, scrap yard or the designated temporary waste storage area	
	Contaminated soil (accidental spills)	Contaminated soil will be collected and temporarily stored in designated drums at the salvage yard, scrap yard or the designated temporary waste storage area	Contaminated soil on site is temporarily handled and stored before being removed by contractors for treatment off-site. Alternatively, contaminated soil can be treated on at the on-site bioremediation facility.
Medical waste	Swabs, bandages	Designated sealed containers in bunded storage area.	Medical waste will be temporarily handled and stored before being removed by contractors for disposal at an appropriately licenced waste disposal facility.

<u>Sewage</u>

The approved EMPr (Metago, May 2009) made provision for an anaerobic digester sewage treatment plant for the treatment of 60 m^3 of sewage per day. The design of the sewage treatment plant has changed to a sludge activated system and treats a capacity of 96 m^3 of sewage per day. The current position of the sewage treatment plant is illustrated in Figure 5. With reference to Figure 15, the sludge activated sewage treatment process and stages are described in further detail below.

Sewage collection

Raw sewage is collected in numerous conservancy tanks located at the mine. Sewage effluent is sourced from the plant and office ablutions facilities and change houses. The sewage effluent is pumped from these designated conservancy tanks for storage in two inlet buffer tanks prior to being sent to the sewage plant for treatment.

Anaerobic treatment

Raw sewage stored in the inlet buffer tanks is pumped to the anoxic tank for anaerobic treatment. Anaerobic treatment allows for bacterial processes to be carried out in the absence of oxygen to allow for the digestion of sludge.

Aeration treatment

Sewage effluent from the anoxic tank is transferred to the aeration tank, where air (oxygen) is introduced into the system by means of a Diffused Air Header, driven by Side Channel Blowers. Aeration treatment allows for bacterial processes to occur which enables bacteria to rapidly consumes organic matter.

Any debris (floating fraction of sewage solids) collected on the surface of the sewage effluent during aeration treatment is removed and stored in a conservancy tank prior to being removed off-site by a certified contractor

Settling

Effluent from the aeration tank is transferred to the settling tank. Solids (sludge) settle out in the bottom of the tank and clear supernatant flows upwards and over to the collection weir to the Chlorine Contact Tank. Sludge that has settled at the bottom of the settling tank is sent back to the anoxic tank for further treatment. Any excess sewage sludge remaining in the settling tank is removed by a certified contractor, when required.

Chlorination

The sewage effluent in the chlorine contact tank is subjected to inline chlorination by means of Sodium Hypo-chloride, calcium hypo-chloride or chlorine gas. Chlorination ensures that any remaining bacteria are killed.

Filtration

The final effluent is processed through a series of sand filters to remove any remaining suspended solids.

Treated sewage effluent

Treated sewage effluent is collected in a lined stormwater dam (referred to as the dirty water dams on Figure 6) and re-used within the mine process. The treated sewage effluent is not to be used for domestic purposes. Any sewage sludge is removed off-site by a certified contractor and disposed of at a licenced sewage works.

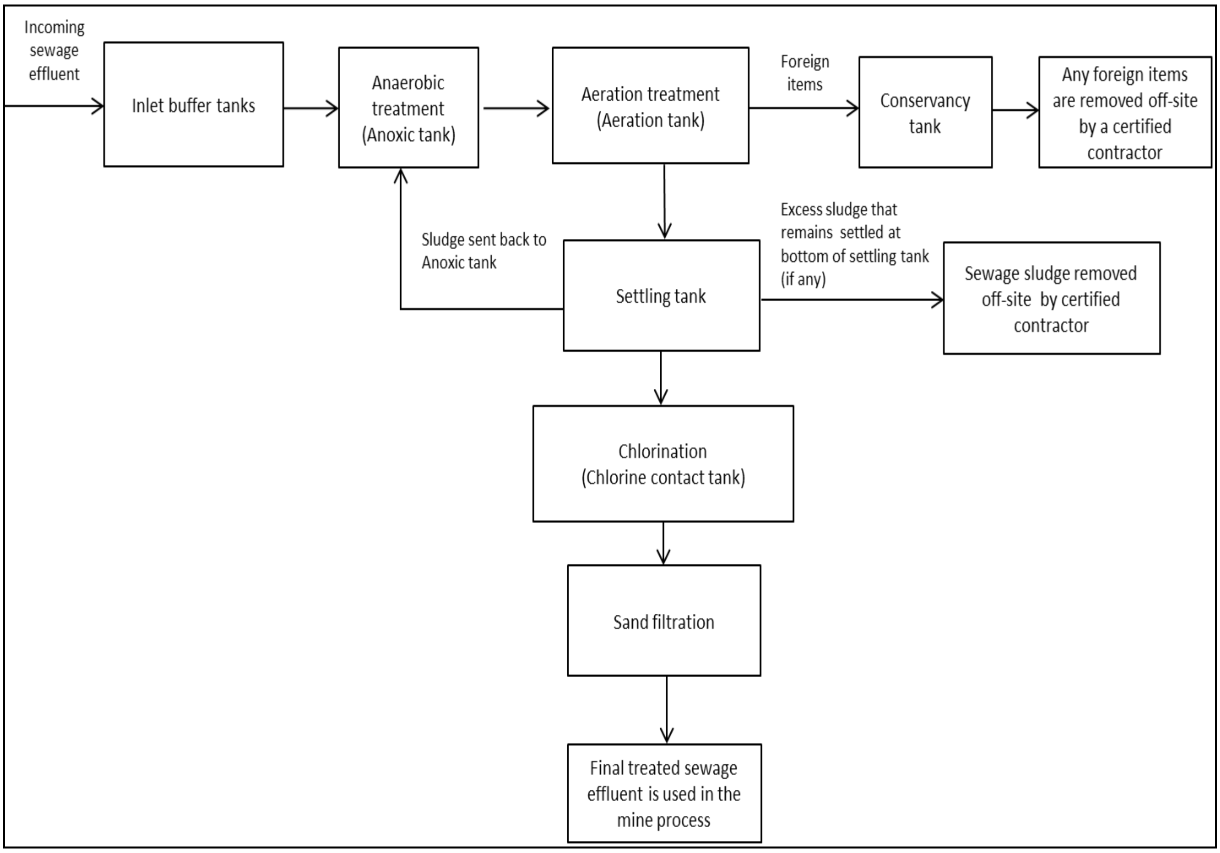


FIGURE 15: SEWAGE TREATMENT PLANT PROCESS

SUPPORT SERVICES

Support services that have been altered are discussed in the section below.

Diesel storage facilities

The approved EMPr (Metago, May 2009) made provision for a number of storage tanks of diesel with a total capacity of approximately 500 000 L located within the offices, plant and workshop area (Figure 28). The total storage capacity of diesel on site is currently 996 000 L. The increase in the storage capacity of diesel was not authorised in the approved EMPr (Metago, May 2009). Under the NEMA the unlawful commencement of activities may be authorised through an application for rectification made in terms of section 24G of the NEMA. In this regard, a separate process is being undertaken for the authorisation of the increase in diesel capacity, but is mentioned in this report for completeness purposes. It follows that this will not be assessed as part of the project.

Tyre Bays

In the approved EMPr (Metago, May 2009), no specific reference to a tyre bay area was made. Two tyre bay areas have been established at the Tshipi Borwa Mine (Figure 5 and Figure 6), one for mining equipment tyres and the other for light vehicle tyres. New tyres are temporarily stored at the tyre bays prior to use. Old tyres are temporarily stored at the tyre bays prior to being collected for disposal off-site.

Topsoil stockpiles

The approved EMPr (Metago, May 2009) made provision for the establishment of a single topsoil stockpile area (Topsoil stockpile No. 1) near the tailings dam facility (Figure 27). As part of the project, Tshipi is proposing to expand this stockpile area (Figure 5). Further to this a second smaller topsoil stockpile area (Topsoil stockpile No.2) has been established near the plant area (Figure 5). The final capacity of the topsoil stockpile area No.1 (including expansion) is approximately 1 315 658 m^3 and covers an area of 35.7 ha. The final capacity of topsoil stockpile area No. 2 is 290 000m^3 and covers an area of 5.8 ha. Topsoil will be stripped, stored and managed in accordance with the soil conservation procedures for the mine as outlined in Table 52. Topsoil will be used for rehabilitation purposes.

Weighbridges

The approved EMPr (Metago, May 2009) made provision for one weighbridge that could cater 50 tons (Figure 28). Tshipi currently has two weighbridges located on site as illustrated in Figure 6. In this regard, the ROM weighbridge can cater for 210 tons and the crushed ore weighbridge can cater for 80 tons.

OTHER SUPPORT SERVICES

As per the approved EMPr (Metago, May 2009) provision was also made for additional support services (Figure 5 and Figure 6) including:

- parking areas for trucks, cars, busses and helicopters (helipad);
- a laboratory at the plant – used for sample preparation and analysis;
- workshops and wash bays – used for servicing equipment and general maintenance;
- a laydown and storage areas;
- stores, tanks and handling areas for storage of general raw materials, consumables, and hazardous chemical substances including anthracite/coke, oil/lubricants, hydraulic fluid, diesel, heavy fuel oil or LPG Gas. The volume of stored hazardous substances may vary during the course of the operation depending on delivery and scheduling constraints. As an order of magnitude guide, the following volumes are provided for on the site:
    - anthracite/coke – approximately 6 000 ton stockpile on a concrete bunded slab in the sinter plant area;
    - gas – 10 000 litres;
    - heavy fuel oil - 22 000 litres; and
    - oil/lubricants and hydraulic fluid - approximately 10 000 litres.
- a salvage, scrap yard and other waste areas for the temporary storage of waste before re-use or collection and removal;

- a polluted soil bioremediation area;
- an explosives storage magazine and destruction area designed and operated in accordance with the relevant mine explosives safety and security legislation;
- a change-houses with ablution facilities for all employees;
- a medical clinic facility for the primary treatment of injuries and illness;
- bus/taxi off-loading and loading areas;
- security checkpoints at all entrances;
- fencing and lighting (with masts) within the mining area for security and safety reasons;
- infrastructure for communication – telephone lines and communication masts; and
- main office/admin block and secondary offices at the mining contractor's areas.

Tshipi has relocated their offices, plant, workshop and related infrastructure. The position of the approved location of these facilities is illustrated in Figure 27. Refer to Figure 5 for the position of the relocated offices, plant, workshop and related infrastructure.

EMPLOYMENT AND HOUSING

As per the approved EMPr (Metago, May 2009), it is anticipated that a maximum of approximately 400 employees will be on site during the operational phase. It is understood from Tshipi that this amount has increased to approximately 800.

OPERATING HOURS

As per the approved EMPr (Metago, May 2009), mining and related activities take place continuously (24 hours, 7 days a week). The proposed changes to the infrastructure layout forms part of these operating hours. It is however important to note that the approved EMPr (Metago, May 2009), only made provision for the crushing and screening and train loading activities during the day-time only. As part of the project this has been changed to also include crushing and screening and train loading at night, including weekends.

LIFE OF MINE

The anticipated life of mine for the open pit, is approximately 25 years. The mine has been operational for seven years.

3.2.6 DECOMMISSIONING AND CLOSURE

A preliminary mine closure plan has been compiled for Tshipi Borwa mine in accordance with the NEMA Regulations (Regulation 1147 of 2015) pertaining to the financial provision for mining operations (SLR, March 2017) (see Appendix R). In this regard, the preliminary closure plan and objectives for decommissioning and closure is outlined in Section 28.

4 POLICY AND LEGISLATIVE CONTEXT

This section outlines the key legislative requirements applicable to the project. The table below provides a summary of the applicable legislative context and policy.

TABLE 13: LEGAL FRAMEWORK

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA) and Regulations	Table 14	Tshipi has applied for a Section 102 in terms of the MPRDA.
National Environmental Management Act No. 107 of 1998) (NEMA)	Table 14	An application for an amendment of the environmental authorisation in accordance to NEMA has been applied for. The NEMA application was submitted on 12 July 2017 to the DMR. A copy of the application form is attached in Appendix E.
Regulations 982 of 4 December 2014 (EIA Regulations), as amended to cater for 2017 changes	Table 14	
National Environmental Management: Waste Act (No 59 of 2008) (NEM:WA)	Table 12	General and hazardous waste as defined by the act are taken into account as part of the project.
SANS 10234 as per Waste Classification and Management Regulations (GN R.634 of 23 August 2013) and the National Norms and Standards for the Assessment of Waste for Landfill Disposal (GN R.635 of 23 August 2013)	Section 3.2.5	A waste assessment was undertaken for the Tshipi Borwa Mine
Guideline on the need and desirability in terms of the Impact Assessment (EIA) Regulations, 2010, GNR. 891 of 2014.	Section 0	Need and desirability has been taken into account as part of project planning.
National Water Act (No. 36 of 1998) (NWA)	Section 6.4.1.7, 6.8, and 27	As part of the project the IWUL needs to be amended. In addition to this, Tshipi needs to ensure compliance with GN R704 for the separation of clean and dirty water.
Regulation 704 of 1999 in terms of the NWA	Section 3.2.2 and 27	
National Forest Act (No. 84 of 1998) (NFA)	Section 6.4.1.6	Permit applications will have to be made to the DAFF to remove and/or translocate protected species in terms of the NFA. Only for new areas to be disturbed.
Northern Cape Nature Conservation Act No. 9 of 2009 (NCNCA)		
International Union for Conservation of Nature (IUCN)	Section 6.4.1.6	Biodiversity was taken into account as part of project planning.
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Section 6.4.1.6	Biodiversity was taken into account as part of project planning.
National Environmental Management: Biodiversity Act (No. 10 of 2004) Alien Invasive Species Regulations (2014)	Section 27	Biodiversity was taken into account as part of project planning.
South African National Botanical Institute (SANBI) Integrated Biodiversity Information	Section 6.4.1.6	Biodiversity was taken into account as part of project planning.
National Freshwater Ecosystem Priority Areas 2011 (NFEPA)	Section 6.4.1.6	Biodiversity was taken into account as part of project planning.

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
National Protected Areas Expansion Strategy 2008 (NPAES)	Section 6.4.1.6	Biodiversity was taken into account as part of project planning.
Conservation of Agricultural Resources Act (No. 43 of 1993) (CARA)	Section 6.4.1.6	Biodiversity was taken into account as part of project planning.
Mining Biodiversity Guideline (2012)	Section 6.4.1.6	Biodiversity was taken into account as part of project planning.
Important Bird and Biodiversity Areas (IBAs)	Section 6.4.1.6	Biodiversity was taken into account as part of project planning.
National Heritage Resource Act (No. 25 of 1999)	Section 6.4.1.13 and 27	Heritage has been taken into account as part of project planning.
National Atmospheric Emission Reporting Regulations in terms of the National Environmental Management: Air Quality Act (No. 39 of 2004)	Section 27 and 29	Registration on the National Emissions Inventory System
Explosives Act (No. 15 of 2003)	Section 27	Blasting and explosives legislation was taken into account as part of project planning.
Mine Health and Safety Act (No. 29 of 1996)	Section 27	

This document has been prepared strictly in accordance with the DMR EMPr Report template format, and was informed by the guidelines posted on the official DMR website, which is in accordance with the requirements of the MPRDA. In addition, this report complies with the requirements of the NEMA and Government Notice Regulation (GNR) 982 of 4 December 2014 (EIA Regulations), as amended to cater for 2017 changes. The table below provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

TABLE 14: EMPR REPORT REQUIREMENTS

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations	Reference in the EMPr report
Part A of DMR report template	**Appendix 3 of the NEMA regulations**	**Section/Appendix**
The EAP who prepared the report	Details of the EAP who prepared the report	Section 1.1
Expertise of the EAP	Details of the expertise of the EAP, including curriculum vitae	Section 1.1 and Appendix B
Description of the property	The location of the activity, including - the 21 digit Surveyor General code of each cadastral land parcel. Where available the physical address and farm name. Where the required information is not available, the coordinates of the boundary of the property or properties	Section 2
Locality plan	A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken or on land where the property has not been defined, the coordinates within which the activity is to be undertaken	Section 3.1
Description of the scope of the proposed overall activity	A description of the scope of the proposed activity, including all listed and specified activities triggered	Section 3.1

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations	Reference in the EMPr report
Description of the activities to be undertaken	A description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for and a description of the associated structure and infrastructure related to the development	Section 3.2
Policy and legislative context	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context	Section 4
Need and desirability of the proposed activity	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location	Section 0
Motivation for the preferred development footprint within the approved site including	A motivation of the preferred development footprint within the approved site including	Section 6
A full description of the process followed to reach the proposed development footprint within the approved site	A full description of the process followed to reach the proposed development footprint within the approved site	Section 6
Details of the development footprint alternatives considered	Details of all the alternatives considered	Section 6.1
Details of the public participation process followed	Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs	Section 6.2
Summary of issues raised by IAPs	A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them	Section 6.3
Environmental attributes associated with the development footprint alternatives	The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects	Section 6.4
Impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts including the degree of the impacts	The impacts and risks identified, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts can be reversed, may cause irreplaceable loss of resources and can be avoided, managed and mitigated	Section 6.5
Methodology used in determining the nature, significance, consequence, extent, duration and probability of potential environmental impacts and risks	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks	Section 6.6
The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternative will have on the environment and the community that may be affected	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects	Section 6.7
The possible management actions that could be applied and the level of risk	The possible management actions that could be applied and level of residual risk	Section 6.8
Motivation where no alternative sites were considered	If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such	Section 6.9

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations	Reference in the EMPr report
Statement motivating the alternative development location within the overall site	A concluding statement indicating the preferred alternatives, including preferred location within the approved site	Section 6.10
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) through the life of the activity	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structure and infrastructure will impose on the preferred location through the life of the activity including a description of all environmental issues and risks that were identified during the environmental impact assessment process and an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of management actions	Section 7
Assessment of each identified potentially significant impact and risk	An assessment of each identified potentially significant impact and risk including cumulative impacts, the nature, significant and consequence of the impact and risk, the extent and duration of the impact and risk, the probability of the impact and risk occurring, the degree to which the impact can be reversed, the degree to which the impact and risk may cause irreplaceable loss of a resources and the degree to which the impact and risk can be mitigated.	Section 8
Summary of specialist reports	Where applicable the summary of the findings and recommendations of any specialist report complying with Appendix 6 of these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report	Section 9
Environmental impact statement	An environmental impact statement which contains a summary of the key findings of the environmental impact assessment, a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers and a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives	Section 10
Proposed impact management objectives and the impact management outcomes for inclusion in the EMPr	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation	Section 11
Final proposed alternatives	The final proposed alternatives which respond to the impact management actions, avoidance, and management actions identified through the assessment	Section 12
Aspects for inclusion as conditions of authorisation	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation	Section 13
Description of any assumptions, uncertainties and gaps in knowledge	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and management actions proposed	Section 14
Reasoned opinion as to whether the proposed activity should or should not be authorised	Reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	Section 15

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations	Reference in the EMPr report
Period for which environmental authorisation is required	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised	Section 16
Undertaking	An undertaking under oath or affirmation by the EAP in relation to the correctness of the information provided in the reports, the inclusion of comments and inputs from stakeholders and I&Aps, the inclusion of inputs and recommendations from the specialist reports where relevant and any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties	Section 17
Financial provision	Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts	Section 18
Deviation from the approved scoping report and plan of study	An indication of any deviation from the approved scoping report, including the plan of study, including any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and a motivation for the deviation	Section 19
Other information required by the competent authority	Any specific information required by the competent authority.	Section 20
Other matter required in terms of section 24(4)(a) and (b) of the Act	Any other matter required in terms of section 24(4)(a) and (b) of the Act	Section 21
Part B of the DMR report template	**Appendix 4 of the NEMA regulations**	**Section/Appendix**
Details of EAP	Details of the EAP who prepared the EMPr and the expertise of that EAP to prepare the EMPr, including a curriculum vitae	Section 22
Description of the aspects of the activity	A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description	Section 23
Composite map	A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers	Section 24
Description of impact management objectives including management statements	A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including planning and design, pre-construction activities, construction activities, rehabilitation of the environment after construction and where applicable post closure; and where relevant, operation activities	Section 25
The determination of closure objectives		Section 25.1
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	-	Section 25.2

EMPr report requirement as per the DMR template	EMPr report requirements as per the 2014 NEMA regulations	Reference in the EMPr report
Potential acid mine drainage	-	Section 25.3
Steps taken to investigate, assess and evaluate the impact of acid mine drainage	-	Section 25.4
Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage	-	Section 25.5
Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage	-	Section 25.6
Volumes and rate of water use required for the mining	-	Section 25.7
Has a water use licence been applied for?	-	Section 25.8
Impacts to be mitigated in their respective phases	-	Section 25.9
Impact management outcomes	A description and identification of impact management outcomes required for the aspects contemplated in paragraph	Section 26
Impact management actions	A description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes be achieved, and must, where applicable, include actions to avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; comply with any prescribed environmental management standards or practices; comply with any applicable provisions of the Act regarding closure, where applicable comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable	Section 27
Financial provision		Section 28
Mechanism for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon	The method of monitoring the implementation of the impact management actions	Section 29
	The frequency of monitoring the implementation of the impact management actions	
	An indication of the persons who will be responsible for the implementation of the impact management actions	
	The time periods within which the impact management actions must be implemented	
	The mechanism for monitoring compliance with the impact management actions	
	A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations	
Environmental Awareness Plan	An environmental awareness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work; and risks must be dealt with in order to avoid pollution or the degradation of the environment	Section 30
Specific information required by the competent authority	Any specific information that may be required by the competent authority	Section 31
Undertaking	-	Section 32

5 NEED AND DESIRABILITY OF THE PROJECT

The need and desirability of the project is described below. This section has been compiled taking into account the need and desirability guidelines in terms of the environmental impact assessment regulations 891 of 2014.

5.1 ECOLOGICAL SUSTAINABLE DEVELOPMENT AND USE OF NATURAL RESOURCES

Due to the nature of mining projects, impacts on sensitive biodiversity areas, linkages between biodiversity areas and related species and the role that they play in the ecosystem are probable. The mine also has the potential to directly disturb vegetation, vertebrates and invertebrates. In addition to this, soil is a valuable resource that supports a variety of ecological functions. The mine has the potential to damage soil resources through physical disturbance and/or contamination, which has a direct impact on the potential loss of the natural capability of the land.

As part of the mine, independent biodiversity and soil specialists were appointed to determine the sensitivity of the mining area. In this regard, the broader Tshipi Borwa Mine incorporates some high sensitive protected species, namely the Grey Camel Thorn (*Vachellia haematoxylon*) and Camel Thorn (*Vachellia erioloba)* which are protected under the NFA and the Goldblatt (*Moraea longistyla)* which is protected under the NCNCA (refer to Section 6.4.1.6 for further information). Where infrastructure changes have already taken place, it is highly likely that these species were removed, specifically within the *Vachellia haematoxylon* Savannah and the Mixed *Vachellia* Savannah vegetation communities, which are associated with a high density of Grey Camel Thorn and Camel Thorn trees. Through the establishment of additional facilities and activities, it is likely that additional protected species may need to be removed given that these facilities are located within the *Vachellia haematoxylon* Savannah and the Mixed *Vachellia* Savannah vegetation communities. Linked to this, is the loss of soil functionality and related land capability as an ecological driver for vegetation and ecosystems that rely on soil (Refer to Appendix F for the detailed assessment).

Measures that were considered to avoid the destruction and disturbance of biodiversity and the loss of soil resources include limiting the mine footprint to what is absolutely necessary. Where sensitive biodiversity areas cannot not be avoided, management actions focus on ensuring ecological sustainability through rehabilitation that aims at restoring pre-mining land capability to grazing and wilderness potential. It is important to note that Tshipi liaises directly with DAFF for tree removal permits in accordance with the NFA for the removal of protected tree species such as the Grey Camel Thorn and Camel Thorn trees. DAFF currently monitors the number of protected tree species that have been removed by Tshipi to date. DAFF has indicated that they will inform Tshipi when an offset needs to be implemented to compensate for unavoidable loss of protected trees. It follows that Tshipi is committed to implement an offset when required by DAFF. Refer to Section 27 for further detail pertaining to biodiversity related management actions.

5.2 PROMOTING JUSTIFIABLE ECONOMIC AND SOCIAL DEVELOPMENT

Community/society priorities are officially expressed through public documents including the provincial growth and development strategy and spatial development framework documents. In this regard, the priorities of the Joe Morolong Local Municipality's Integrated Development Framework (IDP) and the John Taolo Gaetsewe District Municipality's Spatial Development Framework (SDF) are mainly focused around the reduction of unemployment and halving poverty, as well as establishing cheap accommodation in towns experiencing rapid expansion by investing in key sectors and developing and upgrading basic service delivery and infrastructure. One of the ways of achieving this, according to the John Taolo Gaetsewe District Municipality's SDF (May 2016), is to discourage urban sprawl, and to promote more compact and efficient cities. In order to achieve this, development must be channelled into specific nodes and corridors (John Taolo Gaetsewe District Municipality, 2016). In addition, one of the Key Focus Areas for economic growth is the Gamagara Development Corridor.

Taking the above into consideration the mine will result in continued positive socio-economic impacts. The mine already contributes to the national SA economy at macro level by exporting its product that leverages foreign income into the country. Direct economic benefits will be derived from wages, taxes and profits. Indirect economic benefits will be derived from the procurement of goods and services and the spending power of employees (Refer to Appendix F for the detailed assessment). Further to this, through employment, employees of the mine are afforded the opportunity to further their education through the skills development plan of the mine's social and labour plan (SLP) (Tshipi, December 2014). The skills development plan is not the extent of human resources development at the mine. Supplementary plans to enhance the socio-economic benefits of the mine are also in place, and these include a career progression plan, a mentorship plan and internships and bursaries. In addition to these social development plans, the mine also has in place an Employment Equity Plan and targets relating to historically disadvantaged South Africans (HDSAs). The mine will allow for local economic development (LED), since the mine is located within the Gamagara Development Corridor, which has been identified as a key sector to develop within the province to enhance economic growth. Further to this, the SLP includes plans in line with the IDP of the John Taolo Gaetsewe District Municipality and the Joe Morolong Local Municipality. In a broad sense this will include a housing and living conditions plan to improve living conditions of employees, an LED project plan and a procurement plan focusing on assisting HDSAs (Tshipi, December 2014).

Due to the expectation of employment associated with mining projects there is a potential for negative socio-economic impacts to occur (Refer to Appendix F for the detailed assessment). In this regard, an influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. Management actions to manage and remedy these impacts include the implementation of a health policy on HIV/AIDs and tuberculosis, working together with local and regional authorities to address social service constraints and to monitor and prevent the development of informal settlements. In addition to this, formal communication structures and procurement procedures will be developed. Refer to Section 27 for further detail pertaining to socio-economic related management actions.

6 MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT ON THE SITE INCLUDING THE PROCESS FOLLOWED TO DEFINE THE PREFERRED DEVELOPMENT ALTERNATIVES

6.1 DETAILS OF THE DEVELOPMENT FOOTPRINT CONSIDERED

Where changes to the layout have already taken place no site layout alternatives can be considered. Where proposed changes to the infrastructure layout still need to be implemented, no site layout alternatives are being considered. This is discussed further below.

In terms of the 78Ml stormwater dam the proposed location is the only feasible option given that the stormwater dam needs to be down gradient of other dirty water facilities as these facilities drain into the 78Ml stormwater dam. In addition to this, the establishment of clean and dirty water separations systems are dictated by the current placement of infrastructure and as such no alternatives can be considered.

The approved topsoil stockpile is located in the medium sensitivity *Grewia Flava* Scrub vegetation type (Figure 21). The expansion of this stockpile is deemed the only feasible option as the expansion will primarily be located in the medium sensitivity *Grewia Flava* Scrub vegetation type. This is deemed the most appropriate option given that a new topsoil stockpile area would disturb the high sensitive *Vachellia haematoxylon* Savannah and the Mixed *Vachelli*a Savannah vegetation types as these vegetation types dominate the remainder of the project site.

In terms of mining the barrier pillar, only open cast mining activities are deemed feasible due to the shallow nature of the ore body and as such no alternative mining methods (underground mining) are applicable to the project. Further to this, the location of the barrier pillar is dictated by the ore body.

In addition to this, operational and technology alternatives are not applicable to the project.

6.1.1 THE "NO-GO" ALTERNATIVE

The assessment of this option requires a comparison between the options of proceeding with the project with that of not proceeding with the project. Proceeding with the project attracts potential economic benefits and potential negative environmental and social impacts. Not proceeding with the project leaves the status quo.

6.2 DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

This section describes the undertaking of the public participation process and details the information provided to the commenting authorities, community, landowners and IAPs. The public consultation process was undertaken in accordance with the requirements of Chapter 6 of the Government Notice

Regulation (GNR) 982 of 4 December 2014 (EIA Regulations), as amended to cater for 2017 changes and is outlined in Table 15 below. The aim of the public consultation process is to co-ordinate a process through which IAPs are informed of the EMPr amendment process and are provided with an opportunity to provide input into the assessment and proposed management actions.

TABLE 15: PUBLIC PARTICIPATION PROCESS

Task	Description	Date
Notification – IAPs and commenting authorities		
DMR pre-application meeting	A pre-application meeting was held at the DMR. The purpose of the pre-application meeting was to: • provide an overview of the EMPr amendment process; • provide an overview of the existing status of the environment; • provide an overview of the environmental process to be undertaken for the project; • outline specialist input that is required for the project; and • outline the proposed public consultation process. A copy of the pre-application meeting minutes is included in Appendix E.	15 June 2016
Land claims commissioner consultation	As part of the project the Department of Rural Development and Land Reform was contacted to confirm if any land claims have been lodged on the farms Moab 700 and Mamatwan 331. No land claims have been lodged. The correspondence from the land claims commissioner is included in Appendix E.	20 July 2016
A desktop social scan	A desktop social scan was undertaken as part of the EMPr amendment process to verity details of the existing IAPs and commenting authorities public participation database for the Tshipi Borwa Mine. The desktop social scan therefore included: • the verification of the relevant surrounding landowners, land occupiers, relevant ward councillor, municipalities, commenting authorities and other interested and affected parties; • the verification of contact details for IAPs on the existing database; and • the verification of appropriate communication structures. Verification of information was undertaken by networking and direct consultation with IAPs. In addition to this, the project's public participation database was supplemented with information on IAPs provided during the public consultation process and the general public and commenting authorities meetings. A copy of the project's public participation database is included in Appendix E. The database will be updated on an on-going basis throughout the environmental process.	Commenced in June 2016 and is on-going
Notification letter	IAPs and commenting authorities were notified of the project via a newsletter. The purpose of the newsletter was to inform IAPs and commenting authorities about the project, the means of inputting into the EMPr amendment process and details of the general public and commenting authorities meetings. A registration and response form was attached to the newsletter, which provided IAPs and commenting authorities with an opportunity to submit their names, contact details and comments on the project. This letter was translated into Afrikaans. A copy of the newsletter and proof of distribution is included in Appendix E.	03 February 2017
Site notices	Site notices (60cm by 42cm) in English and Afrikaans were placed at key conspicuous positions in and around the Tshipi Borwa Mine. A copy of the site notice including photos are included in Appendix E.	02 February 2017
Newspaper advertisements	Block advertisements were placed in the Kalahari Bulletin (02 February 2017) and Kathu Gazette (04 February 2017). Copies of the advertisement are included in Appendix E.	02 February and 04 February 2017
Public and commenting authority meetings		

Task	Description	Date
Notification – IAPs and commenting authorities		
General Public meeting	A general public meeting was held on 21 February 2017 at 16h00. The purpose of the general public meeting was to: • provide an overview of the project; • provide an overview of the environmental assessment process that will be undertaken for the project; • provide an overview and obtain input on the existing status of the environment; • outline and obtain input on impacts identified for the project; • record any comments and issues raised. These issues and concerns will be used to inform the Plan of Study for the EIA Phase; and • agree on the way forward and the logistics for report distribution. A copy of the general public meeting and associated attendance registers is included in Appendix E.	21 February 2017
Commenting authorities meeting	A commenting authorities meeting was held on 21 February 2017 at 10h00. The purpose of the meeting was to: • provide an overview of the project; • provide an overview of the environmental assessment process that will be undertaken for the project; • provide an overview and obtain input on the existing status of the environment; • outline and obtain input on impacts identified for the project; • record any comments and issues raised. These issues and concerns will be used to inform the Plan of Study for the EIA Phase; and • agree on the way forward and the logistics for report distribution. A copy of the commenting authorities meeting and associated attendance registers is included in Appendix E.	21 February 2017
Review of the EMP amendment report		
Public review of EMP amendment report	The EMP amendment report will be available for public review (for 30 days) and comment at the following venues: • JMLM; • JTGDM; • Hotazel, Black Rock community public libraries; and • Kuruman and Kathu town libraries. Summaries of the EMP amendment report will be made available to all IAPs registered on the public participation database via email, fax, post and hand delivery to venues listed above. IAPs will be notified when the EMP amendment report will be available for review via SMS. Electronic copies of the EMP amendment report will be made available on request. Further to this, a full copy of the EMP amendment report will also be made available on the SLR website.	August 2017
Commenting authorities review of the EMP amendment report	The EMP amendment report will be made available for review to all commenting authorities registered on the public participation database for a period of 30 days. In this regard, electronic (where possible) and hard copies of the EMP amendment report will be delivered to each of the commenting authorities included on the public participation database.	August 2017
Submission of the EMP amendment report	The EMP amendment report will be updated to include any comments received during the review of the report by IAPs and commenting authorities. This updated report will be uploaded onto the SAMRAD website for DMR decision making purposes.	September/October 2017

The relevant commenting authorities, parastatal, NGO's and IAPs that may be affected by the project are listed below:

- Commenting authorities:
  - DMR;
  - DWS;
  - DENC;
  - SAHRA;
  - DALA;
  - DAFF;
  - DRDLR;
  - DPWRT;
  - JTGDM;
  - JMLM; and
  - Ward councillor (Ward 4).
- Parastatals:
  - Telkom;
  - Transnet; and
  - Eskom.
- Non-government organisation
  - Agri Kuruman;
  - Mac Mac Agri; and
  - Kalagadi Water User Forum.
- Others:
  - Landowners and land users; and
  - Surrounding mines.

6.3 SUMMARY OF ISSUES RAISED BY IAPS

The process to amend the approved EMPr initially commenced in early 2013. In this regard a public participation process involving both IAPs and commenting authorities commenced in July 2013. A general public meeting and a commenting authorities meeting were held on 30 July 2013. Due to numerous changes to the project scope the public participation process was redone. It follows that IAPs and commenting authorities were re-engaged in February 2017 as discussed in Section 6.2 above.

A summary of the issues and concerns raised by IAPs and commenting authorities as part of the public participation process, outlined in Section 6.2 above, is provided in Table 16 below. For completeness purposes, this section also includes comments and concerns raised during the initial public participation process that commenced in July 2013. This has been indicated in italics.

TABLE 16: SUMMARY OF ISSUES RAISED BY IAPS AND COMMENTING AUTHORITIES

IAP details		Date of comment	Issue raised	Response (as amended for the purposes of the EMP amendment report)
Affected Parties				
Surrounding Land Owners				
Andrew Pyper	*X*	*30 July 2013 at the general public meeting*	*If all conditions of the mining licences are applied then is it correct to say that there will be no additional changes? For example there will not be changes to include a housing scheme etc.?*	The approved EMPr (Metago, May 2009), stipulates that no employees will be housed at the mine and that employees will stay in nearby towns. This will not change as a result of the project.
			I am not against mining or any type of development, but it is important to ensure that all parties are taken into consideration when such projects go ahead.	As part of the project, key stakeholders are identified. This includes landowners, land users, NGO's, ward councillors and commenting authorities. These stakeholders are involved in the project from the onset. Stakeholders are given the opportunity to review documents, attend public meetings and to submit comments and concerns pertaining to the project which are included into the EMPr. The EMPr which includes all comments raised by stakeholders is submitted for review to commenting authorities for consideration.
			How deep is the ore body?	The depth of the manganese seam at the start of mining was approximately 70 m below the surface with the deepest point approximately 330 m below surface.
			What specialist work was undertaken for the air emissions licence?	Tshipi currently does not have an air emissions licence. It is however important to note that when the Sinter plant is established, Tshipi will need to apply for an air emissions licence. As part of applying for this licence an air quality assessment will need to be undertaken in support of the air emissions licence application. This has been included as a management action for the mine (Section 27).
			I would like to propose that a micro-climatic investigation be undertaken with regards to the effect that opencast mining has on the micro-climate. The opencast mining results in a heat island whereby the incoming solar is reflected differently to if it were to fall onto flat ground. This therefore affects the circulation of air and affects the climate on a localised scale. Backfilling would help to lessen this by reducing the void into which the sun's heat pours and it would allow for the heat energy to be reflected in a more normal manner.	The air quality specialist study undertaken as part of the approved EMPr (Metago, May 2009) qualitatively commented on the micro-climate. In this regard, as the variables affecting climate are regional or even global in scale (atmospheric circulation patterns, the atmospheric radiation balance etc.) it is unlikely that mining on a local or sub regional scale will have noticeable climatological effects. In order to undertake an investigation to determine potential changes in the micro-climate of the area surrounding the mine specific meteorological baseline characterisation could be done. This would require long term historical as well as on-site

IAP details		Date of comment	Issue raised	Response (as amended for the purposes of the EMP amendment report)
				meteorological data neither of which is available at present. As part of the monitoring programme for the Tshipi Borwa Mine (Section 29) Tshipi is required to establish a meteorological station.
			The portion of my farm which borders the mine is the best grazing land that I have. Cattle are trying to get away from the blasting and this means that they stampede and push through the fences. If we know what times blasting is going to occur at Tshipi we can take corrective action.	Tshipi is required to inform all third parties that exist and or that have property within 1500m of the blast site of the blast programme and when blasts will take place (Section 27).
			There are no ablution facilities in the northern area of the Tshipi site. The mine staff are jumping over the fences and using my veld as a lavatory. There are also instances of littering.	Tshipi has been informed of this. Where Tshipi contractors or employees are not complying with Tshipi procedures, Tshipi needs to be notified immediately.
			Will there be any encroachment onto my property? I am concerned that there will be dumping of waste rock on my property.	There will be no dumping and no encroachment onto your property. The changes to the EMPr as a result of the project remain within the boundaries of the approved mining right and surface use areas.
Andrew Pyper	*X*	*30 July 2013 at the general public meeting*	*Vegetation is susceptible to both diesel fumes as well as diesel spills. Some sort of investigation should be undertaken in which the issue is studied from a grazing perspective and the impact that this will have on livestock. Tshipi should take remedial measures to avoid or lessen the impact that such spills and emissions have on surrounding flora.*	Vegetation that is contaminated by diesel will die. It is also highly unlikely that livestock will consume vegetation that has been contaminated. With regards to diesel spills it is important to note that the potential for diesel spills is limited to within the Tshipi Borwa Mine area and along roads leading out of the mine site to connect with the R380. No livestock is located within the Tshipi Borwa Mine area or along these roads. With reference to Section 27 management actions focus on avoiding spills, rehabilitation and fast reactions to any spillage events. With regards to diesel fumes, as part of the approved EMPr (Metago, May 2009), an independent specialist was appointed to undertake an air quality assessment. The main emissions of concern that were identified for the mine include inhalable particulate matter less than 10 microns in size (PM_{10}), larger total suspended particulates (TSP) that relate to dust fallout, Mn concentrations, SO_2, NO_2 and gaseous emissions mainly from vehicles and generators. With reference to Appendix F, vehicle and generator emissions is

IAP details		Date of comment	Issue raised	Response (as amended for the purposes of the EMP amendment report)
				unlikely to exceed the guidelines. With reference to Section 27 management actions focus on the implementation of emission control measures and monitoring.
			In the Kalahari, when the surface is disturbed, this takes years and years to recover. To establish even a small amount of vegetation takes up to 20 years and during this time only the pioneer species will recover. The better grasses and shrub species may take much longer. Existing farming activities have already resulted in the disturbance of naturally occurring grass species and, due to overgrazing and mismanagement, many species have become threatened. Each time there is some sort of disturbance relating to mining, this existing effect is compounded.	As part of the management actions (Section 27) identified for the mine, Tshipi is committed to limit the removal of vegetation to the mine infrastructure footprint area. In addition to this, as part of rehabilitation, Tshipi is committed to implement a rehabilitation plan which will aid in ensuring that the correct species are able to re-establish. Further to this and with reference to Section 28.1.3 the land will be rehabilitated to achieve an end use of wilderness and grazing. Due to the arid nature of the Kalahari, the re-establishment of vegetation is known to take longer than areas that are associated with heavy rainfall. Further to this, grass species are known to re-establish much quicker than tress species. It is for this reason that management actions (Section 27) are focussed on collecting pods of the Camel Thorn and Grey Camel Thorn in order to aid in the re-establishment of these species.
			Why are there changes being made to the currently approved infrastructure?	The changes allow for an improved infrastructure layout to better cater for the mine requirements.
			We are concerned that the tailings dam at the Tshipi Borwa Mine will fail. The tailings dam at the Mamatwan Mine failed about 10 years ago. Even though the Mamatwan Mine cleared up the tailings material, the vegetation still died.	A tailings dam has been established at the Tshipi Borwa Mine. It is however important to note that the full extent of the approved tailings dam has not been established yet and the tailings dam on-site has never been used and is currently not in use. The tailings dam has been designed by a qualified engineer and the design considered stability.
			The availability and quality of water is very important to us. Approximately 10 years ago, one of our cows died as a result of poor groundwater quality. We no longer use this specific borehole. We do still make use of another groundwater borehole on the farm Moab 700. The quality of this borehole water is poor however it is not poor enough to result in the death of our cattle. We also use water from the Vaal Ga-Magara pipeline. *We therefore emphasise that a lot of attention needs to be*	As part of the approved EMPr (Metago, May 2009), and prior to the establishment of the Tshipi Borwa Mine the water quality had been influenced by anthropogenic pollution from farming and surrounding mining activities. Current groundwater quality data indicates that elevated levels of TDS, EC, Chloride and nitrate are consistent with baseline conditions. It is important to note that the EMPr amendment process commenced in early 2013. Since the commencement of the

IAP details		Date of comment	Issue raised	Response (as amended for the purposes of the EMP amendment report)
			given to both groundwater and surface water quality and quantity particularly with regard to backfilling the open pit with a combination of tailings, waste rock, gravel and sand.	process, the backfilling activities have been reviewed and the use of a combination of tailings, waste rock, gravel and sand to back fill the open pit will no longer take place and has been excluded from the project scope. Further to the above and with reference to Section 27, where Tshipi's operations are directly responsible for a loss in third party water supply, appropriate compensation will be provided.
Machiel Andries Kruger	*X*	*05 July 2013 as part of a social scan*	*There is so much dust. The plants are covered in dust and in some instances, these plants almost appear white from all the dust sitting on the leaves and branches.*	The air quality specialist study undertaken as part of the approved EMPr (Metago, May 2009) qualitatively commented on the impacts of dust towards vegetation. In this regard unlike sulphur dioxide and oxides of nitrogen, limited information is available on the effects of dust on vegetation. While there is little direct evidence of what the impact of dust fall on vegetation is under a South African context, a review of European studies has shown the potential for reduced growth and photosynthetic activity in sunflower and cotton plants exposed to dust fall rates greater than 400 mg/m²/day. With reference to Section 6.4.1.9, dust fallout results along the western boundary of the mine remain below 400 mg/m^2/day. Dust fallout results along the northern and southern boundary have been known to exceed 400 mg/m^2/day. Dust fallout results exceed the 400 mg/m^2/day along the eastern boundary of the mine, as that is near the Mamatwan operation and the central section of the mine also exceeds 400 mg/m^2/day as this is in the midst of the Tshipi operations. Dust fallout may have an influence on vegetation in the unmitigated scenario, with the implementation of management actions (Section 27) Tshipi should be able to manage the generation of dust at the mine.
			The conditions of the roads are unacceptable.	As part of the project a traffic study was undertaken by an independent specialist. The result of this traffic study indicates that road infrastructure improvements are currently

IAP details		Date of comment	Issue raised	Response (as amended for the purposes of the EMP amendment report)
				required from a road safety point of view. This includes providing a 60 m dedicated right-turn lane on the northern approach and reflective road studs on the R380. Further details pertaining to the upgrade is included in Appendix O. It is proposed that these upgrades are discussed in collaboration with neighbouring mines and the relevant roads department.
			Blasting is a serious issue for us. Even though our house is located approximately 7km from the Mamatwan Mine, our house shakes when blasting takes place and several cracks have appeared along the walls of our house. There are times when the blasts seems to be a lot more severe than most. We have asked the Mamatwan Mine to reduce the charge but they say that they need large blasts to access the ore. It is also very strange to us that blast measurements are never taken at our house when these blasts are so severe. This house has a lot of meaning to us; it was built in 1928 and has been in the family for generations.	Tshipi is not in a position to comment on blasting related activities at Mamatwan. If is however important to note that the management actions associated with blasting at the Tshipi Borwa Mine are outlined in Section 27. In accordance to the US Bureau of Mines, ground vibrations should not exceed 12.7mm/s at third party infrastructure and air blasts must be kept below 130 dB in accordance with best practise. Tshipi is committed to ensure that blast designs do not exceed these limits. If these limits are maintained, damage to third party structures will not occur. It is highly unlikely that blasting related activities will influence third party structures more than 7km from the mine site. It is however important to note that Tshipi is committed to respond immediately to any blast related complaints and where Tshipi's operation has caused damage, appropriate compensation will be provided.
			While the mine may not necessarily be directly responsible for all the problems that we have experienced in the past, the mine is however indirectly responsible for a lot of the problems we have experienced. We would not experience these problems if the mine was not here. These indirect problems include: • *three years ago there was a fire on our property which we are certain was started by Eskom during the installation of the powerline for Tshipi. The reason we are certain that this fire was started by Eskom is because the fire started in the middle of the veld, close to where Eskom was working and not along the road where people sometimes throw cigarettes out their car windows. We opened up a case at the police station but we were told that we did not have a case. The*	With reference to Section 30.2.2, in the event of a fire, Tshipi is committed to provide emergency firefighting assistance with available trained mine personnel and equipment. Where Tshipi's operations result in third party loss or damage to equipment and livestock, appropriate compensation must be provided.

IAP details		Date of comment	Issue raised	Response (as amended for the purposes of the EMP amendment report)
			case is still open but to this day nothing has been done to resolve this. The loss of grazing land is a huge expense as we need to find alternative land where our cattle can graze; • *there have been several fires since the Tshipi Borwa Mine has been in construction. On one occasion when our son was trying to put out a veld fire on the farm Moab 700, his bakkie caught alight and we almost lost our son and he was in intensive care for a few days;* • *during the establishment of the Eskom powerline, the people that were working on this powerline did not close the gates and as a result our cattle go into the road and one of our cows was hit by a vehicle. It should however be noted that we were compensated for this;* • *some of our calves on the farm Moab 700 have been slaughtered and being sold to people working at the mine; and* • *just to give you another example of how mines do not work together with farmers even though this is not associated with the Tshipi Borwa Mine, an ore truck broke down on the side of the road near one of our other farms and caught alight. We have an electric fence around this specific farm and the power box and panels were burnt down as a result of the fire that started from the ore truck. It cost us R40 000.00 to replace the power box and panels. We are aware that this could have happened to anyone, but once again it was a mine vehicle and we were not compensated.*	
Machiel Andries Kruger	*X*	*05 July 2013 as part of a social scan*	*We are aware that the mines are here to stay, but so are the farmers. A system needs to be put in place to ensure that the mines and the farmers are able to work together. We as farmers have made contributions for mines. One such example is providing Tshipi with a pipeline and railway line servitude. We have never denied the mines in the area anything but when the mines have directly or indirectly had an impact towards farmers; the mines needs*	Tshipi is committed to communicate with land users and owners to facilitate information sharing and environmental impact management relevant to the Tshipi Borwa Mine. Tshipi also communicates with the local farmers forum in terms of sharing information.

IAP details		**Date of comment**	**Issue raised**	**Response (as amended for the purposes of the EMP amendment report)**
			to provide some form of compensation. We are getting very frustrated because we incur so many expenses when we need to resolve problems caused by mines and the mines just makes money.	
			We had a lease agreement with the PHB Billiton to use portion 3 of the farms Mamatwan 331 and Moab 700 for grazing purposes. This lease agreement was valid for 9 years. We were told by BHP Billiton that we had to get off the land, because Tshipi will be establishing a mine and as such the grazing lease agreement was cancelled even though the 9 year period had not been completed.	It is understood from Tshipi that the cancellation of the lease agreement was done in accordance to the relevant lease agreement.
			With reference to the baseline environment, I would like to suggest that the prevailing wind direction is in fact not south east but rather north east.	With reference to Section 6.4.1.3, wind direction within the mining area is dominated by winds from the north, northeast and east.
Andries van den Berg	X	21 February 2017 at the general public meeting	Please clarify the three stormwater dam changes.	The approved EMPr (Metago, May 2009) made provision for the establishment of several stormwater dams within the vicinity of the plant and operational areas. These stormwater dams included the following: • a 10 Ml stormwater dam for the collection of dirty water from the operational areas (mining workshop and primary crusher area); • an 8 Ml stormwater dam for the collection of dirty water from around the plant area; and • a 6.3 Ml settling dam that would receive dirty water from the pit dewatering and the various storm water dams described above. The approved plan has been adjusted such that the above listed stormwater dams have been combined to form one 24.3 Ml dirty water dam which consists of four compartments.
			I do not see the Tshipi substation on portion 8 and the lines coming to and from the substation.	There is an Eskom substation operated by Eskom. Tshipi wants to establish powerlines to the mine but these are not yet in place. The approval of these powerlines will be handled in a separate application.
			Please clarify the separation of clean from the contaminated water.	As per the approved EMPr (Metago, May 2009) the separation of clean and dirty water systems at the mine will be designed, implemented, and managed in accordance with

IAP details		Date of comment	Issue raised	Response (as amended for the purposes of the EMP amendment report)
				the provisions of Regulation 704, 4 June 1999 (Regulation 704) for water management on mines. In general, the footprint of all dirty areas will be minimised by isolating these areas from clean water runoff and dirty water will be contained in designated systems. As part of the project, the stormwater management plan has been reviewed and updated.
			Currently, the dust suppression method is leading to the dusticide running into the veld. Also, the use of the access roads produces a lot of dust. Stormwater facilities need to be established along the road to prevent dusticide running into the veld.	The use of dusticide is a means of managing the generation of dust along gravel roads. This is in compliance with Tshipi's EMP management actions that stipulates the use of dust binding agents. It is understood that dusticide is not considered to be harmful to the environment and will not contribute towards pollution. During the application of the dusticide, Tshipi needs to ensure that the dusticide is limited to the road surface only.
Hendrik Venter	X	21 February 2017 at the general meeting	Who is on the board of directors at Tshipi?	The members that make of the board of directors is available on the Tshipi website (https://www.tshipi.co.za). In this regard, the board of directors includes Saki Macozoma, Brian Gilbertson, Long Ngee Tong, Priyank Thabliyal, Johannes Gumede, Omphemetse Cynthia Mogodi and Brendan Robinson.
			Where will the mine get the water from?	A combination of pit dewatering, the Vaal-Gamagara pipeline and run-off collected in stormwater facilities.
Andries van den Berg	X	21 February 2017 at the general meeting	Will they start mining underground?	At this stage, there is no intention of going underground.
			There is confusion regarding Portion 8, as there are apparently multiple rights held by different companies on this portion.	It is important to note that portion 8 of the farm Mamatwan 331 does not form part of Tshipi's approved surface use and mining rights area. Tshipi only holds the surface rights for portion 8 of the farm Mamatwan 331. Mamatwan Mining has applied for a mining right over portion 8 and 18 of the farm Mamatwan. The mining right is still pending. It is understood that mineral resources are localised to the Northern section of portion 8 of the farm Mamatwan 331. It is understood that when Mamatwan Mining receives their mining right, they will relinquish the southern section of the farm, which does not contain mineral resources, to Tshipi. Similarly, Mamatwan

IAP details		Date of comment	Issue raised	Response (as amended for the purposes of the EMP amendment report)
				Mining will also relinquish portion 18 of the farm Mamatwan 331 to Tshipi, due to the presence of existing Tshipi infrastructure on this portion.
M.M. Louw	X	21 February 2017 at the general meeting	If you say they are going to manage the clean and dirty water, does that mean there will be a treatment plant?	No. In line with legislation it is a requirement for mines to handle clean and dirty water: clean and dirty water must be separated.
Northern Cape DENC				
Thulani Mthombeni	X	21 February 2017 at the commenting authorities meeting	If any of these protected plants are found on site, the permit to remove it must be obtained via DENC.	With reference to Section 27, where any protect trees and/or plants need to be removed as a result of the project the necessary permits will be obtained from DAFF and/or DENC. It is understood from Tshipi that were infrastructure changes have already taken place; the necessary permits have been obtained.
			DENC must receive a hard copy, as electronic copies cannot be registered as documents received by the department. Two copies are required.	This will be done.
			Has an audit been done on the existing permit? I would like to see this report.	Tshipi will make the compliance reports available, Tshipi has submitted compliance reports to DENC in the past.
			The sites to where infrastructure will be shifted to, what is the condition of the existing environment at the moment?	Majority of the infrastructure changes have already taken place. Where infrastructural changes still need to be implemented (78Ml stormwater dam, expansion of topsoil stockpile areas No.1 and No.2) the natural vegetation is undisturbed.
			There is another EIA for another company that I have handled that covered the Remaining Extent of Portion 18. I would suggest confirming what's going on there because it caused some confusion for us. The information may also have been mistakenly represented though.	Mamatwan Mining has applied for a mining right over portion 8 and 18 of the farm Mamatwan. The mining right is still pending. It is understood that mineral resources are localised to the Northern section of portion 8 of the farm Mamatwan 331. It is understood that when Mamatwan Mining receives their mining right, they will relinquish the southern section of the farm, which does not contain mineral resources, to Tshipi. Similarly, Mamatwan Mining will also relinquish portion 18 of the farm Mamatwan 331 to Tshipi, due to the presence of existing Tshipi infrastructure on this portion.
SAHRA				
Kathryn Smuts	*X*	*11 July 2013 via email*	*We have received notification of your intention to expand the infrastructure at the Tshipi Borwa Mine located on*	As part of the approved EMPr process that was undertaken for the mine, a heritage impact assessment was undertaken

IAP details		Date of comment	Issue raised	Response (as amended for the purposes of the EMP amendment report)
			farms Mamatwan 331, Moab 700, to the south of Hotazel in the John Taolo Gaetsewe District Municipality. In terms of the National Heritage Act (NHRA) no 25 of 1999, heritage resources, including archaeological or palaeontological sites over 100 years old, graves older than 60 years, structures older than 60 years are protected. They may not be disturbed without a permit from the relevant heritage resources authority. This means that before such sites are disturbed by development it is incumbent on the developer (or mine) to ensure that a Heritage Impact Assessment is done. It must include the archaeological component (Phase 1) and any other applicable heritage components. Appropriate (Phase 2) management actions, which involved recording, sampling, and dating sites that are to be destroyed, must be done as required. *Although it is stated in the Background Information Document (BID) submitted to SAHRA that no significant heritage resources or cultural materials have been found to occur at the Tshipi Borwa Mine, no indication of a professional assessment is given. SAHRA therefore requests that a full Heritage Impact Assessment is conducted prior to any development related activities occurring on site.* *Consequently, the quickest process to follow for the archaeological component would be to contract a specialist to provide a Phase 1 Archaeological Impact Assessment Report. This must be done before any development related activities take place. The Phase 1 Archaeological Impact Assessment Report will identify the archaeological sites and assess their significance. It should also make recommendations (as indicated in Section 38 of the NHRA) about the process to be followed. For example there may need to be a management actions phase (Phase 2) where the specialist will collect or excavate material and date the site. At the end of the process, the heritage authority may give permission for destruction of the sites.*	on the farm Moab 700 and Mamatwan 331. The findings of this study indicated that no sites of significance were located on these farms. As part of the project, an independent heritage specialist was appointed to confirm if the project would result in a change in the findings of the heritage study undertaken for the approved EMPr. This opinion is attached in Appendix P. With reference to this opinion, there are no changes to the results and recommendations that were made.

IAP details		Date of comment	Issue raised	Response (as amended for the purposes of the EMP amendment report)
			SAHRA is satisfied that, as all work will involve only shallow, surface excavations, no Palaeontological Impact Assessment will be necessary. Any other heritage resources that may be impacted such as built structures over 60 years old, sites of cultural significance associated with oral histories, burial grounds and graves, graves of victims of conflict, and cultural landscapes or viewscapes must also be assessed.	
Kathryn Smuts	*X*	*28 August 2013 via email*	*SAHRA has reviewed the Draft Scoping Report for the proposed amendment to the Tshipi Borwa Manganese Mine. The DSR refers to a heritage report compiled in 2009 by Mr Henk Steyn. Although this report was compiled for another application on the same property, the area surveyed covers enough of that affected by the current application to serve as an adequate indicator of the likely heritage resources found on the properties.* *As indicated in the SAHRA review comment for that 2009 report, SAHRA supports the application provided that:* • *if any evidence of archaeological sites or artefacts (e.g., concentrations of stone artefacts, fossil bones, ostrich egg shell flasks), unmarked human burials or other heritage resources is found during mining activities, SAHRA APM Unit (Colette Scheermeyer/ Katie Smuts, tel: 021-4624502) must be alerted immediately, and a professional archaeologist and/or palaeontologist, depending on the nature of the finds, must be contacted as soon as possible to inspect the findings;* • *if prospecting and/or mining is to be undertaken to the west of the above properties and near the Vlermuisleegte (for instance, Remainder of Mamatwan 331, a property not surveyed for this HIA), an Archaeological Impact Assessment (AIA) must be undertaken by a professional archaeologist prior to*	As part of the approved EMPr process that was undertaken for the mine, a heritage impact assessment was undertaken on the farm Moab 700 and Mamatwan 331. The findings of this study indicated that no sites of significance were located on these farms. As part of the project, an independent heritage specialist was appointed to confirm if the project would result in a change in the findings of the heritage study undertaken for the approved EMPr. This opinion is attached in Appendix P. With reference to this opinion, there are no changes to the results and recommendations that were made. It is important to note that as part of the project, activities and infrastructure have remained within the boundaries of the Tshipi Borwa mine surface use and mining rights area. This is the area that was surveyed as part of the heritage assessment undertaken as part of the approved EMPr. As part of the project an independent palaeontological specialist was appointed. In this regard, the Tshipi Borwa Mine is underlain by the Late Caenozoic Kalahari Formation (Cretaceous to Tertiary). No literature record could be found of fossils from the Kalahari Formation close to Hotazel. Palaeontological evidence is restricted to a few pseudo-bone structures that are preserved in the limestone. No proof of any fossil material was collected from the rest of the Kalahari Formation. The project is therefore unlikely to pose a substantial threat to local fossil heritage. In Palaeontological

IAP details		Date of comment	Issue raised	Response (as amended for the purposes of the EMP amendment report)
			such activities given the identified archaeological sensitivity along this water course; • *if archaeological and/or palaeontological heritage resources are identified in the course of mining operations and related activities, a Phase 2 rescue/ sampling operation may need to be undertaken by a specialist. For this purpose, the relevant professional will require a management actions permit from SAHRA APM Unit in terms of section 35 of the National Heritage Resources Act (NHRA, No. 25 of 1999). On receipt of a satisfactory management actions (Phase 2) permit report from the archaeologist and/or palaeontologist, SAHRA APM Unit will make further recommendations in terms of the report; and* • *where bedrock is to be affected, a Palaeontological Desk Top study must be undertaken to assess whether or not the development will impact upon palaeontological resources, or at least a letter from an accredited palaeontologist mitigating for an exemption is needed to indicate that this is unnecessary. If the area is deemed sensitive, a full Phase 1 Palaeontological Impact Assessment will be required and if necessary a Phase 2 rescue operation might be necessary.*	terms the significance is rated as low to very low. It is important to note that even though no heritage sites are located within the Tshipi Borwa Mine and the palaeontological sensitivity is low, management actions outlined in Appendix F, requires Tshipi to contact SAHRA as well as a qualified specialist in the event of a chance find. Further to this, in the event of a chance find, heritage and palaeontological resources cannot be disturbed or removed without the necessary permits.
Natasha Higgit	*X*	*March 2017 2017*	While the operational mine area has been surveyed for heritage resources previously (SAHRIS Case ID 2904 http://sahra.org.za/sahris/cases/tshipi-emp-amendment and 3629 http://sahra.org.za/sahris/cases/portion-3-8-farm-mamatwan-no331), an assessment of Palaeontological Heritage as not been conducted. Therefore SAHRA requests that a Desktop Heritage Impact Assessment (HIA) is conducted by a qualified heritage practitioner for the proposed EMP amendment as part of the S&EIA Process. The Desktop HIA must include a Desktop Palaeontological Assessment conducted by a qualified palaeontologist. The Desktop HIA must also include a consolidation of all previous HIAs conducted for the project to ensure that	As part of the approved EMPr process that was undertaken for the mine, a heritage impact assessment was undertaken on the farm Moab 700 and Mamatwan 331. The findings of this study indicated that no sites of significance were located on these farms. Taking this into account, only a desktop study was done for the project. A copy of the heritage study undertaken for the approved EMPr has been included in Appendix P. As part of the project, an independent heritage specialist was appointed to confirm if the project would result in a change in the findings of the heritage study undertaken for the approved EMPr. This opinion is also attached in Appendix P. With reference to this opinion, there are no changes to the results and recommendations that were

IAP details		Date of comment	Issue raised	Response (as amended for the purposes of the EMP amendment report)
			heritage has been adequately assessed for the project. The Scoping Report and all appendices must be submitted so that an informed comment may be issued. Should you have any further queries, please contact the designated official using the case number quoted above in the case header.	made. As part of the project an independent palaeontological specialist was appointed. In this regard, the Tshipi Borwa Mine is underlain by the Late Caenozoic Kalahari Formation (Cretaceous to Tertiary). No literature record could be found of fossils from the Kalahari Formation close to Hotazel. Palaeontological evidence is restricted to a few pseudo-bone structures that are preserved in the limestone. No proof of any fossil material was collected from the rest of the Kalahari Formation. The project is therefore unlikely to pose a substantial threat to local fossil heritage. In Palaeontological terms the significance is rated as low to very low. It is important to note that even though no heritage sites are located within the Tshipi Borwa Mine and the palaeontological sensitivity is low, management actions outlined in Appendix F, requires Tshipi to contact SAHRA as well as a qualified specialist in the event of a chance find. Further to this, in the event of a chance find, heritage and palaeontological resources cannot be disturbed or removed without the necessary permits.
Department of Agriculture, Forestry and Fisheries				
Jacoline Mans	*X*	*07 September 2015 via email*	*It is not clear how the proposed changes to the approved EIA will affect the natural vegetation and animal life, and specifically protected trees. It was indicated that no further specialist investigation are required (fauna and flora). May you please indicate how the changes will affect protected trees and what additional impacts will be on the natural vegetation?* *Additional impacts on the natural vegetation may require amendments and/or new Flora permit and NFA licences for disturbance of protected plants and trees.* *Efforts should be made to minimize impacts on slow growing protected trees, by avoiding such trees as far as*	As part of the approved EMPr (Metago, May 2009), a biodiversity study was undertaken. As part of the project an independent biodiversity specialist was appointed to update this study. With reference to Appendix F, the approved EMPr (Metago, May) made provision for the disturbance of 950ha. Although the establishment of additional facilities and activities forms part of the approved 950ha area of disturbance, these will require clearing of vegetation and could result in the loss of additional protected trees such as the Camel Thorn (*Vachellia erioloba)*, Grey Camel Thorn (*Vachellia haematoxylon)* and Goldblatt (*Moraea longistyla)*.

IAP details		Date of comment	Issue raised	Response (as amended for the purposes of the EMP amendment report)
			possible. It is not given that this Department will issue a licence for removal of protected tree. We may request an environmental offset (if deemed necessary) to compensate for the unavoidable loss of protected trees which may take decades to replace. *Kindly provide copies of the relevant documentation to this office for comments and a copy of the amended EMPr outlining how impacts on protected trees will be mitigated.*	Further to this, Tshipi is aware that should the DAFF request an offset then that will need to be implemented by Tshipi with input from DAFF. Refer to Appendix F for the detailed impact assessment on biodiversity and the related mitigation measures.

6.4 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE PROJECT AND ALTERNATIVES

The baseline information provided is aimed at giving the reader perspective on the existing status of the cultural, socio-economic and biophysical environment. The section below includes information sourced from the approved EMPr (Metago, May 2009) and the supporting specialist studies, where applicable, as well as additional specialist input obtained for the project.

6.4.1 BASELINE ENVIRONMENT AFFECTED BY THE PROPOSED ACTIVITY

6.4.1.1 Geology

INTRODUCTION AND LINK TO IMPACT

As a baseline, the geology and associated structural features provides a basis from which to understand:

- the potential for sterilisation of mineral reserves;
- the geochemistry and related potential for the pollution of water from mineralised waste facilities and stockpiles (tailings dam and waste rock dumps); and
- the potential for geological lineaments such as faults and dykes. Faults, dykes and other lineaments can act as preferential flow paths of groundwater which can influence both the dispersion of potential pollution plumes and the inflow of water into mine workings.

Geological processes also influence soils forms (see Section 6.4.1.4) and the potential for palaeontological resources (see Section 6.4.1.13).

To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the groundwater study (SLR, July 2017) undertaken for the project included in Appendix M and the geochemical analysis undertaken for the mine (SLR, March 2014).

Regional and local geological data collection was done through review of available literature (SLR, July 2017) and the approved EMPr (Metago, May 2009).

Geochemical analysis was undertaken to determine the potential for acid mine drainage and the potential leachate from mineralised waste (tailings (not currently in use) and waste rock) and ore that is stockpiled on surface at the Tshipi Borwa Mine. Samples of different lithologies were taken from the open pit for the geochemical analysis of waste rock material. Tailings material is currently not generated at the mine and as such a tailings sample was generated at the laboratory at the mine (SLR, March 2014).

RESULTS

<u>Regional geology</u>

The world's largest land based sedimentary manganese deposit is contained in the Kalahari Manganese Field, situated 47km northwest of Kuruman in the Northern Cape. The general stratigraphic column for the Kalahari Manganese field is included in Table 17 below (SLR, July 2017). The Kalahari Manganese Field comprises five erosional, or structurally preserved, relics of the manganese bearing Hotazel Formation of the Paleoproterozoic Transvaal Supergroup. These include the Mamatwan-Wessels deposit (also known as the main Kalahari Basin), the Avontuur and Leinster deposits, and the Hotazel and Langdon Annex/Devon deposits. The Tshipi Borwa Mine is located in the Hotazel Formation (Transvaal Supergroup) towards the southern end of the Kalahari Basin (Metago, May 2009). Three beds of manganese ore are interbedded with the Banded Iron Formation (BIF) of the Hotazel Formation (Transvaal Supergroup). The BIF of the Hotazel Formation typically consists of repeated thin layers of black iron oxides (magnetite or hematite) alternating with bands of iron-poor shales and cherts.

TABLE 17: GENERAL STRATIGRAPHIC COLUMN FOR THE KALAHARI MANGANESE FIELD (SLR, JULY 2017)

<table>
<tr><th colspan="4">Supergroup / Group / Subgroup / Formation</th><th>Geological Description</th></tr>
<tr><td colspan="4">Kalahari Group</td><td>Kalahari sands, calcrete, clays & gravel beds</td></tr>
<tr><td colspan="5">Kalahari unconformity</td></tr>
<tr><td colspan="4">Karoo Supergroup</td><td>Dwyka tillite</td></tr>
<tr><td colspan="5">Dwyka unconformity</td></tr>
<tr><td colspan="3" rowspan="2">Olifantshoek Supergroup</td><td>Lucknow Formation</td><td>White ortho-quartzite</td></tr>
<tr><td>Mapedi Formation</td><td>Green, maroon and black shales and quartzites</td></tr>
<tr><td colspan="5">Olifantshoek unconformity</td></tr>
<tr><td rowspan="9">Transvaal Supergroup</td><td rowspan="9">Postmansburg Group</td><td rowspan="8">Voelwater Subgroup</td><td>Mooidraai Formation</td><td>Dolomite, chert</td></tr>
<tr><td rowspan="7">Hotazel Formation</td><td>Banded ironstone (upper)</td></tr>
<tr><td>Upper Mn Ore Body</td></tr>
<tr><td>Banded ironstone (middle)</td></tr>
<tr><td>Middle manganese body</td></tr>
<tr><td>Banded ironstone (middle)</td></tr>
<tr><td>Lower manganese body</td></tr>
<tr><td>Banded ironstone (lower)</td></tr>
<tr><td colspan="2">Ongeluk Formation</td><td>Andesitic Lava</td></tr>
</table>

<u>Local and operational geology</u>

The Hotazel Formation is underlain by basaltic lava of the Ongeluk Formation (Transvaal Supergroup) and directly overlain by dolomite of the Moodraai Formation (Transvaal Supergroup) as shown in Table 17 (SLR, July 2017).

The Transvaal Supergroup is overlain unconformably by the Olifantshoek Supergroup which consists of arenaceous sediments, typically interbedded shale, quartzite and lavas overlain by coarser quartzite and shale. The different formations at the Tshipi Borwa Mine include the Mapedi and Lucknow units. The whole Supergroup has been deformed into a succession with an east-verging dip.

The Olifantshoek Supergroup is overlain by Dwyka Formation which forms the basal part of the Karoo Supergroup. At the Tshipi Borwa Mine this consists of tillite (diamictite) which is covered by sands, claystone and calcrete of the Kalahari Group (SLR, July 2017).

Tshipi is exploiting the manganese from the Hotazel Formation (Transvaal Supergroup). The Hotazel Formation consists of Banded Iron Formation (BIF). The ore is contained within a 30 to 45 metre thick mineralised zone which occurs along the entire Tshipi Borwa Mine and is made up of three manganese rich zones; the Upper Manganese Ore Body (UMO), the Middle Manganese Ore Body (MMO) and the Lower Manganese Ore Body (LMO) (Table 17). The UMO is 10cm to 15cm-thick and comprises moderate deposits of manganese. The poorly mineralised MMO is approximately 1m-thick and not economically efficient. The LMO is a highly mineralised. The ore layer dips gradually to the north-west at approximately five degrees (SLR, July 2017).

Faults and dykes

No significant faults, fractures or other lineaments were observed on site (Metago, May 2009).

Geochemistry analysis – Acid base accounting (ABA)

Acid base accounting (ABA) is undertaken to determine the potential for material to generate acid mine drainage. A total of twenty three samples were analysed to determine if waste rock, ore and tailings are likely to generate acid mine drainage. The results are presented in Table 18 below.

The Acid Base Accounting (ABA) results (Table 18) show that the total sulphur content and more importantly the sulphide sulphur content of all samples are below the laboratory detection limit of <0.01% which suggests the potential to generated acid is negligible for waste rock, ore and tailings. In addition, the neutralising potential ratio (NPR) of all samples is above 2, with some significantly above 2, which implies all lithologies have sufficient neutralising potential to offset the low acid potential. This is interpreted to be due to carbonate minerals, as suggested by the generally high inorganic carbon in the samples and the carbonate-rich geology (calcretes, dolomites, etc.) (SLR, March 2014).

TABLE 18: ACID BASE ACCOUNTING RESULTS FOR THE TSHIPI BORWA MINE (SLR, MARCH 2014)

Sample ID	Lab ID	Lithology	Elevation (mamsl)	Location	Paste pH	Acid Potential (AP) (kg/t)	Neutralization Potential (NP)	Nett Neutralization Potential (NNP)	Neutralising Potential Ratio (NPR) (NP : AP)	NAG pH: (H_2O_2)	NAG (kg H_2SO_4 / t)	Total Sulphur (%)	Sulphate Sulphur as S (%)	Sulphide Sulphur (%)	Total Carbon (%)	Organic Carbon (%)	Inorganic Carbon (%)
SLR-TB-01	**11220**	Braunie Lutite	1021.922	East Side	8	0.313	280	280	897	8.4	<0.01	<0.01	<0.01	<0.01	5.6	0.172	5.428
SLR-TB-02	**11221**	Upper BIF	1020.801	East Side	8.5	0.313	66	66	213	8.3	<0.01	<0.01	<0.01	<0.01	0.86	0.208	0.652
SLR-TB-03	**11222**	Lower BIF	1018.252	East Side	8.4	0.313	13	13	41	8.8	<0.01	<0.01	<0.01	<0.01	0.148	0.13	0.018
SLR-TB-04	**11223**	Lower BIF - red in colour	1018.919	East Side	8.4	0.313	130	130	417	8.5	<0.01	<0.01	<0.01	<0.01	4.09	0.202	3.888
SLR-TB-05	**11224**	VW Ore Zone	1015.028	East Side	8.6	0.313	167	167	535	8.4	<0.01	<0.01	<0.01	<0.01	6.7	0.17	6.53
SLR-TB-06	**11225**	Top Cut Ore	1013.186	East Side	8.8	0.313	146	145	466	8.4	<0.01	<0.01	<0.01	<0.01	6.91	0.118	6.792
SLR-TB-07	**11226**	Lower Ore body	1010.049	East Side	8.5	0.313	122	121	389	8.4	<0.01	<0.01	<0.01	<0.01	7.33	0.231	7.099
SLR-TB-08	**11227**	Pebble bed in calcareous clay	1026.990	North Side	8.3	0.313	4.26	3.95	14	8.2	<0.01	<0.01	<0.01	<0.01	0.07	0.069	0.001
SLR-TB-09	**11228**	Pebble bed in red calcareous clay	1030.217	North Side	8.5	0.313	323	323	1034	8.3	<0.01	<0.01	<0.01	<0.01	7.8	0.258	7.542
SLR-TB-10	**11229**	Red clay	1031.184	North Side	8.2	0.313	51	51	163	8.8	<0.01	<0.01	<0.01	<0.01	3.34	0.257	3.083
SLR-TB-11	**11230**	Lower BIF	1012.341	North Side	8.7	0.313	100	100	322	8.5	<0.01	<0.01	<0.01	<0.01	3.38	0.119	3.261
SLR-TB-12	**11231**	Red clay	1030.098	South Side	8.2	0.313	74	73	236	8.8	<0.01	<0.01	<0.01	<0.01	1.28	0.247	1.033
SLR-TB-13	**11232**	White Clay	1052.157	South Side	8.1	0.313	5	4.69	16	7.7	<0.01	<0.01	<0.01	<0.01	0.335	0.331	0.004
SLR-TB-14	**11233**	White gravel bed	1054.877	South Side	8.6	0.313	5.75	5.43	18	7.8	<0.01	<0.01	<0.01	<0.01	0.278	0.273	0.005
SLR-TB-15	**11234**	Red Iron Calcareous Sand	1066.225	South Side	8.3	0.313	110	109	351	8.5	<0.01	<0.01	<0.01	<0.01	2.5	0.361	2.139
SLR-TB-16	**11235**	Pebbly Calcrete	1067.984	South Side	8.5	0.313	79	79	254	8.4	<0.01	<0.01	<0.01	<0.01	2.01	0.203	1.807
SLR-TB-17	**11236**	Iron rich Ccalcareous Sands	1067.131	South Side	8.4	0.313	106	106	339	8.5	<0.01	<0.01	<0.01	<0.01	2.76	0.272	2.488
SLR-TB-18	**11237**	Pebbly Calcrete	1072.483	South Side	8.5	0.313	106	105	338	8.5	<0.01	<0.01	<0.01	<0.01	5.41	0.275	5.135
SLR-TB-19	**11238**	Red Kalahari Sands	1088.848	East Side	8.1	0.313	2.73	2.41	8.72	7.7	<0.01	<0.01	<0.01	<0.01	0.26	0.255	0.005
SLR-TB-20	**11239**	Calcrete	1081.302	East Side	8.5	0.313	146	146	467	8.5	<0.01	<0.01	<0.01	<0.01	4.48	0.356	4.124
SLR-TB-21	**11240**	Pebbly Calcrete	1075.395	-	8.7	0.313	113	113	361	8.3	<0.01	<0.01	<0.01	<0.01	3.32	0.314	3.006
SLR-TB-22	**11241**	Tailings Sample	-	-	8.4	0.313	101	100	322	8.4	<0.01	<0.01	<0.01	<0.01	11.5	0.203	11.3
SLR-TB-23	**11242**	Dolomite	998.00	-	8.7	0.313	115	114	367	8.4	<0.01	<0.01	<0.01	<0.01	11.48	0.148	11.33

Geochemistry analysis – leachate

Synthetic Precipitation Leaching Procedure (SPLP) was used to determine the potential drainage quality from the sampled lithologies at the Tshipi Borwa Mine at neutral (pH7) drainage conditions. In this regard, a total of twenty three samples were analysed. The results are provided in Table 19 below. The results indicated that a number of metals are leachable at concentrations in excess of relevant water quality standards for waste rock, ore and tailing. These include:

- aluminium (Al) in terms of the SANS 241 (2105) Operational standards for waste rock;
- iron (Fe) in terms of the SANS 241 (2015) Aesthetic standards for ore;
- manganese (Mn) in terms of the SANS 241 (2015) Aesthetic standards for ore and waste rock; and
- electrical conductivity in terms of SANS 241 (2015) Aesthetic for tailings.

TABLE 19: LEACHATE RESULTS FOR SAMPLES COLLECTED AT THE TSHIPI BORWA MINE (SLR, MARCH 2014)

Lithology	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
SANS 241 (2015) Operational	**N/A**	**0.3**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
SANS 241 (2015) Aesthetic	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0.3**	**N/A**	**N/A**	**N/A**	**0.1**	**N/A**	**200**	**N/A**
SANS 241 (2015) Acute Heath	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
SANS 241 (2015) Chronic Health	**N/A**	**N/A**	**0.01**	**2.4**	**0.7**	**N/A**	**N/A**	**N/A**	**0.003**	**0.5**	**0.05**	**2**	**2**	**N/A**	**N/A**	**N/A**	**0.4**	**N/A**	**N/A**	**0.07**
Braunie Lutite	<0.025	<0.100	<0.010	0.04	<0.025	<0.025	<0.025	14	0.005	<0.025	<0.025	<0.025	<0.025	1.1	<0.025	10	<0.025	<0.025	13	<0.025
Upper BIF	<0.025	<0.100	0.01	<0.025	<0.025	<0.025	<0.025	12	0.005	<0.025	<0.025	<0.025	0.031	<1.0	<0.025	6	<0.025	<0.025	3	<0.025
Lower BIF	<0.025	<0.100	<0.010	0.06	0.072	<0.025	<0.025	10	0.005	<0.025	<0.025	<0.025	0.478	<1.0	<0.025	<2	0.128	<0.025	3	<0.025
Lower BIF - red in colour	<0.025	<0.100	<0.010	<0.025	<0.025	<0.025	<0.025	14	0.005	<0.025	<0.025	<0.025	<0.025	<1.0	<0.025	7	<0.025	<0.025	9	<0.025
VW Ore Zone	<0.025	<0.100	<0.010	0.087	0.079	<0.025	<0.025	9	0.005	<0.025	<0.025	<0.025	<0.025	<1.0	<0.025	6	<0.025	<0.025	7	<0.025
Top Cut Ore	<0.025	<0.100	<0.010	0.05	<0.025	<0.025	<0.025	9	0.005	<0.025	<0.025	<0.025	<0.025	<1.0	<0.025	8	0.119	<0.025	<2	<0.025
Lower Ore body	<0.025	<0.100	<0.010	0.102	<0.025	<0.025	<0.025	10	0.005	<0.025	<0.025	<0.025	<0.025	<1.0	<0.025	8	0.09	<0.025	3	<0.025
Pebble bed in calcareous clay	<0.025	<0.100	<0.010	0.082	0.105	<0.025	<0.025	6	0.005	<0.025	<0.025	<0.025	<0.025	1.3	<0.025	4	<0.025	<0.025	10	<0.025
Pebble bed in red calcareous clay	<0.025	<0.100	<0.010	0.074	0.139	<0.025	<0.025	13	0.005	<0.025	<0.025	<0.025	<0.025	1	<0.025	6	<0.025	<0.025	8	<0.025
Red clay	<0.025	<0.100	0.019	0.12	0.134	<0.025	<0.025	10	0.005	<0.025	<0.025	<0.025	<0.025	1.4	<0.025	6	<0.025	<0.025	14	<0.025
Lower BIF	<0.025	<0.100	0.023	0.074	0.096	<0.025	<0.025	10	0.005	<0.025	<0.025	<0.025	<0.025	<1.0	<0.025	8	<0.025	<0.025	2	<0.025
Red clay	<0.025	<0.100	<0.010	0.073	<0.025	<0.025	<0.025	11	0.005	<0.025	<0.025	<0.025	0.041	1.3	<0.025	6	<0.025	<0.025	12	<0.025
White Clay	<0.025	<0.100	<0.010	<0.025	<0.025	<0.025	<0.025	5	0.005	<0.025	<0.025	<0.025	0.045	1.8	<0.025	3	<0.025	<0.025	9	<0.025
White gravel bed	<0.025	<0.100	<0.010	0.064	0.173	<0.025	<0.025	7	0.005	<0.025	<0.025	<0.025	0.037	1.3	<0.025	4	<0.025	<0.025	7	<0.025
Red Iron Calcareous Sand	<0.025	<0.100	<0.010	<0.025	<0.025	<0.025	<0.025	11	0.005	<0.025	<0.025	<0.025	0.038	1.6	<0.025	6	<0.025	<0.025	9	<0.025
Pebbly Calcrete	<0.025	<0.100	<0.010	<0.025	0.042	<0.025	<0.025	12	0.005	<0.025	<0.025	<0.025	0.069	1.8	<0.025	7	<0.025	<0.025	9	<0.025
Iron rich Calcareous Sands	<0.025	<0.100	0.013	0.146	1.21	<0.025	<0.025	12	0.005	<0.025	<0.025	<0.025	<0.025	1.4	<0.025	6	<0.025	<0.025	14	<0.025
Pebbly Calcrete	<0.025	<0.100	0.012	0.107	1.06	<0.025	<0.025	11	0.005	<0.025	<0.025	<0.025	<0.025	1.3	<0.025	7	<0.025	<0.025	13	<0.025
Red Kalahari Sands	<0.025	1.72	0.022	0.053	0.027	<0.025	<0.025	5	0.005	<0.025	<0.025	<0.025	1.51	4.1	<0.025	3	<0.025	<0.025	2	<0.025
Calcrete	<0.025	<0.100	<0.010	<0.025	<0.025	<0.025	<0.025	14	0.005	<0.025	<0.025	<0.025	<0.025	3	<0.025	8	<0.025	<0.025	42	<0.025
Pebbly Calcrete	<0.025	0.147	<0.010	<0.025	0.028	<0.025	<0.025	10	0.005	<0.025	<0.025	<0.025	0.196	1.9	<0.025	5	<0.025	<0.025	19	<0.025
Tailings Sample	<0.025	<0.100	<0.010	0.126	<0.025	<0.025	<0.025	21	0.005	<0.025	<0.025	<0.025	<0.025	1.1	<0.025	14	<0.025	<0.025	10	<0.025
Dolomite	<0.025	<0.100	0.014	0.129	1.07	<0.025	<0.025	10	0.005	<0.025	<0.025	<0.025	<0.025	<1.0	<0.025	17	<0.025	<0.025	4	<0.025

Lithology	P	Pb	Sb	Se	Si	Sn	Sr	Ti	V	W	Zn	Zr	pH Value at 25˚C	Electrical Conductivity	Alkalinity as $CaCO_3$	Chloride as Cl	Sulphate as SO_4	Nitrate as N	Fluoride as F
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	pH Value	mS/m	mg/l	mg/l	mg/l	mg/l	mg/l
SANS 241 (2015) Operational	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**5 - 9.7**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
SANS 241 (2015) Aesthetic	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**5**	**N/A**	**N/A**	**170**	**N/A**	**300**	**250**	**N/A**	**N/A**
SANS 241 (2015) Acute Heath	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**500**	**11**	**N/A**
SANS 241 (2015) Chronic Health	**N/A**	**0.01**	**0.02**	**0.04**	**N/A**	**N/A**	**N/A**	**N/A**	**0.2**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**1.5**
Braunie Lutite	<0.025	0.02	<0.010	<0.020	6	<0.025	0.029	<0.025	<0.025	<0.025	<0.025	<0.025	10.1	21.1	12	12	7	2	0.3
Upper BIF	<0.025	0.02	<0.010	<0.020	17.2	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	8	11.7	16	<5	<5	<0.2	0.2
Lower BIF	<0.025	0.02	<0.010	<0.020	15.4	<0.025	<0.025	<0.025	<0.025	<0.025	0.098	<0.025	7.9	7.7	12	<5	<5	<0.2	0.2
Lower BIF - red in colour	<0.025	0.02	<0.010	<0.020	6.6	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	8.1	17.1	20	<5	5	1	0.3
VW Ore Zone	<0.025	0.02	<0.010	<0.020	3.1	<0.025	<0.025	<0.025	<0.025	<0.025	0.07	<0.025	8.1	12.7	60	<5	<5	0.3	0.5
Top Cut Ore	<0.025	0.02	<0.010	<0.020	<0.2	<0.025	0.026	<0.025	<0.025	<0.025	<0.025	<0.025	8.2	11.8	64	<5	<5	<0.2	0.2
Lower Ore body	<0.025	0.02	<0.010	<0.020	<0.2	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	8.1	12.5	60	<5	<5	<0.2	0.2
Pebble bed in calcareous clay	<0.025	0.02	<0.010	<0.020	4.7	<0.025	0.042	<0.025	<0.025	<0.025	0.102	<0.025	7.9	11.7	52	<5	<5	<0.2	0.5
Pebble bed in red calcareous clay	<0.025	0.02	<0.010	<0.020	3.6	<0.025	0.06	<0.025	<0.025	<0.025	0.06	<0.025	8.4	14.7	64	<5	<5	0.3	0.5
Red clay	0.072	0.02	<0.010	<0.020	1.3	<0.025	0.065	<0.025	<0.025	<0.025	0.061	<0.025	8.2	16.8	80	<5	6	0.4	0.7
Lower BIF	0.124	0.02	<0.010	<0.020	0.7	<0.025	0.026	<0.025	<0.025	<0.025	0.041	<0.025	8.5	13.6	56	<5	<5	<0.2	0.7
Red clay	<0.025	0.02	<0.010	<0.020	0.7	<0.025	0.061	<0.025	<0.025	<0.025	<0.025	<0.025	8.1	16.7	68	<5	6	0.5	0.9
White Clay	<0.025	0.02	<0.010	<0.020	10.8	<0.025	0.027	<0.025	0.027	<0.025	<0.025	<0.025	7.8	10.9	32	<5	6	1.6	0.8
White gravel bed	<0.025	0.02	<0.010	<0.020	9	<0.025	0.049	0.042	<0.025	<0.025	0.116	<0.025	7.8	11	52	<5	5	1.2	0.3
Red Iron Calcareous Sand	<0.025	0.02	<0.010	<0.020	19.2	<0.025	0.062	<0.025	0.029	<0.025	<0.025	<0.025	9	15.1	64	<5	<5	2.4	0.5
Pebbly Calcrete	<0.025	0.02	<0.010	<0.020	13.9	<0.025	0.076	<0.025	<0.025	<0.025	<0.025	<0.025	8	12.7	68	5	<5	3.4	0.5
Iron rich Calcareous Sands	<0.025	0.02	<0.010	<0.020	19.9	<0.025	0.083	<0.025	<0.025	<0.025	0.211	<0.025	8.2	15.8	72	<5	<5	2.1	0.6
Pebbly Calcrete	<0.025	0.02	<0.010	<0.020	14.8	<0.025	0.081	<0.025	<0.025	<0.025	0.127	<0.025	8.2	16.3	68	<5	<5	2.8	0.5
Red Kalahari Sands	0.207	0.02	<0.010	<0.020	21	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	7.7	6.5	40	<5	11	0.5	0.2
Calcrete	<0.025	0.02	<0.010	<0.020	12.4	<0.025	0.08	<0.025	<0.025	<0.025	<0.025	<0.025	8.1	24.9	60	26	26	18	0.4
Pebbly Calcrete	<0.025	0.02	<0.010	<0.020	11.3	<0.025	0.049	<0.025	<0.025	<0.025	<0.025	<0.025	8.2	24.9	68	6	<5	5.6	0.4
Tailings Sample	<0.025	0.02	<0.010	<0.020	4.1	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	8.3	172	92	<5	33	2	0.4
Dolomite	<0.025	0.02	<0.010	<0.020	<0.2	<0.025	0.03	<0.025	<0.025	<0.025	0.039	<0.025	8.9	0.7	96	<5	<5	<0.2	0.4

CONCLUSION

Where mineralized waste is produced by a project, there is the possibility that sterilization can occur depending on the project design and placement of infrastructure. Geochemical tests and analysis indicate that there is a limited possibility for waste rock dump and tailings dam to generate acid. There is a potential for leachate to exceed the SANS guidelines for various parameters for waste rock, ore and tailings. This presents a potential pollution risk for both surface and groundwater in the both the short and long term. It follows that short and long term pollution prevention measures must be considered.

6.4.1.2 Topography

INTRODUCTION AND LINK TO IMPACT

Changes to topography through the development of the mine may impact on surface water drainage (Section 6.4.1.7), visual aspects (Section 6.4.1.11) and the safety of both third parties and animals. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from site visits undertaken by the project team and topographical data.

RESULTS

In general the area surrounding the Tshipi Borwa Mine is relatively flat with a gentle slope towards the North West. The elevation varies from 1087 m to 1107 m above mean sea level (mamsl). The Vlermuisleegte River is located approximately 2 km west from the Tshipi Borwa Mine boundary. The natural topography of the area surrounding the Tshipi Borwa Mine has been influenced through the presence of isolated farmsteads and mining activities such as the Mamatwan Mine, the old Middelplaats Mine and the United Manganese of Kalahari Mine (see section 6.4.2 for further information). The highest topographical features near the Tshipi Borwa Mine are the Mamatwan waste rock dumps located adjacent to the eastern boundary of the Tshipi Borwa Mine (Figure 2).

The majority of the natural topography at the Tshipi Borwa Mine has been disturbed as a result of the existing mining infrastructure and activities. The topography of the undisturbed areas at the Tshipi Borwa Mine are relatively flat with a gentle North West slope towards the Vlermuisleegte River (Figure 2).

CONCLUSION

While the topography has already been altered by infrastructural changes that have already taken place, the establishment of additional facilities and activities has the potential to alter the topography and the natural state of undisturbed areas. In the absence of security and access control measures an alteration of the natural topography has the potential to present dangers to both animals and third parties. Changes to the surface infrastructure layout should be such that any changes to topography result in stable topographical features, which do not pose significant risk to third parties and animals and limit impacts on the visual character of the area.

6.4.1.3 Climate

INTRODUCTION AND LINK TO IMPACT

Climate can influence the potential for environmental impacts and related mine design. Specific issues include:

- rainfall could influence erosion, evaporation, vegetation growth, rehabilitation planning, dust suppression, and surface water management planning;
- temperature could influence air dispersion through impacts on atmospheric stability and mixing layers, vegetation growth, and evaporation which could influence rehabilitation planning; and
- wind could influence erosion, the dispersion of potential atmospheric pollutants, and rehabilitation planning.

To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the review of the approved EMPr (Metago, May 2009), the review of available literature undertaken for nearby mining operations (Airshed, September 2015) and the updated stormwater management plan undertaken for the project (SLR, June 2017) included in Appendix L.

Monthly average rainfall was estimated from 67 year daily rainfall record from Milner weather station (Figure 2), located 7km east of the Tshipi Borwa Mine. Evaporation data was obtained from the Water Resources (WR) of South Africa 2005 Study. Monthly S-pan evaporation data was obtained from the WR of South Africa manual and converted to open water evaporation. Rainfall depth frequency data was obtained from the design rainfall software (SLR, June 2017).

Monthly temperature and wind data was sourced from the Mesoscale Model 5 (2011 to 2013) (Airshed, September 2015).

RESULTS

Regional climate

The mine falls within the Northern Steppe Climatic Zone, as defined by the South African Weather Bureau (Metago, May 2009). This is a semi-arid region characterised by seasonal rainfall, hot temperatures in summer, and colder temperatures in winter (SLR, June 2017).

Rainfall, rainfall depths and evaporation

Monthly rainfall and evaporation data for the Milner weather station is summarised in Table 20 below (SLR, June 2017). Rainfall depth frequency data is summarised in Table 21 below.

With reference to Table 20 below, the average rainfall at the Milner weather station is 372 mm per annum. Given that the Milner weather station is only 7 km from the mine site, similar rainfall levels can be expected at the mine. With reference to Table 20 the average evaporation rates recorded at the Milner weather station are 2351 mm per annum for S-Pan and 1972 mm per annum for open water.

TABLE 20: SUMMARY OF AVERAGE MONTHLY AND ANNUAL RAINFALL AND EVAPORATION DATA (SLR, JUNE 2017)

Month	Rainfall (mm)	WR2005	WR2005
	Milner (393083 W)	S-Pan Evaporation	Open Water Evaporation
January	59.8	276.9	232.6
February	63.0	209.9	184.8
March	72.3	193.3	170.1
April	39.9	144.1	126.8
May	19.2	114.7	99.8
June	9.1	91.0	77.3
July	1.3	106.0	88.0
August	5.4	153.8	124.5
September	6.4	213.0	172.5
October	19.2	269.7	218.4
November	31.5	248.0	232.9
December	44.5	294.6	244.5
Annual	**372.0**	**2351.0**	**1972.0**

TABLE 21: RAINFALL DEPTH FREQUENCY (SLR, JUNE 2017)

Storm Duration (m/h/d)	Return Period (years)						
	2	5	10	20	50	100	200
15 m	15.0	21.3	25.7	30.2	36.3	41.2	46.2
30 m	19.8	28.1	34.0	40.0	48.0	54.4	61.1
45 m	23.3	33.1	40.1	47.1	56.6	64.1	71.9
1 hr	26.1	37.2	45.0	52.8	63.5	72.0	80.7
1.5 hr	30.8	43.8	53.0	62.2	74.8	84.7	95.1
2 hr	34.6	49.2	59.5	69.9	84.0	95.2	106.8
4 hr	40.0	56.9	68.8	80.7	97.0	110.0	123.4
6 hr	43.5	61.9	74.9	87.9	105.6	119.7	134.3
8 hr	46.2	65.7	79.5	93.3	112.1	127.1	142.6
10 hr	48.4	68.8	83.3	97.8	117.5	133.1	149.4
12 hr	50.3	71.5	86.5	101.5	122.0	138.3	155.2
16 hr	53.4	75.9	91.9	107.8	129.6	146.9	164.8
20 hr	55.9	79.6	96.2	113.0	135.8	153.9	172.6
24 hr	58.1	82.6	100.0	117.3	141.0	159.8	179.3
1 d	46.7	66.5	80.5	94.5	113.5	128.6	144.3
2 d	56.8	80.8	97.7	114.7	137.9	156.2	175.3
3 d	63.6	90.5	109.5	128.5	154.4	175.0	196.3
4 d	68.2	97.1	117.4	137.8	165.7	187.7	210.6

Storm Duration (m/h/d)	Return Period (years)						
	2	5	10	20	50	100	200
5 d	72.0	102.5	124.0	145.5	174.9	198.2	222.4
6 d	75.3	107.2	129.6	152.1	182.9	207.2	232.5
7 d	78.2	111.3	134.6	158.0	189.9	215.1	241.4

Temperature

Monthly mean, maximum and minimum temperatures for the project area are provided in Table 22 below. Temperatures range between -0.6 °C and 35 °C. During the day, temperatures increase to reach a maximum at around 15:00 in the afternoon. Ambient air temperature decreases to reach a minimum at around 06:00 just before sunrise (Airshed, September 2015).

TABLE 22: MONTHLY TEMPERATURE DATA (AIRSHED, SEPTEMBER 2015)

Months	Minimum	Maximum	Average
January	15.3	35.0	26.4
February	14.1	34.1	25.8
March	10.1	32.5	24.5
April	4.4	29.9	18.7
May	2.4	26.9	15.4
June	-0.6	22.3	10.8
July	1.0	21.7	11.4
August	0.4	28.3	13.1
September	2.1	27.8	16.8
October	6.7	32.3	20.5
November	8.8	34.7	23.3
December	11.9	35.0	25.2

Wind

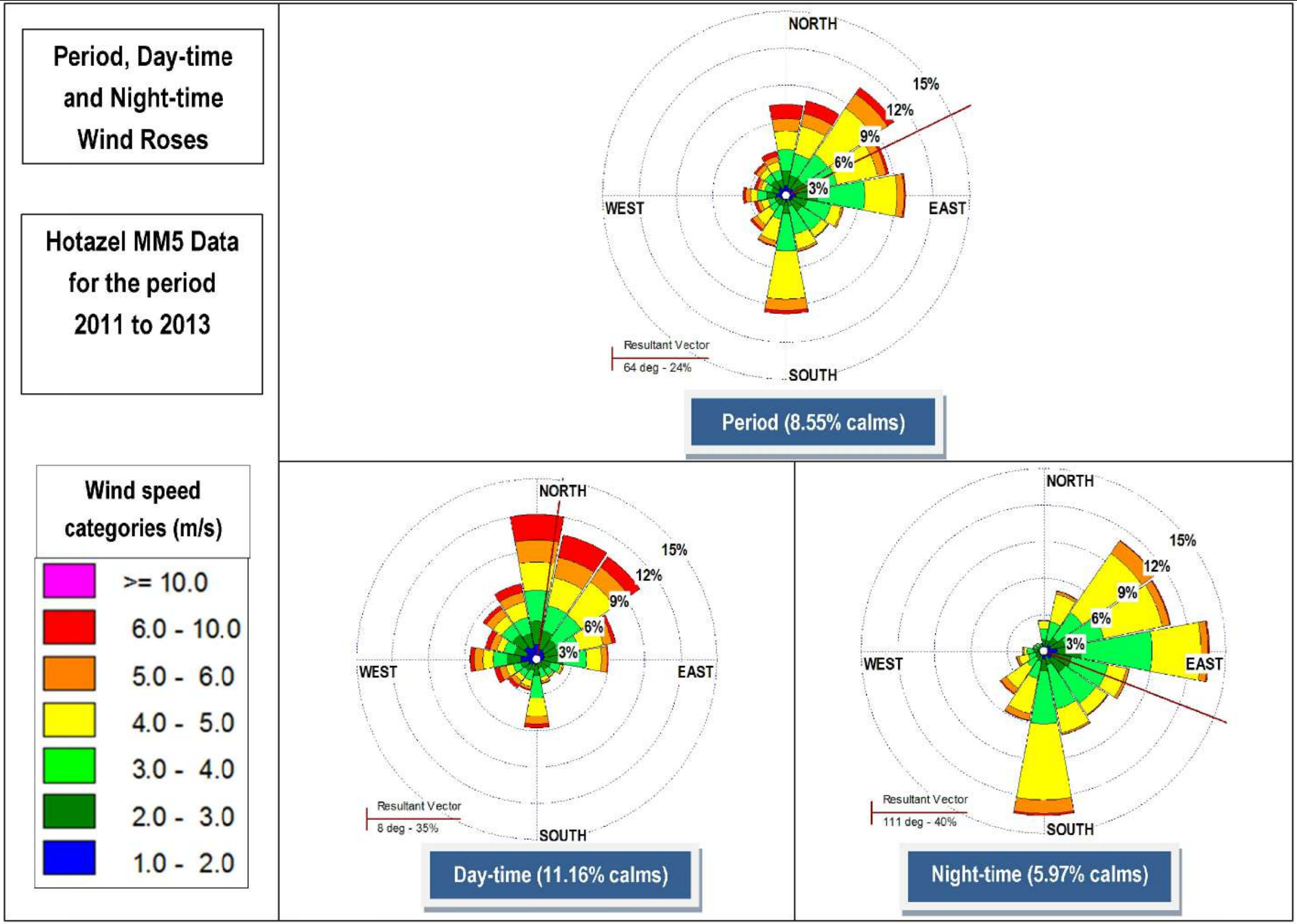
Wind roses comprise 16 spokes which represent the directions from which winds blew during the period. The colours reflected the different categories of wind speeds, the orange area, for example, representing winds of 5 m/s to 6 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. The frequency, at which calms occurred, i.e. periods during which the wind speed was below 1 m/s, is also indicated.

The average annual, day time and night time wind roses are shown in Figure 16, while the seasonal variations are shown in Figure 17. Wind direction within the mining area is dominated by winds from the north, northeast and east, with an average wind speed of 3.4 m/s. The strongest winds (more than 6 m/s) are from the east and northeast and occurred mostly during the day (06:00 to 18:00). On average calm conditions occurred 8.55 % of the time. A distinct increase in winds from the south occurred at night (18:00 to 06:00).

Wind direction and speed at the Tshipi Borwa Mine shows considerable differences between the seasons. During summer, autumn and winter the dominant winds are from the east, northeast and south, while in spring, the southerly winds dominate (Airshed, September 2015).

CONCLUSION

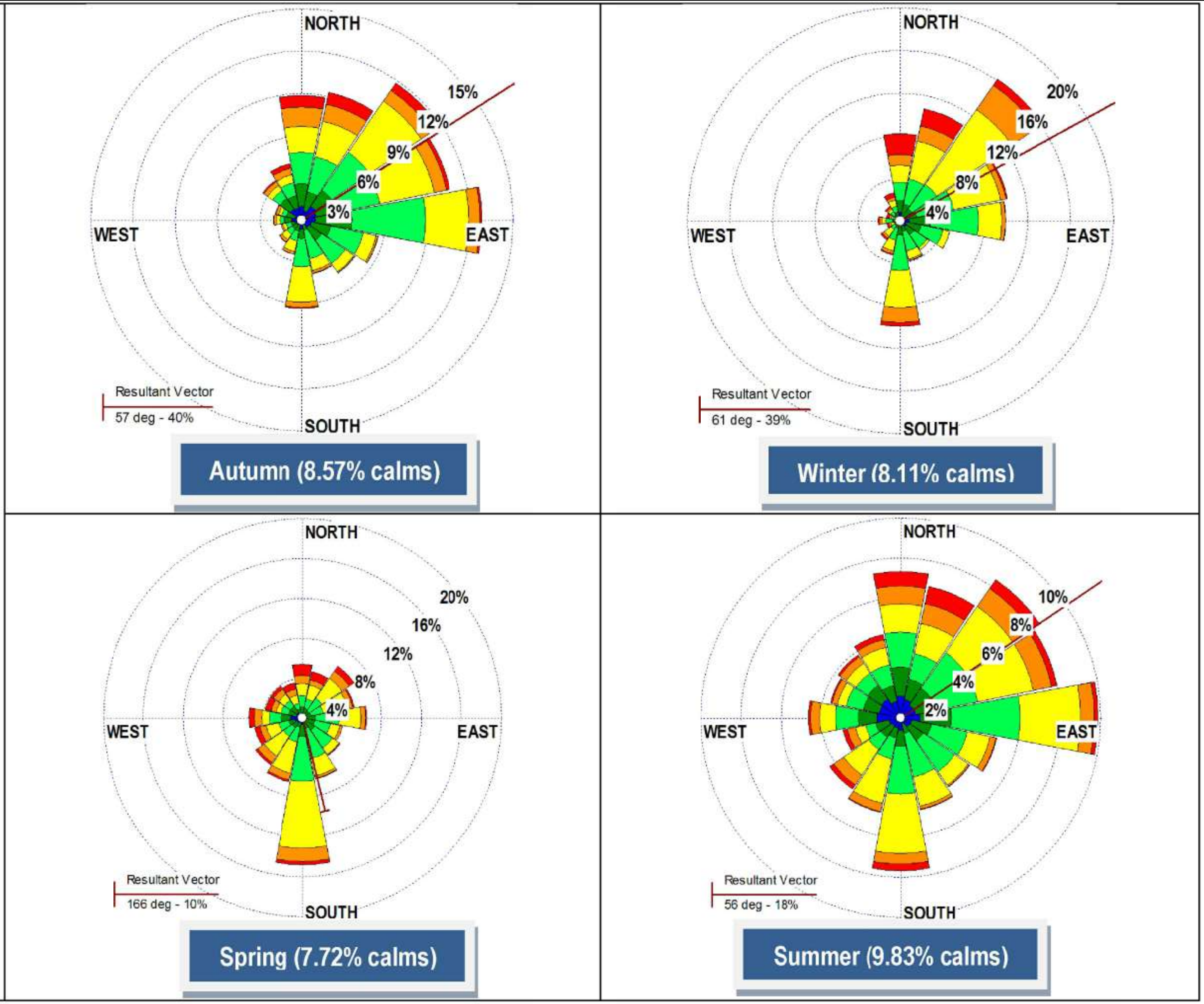
The Tshipi Borwa Mine is characterised by hot summers and cool winters with rain generally occurring in the form of thunderstorms that last for short periods at a time during rainy periods. High evaporation rates reduce infiltration, while rainfall events can increase the erosion potential and the formation of erosion gullies. The presence of vegetation does however reduce the effects of erosion. The mixing of layers resulting in the formation of temperature inversions, and the presence of cloud cover limits the dispersion of pollutants into the atmosphere. Wind significantly affects the amount of material that is suspended from exposed surface to the atmosphere. The wind speed determines the distance of downward transport as well as the rate of dilution of pollutants in the atmosphere. Although wind speeds above 5.3m/s can occur, the data shows that on average they are below this value and therefore not able to carry dust particles. These climatic aspects need to be taken into consideration during operations, rehabilitation and surface water management planning.



PERIOD WIND FIELD AND DIURNAL VARIABILITY IN THE WIND ROSES (AIRSHED, September 2015)	06/2017	FIGURE 16
	710.20029.00008	

Seasonal Wind Roses

Hotazel MM5 Data for the period 2011 to 2013



Wind speed categories (m/s)

- >= 10.0
- 6.0 - 10.0
- 5.0 - 6.0
- 4.0 - 5.0
- 3.0 - 4.0
- 2.0 - 3.0
- 1.0 - 2.0

SEASONAL WIND ROSES (AIRSHED, September 2015)	06/2017	FIGURE 17
	710.20029.00008	

6.4.1.4 Soil

INTRODUCTION AND LINK TO IMPACT

Soils are a significant component of most ecosystems. As an ecological driver, soil is the medium in which most vegetation grows and a range of vertebrates and invertebrates exist. In the context of mining operations, soil is even more significant if one considers that mining is a temporary land use where after rehabilitation (using soil) is the key to re-establishing post closure land capability that will support post closure land uses.

Mining projects have the potential to damage soil resources through physical loss of soil and/or the contamination of soils, thereby impacting on the soils' ability to sustain natural vegetation and altering land capability. Contamination of soils may in turn contribute to the contamination of surface and groundwater resources. Loss of the topsoil resource reduces chances of successful rehabilitation and restoration. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the soil study undertaken by ARC (ARC, October 2008) as part of the approved EMPr (Metago, May 2009). As part of the project, the specialist confirmed that the results of the soil study undertaken in October 2008 are still relevant. The soil study undertaken as part of the approved EMPr (Metago, May 2009) and the specialist opinion (PGS, July 2017) is included in Appendix J.

Soil information sourced through the review of available literature as well as studies undertaken near the Tshipi Borwa Mine (ARC, October 2008).

RESULTS

Soil forms

The soil study (ARC, October 2008) undertaken for the approved EMPr (Metago, May 2009) indicated that the soil form associated with the Tshipi Borwa Mine is Hutton. The Hutton soil form comprises the following characteristics:

- a homogeneous texture, structure, and soil depth;
- a reddish brown apedal sandy topsoil on yellowish red apedal sandy subsoil;
- a low clay content; and
- it consists of deep (>1.5m) windblown sand and therefore drains rapidly.

Soil chemical characteristics

The cation exchange capacity (CEC) values are low, due to the low clay content of the soil. The Hutton soil form is generally slightly acidic to mildly alkaline with low fertility levels due to a deficiency of key nutrients such as phosphorus (P) (ARC, October 2008).

<u>Soil Physical Characteristics</u>

Dry land agriculture potential

The Hutton soil form located at the Tshipi Borwa Mine has a low agricultural potential due to the rapid drainage nature of the soil and lack of soil fertility. In addition to this the hot, dry nature of the climatic regime, is not suited to dryland arable agriculture (ARC, October 2008).

Irrigation potential

The soils would have a moderate potential for irrigation, due to the very low clay content (ARC, October 2008).

CONCLUSION

The Hutton soil form found at the Tshipi Borwa Mine is homogeneous in terms of texture, structure, and soil depth. This soil form is a well-drained sandy soil which allows for high infiltration rates and low organic content. These soils are therefore highly erodible. The rapid drainage nature of the Hutton soil form reduces the dry production potential as well as the irrigation potential. The soil fertility is low due to a deficiency in key nutrients such as phosphorus. In general the soil forms located at the Tshipi Borwa Mine are difficult to work and have a limited utilization potential.

Soil resources have already been influenced through the presence of approved infrastructure and activities at the Tshipi Borwa Mine. The establishment of additional facilities and activities has the potential to contribute to additional sources of soil pollutants and increase the disturbance footprint.

Taking the above into consideration soils located at the Tshipi Borwa Mine will require appropriate management actions to prevent the loss of soil resources through pollution and erosion as soil resources form a crucial role during rehabilitation.

6.4.1.5 Land capability

INTRODUCTION AND LINK TO IMPACT

The land capability classification is based on the soil properties and related potential to support various land use activities. Mining projects have the potential to significantly transform the land capability. To understand the basis of this potential impact, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the soil study undertaken by ARC (ARC, October 2008) as part of the approved EMPr (Metago, May 2009). As part of the project, the specialist confirmed that the results of the soil study undertaken in October 2008 are still relevant. The soil study undertaken as part of the approved EMPr (Metago, May 2009) and the specialist opinion is included in Appendix J.

Land capability was assessed in terms of arable land, grazing land, wilderness land and wetlands, as defined by the MEM Guideline for planning and authorisation (Department of Minerals and Energy, 2000) (ARC, October 2008).

RESULTS

The land capability at the Tshipi Borwa Mine is considered to be of low agricultural potential due to the low clay content of the soils and the low rainfall. Given this, the land capability at the Tshipi Borwa Mine is classified as having a grazing potential (ARC, October 2008).

CONCLUSION

The land capability at the Tshipi Borwa Mine is classified as having a grazing potential. The land capability at the Tshipi Borwa Mine has changed due to the presence of approved infrastructure and activities. The establishment of additional surface infrastructure have the potential to influence the land capability of undisturbed areas. Therefore, impact management and rehabilitation planning is required to achieve acceptable post rehabilitation land capabilities.

6.4.1.6 Biodiversity

INTRODUCTION AND LINK TO IMPACT

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

- soil formation and fertility maintenance;
- primary production through photosynthesis, as the supportive foundation for all life;
- provision of food and fuel;
- provision of shelter and building materials;
- regulation of water flows and water quality;
- regulation and purification of atmospheric gases;
- moderation of climate and weather;
- control of pests and diseases; and
- maintenance of genetic resources.

The establishment of infrastructure as well as certain supportive activities have the potential to result in the loss of vegetation, habitat and related ecosystem functionality through physical disturbance and/or contamination of soil and/or water resources.

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

DATA SOURCE

Information in this section was sourced from the biodiversity study conducted by Ecological Management Services (EMS) (EMS, November 2008) as part of the approved EMPr (Metago, May 2009). Information was also sourced from the updated biodiversity study undertaken for the project (EMS, February 2017) and included in Appendix K.

<u>Flora</u>

Desktop vegetation type information and the associated conservational status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006). Information on plant and animal species recorded for the Quarter Degree Squares (QDS), was extracted from the SABIF/SIBIS database hosted by SANBI. Numerous national and provincial databases were utilised to determine the conservational sensitivity of the Tshipi Borwa Mine. These databases included:

- the IUCN database based on the Threatened Species Programme, Red List of South African Plants (2011);

- the NEM:BA list of threatened ecosystems (SANBI 2008);
- the freshwater and wetland information was extracted from the NFEPA;
- important catchments and protected areas expansion areas in terms of the NPAES;
- the Mining and Biodiversity Guidelines (2012);
- the Griqualand West Centre of Endemism;
- the SANBI critical biodiversity areas (CBAs); and
- Important Bird Areas (IBA's)

Fieldwork was undertaken in 2008 (EMS, November 2008). Aerial photographical satellite images were used to identify homogenous vegetation/habitat units at the Tshipi Borwa Mine. These were then sampled on the ground in order to characterise the species composition. Quantitative data was collected such as species composition, vegetation height, presence of biotic disturbances, e.g. grazing, animal burrows, etc. Additional checklists of plant species were compiled by traversing a linear route and recording species as they were encountered.

Fauna

Desktop information was sourced from the review of existing literature and various databases (SANBI's SIBIS and BGIS databases) in order to identify a list of mammals, reptiles and amphibians likely to occur at the Tshipi Borwa Mine. Information from the SABAP 1 and SABAP 2 database and the Birdlife South Africa's Important Bird Areas was utilised to identify any threatened species likely to occur at the Tshipi Borwa Mine. The conservational status of species likely to occur at the Tshipi Borwa Mine was determined using the IUCN Red List database.

Fieldwork was undertaken in 2008 (EMS, November 2008). The habitats on-site were assessed to compare with habitat requirements of red data species determined during the original literature survey. During the site visit for the original report the presence and identification of bird and mammal species was determined using the various techniques such as identification by visual observation, spoor and faeces, bird and mammal calls and presence of burrows and / or nests.

Site sensitivity

EMS conducted a site sensitivity analysis using a combination of criteria as follows:

TABLE 23: SITE SENSITIVITY ANALYSIS CRITERIA (EMS, FEBRUARY 2017)

	Criterion	**Definition**
1	Conservation status of untransformed habitats occurring in the Tshipi Borwa Mine	The extent of each vegetation type occurring within the Tshipi Borwa Mine that is conserved and/or transformed relative to a targeted amount required for conservation
2	Presence and number of Red Data species and other species of special concern	Presence or potential presence of Red Data species within habitats

	Criterion	Definition
3	Within-habitat species richness of flora and the between-habitat (beta) diversity of the site	Presence or potential presence of Red Data Species within habitats.
4	The type or nature of topography of the site, i.e. presence of ridges koppies etc.	Steepness and/or nature of topography in the Tshipi Borwa Mine.
5	The type and nature of important ecological processes on site, especially hydrological processes, i.e. wetlands drainage patterns etc.	Habitats and/or terrain features that represent ecological processes such as water-flow migration routes etc.

RESULTS - FLORA

Vegetation types

The Tshipi Borwa Mine falls within the Kathu Bushveld, which is described as an open savannah with the Camel Thorn (*Vachellia erioloba)* (formerly known as *Acacia erioloba*) and Shepard's Tree, (*Boscia albitrunca)* as the prominent trees. The shrub layer contains the Grey Camel Thorn (*Vachellia haematoxylon)* (formerly known as *Acacia haematoxylon*), Black thorn (*Senegalia mellifera)* (formerly known as *Acacia mellifera*), Blue bush (*Diospyros lycioides*) and River Honey-thorn (*Lycium hirsutum)*. The grass layer is vary variable.

The Tshipi Borwa Mine area consists of three vegetation types, namely the Mixed *Vachellia* Savannah, the *Vachellia haematoxylon* Savannah and the *Grewia* Flava Scrub. For a distribution of these vegetation types within the mine area, refer to Figure 18. Further information on the various vegetation types at the Tshipi Borwa Mine is provided in Table 24 below.

TABLE 24: DESCRIPTION OF VEGETATION TYPES (EMS, FEBRUARY 2017)

Vegetation type	Description
Mixed *Vachellia* Savannah	This vegetation type is characterised by the height of the tree layer which is mainly comprised of tall Camel Thorns (*Vachellia erioloba)* trees. Three vegetation strata are evident within this vegetation unit. There is a prominent tree layer between 2.5m – 6m, a shrub layer, between 1.5m – 2.5m and a grass layer with an average height of 70cm. Camel Thorns (*Vachellia erioloba),* Grey Camel Thorns (*Vachellia haematoxylon),* and Candle-pod Thorn (*Vachellia hebeclada)*, are prominent within this vegetation type, however Buffalo Thorn (*Ziziphus murconata),* Brandybush *(Grewia flava)* and Black Thorn (*Vachellia mellifera)* also occur. The grass layer contains species such as Lehmanns lovegrass (*Eragrostis lehmanniana)*, Beesgrass (*Stipagrostis uniplumis),* Bushman grass *(Schmidtia kalihariensis),* Single Grass *(Aristida stipitata)* and Cats-Tail Three-Awned Grass (*Aristida congesta)* are common. Other common species include Besembossie (*Gnidia polycephala),* Dubbeltjie *(Tribulus zeyheri),* Bitterbos (*Chrysocoma ciliate)* and *Walafrida geniculate.* Within this vegetation type there are areas that contain a significantly higher percentage of Camel Thorn (*Vachellia erioloba)* trees. These areas form distinctive patches but have not been mapped as a separate vegetation unit as they cover relatively small areas and do not show a significantly different floristic composition
Vachellia haemoatoxylon Savannah	This community has a moderate grass cover (50-60%), the shrub layer is moderately developed. Grey Camel Thorn (*Vachellia haematoxlyon)* is the dominant shrub species. The tree layer is poorly developed with individuals of Camel Thorn (*Vachellia erioloba)* occurring within the community. Common grass species include, Blougras (*Schmidtia pappophoroides)* (dominant), Lehmanns love grass (*Eragrostis*

Vegetation type	Description
	lehmanniana), Finessa grass (*Eragrostis micrantha)*, Silky bushmans grass *(Stipagrostis uniplumis)*, Long-awned Three awn (*Aristida congesta)* and Single Grass (*Aristida stipitata)*. Other common species within this vegetation type include, Gemsbok cucumber (*Acanthosicyos naudiniana),* Large-flowered devil-thorns *(Tribulus zeyheri),* Besembossie *(Gnidia polycephala), Helichrysum argyrosphaerum* and *Monochema incanum*.
Grewia Flava Scrub	This vegetation type is characterised by a high percentage occurrence of Brandybush (*Grewia flava)*. This vegetation type is characteristically shorter although scattered individuals of taller trees do occur. Grey Camel Thorn (*Vachellia haematoxylon),* Desert wolfberry (*Lycium hirsutum)* and Black Thorn (*Senegalia mellifera)* are also present within this vegetation type. The grass layer is very patchy, but in some areas it is moderately well developed. Species such as, Blou gras (*Schmidtia pappophoroides),* Lehmann lovegrass *(Eragrostis lehmanniana),* Sickle Grass *(Pogonarthria squarrosa),* Giant Three-awn *(Aristida meridionalis)* and Cats-Tail Three-Awned Grass (*Aristida congesta)* are common.

With reference to Figure 18, these vegetation types have been disturbed by the presence of existing mining infrastructure associated with the Tshipi Borwa Mine.

Species of concern

Several species of concern were identified at the Tshipi Borwa Mine (EMS, February 2017). These included the Camel Thorn (*Vachellia erioloba)* and the Grey Camel Thorn (*Vachellia haematoxylon)* which are protected under the National Forest Act (No. 84 of 1998) (NFA). In addition to this, the species Goldblatt (*Moraea longistyla)* which is considered to be a Schedule 2 (protected) species under the Northern Cape Nature Conservation Act No. 9 of 2009 (NCNCA) is also located at the Tshipi Borwa Mine.

Other species of concern that are likely to occur at the Tshipi Borwa Mine are included in Table 25 below.

TABLE 25: SPECIES OF CONCERN LIKELY TO OCCUR AT THE TSHIPI BORWA MINE (EMS, FEBRUARY 2017)

Species	Common Name	Legislation	Conservational status*
Vachellia erioloba	Camel Thorn	NFA	Protected
Vachellia haematoxylon	Grey Camel Thorn		Protected
Moraea longistyla	Goldblatt	NCNCA	Schedule 2
Moraea pallida	Geeltulp		Schedule 2
Babiana hypogaea	Bobbejaankalkoentjie		Schedule 2
Harpagophytum procumbens	Devil's claw		Schedule 1
Boophone Disticha	Poison bulb		Schedule 2
Brunsvigia radula	Limestone hedgehogs		Schedule 2
Orthanthera jasminiflora	Sandmelktou, Moerwortel		Schedule 2
Boscia albitrunca	Shepherd's Tree		Schedule 2
Crassula capitella	Aanteelrosie		Schedule 2
Kalanchoe brachyloba	Gelobde plakkie		Schedule 2
Ruschia griquensis	-		Schedule 2
Olea europaea	African olive		Schedule 2
Oxalis haedulipes	-		Schedule 2

* Endangered (Schedule 1), protected (schedule 2)

Alien invasive species

Alien invaders are plants that are of exotic origin and invade previously pristine areas or ecological niches. Alien invasive species cause a decline in species diversity, local extinction of indigenous species, ecological imbalance, decreased productivity of grazing pastures and increased agricultural costs. Alien invasive species likely to occur at the Tshipi Borwa Mine in terms of Regulation 15 and Regulation 16 of the CARA are outlined in Table 26 below.

TABLE 26: ALIEN INVASIVE SPECIES LIKELY TO OCCUR AT THE TSHIPI BORWA MINE (EMS, FEBRUARY 2017)

Scientific name	Common name	Category
Argemone mexicana	Yellow flowered Mexican Poppy	1
Atriplex nummularia	Old Man Salt Bush	2
Pennisetum setaceum	Fountain Grass	1
Prosopis cf. glandulosa	Mesquite	2
Opuntia humifusa	Prickly pear	1
Achyranthes aspera	Bur weed	1
Xanthium spinosum	Spiny cocklebur	1
Argemone ochroleuca	White flowered Mexican poppy	1

According to the Regulation 15 and Regulation 16 CARA, Category 1 species must be removed and destroyed immediately. Category 2 species include alien invasive species that may only be grown under controlled conditions. These plants have certain useful qualities and are allowed in demarcated areas. In other areas, these species must be eradicated and controlled.

RESULTS - FAUNA

Mammals

Red data mammal species that are likely to occur at the Tshipi Borwa Mine are included in Table 27 below.

TABLE 27: RED DATA MAMMALS LIKELY TO OCCUR AT THE TSHIPI BORWA MINE (EMS, FEBRUARY 2017)

Scientific Name	Common Name	Conservational status	Suitable habitat	Occurrence potential
Rhinolophus denti	Dent's Horseshoe Bat	Near threatened	Limited – Requires substantial cover such as caves and rock crevices.	Very little – Roosting habitat in the form of rock crevices may be available in the old mining area adjacent to the site. However, as the landscape in the area is flat sand veld and does not offer suitable roosting habitat for this species, it is unlikely that this species would have colonised the adjacent mining areas.
Mellivora capensis	Honey badger	Near threatened	High – As they are catholic in habitat	High– Suitable habitat within the Tshipi Borwa Mine.

Scientific Name	Common Name	Conservational status	Suitable habitat	Occurrence potential
			requirements, they are likely to occur on-site.	
Atelerix frontalis	South African Hedgehog	Near threatened	High – Require ample groundcover and dry places for nesting.	High to Medium – Suitable habitat available.

Avifaunal

A few red data avifaunal species are likely to occur at the Tshipi Borwa Mine as outlined in Table 28 below (EMS, February 2017).

TABLE 28: RED DATA AVIFAUNAL SPECIES LIKELY TO OCCUR AT THE TSHIPI BORWA MINE (EMS, JANUARY 2017)

Scientific Name	Common Name	Conservational status (regional, global)	Suitable habitat	Occurrence potential
Polemaetus bellicosus	Martial Eagle	Endangered, Vulnerable	Woodland, savannah or grassland with clumps of large trees or power pylons for nest sites	High – Nesting habitat in the Mixed Savannah
Sagittarius serpentarius	Secretary bird	Vulnerable, Vulnerable	Requires open grassland with scattered trees, shrubland, open Mixed Savannah.	High – Patches of open savannah will accommodate this species.
Neotis ludwigii	Ludwig's Bustard	Endangered, Endangered	Requires semi-arid dwarf shrublands, occasionally visiting the southern Kalahari	Medium – Moderate to high shrub density throughout the sit

Reptiles and amphibians

No red data reptiles or amphibians are likely to occur at the Tshipi Borwa Mine.

RESULTS - ECOLOGICAL SENSITIVITY

National and provincial databases

The section below provides information on the sensitivity of the Tshipi Borwa Mine in accordance with existing national and provincial databases. It is important to note, that although all data sources used provide useful and often verifiable, high quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics. This information is however considered to be useful as background information.

The NEM:BA provides for listing of threatened or protected ecosystems, in one of four categories: critically endangered, endangered, vulnerable or protected. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing threatened ecosystems is primarily to conserve sites of exceptionally high conservation value (SANBI, BGIS). According to the National List of Threatened Terrestrial Ecosystems (2011) the Tshipi Borwa Mine is not located in any threatened ecosystems.

The goal of the NPAES is to achieve cost effective protected area expansion for ecological sustainability and adaptation to climate change. The NPAES sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion. According to the NPAES database, the Tshipi Borwa Mine is not affected by areas earmarked as part of the NPAES.

The Mining and Biodiversity Guideline (2012) provides explicit direction in terms of where mining-related impacts are legally prohibited, where biodiversity priority areas may present high risks for mining projects, and where biodiversity may limit the potential for mining. According to the Mining and Biodiversity Guidelines, the Tshipi Borwa Mine is not located in any important biodiversity areas.

The Tshipi Borwa Mine falls within the Griqualand West Centre of Endemism (EMS, February, 2017). A centre of plant endemism is an area with high concentrations of plant species with very restricted distributions, known as endemics. Centres of endemism are important because it is these areas, which if conserved, would safeguard the greatest number of plant species. According to EMS (EMS, 2017), the Griqualand West Centre of Endemism is considered a priority in the Northern Cape, as the number of threats to the area is increasing rapidly and it is poorly understood. Furthermore, this centre of endemism is extremely poorly conserved, and is a national conservation priority (EMS, February 2017). Refer to Figure 19 for the location of the Tshipi Borwa Mine in relation to the Griqualand West Centre of Endemism.

The NFEPA (2011) database was consulted to define the aquatic ecology of the wetlands or river systems close to the Tshipi Borwa Mine that may be of ecological importance. The Vlermuisleegte River is located approximately 2 km to the west of the Tshipi Borwa Mine. The Vlermuisleegte River is considered to be a Class B (largely natural) river (Figure 20). A NFEPA wetland (depression) is located approximately 1.7 km west of the Tshipi Borwa Mine. In addition to this the Tshipi Borwa Mine is classified as an upstream management area. Upstream Management Areas are sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas.

SANBI has defined CBAs in the Northern Cape Province. These are areas required to meet biodiversity targets for ecosystems, species and ecological processes, as identified in a systematic biodiversity plan. The Tshipi Borwa Mine does not fall within any CBA areas, however the Vlermuisleegte River located approximately 2 km to the west of the Tshipi Borwa Mine is located in a CBA area of ecological support

(Figure 20). An Ecological Support Area is considered important as these areas are associated with high diversity and topographic diversity.

IBA's are sites of international significance for the conservation of the world's birds and other biodiversity. The Tshipi Borwa Mine does not fall within an IBA.

Aquifer Dependent Ecosystems

Aquifer Dependent Ecosystems (ADEs) occur throughout the South African landscape in areas where aquifer flows and discharge influence ecological patterns and processes. They are ecosystems, which require groundwater from aquifers for all or part of their life-cycle (EMS, February 2017). ADEs provide habitats for an array of species, especially in arid areas, and are considered important in ecological processes and making available resources for the biodiversity in an area that would otherwise not be available.

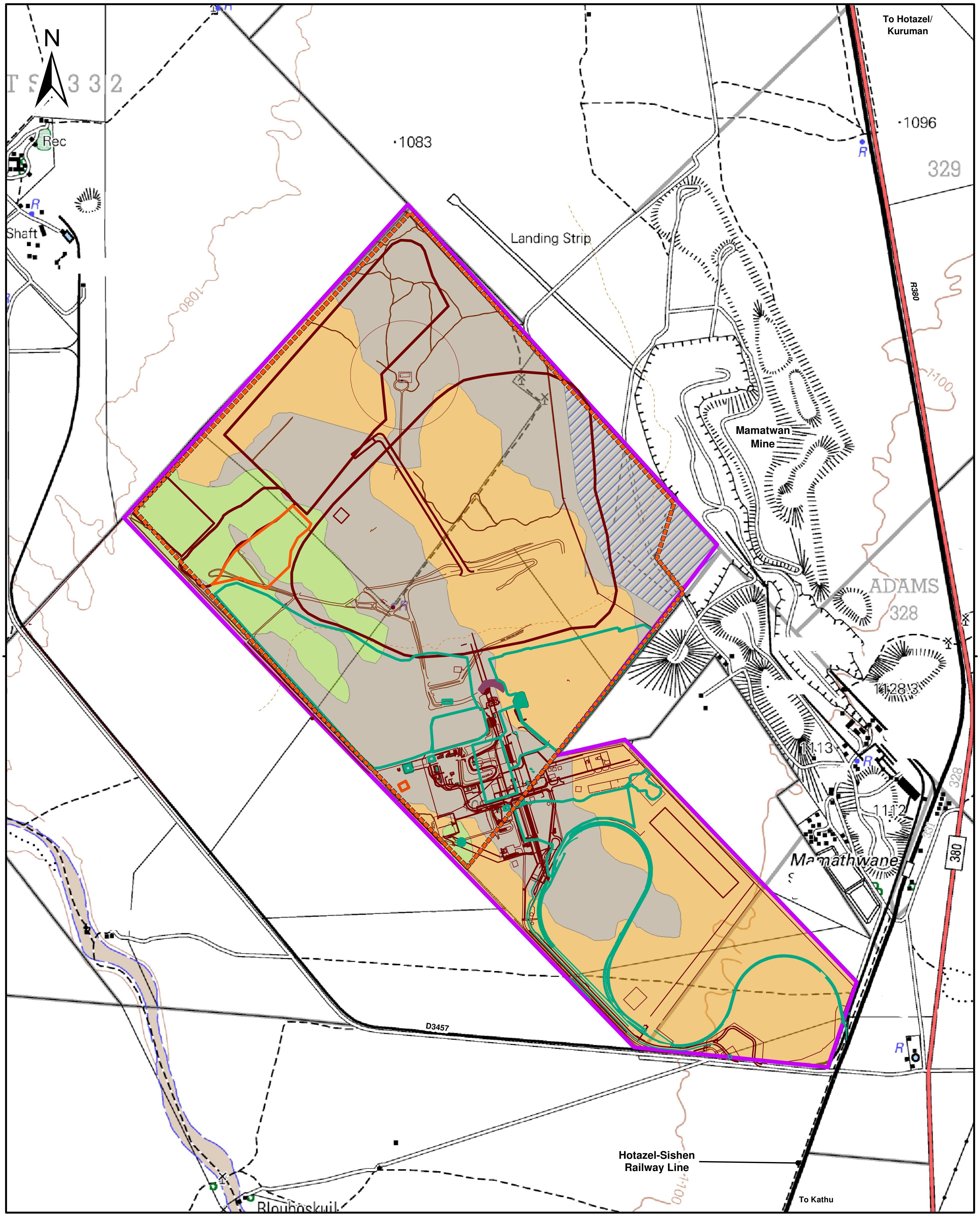
A study conducted by David Hoare Consulting (2013) showed that Camel Thorn (*Vachellia erioloba)* trees occurred as scattered to more concentrated individuals throughout the region. However there appeared to be higher densities along the banks of the main channel of the Kuruman and Ga-Mogara Rivers in the area around Hotazel, and this could show that an ADE relationship exists between the ephemeral Rivers and the Camel Thorn *Vachellia erioloba* tree. No information is currently available on the fine scale distribution of ADEs, type of plant association, (singly, in stands or gallery forests), aquifer association, condition of vegetation etc. and therefore a precautionary approach should be taken when developing in and around these systems.

Site sensitivity

According to EMS, the Tshipi Borwa Mine is uniform in terms of topography, habitat structure and the types and nature of ecological processes that occur. However, two of the described vegetation types can be considered to have a slightly higher conservation priority and have been classified as high sensitivity areas. This is attributed to the higher density of the protected trees (Camel Thorn (*Vachellia erioloba)* and the Grey Camel Thorn (*Vachellia haematoxylon))* that occur within them. These communities are the Mixed *Vachellia* Savannah and the *Vachellia haematoxylon* Savannah. The *Grewia Flava* Scrub vegetation type is considered to have a moderate sensitivity given that while protected species (Camel Thorn (*Vachellia erioloba)* and the Grey Camel Thorn (*Vachellia haematoxylon))* are located within the vegetation unit, there is a lower density of these species in this vegetation type. The site sensitivity mapping is provided in Figure 21.

CONCLUSION

The placement of infrastructure as well as mining activities in general have the potential to disturb and/or destroy vegetation, habitat units and related ecosystem functionality including the loss or disturbance of protected species. Protected species located at the Tshipi Borwa Mine include the Camel Thorn (*Vachellia erioloba)* and the Grey Camel Thorn (*Vachellia haematoxylon)* which are protected in terms of the NFA. In addition to this, the species Goldblatt (*Moraea longistyla)* is protected in in terms of the NCNCA. Some of these species have been removed due to approved infrastructure associated with the Tshipi Borwa Mine. Where additional areas need to be cleared at the Tshipi Borwa Mine, as part of the establishment of additional facilities and activities, the necessary permits need to be obtained from DAFF. Areas of high to medium sensitivity are associated with the Tshipi Borwa Mine and are unavoidable; however these areas have been disturbed by approved infrastructure. When considering the design of the infrastructure layout in particular to cater for the establishment of additional facilities and activities, areas of sensitivity should be taken into consideration and the footprints need to be minimised to minimise the loss of biodiversity. In addition to this, management actions need to be formulated to reduce the impacts that the project may have towards these areas.



Legend

- Surface Use Area
- Approved Mining Right Area
- Mine Infrastructure (no changes to approved infrastructure layout)
- Changes to Approved Layout (already implemented)
- Proposed Changes to Approved Layout
- Barrier Pillar

Vegetation Types

- *Vachellia haematoxylon* Savannah
- Grewia Flava Scrub
- Mixed *Vachellia* Savannah

0 500 1 000 Meters

Scale: 1:25 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

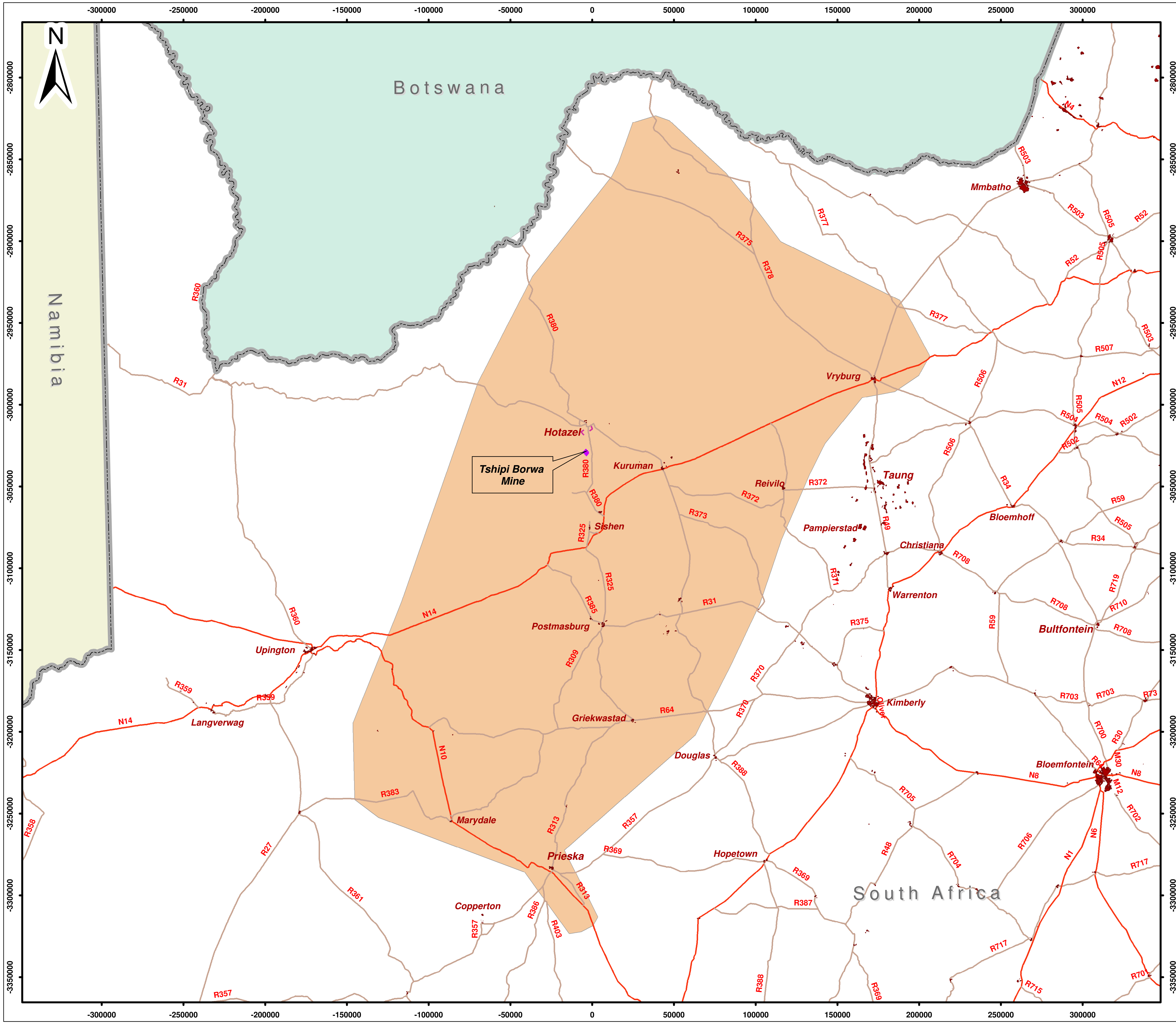
Figure 18

Vegetation Types (EMS, February 2017)

SLR
SLR Consulting (Africa) (Pty) Ltd
P O Box 1596, Cramerview, 2060, South Africa
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.20029.00008

2017/07/12



Legend

- National Boundary
- National Roads
- Route Roads
- Urban Areas
- Griqualand and West Center of Endemism
- Tshipi é Ntle Mining Right Area

0 30 60 Kilometers

Scale: 1 : 2 250 000 @ A3

Projection: Transverse Mercator

Datum: Hartebeeshoek, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 19

Griqualand and West Center of Endemism (EMS, February 2017)

SLR

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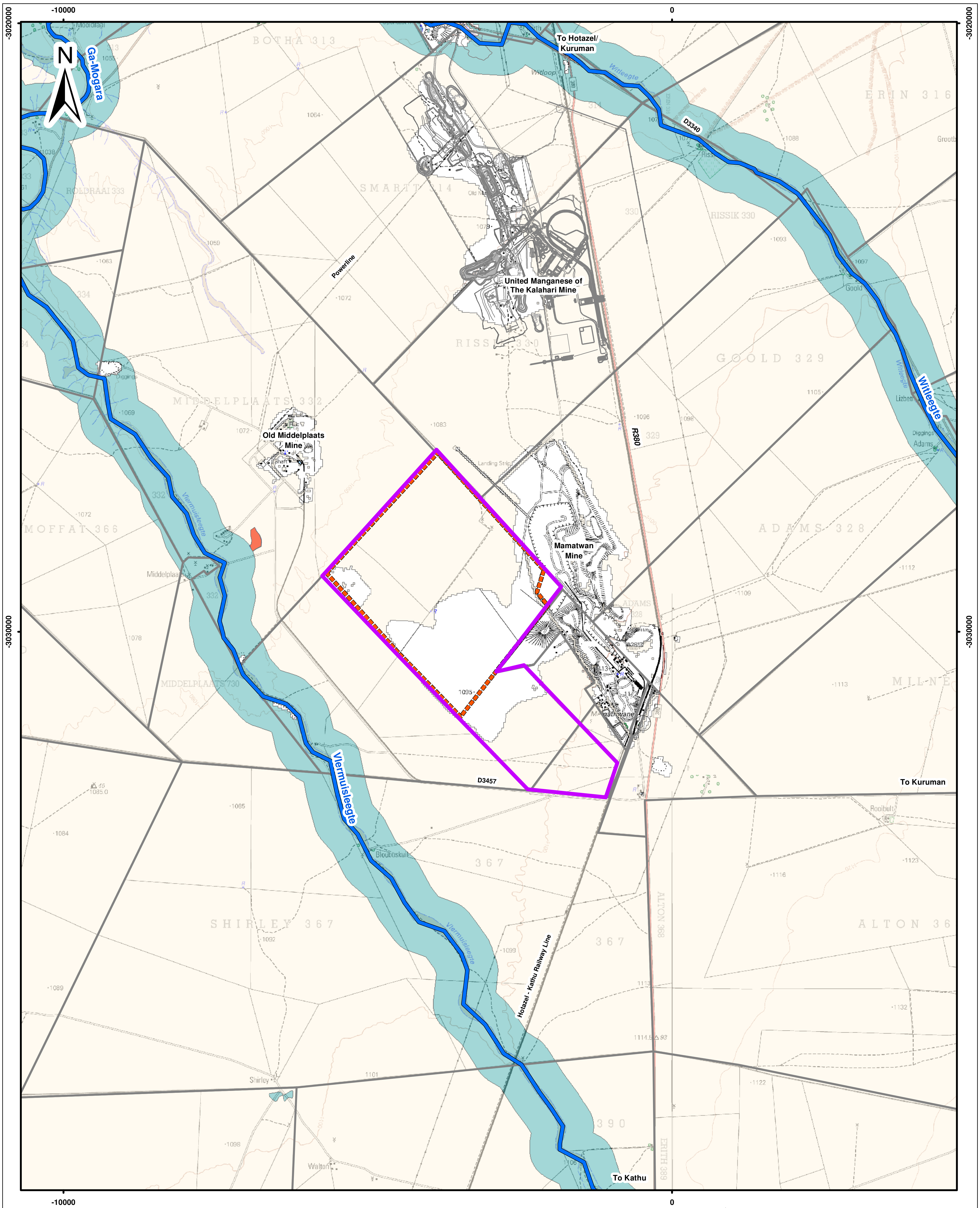
720.09012.00001

June 2017



Legend

- Surface Use Area
- Approved Mining Right Area
- Farm Boundaries

NFEPA Wetlands

- Depression

NFEPA Rivers (PES1999)

- CLASS B: Largely Natural

Critical Biodiversity Areas

- Ecological Support Area
- Other Natural Areas
- No Category

0 1 000 2 000 Meters

Scale: 1:60 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 20

Critical Biodiversity Areas and NFEPA

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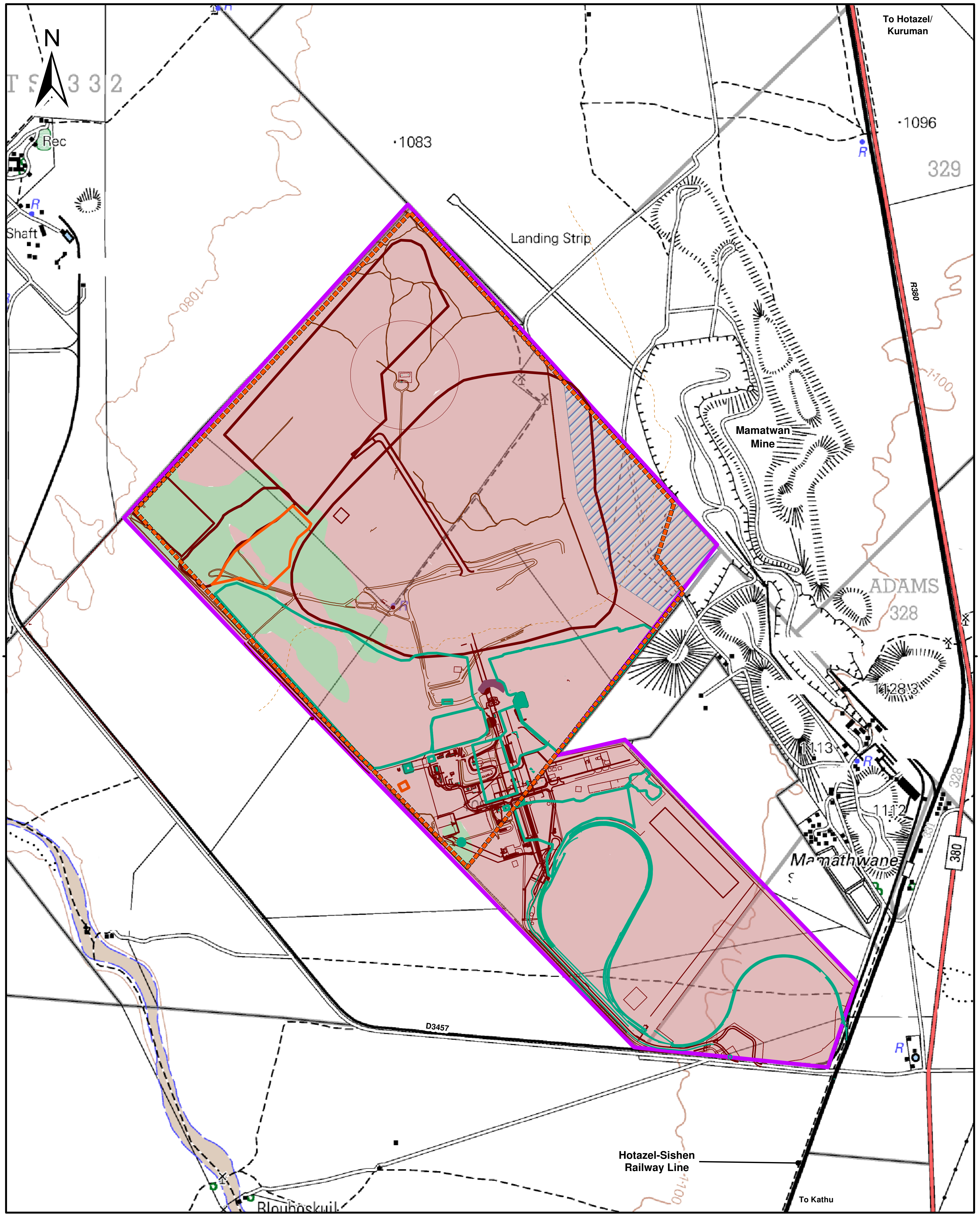
710.20029.00008 | June 2017



Legend

- Surface Use Area
- Approved Mining Right Area
- Mine Infrastructure (no changes to approved infrastructure layout)
- Changes to Approved Layout (already implemented)
- Proposed Changes to Approved Layout
- Barrier Pillar

Sensitivity

- High
- Medium

0 500 1 000 Meters

Scale: 1:25 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 21

Sensitivity Map (EMS, February 2017)

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710.20029.00008 | 2017/07/12

6.4.1.7 Surface water

INTRODUCTION AND LINK TO IMPACT

Surface water resources include drainage patterns and paths of preferential flow of stormwater runoff. Mine related activities have the potential to alter the drainage of surface water through the establishment of infrastructure and/or result in the contamination of the surface water resources through seepage and/or spillage of process materials, non-mineralised (general and hazardous) and mineralised wastes. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

The information in this section was sourced from the approved EMPr (Metago, May 2009) and the updated stormwater management plan undertaken for the project (SLR, June 2017) included in Appendix L.

Information pertaining to catchments, mean annual run-off and water management areas was sourced from the Water Resources of South Africa Manual WR2012 (WR 2012). Information regarding the relevant rivers surrounding the mine was sourced from the review of topographical data and on-site observations.

RESULT

Catchments within the context of South Africa

The Tshipi Borwa Mine is located within the Lower Vaal Water Management Area. The major rivers associated with this water management area include the Molopo River, Harts River and the Vaal River which ultimately drain into the Orange River (Metago, May 2009).

Regional hydrology

The Tshipi Borwa Mine falls within the quaternary catchment D41K (Figure 22) which has a gross total catchment area of 4216 km^2, with a net mean annual run-off (MAR) of 6.53 million cubic meters (mcm) (SLR, June 2017).

The major river within quaternary catchment D41K is the Ga-Mogara drainage channel which is located approximately 6 km North West of the Tshipi Borwa Mine (Figure 22). The Ga-Mogara drainage channel forms a tributary of the Kuruman River. The Kuruman River flows west joining the Molopo River approximately 250 km from the confluence of the Ga-Mogara drainage channel and Kuruman River. The Molopo River drains in a southerly direction eventually joining the Orange River (SLR, June 2017).

Local hydrology

The nearest watercourses to the Tshipi Borwa Mine are the ephemeral Vlermuisleegte River (approximately 2 km west) and the ephemeral Witleegte River (approximately 10km northeast) (Figure

22). It follows that no watercourses are located at the Tshipi Borwa Mine. Both the Vlermuisleegte and the Witleegte Rivers are tributaries of the Ga-Mogara River. The catchment characteristics of the Witleegte and the Vlermuisleegte Rivers are provided in Table 29 below (Metago, May 2009). Any natural runoff from the Tshipi Borwa Mine will drain in a westerly direction towards the Vlermuisleegte River.

TABLE 29: CATCHMENT CHARACTERISTICS

Catchment	Catchment area (km^2)	MAR (nett) (million m^3/annum)	Watercourse length (km)	Drainage density (km/km^2)
Witleegte catchment	661	0.73	70 350	106.4
Vlermuisleegte catchment	487	0.54	47 250	97

(Metago, May 2009)

The normal dry weather flow of watercourses in the region is no flow.

Surface water quality

No water sampling within the Tshipi Borwa Mine area has been conducted because there are no permanent surface water features. Given this, no surface water quality data is available.

Surface water use

Due to the ephemeral nature of Witleegte and Vlermuisleegte Rivers, there is no third party reliance on surface water.

Floodlines

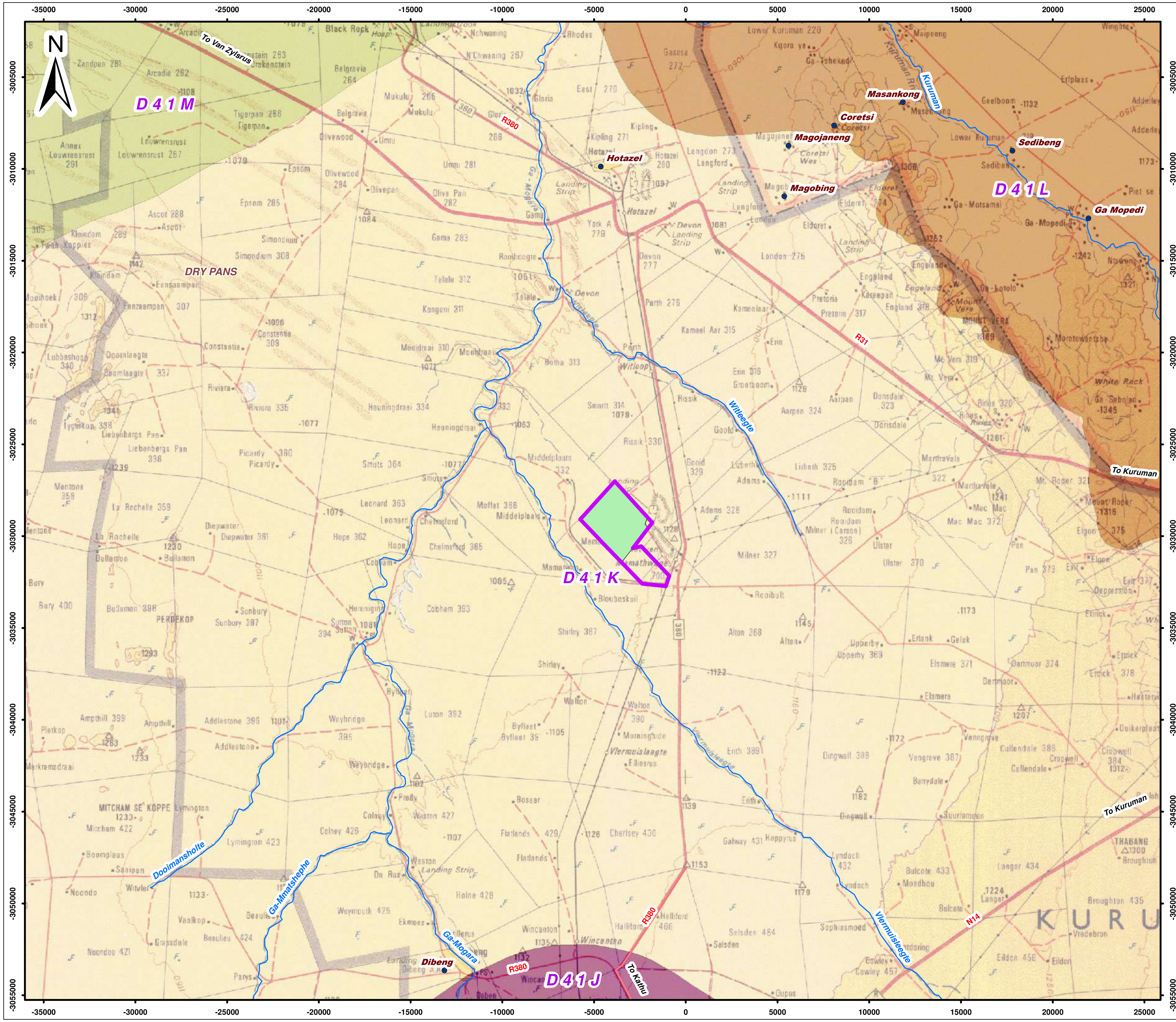
No floodlines were determined, as no watercourses are located within the Tshipi Borwa Mine area (Metago, May 2009).

Wetlands

No wetlands are located within the Tshipi Borwa Mine area (Metago, May 2009).

CONCLUSION

Infrastructural changes that have already taken place at the Tshipi Borwa Mine present sources of contaminates that present a potential for the pollution of surface water resources. Further to this, natural run-off is collected in all areas that have been designed with water containment infrastructure as required by legislation. It follows that the natural run-off to the catchment has already been influenced by infrastructural changes that have already taken place. The continued operation of the Tshipi Borwa Mine and the establishment of additional facilities and activities must be managed/implemented in a way that pollution of water resources is prevented. Moreover, care is required to ensure that surface run-off patterns are disturbed as little as possible to promote the continued flow of water and nutrients



Legend

- Surface Use Area
- Approved Mining Right Area
- Main Roads
- Rivers

Quaternary Catchments

- D41J
- D41K
- D41L
- D41M

0 4 8 Kilometers

Scale: 1:2 000 000 @ A3

Projection:Transverse Mercator
Datum: Hartebeeshoek, Lo 23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 22

Catchments

SLR

SLR Consulting (Africa) (Pty) Ltd
P O Box 1596, Cramerview, 2060, South Africa
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.21029.00008	2017/07/12

6.4.1.8 Groundwater

INTRODUCTION AND LINK TO IMPACT

Groundwater is a valuable resource and is defined as water which is located beneath the ground surface in soil/rock pore spaces and in the fractures of lithological formations. Activities such as the handling and storage of hazardous materials and handling and storage of mineralised (waste rock and tailings) and non-mineralised wastes have the potential to result in the loss of groundwater resources, both to the environment and third party users, through pollution. In addition, where mining requires dewatering in order to provide a safe working environment and for water supply, there is the potential for a dewatering cone to develop and this can result in a loss of water supply to surrounding users. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the groundwater assessment (SLR, July 2017) undertaken for the project and included in Appendix M, the approved EMPr (Metago, May 2009) and data from the on-going groundwater monitoring programme (SLR, June 2017).

Information pertaining to aquifer characteristics was sourced from the Aquifer Classification Map of South Africa and the approved EMPr (Metago, May 2009).

Groundwater flow and yield information was sourced from the approved EMPr (Metago, May 2009). Information pertaining to groundwater quality and quantity was sourced from the groundwater monitoring programme (SLR, June 2017).

RESULTS

Presence of groundwater

Two aquifers are present beneath the Tshipi Borwa Mine. This includes a shallow aquifer comprising the Kalahari sands and calcrete and a deeper fractured aquifer comprising Dwyka clay and Mooidraai dolomite formation (Metago, May 2009). The aquifers are classified as poor to minor aquifers. These can be fractured or potentially fractured rocks, which do not have a high primary permeability or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although those aquifers seldom produce large quantities of water, they are important both for local supplies and in supplying baseflow for rivers. These aquifers are moderately yielding aquifers (1-5 L/s) of acceptable quality or high yielding aquifer (5-20 L/s) of poor water quality (SLR, July 2017).

Groundwater levels and flow

Groundwater flows across the mine area in accordance with the topography in a west-north-west direction. Average groundwater levels recorded as part of the approved EMPr (Metago, May 2009) ranged from 20m to 45m below ground level. Groundwater levels are currently being monitored as part of

Tshipi's on-going groundwater monitoring programme. In this regard, the groundwater levels within and around the Tshipi Borwa Mine range between 41m to 74m below groundwater level (SLR, June 2017). It follows that since the commencement of the mine, there has been a decrease in the groundwater levels.

Groundwater use

The majority of the groundwater is used to supply drinking water for cattle and in some instances supply water for domestic use.

Groundwater quality

Borehole samples collected during the hydrocensus undertaken as part of the approved EMPr (Metago, May 2009) were analysed and the results were compared to the South African National Standards (SANS) standard for domestic use (SANS 241:2005). The results were also classified in terms of their suitability for domestic water supplies based on the classification compiled by the Water Research Commission (WRC) together with DWAF and the Department of Health. Table 30 shows the various classes defined.

TABLE 30: WATER CLASS GUIDELINE VALUE

Class 0	Ideal water quality - suitable for lifetime use
Class 1	Good water quality - suitable for use, rare instances of negative effects
Class 2	Marginal water quality - conditionally acceptable. Negative effects may occur in some sensitive groups.
Class 3	Poor water quality - unsuitable for use without treatment. Chronic effects may occur.
Class 4	Dangerous water quality - totally unsuitable for use. Acute effects may occur.

The sampling results showed that the groundwater quality in the area ranged from marginal to dangerous (DWAF classification of Class 2 and 4). This was mainly due to elevated nitrate levels (refer to Table 31). These trends are most probably linked to anthropogenic pollution from farming or mining activities.

TABLE 31:SUMMARY OF GROUNDWATER QUALITY (METAGO, MAY 2009)

Analyses in mg/l	SANS water quality guidelines for domestic use		Site Reference							
	Class 1	Class 2	Nt6	Nt8	Nt9	Nt14	Nt15	Nt17	Nt18	WGC2
pH Value at 25°C	5.0 – 9.0	4.0 – 10.0	7.3	7.7	7.9	7.5	7.0	7.4	7.2	8.2
EC in mS/m	<150	150 – 370 (7yrs)	96.6	179	82.0	101	**396**	186	243	95.6
Total Dissolved Solids at 180°C	<1000	1000 – 2400 (7 yrs.)	696	1208	420	592	**2910**	1340	1650	622
Total Alkalinity as $CaCO_3$	N/A	N/A	392	264	316	380	264	304	292	240
Nitrate as N	<10	10–20 (7 yrs.)	11	0.2	14	16	**175**	**111**	**101**	**21**
Chloride as Cl	<200	200–600(7	50	176	40	56	**743**	172	304	88

Analyses in mg/l	SANS water quality guidelines for domestic use		Site Reference							
	Class 1	Class 2	Nt6	Nt8	Nt9	Nt14	Nt15	Nt17	Nt18	WGC2
		yrs.)								
Sulphate as SO_4	<400	400–600 (7 yrs.)	16	481	25	47	51	52	126	45
Fluoride as F	<1.0	1 – 1.5 (1 yr.)	0.5	0.6	0.2	0.2	<0.2	0.4	0.4	0.5
Calcium as Ca	<150	150-300 (7 yrs.)	83	132	48	84	**377**	141	175	23
Magnesium as Mg	<70	70-100 (7 yrs.)	52	59	36	45	**184**	**104**	**123**	48
Sodium as Na	<200	200–400(7 yrs.)	46	152	74	45	62	85	88	100
Potassium as K	<50	50-100 (7 yrs.)	4.4	2.6	3.0	2.8	6.0	6.6	7.0	5.7
Classification of the water (the parameter listed are those responsible for the class of the water)			Nitrate	EC, TDS, SO4	Nitrate	Nitrate	Nitrate	Nitrate	Nitrate	Nitrate

Groundwater and surface water monitoring has been undertaken at the mine on a quarterly basis since 2012. Refer to Figure 26 for the location of the groundwater monitoring points. When results against relevant water quality standards, chemicals of concern that were identified include:

- Electrical Conductivity (EC): Concentrations in boreholes NT15 and TSH05 generally exceed the SANS 241:2015 Aesthetics limit. The baseline EC concentration measured in 2009 (Metago, May 2009) in NT15 also exceeded the SANS 241:2015 Aesthetics limit;
- Total Dissolved Solids (TDS): Concentration in NT15 exceeded the DWAF Target Water Quality Guideline (TWQR) for Livestock Watering and SANS 241:2015 Aesthetic limit. The baseline TDS concentration (Metago, May 2009) in NT15 already exceeded both of these limits;
- Nitrate (NO_3): Concentrations in NT15 exceeded the SANS 241:2015 Acute health and the SANS and the DWAF TWQR for Livestock Watering limits. The baseline NO_3 concentration measured in 2009 (Metago) in NT15 already exceeded these limits;
- Chloride (Cl): Concentrations in NT15 exceeded the SANS 241:2015 Aesthetic limit (300 mg/L). The baseline Cl concentration measured in 2009 (Metago, May 2009) in NT15 already exceeded this limit;
- Manganese (Mn): Concentrations in NT15, NT8, TSH01, TSH02, TSH03, TSH05, TSH06 exceeded the SANS 241:2015 Chronic health limit. No baseline Mn data is available;
- Molybdenum (Mo): Concentrations in NT8 exceeded the SANS 241:2015 Aesthetic limit. NT15 and TSH06 also exceeded this limit at times. No baseline Mo information is available; and
- Lead (Pb) concentrations in TSH03, TSH01 and TSH06 exceeded the SANS 241:2015 Chronic health limit at times, while TSH01 also exceeded the DWAF TWQR for Livestock Watering limit once. No baseline Pb data is available.

<u>Groundwater yield</u>

The groundwater yield is anticipated to be 2L/s.

CONCLUSION

The nature of mining infrastructure and activities are such that they present potential for pollution of groundwater resources and the lowering of groundwater levels. Baseline groundwater quality results indicate that prior to the establishment of the Tshipi Borwa Mine, groundwater quality had been influenced by anthropogenic pollution from farming and surrounding mining activities. Current groundwater quality data indicates that elevated levels of TDS, EC, Chloride and nitrate are consistent with baseline conditions. In terms of groundwater quantity, there has been a decrease in the groundwater levels since the establishment of the Tshipi Borwa Mine. The project must be implemented/ managed in a way that pollution and reduction of groundwater resources is taken into consideration.

6.4.1.9 Air quality

INTRODUCTION AND LINK TO IMPACT

Existing sources of emissions in the region and the characterisation of existing ambient pollution concentrations is fundamental to the assessment of cumulative air impacts. A change in ambient air quality can result in a range of impacts which in turn may cause a disturbance and/or health impacts to nearby receptors. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the air quality study undertaken by Airshed Planning Professionals (Airshed, April 2009) as part of the approved EMPr (Metago, May 2009). As part of the project the specialist provided a qualitative opinion regarding the changes to the infrastructure layout. The air quality study undertaken as part of the approved EMPr (Airshed, April 2009) and the specialist opinion (Airshed, February 2017) are included in Appendix N.

Dust fallout monitoring data was sourced from the annual monitoring report compiled by Boletshe Trading Enterprise CC (Boletshe, March 2016).

RESULTS

Ambient air quality within the region

The following regional sources of emissions were identified:

- fugitive dust: Occur as a result of vehicle entrainment of dust from local paved and unpaved roads, wind erosion from open areas and dust generated by agricultural activities. Given that the agriculture in the area is primarily restricted to livestock and game farming, agriculture is not anticipated to contribute significantly to ambient dust rates. Vehicle entrainment from the various unpaved farm and public roads is anticipated to be a significant but localised source of dust;

- current mining operations in the area: Particulates represent the main pollutant of concern at mining operations, whether it is underground or opencast. The amount of dust emitted by these activities depends on the physical characteristics of the material, the way in which the material is handled and the weather conditions. Current mining operations in relatively close proximity to the mining area include Kalagadi, Mamatwan, Black Rock, Gloria, Wessels, Sebilo, UMK and Kudumane (Figure 24);
- biomass burning: biomass burning emissions include with carbon monoxide (CO), methane (CH_4) and nitrogen dioxide (NO_2) gases;
- veld burning: represent significant sources of combustion-related emissions in many areas of the country;
- rail related emissions: Emissions from diesel generated locomotives include particulates, nitrogen oxides (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO) and various volatile organic compounds including polycyclic aromatic hydrocarbons;
- household fuel combustion: It is likely that households within the district municipality utilise coal or wood for cooking and space heating (during winter) purposes. Emissions from domestic burning include PM10, nitrogen dioxide (NO_2), carbon dioxide (CO_2), carbon monoxide (CO), polycyclic aromatic hydrocarbons, particulate benzo(a)pyrene and formaldehyde; and
- vehicle tailpipe emissions: Significant primary pollutants include carbon dioxide (CO_2), carbon monoxide (CO), hydrocarbons (HCs), sulphur dioxide (SO^2), oxides of nitrogen (mainly NOx), particulates. Secondary pollutants include NO^2, photochemical oxidants (ozone), sulphur acid, sulphates and nitric acid;

<u>Emission sources associated with the Tshipi Borwa Mine</u>

The activities associated with the Tshipi Borwa Mine that contribute to ambient air quality include:

- diesel generators;
- vehicle tail pipe emissions;
- material handling such as crushing, tipping of waste rock and ore, conveying of ore, stockpiles;
- dust generation from open pit operations (blasting and material handling);
- vehicle activity on paved and unpaved roads;
- wind erosion from exposed working surfaces;
- excavations;
- earthworks; and
- removal of soil.

These emissions contribute towards both nuisance value, mainly in the immediate area of the source (large particle deposition) and potential increased health impacts (PM10).

<u>Dust fallout data</u>

Tshipi has a monthly dust fallout monitoring programme in accordance with the approved EIA and EMPr (Metago, May 2009) that commenced in February 2012 and consists of five directional dust buckets. The position of the dust fallout monitoring points is illustrated in Figure 26. Annual dust fallout monitoring results for the period January 2016 to December 2016 is provided in Table 32 below. Dust fallout monitoring results are compared to the industrial dust fallout limits (600<D<1200) for DW-01, DW-02 and DW-03 in accordance with the National Dust Control Regulations (NDCR). DW-04 is located outside of the Tshipi Borwa Mine and as such is monitoring results are compared to the residential dust fallout limits (< 600) in accordance with the NDCR.

Based on the results provided below, dust fallout limits for DW-01, DW-02 and DW-04 remain within the prescribed NDCR industrial and residential acceptable dust fall rates. Dust fallout for DW-03 and DW-05 exceeded the NDCR non-residential rates six times during 2016. The NDCR allows for the exceedance of the non-residential limits (600 <D< 1200) two times in a year with no sequential months. It follows that DW-03 and DW-05 are in exceedance of the alert dust fall threshold rate of 1200mg/m^2/day and the permitted frequency of the non-residential dust fall rate.

TABLE 32: DUST FALLOUT MONITORING DATA (BOLETSHE, MARCH 2017)

DIRECTION	MONTHS											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
DW-01 – Northern mine boundary												
North	57	56	61	531.0	531.0	541.3	244.8	280.7	ND	273.3	177	72
East	140.0	55.0	9.0	428.0	428.1	168.9	178.2	63.8	ND	214.6	91.0	64.0
South	64.0	57.0	74.0	278.0	278.4	171.2	179.9	122.6	ND	167.3	380.8	ND
West	79.0	323.0	47.0	585.0	584.5	444.3	93.5	397.1	ND	380.8	111.0	74.0
DW-02 – Southern mine boundary												
North	81.0	54.0	126.0	436.0	435.7	237.0	297.7	246.9	ND	148.0	219.0	74.0
East	96.0	84.0	167.0	412.0	411.9	406.6	147.4	206.2	ND	213.4	117.0	62.0
South	73.0	99.0	88.0	421.0	421.1	317.7	428.6	295.1	ND	198.9	168.0	70.0
West	70.0	113.0	113.0	147.0	147.4	209.0	142.4	156.0	ND	177.3	191.0	70.0
DW-03 – Eastern mine boundary												
North	673.0	1964.0	879.0	2438.0	2437.7	1079.3	1632.2	5603.7	ND	423.1	370.0	91.0
East	1165.0	2028.0	370.0	1745.0	1744.8	1348.3	1308.9	5176.4	ND	483.4	175.0	168.0
South	717.0	1067.0	783.0	1696.0	1696.0	251.5	1113.2	4246.4	ND	663.9	177.0	148.0
West	592.0	982.0	1148.0	1218.0	1217.8	852.3	943.2	5535.9	ND	441.4	742.0	187.0
DW-04 – Western mine boundary												
North	37.0	51.0	62.0	349.0	349.4	185.8	134.5	160.6	ND	131.0	104.0	94.0
East	63.0	57.0	15.0	196.0	196.3	306.4	51.2	134.7	ND	69.7	78.0	56.0

DIRECTION	MONTHS											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
South	68.0	57.0	50.0	253.0	252.7	224.5	141.5	212.8	ND	72.3	41.0	54.0
West	69.0	65.0	28.0	294.0	294.3	221.0	92.4	86.3	ND	84.2	41.0	117.0
DW-05 – Central location												
North	388	4360.0	639.0	639.0	1367.5	2960.5	1803.9	ND	ND	1863.5	ND	185.0
East	298	3264.0	522.0	1370.0	1370.2	1727.0	1343.6	ND	ND	2290.2	ND	180.0
South	469	3064.0	832.0	1118.0	1118.1	2031.5	1613.6	ND	ND	2494.8	ND	51.0
West	602	3027.0	736.0	1151.0	1151.5	2171.9	1536.5	ND	ND	2274.5	ND	109.0

* No data

Potential air receptors

Potential receptors include the isolated residences and farmhouses on the surrounding farms, ranging between 2 and 2.5km from the mine (Figure 24). These are owned and/or occupied by farmers and farm workers.

CONCLUSION

Air quality within and surrounding the Tshipi Borwa Mine has already been influenced through the presence of approved infrastructure and activities. In this regard, monitoring results indicate that mining and surrounding activities and infrastructure contribute towards sources of emissions such as dust fallout that occasionally exceed relevant NAAQS and NDCR limits. The establishment of additional facilities and activities presents additional sources of pollutants that may influence existing pollutant concentrations. The activities should therefore be carefully managed to ensure that contributions from the project remain within acceptable limits with associated acceptable impacts.

6.4.1.10 Noise

INTRODUCTION AND LINK TO IMPACT

Certain noise generating activities associated with the mine and related changes to the operations could cause an increase in ambient noise levels in and around the mining area. This may cause a disturbance to nearby receptors. Land uses surrounding the mine have been described in Section 6.4.2. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCE

Information in this section was sourced from the approved EMPr (Metago, May 2009).

RESULTS

The greater area is generally defined by rural features and is not subjected to elevated noise levels. Noise in the vicinity of the Tshipi Borwa Mine is mainly caused by surrounding farming activities, localised traffic, train movements, and mining operations. Previously measured pre-Tshipi ambient noise levels varied from 39 dBA during the day to 33 dBA during the night. These levels are typical of ambient noise levels for rural areas as defined by SANS 10103:2008, which range between 45 dBA during the day and 35 dBA at night.

Potential noise receptors include the isolated residences and farmhouses on the surrounding farms, ranging between 2 and 2.5km from the mine (Figure 24). These are owned and/or occupied by farmers and farm workers.

CONCLUSION

Changes to the operations at the Tshipi Borwa Mine have the potential to increase ambient noise levels within and surrounding the mine. It is however important to note that the current mining activities at the Tshipi Borwa Mine already generate noise. Potential human noise receptors include the isolated residences and farmhouses within 2 and 2.5 km of the mine. Careful planning should therefore be taken into consideration for the project in order to minimise increasing disturbing noise levels.

6.4.1.11 Visual aspects

INTRODUCTION AND LINK

Mining infrastructure has the potential to alter the landscape character at the Tshipi Borwa and surrounding area through the establishment of both temporary and permanent infrastructure. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCE

Information in this section was sourced from on-site observations by the SLR project team and the review of relevant maps.

RESULTS

<u>Landscape character</u>

The landscape character within the Tshipi Borwa Mine area has been transformed due to Tshipi's current approved mining infrastructure and activities. The landscape character towards the south east, south and west of the Tshipi Borwa Mine area is characterised by flat open areas associated with semi-arid vegetation, the ephemeral drainage line (Vlermuisleegte River), isolated farmsteads, the regional road (R380), a gravel road (D3457) and the regional powerline. The landscape character directly to the east of the Tshipi Borwa Mine area has been extensively disturbed by existing mining operations associated with the Mamatwan Mine, the regional road (R380), a gravel road (D3457), railway line and powerline infrastructure. The landscape character to the north and north west of the Tshipi Borwa Mine consists of a combination of open flat areas associated with semi-arid vegetation and ephemeral drainage patterns (Witleegte River), existing mining operations (United Manganese (Pty) Ltd and the old Middelplaats mine), the regional road (R380) and powerline infrastructure.

Scenic quality

The scenic quality of the Tshipi Borwa Mine and surrounding area is linked to the type of landscapes that occur within an area. In this regard, scenic quality can range from high to low as follows:

- high – these include the natural features such as mountains and koppies and drainage systems;
- moderate – these include agricultural activities, smallholdings, and recreational areas; and
- low – these include towns, communities, roads, railway line, industries and existing mines.

The scenic quality within the Tshipi Borwa Mine area is considered to be low due the presence of existing mining activities.

Although the area surrounding the Tshipi Borwa Mine has been influenced by the presence of existing mining operations, road infrastructure, powerline infrastructure and isolated residences and farmhouses, the overall scenic quality is considered to be moderate given the presence of undisturbed areas that provide open views of the natural bushveld and the Vlermuisleegte River.

Sensitivity of Visual Resource

It follows that the highest value visual resource described above is also the most sensitive to changes. In contrast, areas, which are not considered to have a high scenic value, are expected to be the least sensitive to change such as the mining and infrastructure areas.

Sense of place

The sense of place results from the combined influence of landscape diversity and distinctive features. The primary informant of these qualities is the spatial form and character of the natural landscape taken together with the cultural transformations and traditions associated with the historic use and habitation of the area. The Tshipi Borwa Mine is located within a “mining belt”. Surrounding existing mining operations and the infrastructure that supports these mines dominates the area to the east, north and North West of the Tshipi Borwa Mine. It follows that the immediate area within and surrounding the Tshipi Bora Mine has a relatively weak sense of place (when the viewer is within the mining belt). However, seen in context with the site surrounded by large open spaces of arid vegetation the harsh nature of the mining activities is “softened”. When the viewer views the area from outside the “mining belt”, the larger area has a stronger sense of place.

Visual receptors

When viewed from the perspective of tourists and residences within the area, mining operations could be associated with a sense of disenchantment. People who benefit from the project (employees, contractors, service providers etc.) may not experience this disenchantment but rather see the mine with a sense of excitement and anticipation.

It follows that the sensitive viewer locations are located towards the west and southwest of the Tshipi Borwa Mine (isolated residences and farmhouses) and third parties travelling along the R380 and D3457.

CONCLUSION

When considering landscape character, scenic quality, visual resource, sense of place and visual receptors, the area to the southwest and west of the Tshipi Borwa Mine surface use area has a high visual value. The areas within the Tshipi Borwa Mine surface use area as well as areas located to the north, northwest and east of the surface use area that have been disturbed have a low visual value. This indicates that mining and infrastructure activities impact on the available visual resources and that visual resource management must be considered for the current activities at Tshipi as well as for the establishment of additional facilities and activities as part of the project.

6.4.1.12 Traffic

INTRODUCTION AND LINK

Traffic from mining developments has the potential to affect the capacity of existing road networks as well as result in noise, air quality and public road safety issues. This section provides an overview of the current road network, conditions and road use. Understanding the layout, use and conditions of transport systems relevant to the mine provides a basis for understanding a change as a result of project contributions.

DATA COLLECTION

Information was sourced from the traffic specialist study (Siyazi, June 2017) included in Appendix O.

The study comprised sourcing relevant data from a site inspection of the existing road network, consultations with the roads authorities, traffic counts, calculations and reference to relevant traffic impact assessment guideline documents. Further detail is provided in the traffic study.

RESULTS

<u>Existing road network</u>

There are no public roads traversing the Tshipi Borwa Mine. The following public roads are however located outside of the Tshipi Borwa Mine area:

- the provincial R30 lies to the west of the Tshipi Borwa Mine and Mamatwan Mine and proceeds in a northern direction to Hotazel (Figure 24);
- the D3457 lies to the south of Tshipi Borwa Mine towards Kuruman in an easterly direction. The D3457 provides access to both the Tshipi and Mamatwan mines (Figure 25); and
- the R31 crosses the R380 north of Tshipi Borwa Mine and provides access to the UMK and Kudumane Mine (Figure 24).

Existing traffic data

12-hour manual traffic counts were undertaken at the following intersections (refer to Figure 23 and Table 33):

- point A: Intersection of R380 and R31;
- point B: Intersection of R380 and UMK Mine access road;
- point C: Intersection of R380 and D3457;
- point D: Intersection of D3457 and Mamatwan Mine access road;
- point E1: Intersection of D3457 and Tshipi Borwa Mine Access Gate 1; and
- point E2: Intersection of D3457 and Tshipi Borwa Mine Access Gate 2.

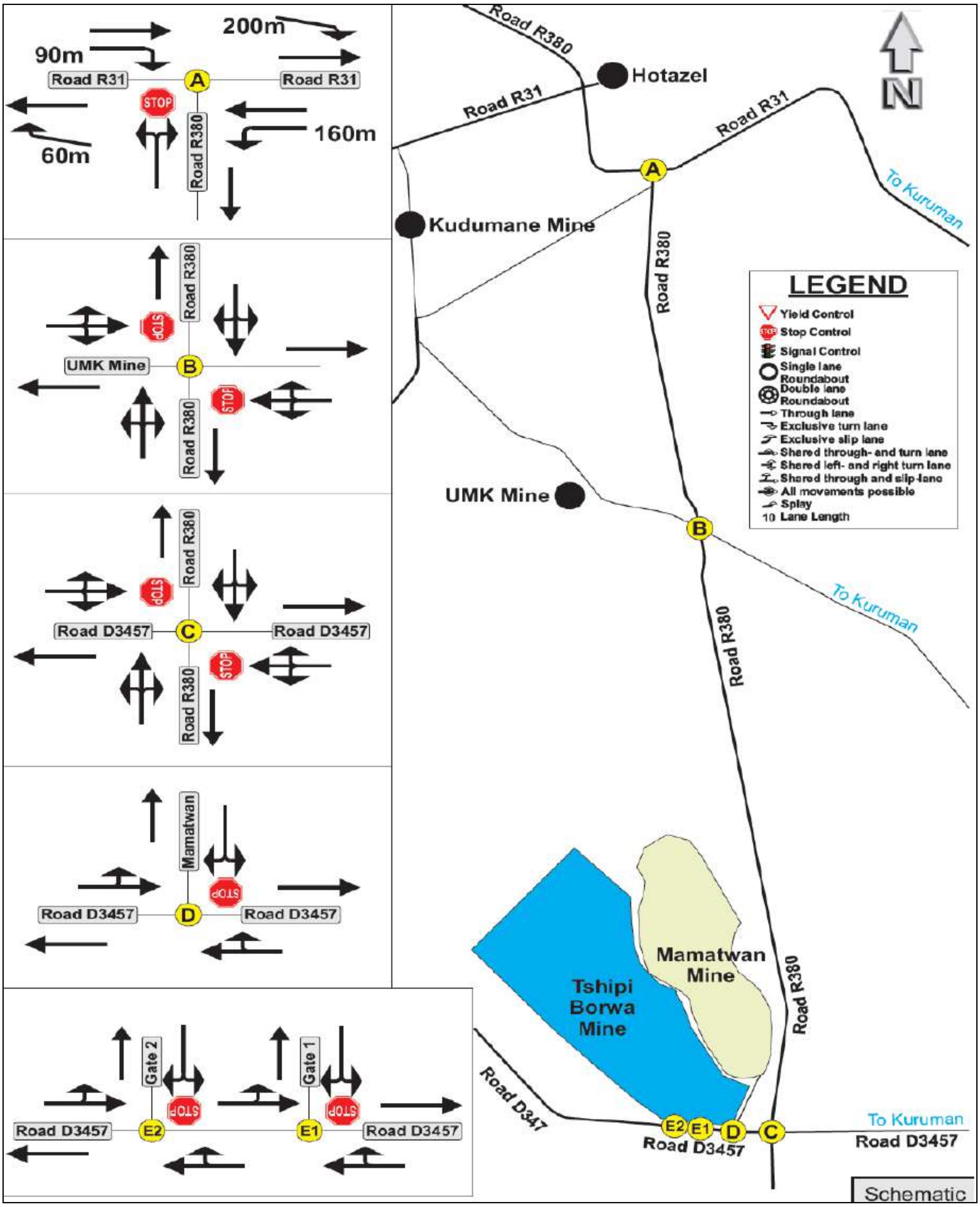


FIGURE 23: EXISTING ROAD NETWORK AND TRAFFIC COUNT INTERSECTIONS (SIYAZI, JUNE 2017)

TABLE 33: TRAFFIC COUNT INFORMATION (SIYAZI, JUNE 2017)

Point	Intersection	AM peak		PM Peak	
		Time interval	Number of vehicles	Time interval	Number of vehicles
A	R380 and R31	06h00 – 07h00	466	15h30 – 16h30	378
B	R380 and UMK Mine	06h15 – 07h15	133	13h15 – 14h15	142

Point	Intersection	AM peak		PM Peak	
		Time interval	Number of vehicles	Time interval	Number of vehicles
	access road				
C	R380 and D3457	06h00 – 07h00	258	13h00 – 14h00	193
D	D3457 and Mamatwan Mine access road	06h00 – 07h00	181	13h00 – 14h00	112
E1	D3457 and Tshipi Borwa Mine Access Gate 1	06h00 – 07h00	141	13h00 – 14h00	76
E2	D3457 and Tshipi Borwa Mine Access Gate 2	06h00 – 07h00	53	13h00 – 14h00	43

Based on the results of the manual traffic counts, the peak traffic hours occur between 06h00 and 07h15 in the morning, and 13h00 and 16h30 in the afternoons. The current level of service for all intersections that were investigated were considered to be operating at a good level of service. The result of this traffic study however does indicate that the intersection at the D3457 and R380 to the Tshipi Borwa Mine is not adequate from a road safety perspective.

CONCLUSION

The existing road network provides a good level of service. Changes to the surface infrastructure layout associated with the project will not alter the level of service, given that the project will not result in an increase in traffic volumes as existing contractors were and will be used. It is however important to note that Tshipi in collaboration with neighbouring mines and the relevant roads department should discuss upgrades required at the intersection at the D3457 and R380. These upgrades will need to consider public safety.

6.4.1.13 Heritage/cultural and palaeontological resources

INTRODUCTION AND LINK

This section describes the existing status of the heritage and cultural environment that may be affected by the project. Heritage (and cultural) resources include all human-made phenomena and intangible products that are the result of the human mind. Natural, technological or industrial features may also be part of heritage resources as places that have made an outstanding contribution to the cultures, traditions and lifestyles of the people or groups of people of South Africa.

Paleontological resources are fossils, the remains or traces of prehistoric life preserved in the geological (rock stratigraphic) record. They range from the well-known and well publicized (such as dinosaur and mammoth bones) to the more obscure but nevertheless scientifically important fossils (such as palaeobotanical remains, trace fossils, and microfossils). Paleontological resources include the casts or impressions of ancient animals and plants, their trace remains (for example, burrows and trackways), microfossils (for example, fossil pollen, ostracodes, and diatoms), and unmineralised remains (for example, bones of Ice Age mammals).

DATA SOURCE

Information in this section was sourced from the heritage study undertaken by Professional Graves Solutions (PGS, March 2009) as part of the approved EMPr (Metago, May 2009). As part of the project, the specialist confirmed that the results of the heritage study undertaken in March 2009 are still relevant. The heritage study undertaken as part of the approved EMPr (Metago, May 2009) and the specialist opinion (PGS, February 2017) are included in Appendix P. In addition to this, information was also sourced from the palaeontological study undertaken by Banzai Environmental (Pty) Ltd (Banzani, February 2017) and included in Appendix Q.

Information for the heritage study was obtained through the review of aerial photographs, topographical maps and existing literature in order to identify topographical areas of possible historic and pre-historic activity. In addition to this, a site survey was undertaken to identify any cultural/heritage resources located at the Tshipi Borwa Mine (PGS, March 2009).

Information for the palaeontological study was sourced through the review of available literature (Banzani, February 2017).

RESULTS

The Tshipi Borwa Mine is situated in an area that as a whole has a relatively low human presence due to the dryness of the region, and as such if there are human settlements they tend to be located on or near water courses.

As part of the heritage study (PGS, March 2009), a single site of low heritage/cultural significance was identified at the Tshipi Borwa Mine. The heritage/cultural site consisted of a large scatter of calcrete excavated during historical prospecting activities. This heritage site has been destroyed due to current activities at the mine. The destruction of the low significance heritage site was in accordance with the recommendation set out in the heritage study undertaken in March 2009 (PGS, February 2017) and SAHRA classification standards. It follows that no heritage sites are located at the Tshipi Borwa Mine.

The Tshipi Borwa Mine is underlain by the Late Caenozoic Kalahari Formation (Cretaceous to Tertiary). No literature record could be found of fossils from the Kalahari Formation close to Hotazel. Palaeontological evidence is restricted to a few pseudo-bone structures that are preserved in the limestone. No proof of any fossil material was collected from the rest of the Kalahari Formation. The project is therefore unlikely to pose a substantial threat to local fossil heritage. In Palaeontological terms the significance is rated as low to very low.

CONCLUSION

There is a low possibility of palaeontological resources occurring at the Tshipi Borwa Mine. In addition to this, no heritage/cultural resources are associated with the Tshipi Borwa Mine.

Paleontological and heritage resources are important to the history of South Africa and are protected by national legislation. It follows that in the event on any chance finds, SAHRA needs to be notified and where necessary permits need to be obtained prior to disturbance. This in particular applies to the establishment of additional facilities and activities as part of the project and the mining of the barrier pillar.

6.4.1.14 Socio-economic

INTRODUCTION AND LINK

Mining operations have the potential to result in both positive and negative socio-economic impacts. The positive impacts are usually economic in nature with mines contributing directly towards employment, procurement, skills development and taxes on a local, regional and national scale. In addition, mines indirectly contribute to economic growth in the national, local and regional economies by strengthening the national economy and because the increase in the number of income earning people has a multiplying effect on the trade of other goods and services in other sectors.

The negative impacts can be both social and economic in nature. In this regard, mines can cause:

- Influx of people seeking job opportunities which can lead to increased pressure on basic infrastructure and services (housing, health, sanitation and education), informal settlement development, increased trespassing, increased crime, introduction of diseases and disruption to the existing social structures within communities
- A change to not only pre-existing land uses, but also the associated social structure and meaning associated with these land uses and way of life. This is particularly relevant in the closure phase when the economic support provided by mines ends, the natural resources that were available to the pre-mining society are reduced, and the social structure that has been transformed to deal with the threats and opportunities associated with mining finds it difficult to readapt

DATA SOURCE

Information in this section was sourced from the JMLM Integrated Development Plan of 2016 and StatsSA.

RESULTS

<u>Population</u>

The Northern Cape Province has a population number of 1 145 861. The JTDGM has a population number of 224 797 while JMLM has a total population of 89 531 people. The Hotazel community has a total of approximately 1 755 people.

Dwellings

The most dominant type of dwelling utilized within the Northern Cape Province, the JTGDM, the JMLM and Hotazel is a formally constructed house or brick structure. This consists of 76% in the Northern Cape Province, 73% within the JTGDM, 71% within the JMLM and 82% within Hotazel. Traditional dwellings (e.g. huts/ structures made of traditional material) are the second highest used dwelling type with percentages ranging from 12% to 22% within the JTGDM and the JMLM respectively. No traditional dwellings are located within the town Hotazel, rather the second highest used dwelling type is flats. The second highest dwelling type within the Northern Cape Province is informal dwellings (e.g. shacks).

The population profile of the Northern Cape Province, JTGDM and JMLM demonstrates a consistent average household size of four people per household despite the significant decline in population numbers between the regional levels as reflected in Table 34 below. The local community of Hotazel has a slightly more favourable household size with an average of three members per household. These results are relatively typical of rural or semi-rural developing communities, however the low household density within Hotazel may be attributed to the fact that the town is largely a mining community established for and servicing surrounding mines.

TABLE 34: SOCIO ECONOMIC PROFILE - POPULATION

Category	Northern Cape Province	John Taolo Gaetsewe District Municipality	Joe Morolong Local Municipality	Hotazel
Number of households	301 405	61 330	23 707	600
Average number of people per household	4	4	4	3

Basic services

In general, despite the relatively formalized housing infrastructure, basic services infrastructure appears to be far less formalized. With reference to Table 35, majority of the Northern Cape Province have access to flush toilets and Hotazel primarily utilising the flush toilets, however the JTGDM and the JMLM mostly make use of pit toilets. Similarly, while in general the Northern Cape Province and Hotazel have access to piped water inside dwellings and yards, a large percentage of households rely on piped water to community stands at varying distances from their dwellings in both the JTGDM and the JMLM (Table 35). A total of 64% of the households in the Northern Cape Province have their waste removed by the local municipality or a private company once a week. This depicts that basic services are not provided to the whole province, with 36% of the province not receiving refuse removal services (Table 37). The occurrence of refuse removal by the JTGDM and JMLM constitutes only 26% and 6% of households respectively, however Hotazel is largely (96%) receiving the required services (Table 37).

In general, Hotazel is well formalised in terms of basic services. This may be attributed to the Hotazel area being more urbanized having been developed and supported by surrounding mines in recent years.

TABLE 35:SOCIO-ECONOMIC PROFILE – TOILET FACILITIES

Category	Northern Cape Province	John Taolo Gaetsewe District Municipality	Joe Morolong Local Municipality	Hotazel
None	8%	9%	10%	1%
Flush toilet (connected to sewerage system)	60%	26%	6%	97%
Flush toilet (with septic tank)	6%	3%	1%	1%
Chemical toilet	1%	1%	2%	0%
Pit toilet with ventilation (VIP)	9%	22%	40%	0%
Pit toilet without ventilation	11%	34%	37%	1%
Bucket toilet	4%	2%	2%	0%
Other	2%	2%	2%	1%

TABLE 36: SOCIO-ECONOMIC PROFILE– POTABLE WATER ACCESS

Category	Northern Cape Province	John Taolo Gaetsewe District Municipality	Joe Morolong Local Municipality	Hotazel
Piped (tap) water inside dwelling/institution	46%	23%	9%	89%
Piped (tap) water inside yard	32%	18%	7%	11%
Piped (tap) water on community stand: distance less than 200m from dwelling/institution	13%	35%	50%	0%
Piped (tap) water on community stand: distance between 200m and 500m from dwelling/institution	4%	13%	18%	0%
Piped (tap) water on community stand: distance between 500m and 1000m (1km) from dwelling /institution	2%	5%	5%	0%
Piped (tap) water on community stand: distance greater than 1000m (1km) from dwelling/institution	1%	3%	4%	0%
No access to piped (tap) water	3%	4%	8%	0%

TABLE 37: SOCIO-ECONOMIC PROFILE – REFUSE REMOVAL

Category	Northern Cape Province	John Taolo Gaetsewe District Municipality	Joe Morolong Local Municipality	Hotazel
Removed by local authority/private company at least once a week	64%	26%	6%	96%
Removed by local authority/private company less often	2%	1%	1%	1%
Communal refuse dump	2%	2%	1%	0%
Own refuse dump	25%	59%	80%	2%
No rubbish disposal	5%	7%	11%	1%
Other	2%	4%	1%	0%
Unspecified	0%	0%	0%	0%
Not applicable	0%	0%	0%	0%

<u>Education</u>

In general, statistics throughout the identified regions indicate poor educational profiles. With reference to Table 38, significant numbers of the population have received no schooling (9% of JTGDM, 13% of JMLM and 8% of the Northern Cape Province) or only limited primary education (35% of JTGDM, 42% of JMLM, 33% of Northern Cape Province and 22% of Hotazel). The average number across the regions profiled of people completing high school education were relatively consistent (on average 25%) however there is greater disparity when considering Grade 12 education, further education and training and tertiary education. The education profile within Hotazel is more positive in terms of the percentage of the population that have received further education and tertiary education when compared to the Northern Cape Province, the JGDM and the JMLM.

TABLE 38: SOCIO-ECONOMIC PROFILE – EDUCATION

Category	Northern Cape Province	John Taolo Gaetsewe District Municipality	Joe Morolong Local Municipality	Hotazel
No Schooling	8%	9%	13%	3%
Primary School	33%	35%	42%	22%
High School	28%	24%	21%	27%
Grade 12 / Std 10 / Form 5	14%	12%	7%	17%
Further Education and Training	1%	2%	0%	5%
Tertiary Education	4%	4%	2%	14%
Not applicable	12%	14%	15%	13%
Other	0%	0%	0%	0 %

<u>Economic profile</u>

Majority of the population within the Northern Cape, JGDM and JMLM are not economically active, while 48% of the Hotazel population is employed (Table 39). In general, Table 39 is an indication of the job scarcity of the area.

TABLE 39: SOCIO-ECONOMIC PROFILE – EMPLOYMENT

Category	Northern Cape Province	John Taolo Gaetsewe District Municipality	Joe Morolong Local Municipality	Hotazel
Employed	25%	19%	9%	48%
Unemployed	9%	8%	5%	5%
Discouraged work-seeker	3%	5%	7%	2%
Other not economically active	27%	29%	33%	23%
Not applicable	36%	39%	46%	23%

CONCLUSION

In general mining activities have the potential to influence socio-economic conditions both positively and negatively to which the approved mine already contributes. In the context of the approved mine, positive socio-economic influences include contributions in various ways to the local and regional economies while negative socio-economic influences include inward migration of people with the resultant pressure on basic infrastructure and services. As part of the project care should be taken to avoid influencing negative socio-economic impacts further and allowing for the continuation of the positive socio-economic conditions.

6.4.2 CURRENT LAND USES

INTRODUCTION AND LINK

Mining activities have the potential to affect land uses both within the mine area and in the surrounding areas. This can be caused by physical land transformation and through direct or secondary impacts. The key related potential environmental impacts are: loss of soil, loss of biodiversity, pollution of water, dewatering, air pollution, noise pollution, damage from blasting, visual impacts and the influx of job seekers with related social ills. To understand the basis of the potential land use impacts, a baseline situational analysis is described below.

DATA SOURCE

Mining right and land ownership details were sourced from Tshipi and a deed search undertaken by SLR as part of the project. On-site and surrounding land use data was sourced from site observations, specialist studies conducted for the mine and the review of topographical maps and satellite imagery.

RESULTS – MINING AND PROSPECTING RIGHTS

Tshipi holds an approved mining right (Reference number NC/30/5/1/2/2/0206MR) on a portion of portion 1 (Currently portion 16) and a portion of portion 2 (Currently portion 17) of the farm Mamatwan 331. The mining right was granted on 7th April 2010 to Ntsimbintle Mining (Pty) Ltd and transferred via a Section 11 MPRDA process to Tshipi on 17th March 2011.

Mamatwan Mining holds prospecting rights on the remaining extent, portion 3 (Currently portion 18) and portion 8 of the farm Mamatwan 331. Samancor Hotazel Manganese Mining (Pty) Ltd holds a mining right (NC 252 MR) on portion 3 of the farm Moab 700.

RESULTS - LAND OWNERS WITHIN AND SURROUNDING THE TSHIPI BORWA MINE AREA

The surface right owners and corresponding title deeds numbers of the land in and adjacent to the Tshipi Borwa Mine surface use and mining rights areas is listed in Table 40 and Table 41 respectively.

TABLE 40: LAND OWNERSHIP WITHIN THE TSHIPI BORWA MINE SURFACE USE AND MINING RIGHTS AREAS

Portion	Landowner	Title deed number
Mamatwan 331		
Portion 16 (Portion of portion 1)	Tshipi	T416/2014

Portion	Landowner	Title deed number
Portion 17 (Portion of portion 2)	Tshipi	T416/2014
Portion 18 (Portion of portion 3)	Tshipi	T416/2014
Moab 700		
Remaining extent	Machiel Andries Kruger	T594/1987

TABLE 41: LANDOWNERS ADJACENT TO THE TSHIPI BORWA MINE SURFACE USE AND MINING RIGHTS AREAS

Portion	Landowner	Title deed number
Mamatwan 331		
Remaining extent	Andries Mathys Van Den Berg	T594/ 1987
Portion 1	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Portion 2		T2426/2010
Portion 3		T953/2009
Portion 7	Transnet	T666/1965
Portion 8	Tshipi	T515/1992
Moab 700		
Portion 1	Transnet (Pty) Ltd	T250/1983
Portion 3	Hotazel Manganese Mines (Pty) Ltd	T953/2009
Sinterfontein 748		
Portion 0	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Middelplaats 332		
Remaining Extent	Saltrim Ranches (Pty) Ltd	T2297/2006
Portion 1	Terra Nominees (Samancor Manganese)	T2397/1996
Portion 4	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Middleplaats 184		
Whole farm	Abraham Johannes De Klerk	T1135/1965
Adams 328		
Remaining Extent	Saltrim Ranches (Pty) Ltd	T2297/2006
Portion 1	Eskom Holdings	T347/1971
Portion 2		T1162/1982
Portion 3	Transnet	T1107/1992
Portion 4	Hotazel Manganese Mines (Pty) Ltd	T338/2009
Rissik 330		
Portion 0	Gideon Poolman Familie Trust	T3211/2015
Portion 1	Terra Nominees (Samancor Manganese)	T2395/1996
Portion 2	Transnet	T515/1992
Portion 3	United Manganese of Kalahari Pty Ltd	T2092/2009
Goold 329		
Portion 1	Kruger Machiel Andries	T399/1977
Portion 2	Kruger Nicolaas Philippus Fourie	T455/2010
Portion 5	Hotazel Manganese Mines (Pty) Ltd	T2426/2010
Portion 6	Gideon Poolman Familietrust	T3211/2015
Portion 8	Transnet	T515/1992
Portion 9	Hotazel Manganese Mines (Pty) Ltd	T2821/2011
Shirley 367		
Portion 0	Leatitia Penny Trust	T3464/1997
Portion 1	Annalien Elizabeth Fourie	T730/1984
Portion 2	Pretorius Hester Johannes	T718/1979
Portion 3	Transnet	T43/1993

Portion	Landowner	Title deed number
Smartt 314		
Portion 0	Terra Nominees (Samancor Manganese)	T2396/1996
Portion 1	Transnet	T221/1966
Alton 368		
Portion 0	Booysen Jacomina Maria	T285/1979
Portion 1	Andries Matthys Duvenhage Testamentere	T905/2009
Milner 327		
Whole Farm	Kruger Machiel Andries	T26/1931

RESULTS - LAND CLAIMS

According to the Department of Rural Development and Land Reform no land claims have been lodged on the farms Mamatwan 331 and Moab 700. Refer to Appendix E for the proof of consultation with the Department of Rural Development and Land Reform.

RESULTS – LAND USE WITHIN THE TSHIPI BORWA MINE AREA

Land use within the Tshipi Borwa Mine area is limited to the mining activities and infrastructure associated with the mine.

Third party prospecting activities (Mamatwan Mining) and mining activities (Samancor Hotazel Manganese Mining (Pty) Ltd) within the surface use area may take place within the near future. These will be subject to separate environmental authorisation processes where required.

RESULTS – LAND USE SURROUNDING THE TSHIPI BORWA MINE AREA

Land use surrounding the Tshipi Borwa Mine is a mixture of agriculture, isolated residence/ residential areas, infrastructure/servitudes and mining activities. More detail is provided below:

<u>Agriculture</u>

Agricultural activities currently undertaken within the areas surrounding the Tshipi Borwa Mine includes game farming and ad-hoc livestock grazing.

<u>Isolated residence/ residential area</u>

With reference to Figure 24, the nearest residential areas to the Tshipi Borwa Mine include:

- the Black Rock mining community located approximately 26 km north west of the Tshipi Borwa Mine;
- the Hotazel town situated approximately 18 km north of the Tshipi Borwa Mine;
- the town Kuruman located approximately 48km south east of the Tshipi Borwa Mine; and
- the town Kathu located approximately 46km to the south of the Tshipi Borwa Mine.

Due to the lack of available surface water resources in the area, no informal settlements are located in immediate proximity to the Tshipi Borwa Mine. There are sparsely situated residences and farmhouses on the surrounding farms. These are owned and/or occupied by farmers and farm workers and include:

- farm workers residence located on the farm Middelplaats 332 located approximately 2 km north west from the mine (Figure 25);
- a permanent farm homestead (A. Pyper) located on the farm Middelplaats 332 approximately 2 km west of the mine (Figure 25);
- a permanent farm homestead (Andries van den Berg) located on the farm Mamatwan 331 approximately 2.5 km south west of the mine (Figure 24); and
- a permanent farm homestead (Nic Fourie) located on the farm Shirley 367 approximately 2 km south of the mine (Figure 25).

Infrastructure and servitudes

A 132 KV powerline passes to the east of the site, along the R380 Hotazel to Kathu road (Figure 24).

The Sedibeng Vaal-Gamagara water supply pipeline supplies the Tshipi Borwa Mine with process and potable water. A pipeline connection to the Sedibeng Vaal-Gamagara reservoir is located approximately 500m east of the Tshipi Borwa Mine (Figure 25).

A railway line connecting Kathu, Mamatwan and Hotazel runs along the east of the surface use area, parallel to the R380 (Figure 24).

A servitude right is held by Ntsimbintle Mining (Pty) Ltd for the establishment of a railway siding located on the remaining extent of the farm Moab 700 and portion 18 (Portion of portion 3) of the farm Mamatwan 331.

Surrounding mines

Various other mining operations located in the immediate vicinity of the Tshipi Borwa Mine include (Figure 25):

- the Unitied Manganses of Kalahari Mine (United Manganese of Kalahari (Pty) Ltd) – Located approximately 2 km north east from the nearest section of the surface use area;
- the Mamatwan Mine (South 32 (Pty) Ltd) – Located directly adjacent to the eastern boundary of the surface use area);
- the old Middelplaats Mine (dormant/closed) – located approximately 1.6 km north west from the nearest section of the surface use area;
- the old Adams Mine (dormant/closed) – Located approximately 600 m east of the nearest section of the surface use area; and

- the Sebilo Mine (Sebilo Resources (Pty) Ltd) – Located approximately 7.6 km north from the nearest section of the surface use area

Mining operations located further afield from the Tshipi Borwa mine include the:

- the Gloria Mine (Assmang (Pty) Ltd) – Located approximately 20 km north from the nearest section of the surface use area;
- the Kalagadi Mine (Kalagadi Manganese (Pty) Ltd) – Located approximately 18 km north west form the nearest section of the surface use area;
- the Kudumane Mine (Kudumane Manganese (Pty) Ltd) – Located approximately 12 km north from the nearest section of the surface use area;
- the old Hotazel Mine (dormant/closed) – Located approximately 15 km north east from the nearest section of the surface use area;
- the old York Mine (dormant/closed) – Located approximately 12.8 km north from the nearest section of the surface use area; and
- the old Devon mine (dormant/closed) – Located approximately 14.7 km north east from the nearest section of the surface use area.

Solar plant

The Adams Solar Plant (Adams Solar PV Project Two (Pty) Ltd) owned by Enel Green Power (Pty) Ltd is situated approximately 30km south east from the mining area and is located on the farm Adams 328. The Adams Solar Plant will aid the new renewable generation capacity of the national grid and contribute to the 42% share targeted by the Department of Energy for renewable energy (Integrated Resource Plan, 2010-2030). According to the strategy, 8.4 GW of new generation capacity in South Africa will be obtained from the Adams Solar Plant over the next twenty years.

CONCLUSION

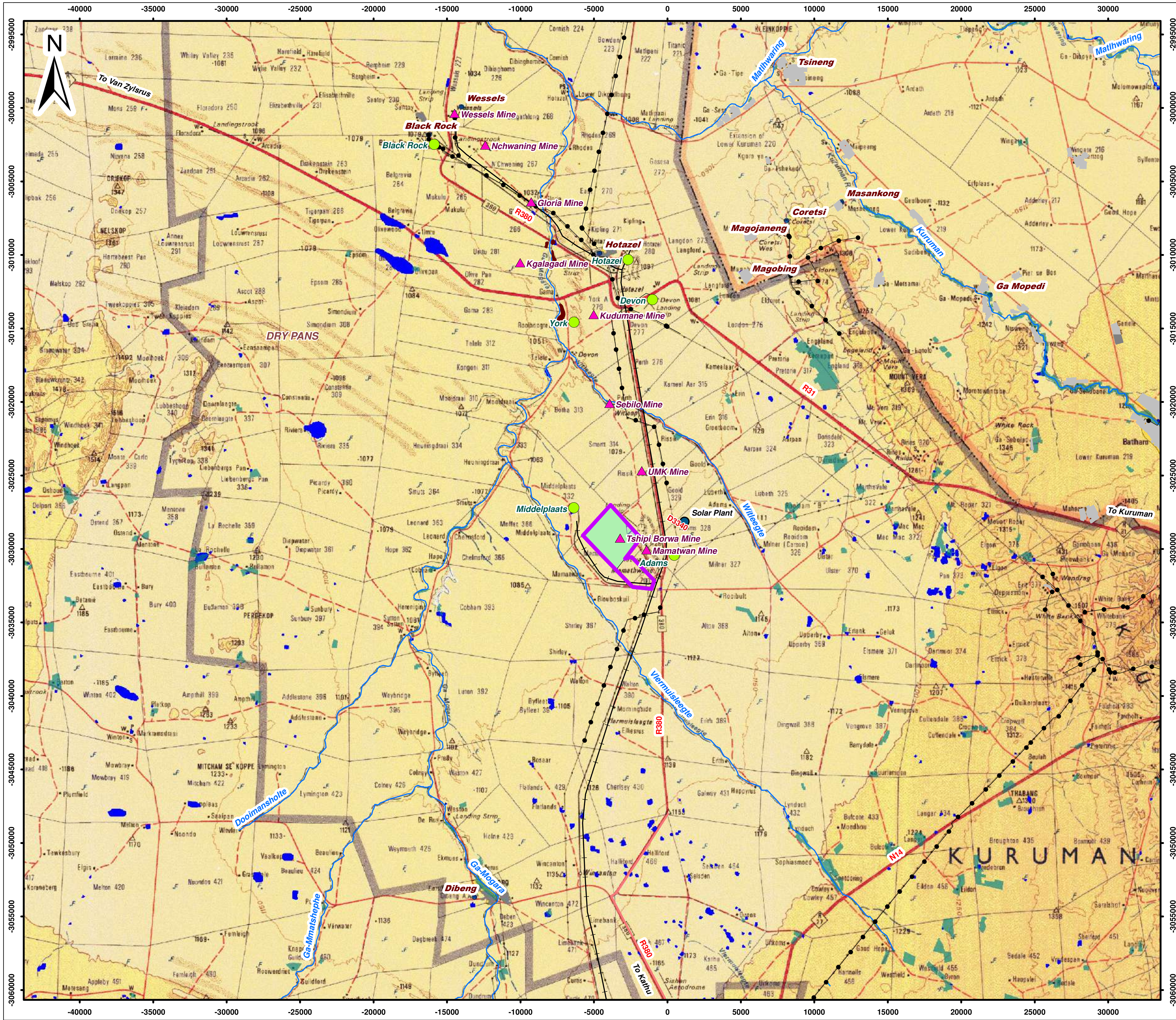
There are a number of land uses within and surrounding the Tshipi Borwa Mine which may be influenced by the mine and associated potential environmental impacts. It should however be noted that land has already been significantly influenced through mining, agricultural as well as infrastructure and servitudes.

6.4.3 DESCRIPTION OF SPECIFIC ENVIRONMENTAL FEATURES AND INFRASTRUCTURE ON THE SITE

The environmental features in the surface use area are described in Section 6.4.1 above, however no notable features are located within the surface use area. Infrastructure within and close to the mine is discussed in Section 6.4.2 above. The notable infrastructure within the surface use area includes the railway line, the powerline and the water pipeline.

6.4.4 ENVIRONMENT AND CURRENT LAND USE MAP

A conceptual map showing topographical information as well as land uses on and immediately surrounding the Tshipi Borwa Mine area is provided in Figure 24 and Figure 25.



Legend

- Surface Use Area
- Approved Mining Right Area
- Barrier Pillar
- Operating Manganese Mines
- Closed/Dormant Mines
- High Urban Density
- Low Urban Density
- Cultivated Land
- Historical Borrow Pits
- Main Roads
- Rivers and Streams
- Railway
- Powerline

0 4 8 Kilometers

Scale: 1:250 000 @ A3

Projection:Transverse Mercator
Datum: Hartebeeshoek, Lo 23

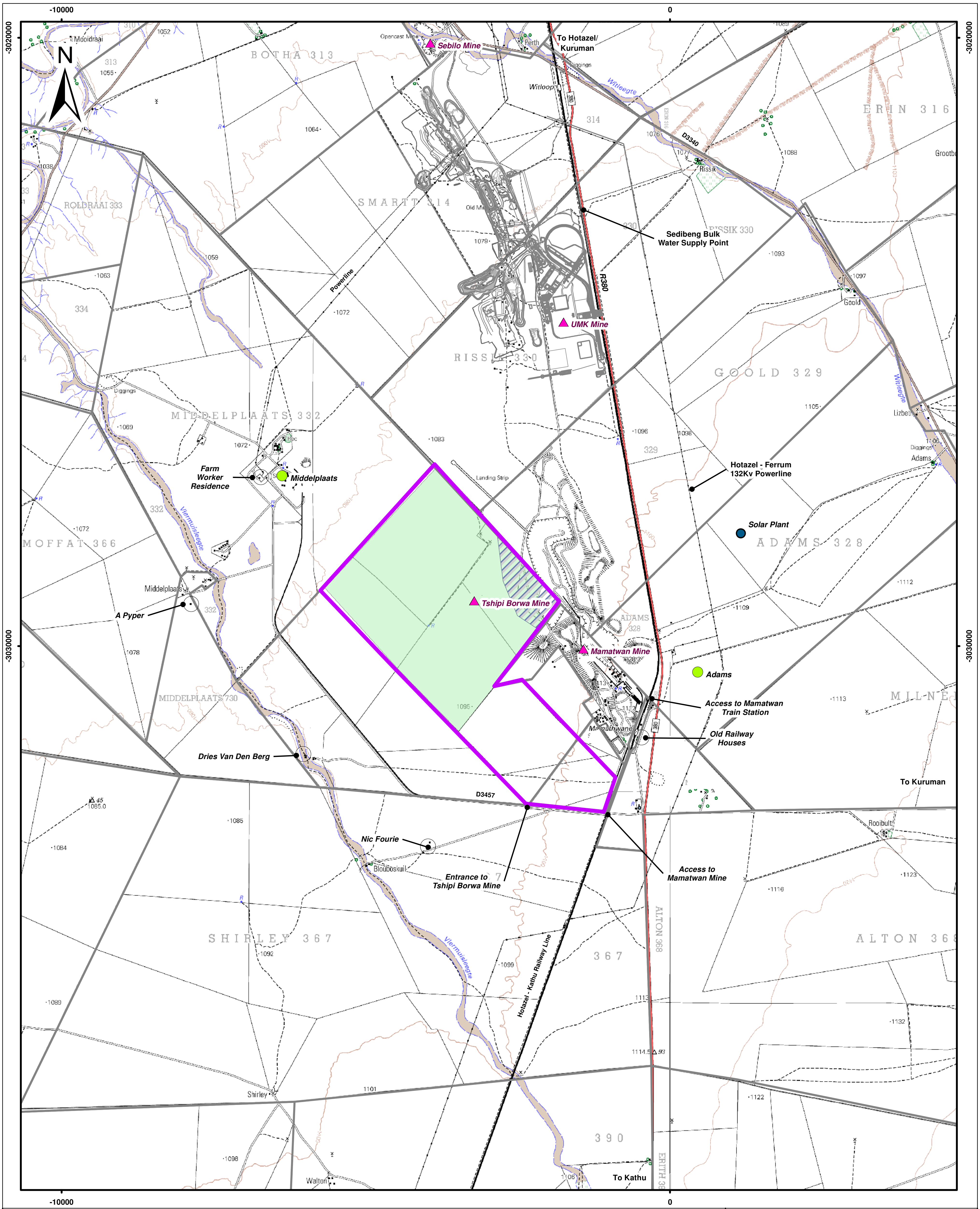
Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 24

Regional Land Use Map

SLR Consulting (Africa) (Pty) Ltd
P O Box 1596, Cramerview, 2060, South Africa
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.20029.00008 | 2017/08/08



Legend

- Surface Use Area
- Approved Mining Right Area
- Operating Manganese Mines
- Closed/Dormant Mines
- Barrier Pillar
- Main Roads
- Secondary Roads
- Power Line
- Rivers and Streams

0 1 000 2 000 Meters

Scale: 1:60 000 @ A3

Projection: Transverse Mercator

Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 25

Local Land Use

SLR

SLR Consulting (Africa) (Pty) Ltd
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710.20029.00008

2017/08/08

6.5 ENVIRONMENTAL IMPACTS AND RISKS OF THE ALTERNATIVES

This section provides a list of potential impacts on environmental and socio-economic aspects that have been identified in respect of each of the main project actions / activities and processes for each of the project phases (Table 3) in terms of the **project alternatives**. With reference to Section 6.1 no project alternatives were considered and as such an assessment of alternatives is not applicable to the project.

6.6 METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

The proposed method for the assessment of environmental issues is set out in the Table 42 below. Part A in Table 42 below provides a list of criteria that can be selected in order to rank the severity, duration and spatial scale of an impact. The consequence of the impact is determined by combining the selected criteria ratings allocated for severity, spatial scale and duration in part B of Table 42. The significance of the impact is determined in Part C of Table 42 whereby the consequence determined in part B is combined with the probability of the impact occurring. The interpretation of the impact significance is given in Part D.

This assessment methodology enables the assessment of environmental issues including: cumulative impacts, the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated. This assessment method was used to assess impacts associated with all project alternatives.

TABLE 42: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of severity, spatial extent and duration**
Criteria for ranking of the SEVERITY of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PART B: DETERMINING CONSEQUENCE		

SEVERITY = L

DURATION	Long term	**H**	**Medium**	**Medium**	**Medium**
	Medium term	**M**	**Low**	**Low**	**Medium**
	Short term	**L**	**Low**	**Low**	**Medium**

		SEVERITY = M			
DURATION	Long term	**H**	Medium	**High**	**High**
	Medium term	**M**	Medium	Medium	**High**
	Short term	**L**	**Low**	Medium	Medium
		SEVERITY = H			
DURATION	Long term	**H**	**High**	**High**	**High**
	Medium term	**M**	**Medium**	Medium	**High**
	Short term	**L**	**Medium**	Medium	**High**
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/ national
			SPATIAL SCALE		
PART C: DETERMINING SIGNIFICANCE					
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**H**	Medium	Medium	**High**
	Possible/ frequent	**M**	Medium	Medium	**High**
	Unlikely/ seldom	**L**	**Low**	**Low**	Medium
			L	**M**	**H**
			CONSEQUENCE		

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
High	It would influence the decision regardless of any possible management actions.
Medium	It should have an influence on the decision unless it is mitigated.
Low	It will not have an influence on the decision.

***H = high, M= medium and L= low and + denotes a positive impact.**

6.7 POSITIVE AND NEGATIVE IMPACTS OF THE PROPOSED ACTIVITY AND ALTERNATIVES

With reference to Section 6.1 no project alternatives were considered and as such an assessment of alternatives is not applicable to the project.

6.8 POSSIBLE MANAGEMENT ACTIONS THAT COULD BE APPLIED AND THE LEVEL OF RESIDUAL RISK

Section 6.3, provides a summary of issues and concerns raised by IAPs as part of the project. This section focusses on possible management actions that are available to accommodate or address issues and concerns raised by IAPs where relevant. In addition to this, this section will also provide an assessment of the impact or risks associated with the identified possible management actions.

TABLE 43: POSSIBLE MANAGEMENT ACTIONS AND ANTICIPATED LEVEL OF RISK

Issue and concern raised	Possible management actions or alternative to address issue	Impact significance of the possible management actions or alternative before and after management actions (Section 8)	
		Unmitigated	Mitigated
I would like to propose that a micro-climatic investigation be undertaken with regards to the effect that opencast mining has on the micro-climate. The opencast mining results in a heat island whereby the incoming solar is reflected differently to if it were to fall onto flat ground. This therefore affects the circulation of air and affects the climate on a localised scale. Backfilling would help to lessen this by reducing the void into which the sun's heat pours and it would allow for the heat energy to be reflected in a more normal manner.	• Ensure the implementation of the air quality monitoring programme (Section 29).	High	Medium
Vegetation is susceptible to both diesel fumes as well as diesel spills. Some sort of investigation should be undertaken in which the issue is studied from a grazing perspective and the impact that this will have on livestock. Tshipi should take remedial measures to avoid or lessen the impact that such spills and emissions have on surrounding flora.	• Ensure implementation of waste management conservation procedure (Table 56) and the soil conservation plan (Table 57); and • implementation of emergency response procedure (Table 55)	High	Medium
In the Kalahari, when the surface is disturbed, this takes years and years to recover. To establish even a small amount of vegetation takes up to 20 years and during this time only the pioneer species will recover. The better grasses and shrub species may take much longer. Existing farming activities have already resulted in the disturbance of naturally occurring grass species and, due to overgrazing and mismanagement, many species have become threatened. Each time there is some sort of disturbance relating to mining,	• Ensure implementation of the biodiversity monitoring programme (Section 29); and • ensure necessary permits are obtained prior to removal of project trees (Section 27)	High	Medium

Issue and concern raised	Possible management actions or alternative to address issue	Impact significance of the possible management actions or alternative before and after management actions (Section 8)	
		Unmitigated	Mitigated
this existing effect is compounded.			
We are concerned that the tailings dam at the Tshipi Borwa Mine will fail. The tailings dam at the Mamatwan Mine failed about 10 years ago. Even though the Mamatwan Mine cleared up the tailings material, the vegetation still died.	• Ensure implementation of slope stability monitoring (Section 29)	High	Low
The availability and quality of water is very important to us. Approximately 10 years ago, one of our cows died as a result of poor groundwater quality. We no longer use this specific borehole. We do still make use of another groundwater borehole on the farm Moab 700. The quality of this borehole water is poor however it is not poor enough to result in the death of our cattle. We also use water from the Vaal Ga-Magara pipeline. We therefore emphasise that a lot of attention needs to be given to both groundwater and surface water quality and quantity particularly with regard to backfilling the open pit with a combination of tailings, waste rock, gravel and sand.	• Ensure implementation of groundwater monitoring programme (Section 29); and • provide appropriate compensation for third party loss in water supply (Section 27)	Low	Low
There is so much dust. The plants are covered in dust and in some instances, these plants almost appear white from all the dust sitting on the leaves and branches.	• Ensure implementation of dust control measures (Section 27); and • ensure implementation of dust monitoring programme (Section 29)	High	Medium
The conditions of the roads are unacceptable.	• Ensure implementation of road maintenance plan in conjunction with neighbouring mines and relevant authorities (Section 27)	Medium	Low
Blasting is a serious issue for us. Even though our house is located approximately 7km from the Mamatwan Mine, our house shakes when blasting takes place and several cracks have appeared along the walls of our house. There are times when the blasts seems to be a lot more severe than most. We have asked the Mamatwan Mine to reduce the charge but they say that they need large blasts to access the ore. It is also very strange to us that blast measurements are never taken at our house when these blasts are so severe. This house has a lot of meaning to us; it was built in	• Provide appropriate compensation for damage to third party infrastructure (Section 27); • ensure the implementation of appropriate blast design (Section 27); and • implementation of emergency response procedure (Table 55)	High	Medium

Issue and concern raised	Possible management actions or alternative to address issue	Impact significance of the possible management actions or alternative before and after management actions (Section 8)	
		Unmitigated	Mitigated
1928 and has been in the family for generations.			
The portion of my farm which borders the mine is the best grazing land that I have. Cattle are trying to get away from the blasting and this means that they stampede and push through the fences. If we know what times blasting is going to occur at Tshipi we can take corrective action.			
While the mine may not necessarily be directly responsible for all the problems that we have experienced in the past, the mine is however indirectly responsible for a lot of the problems we have experienced. We would not experience these problems if the mine was not here. These indirect problems include: • Three years ago there was a fire on our property which we are certain was started by Eskom during the installation of the powerline for Tshipi. The reason we are certain that this fire was started by Eskom is because the fire started in the middle of the veld, close to where Eskom was working and not along the road where people sometimes throw cigarettes out their car windows. We opened up a case at the police station but we were told that we did not have a case. The case is still open but to this day nothing has been done to resolve this. The loss of grazing land is a huge expense as we need to find alternative land where our cattle can graze. • There have been several fires since the Tshipi Borwa Mine has been in construction. On one occasion when our son was trying to put out a veld fire on the farm Moab 700, his bakkie caught alight and we almost lost our son and he was in intensive care for a few days • During the establishment of the Eskom powerline, the people that were working on this powerline did not close the gates and as a result our cattle go into the road and one of our cows was hit by a vehicle. It should however be noted that we were compensated for this • Some of our calves on the farm Moab 700 have been slaughtered and being sold to people working at the mine. • Just to give you another example of how mines do not work together	• Implementation of emergency response procedure (Table 55) in the event of a fire	High	Low

Issue and concern raised	Possible management actions or alternative to address issue	Impact significance of the possible management actions or alternative before and after management actions (Section 8)	
		Unmitigated	**Mitigated**
with farmers even though this is not associated with the Tshipi Borwa Mine, an ore truck broke down on the side of the road near one of our other farms and caught alight. We have an electric fence around this specific farm and the power box and panels were burnt down as a result of the fire that started from the ore truck. It cost us R40 000.00 to replace the power box and panels. We are aware that this could have happened to anyone, but once again it was a mine vehicle and we were not compensated.			
We are aware that the mines are here to stay, but so are the farmers. A system needs to be put in place to ensure that the mines and the farmers are able to work together. We as farmers have made contributions for mines. One such example is providing Tshipi with a pipeline and railway line servitude. We have never denied the mines in the area anything but when the mines have directly or indirectly had an impact towards farmers; the mines needs to provide some form of compensation. We are getting very frustrated because we incur so many expenses when we need to resolve problems caused by mines and the mines just makes money.	• Ensure implementation of communication structures with key stakeholders (Section 27)	Medium	Low
Please clarify the separation of clean from the contaminated water.	• Ensure compliance with comply with the provisions of the Regulation 704 of 1999 for the separation of clean and dirty water (Section 27)	Medium	Low
Currently, the dust suppression method is leading to the dusticide running into the veld. Also, the use of the access roads produces a lot of dust. Stormwater facilities need to be established along the road to prevent dusticide running into the veld.	• Ensure that the application of dusticide is limited to road surfaced only (Section 27)	High	Medium
If any of these protected plants are found on site, the permit to remove it must be obtained via DENC.	• Ensure tree removal permits are obtained (Section 27)	High	Medium
We have received notification of your intention to expand the infrastructure at the Tshipi Borwa Mine located on farms Mamatwan 331, Moab 700, to the south of Hotazel in the John Taolo Gaetsewe District Municipality. In terms of the National Heritage Act (NHRA) no 25 of 1999, heritage resources,	• Contact SAHRA in the event of a chance find (Section 27); and • implementation of emergency response procedure (Table 55) in the event of a chance find	N/A	N/A

Issue and concern raised	Possible management actions or alternative to address issue	Impact significance of the possible management actions or alternative before and after management actions (Section 8)	
		Unmitigated	Mitigated
including archaeological or palaeontological sites over 100 years old, graves older than 60 years, structures older than 60 years are protected. They may not be disturbed without a permit from the relevant heritage resources authority. This means that before such sites are disturbed by development it is incumbent on the developer (or mine) to ensure that a Heritage Impact Assessment is done. It must include the archaeological component (Phase 1) and any other applicable heritage components. Appropriate (Phase 2) management actions, which involved recording, sampling, and dating sites that are to be destroyed, must be done as required. Although it is stated in the Background Information Document (BID) submitted to SAHRA that no significant heritage resources or cultural materials have been found to occur at the Tshipi Borwa Mine, no indication of a professional assessment is given. SAHRA therefore requests that a full Heritage Impact Assessment is conducted prior to any development related activities occurring on site. Consequently, the quickest process to follow for the archaeological component would be to contract a specialist to provide a Phase 1 Archaeological Impact Assessment Report. This must be done before any development related activities take place. The Phase 1 Archaeological Impact Assessment Report will identify the archaeological sites and assess their significance. It should also make recommendations (as indicated in Section 38 of the NHRA) about the process to be followed. For example there may need to be a management actions phase (Phase 2) where the specialist will collect or excavate material and date the site. At the end of the process, the heritage authority may give permission for destruction of the sites. SAHRA is satisfied that, as all work will involve only shallow, surface excavations, no Palaeontological Impact Assessment will be necessary. Any other heritage resources that may be impacted such as built structures over			

Issue and concern raised	Possible management actions or alternative to address issue	Impact significance of the possible management actions or alternative before and after management actions (Section 8)	
		Unmitigated	**Mitigated**
60 years old, sites of cultural significance associated with oral histories, burial grounds and graves, graves of victims of conflict, and cultural landscapes or viewscapes must also be assessed.			
SAHRA has reviewed the Draft Scoping Report for the proposed amendment to the Tshipi Borwa Manganese Mine. The DSR refers to a heritage report compiled in 2009 by Mr Henk Steyn. Although this report was compiled for another application on the same property, the area surveyed covers enough of that affected by the current application to serve as an adequate indicator of the likely heritage resources found on the properties. As indicated in the SAHRA review comment for that 2009 report, SAHRA supports the application provided that: • If any evidence of archaeological sites or artefacts (e.g., concentrations of stone artefacts, fossil bones, ostrich egg shell flasks), unmarked human burials or other heritage resources is found during mining activities, SAHRA APM Unit (Colette Scheermeyer/ Katie Smuts, tel: 021-4624502) must be alerted immediately, and a professional archaeologist and/or palaeontologist, depending on the nature of the finds, must be contacted as soon as possible to inspect the findings. • If prospecting and/or mining is to be undertaken to the west of the above properties and near the Vlermuisleegte (for instance, Remainder of Mamatwan 331, a property not surveyed for this HIA), an Archaeological Impact Assessment (AIA) must be undertaken by a professional archaeologist prior to such activities given the identified archaeological sensitivity along this water course. • If archaeological and/or palaeontological heritage resources are identified in the course of mining operations and related activities, a Phase 2 rescue/ sampling operation may need to be undertaken by a specialist. For this purpose, the relevant professional will require a management actions permit from SAHRA APM Unit in terms of section	• Contact SAHRA in the event of a chance find (Section 27); and • implementation of emergency response procedure (Table 55) in the event of a chance find	N/A	N/A

Issue and concern raised	Possible management actions or alternative to address issue	Impact significance of the possible management actions or alternative before and after management actions (Section 8)	
		Unmitigated	Mitigated
35 of the National Heritage Resources Act (NHRA, No. 25 of 1999). On receipt of a satisfactory management actions (Phase 2) permit report from the archaeologist and/or palaeontologist, SAHRA APM Unit will make further recommendations in terms of the report. • Where bedrock is to be affected, a Palaeontological Desk Top study must be undertaken to assess whether or not the development will impact upon palaeontological resources, or at least a letter from an accredited palaeontologist mitigating for an exemption is needed to indicate that this is unnecessary. If the area is deemed sensitive, a full Phase 1 Palaeontological Impact Assessment will be required and if necessary a Phase 2 rescue operation might be necessary.			
While the operational mine area has been surveyed for heritage resources previously (SAHRIS Case ID 2904 http://sahra.org.za/sahris/cases/tshipi-emp-amendment and 3629 http://sahra.org.za/sahris/cases/portion-3-8-farm-mamatwan-no331), an assessment of Palaeontological Heritage as not been conducted. Therefore SAHRA requests that a Desktop Heritage Impact Assessment (HIA) is conducted by a qualified heritage practitioner for the proposed EMP amendment as part of the S&EIA Process. The Desktop HIA must include a Desktop Palaeontological Assessment conducted by a qualified palaeontologist. The Desktop HIA must also include a consolidation of all previous HIAs conducted for the project to ensure that heritage has been adequately assessed for the project. The Scoping Report and all appendices must be submitted so that an informed comment may be issued. Should you have any further queries, please contact the designated official using the case number quoted above in the case header.	• Contact SAHRA in the event of a chance find (Section 27); and • implementation of emergency response procedure (Table 55) in the event of a chance find	N/A	N/A
It is not clear how the proposed changes to the approved EIA will affect the natural vegetation and animal life, and specifically protected trees. It was indicated that no further specialist investigation are required (fauna and flora). May you please indicate how the changes will affect protected trees and what additional impacts will be on the natural vegetation?	• Ensure tree removal permits are obtained (Section 27); • ensure implementation of biodiversity offset (Section 27); and • ensure implementation of the a biodiversity offset if requested by DAFF (Section 27)	High	Medium

Issue and concern raised	**Possible management actions or alternative to address issue**	**Impact significance of the possible management actions or alternative before and after management actions (Section 8)**	
		Unmitigated	**Mitigated**
Additional impacts on the natural vegetation may require amendments and/or new Flora permit and NFA licences for disturbance of protected plants and trees. Efforts should be made to minimize impacts on slow growing protected trees, by avoiding such trees as far as possible. It is not given that this Department will issue a licence for removal of protected tree. We may request an environmental offset (if deemed necessary) to compensate for the unavoidable loss of protected trees which may take decades to replace. Kindly provide copies of the relevant documentation to this office for comments and a copy of the amended EMPr outlining how impacts on protected trees will be mitigated.			

6.9 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

Where changes to the layout have already taken place no site layout alternatives can be considered. Where proposed changes to the infrastructure layout still need to be implemented, no site layout alternatives are being considered. This is discussed further below.

In terms of the 78Ml stormwater dam the proposed location is the only feasible option given that the stormwater dam needs to be down gradient of other dirty water facilities as these facilities drain into the 78Ml stormwater dam. In addition to this, the establishment of clean and dirty water separations systems are dictated by the current placement of infrastructure and as such no alternatives can be considered.

The approved topsoil stockpile is located in the medium sensitivity *Grewia Flava* Scrub vegetation type (Figure 21). The expansion of this stockpile is deemed the only feasible option as the expansion will primarily be located in the medium sensitivity *Grewia Flava* Scrub vegetation type. This is deemed the most appropriate option given that a new topsoil stockpile area would disturb the high sensitive *Vachellia haematoxylon* Savannah and the Mixed *Vachelli*a Savannah vegetation types as these vegetation types dominate the remainder of the project site.

In terms of mining the barrier pillar, only open cast mining activities are deemed feasible due to the shallow nature of the ore body and as such no alternative mining methods (underground mining) are applicable to the project. Further to this, the location of the barrier pillar is dictated by the ore body.

In addition to this, operational and technology alternatives are not applicable to the project.

6.10 STATEMENT MOTIVATING THE PREFERRED ALTERNATIVE

With reference to Section 6.1, no site layout alternatives were considered and as such this section is not applicable.

7 FULL DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY, ASSESS AND RANK THE IMPACTS AND RISKS THE ACTIVITY WILL IMPOSE ON THE PREFERRED SITE THROUGH THE LIFE OF THE ACTIVITY

7.1 DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY IMPACTS

Environmental and socio-economic impacts associated with the project were identified through site visits, undertaken by SLR, the social scan, consideration of the project description, site layout and specialist studies. As part of the public participation process, IAPs and commenting authorities (Section 6.2) were given an opportunity to provide input to the project through the review of the notification newsletter, adverts and the EMP amendment report. The feedback received from IAPs and commenting authorities also provided input into the identification of environmental and socio-economic impacts.

7.2 DESCRIPTION OF THE PROCESS UNDERTAKEN TO ASSESS AND RANK THE IMPACTS AND RISKS

A description of the assessment methodology use to assess the severity of identified impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated is provided in Section 6.6.

7.3 A DESCRIPTION OF THE ENVIRONMENTAL IMPACTS AND RISKS IDENTIFIED DURING THE ENVIRONMENTAL ASSESSMENT PROCESS

This section below (Table 44) provides a description of the impacts on environmental and socio-economic aspects in respect of each of the main project actions / activities and processes that will be assessed in Section 8.

TABLE 44: LIST OF POTENTIAL IMPACTS AS THEY RELATE TO PROJECT ACTIONS / ACTIVITIES / PROCESSES

Main activity/process	Impacts (unmitigated)
Earthworks	Hazardous excavations and infrastructure resulting in safety risks to third parties and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Alteration of natural drainage patterns Contamination of surface water resources Contamination of groundwater resources Air pollution Increase in disturbing noise levels Negative visual views Loss of heritage/cultural and palaeontological resources Inward migration

Main activity/process	Impacts (unmitigated)
	Economic impact Change in land use
Mineralise ore and waste	Loss and sterilisation of mineral resources Hazardous excavations and infrastructure resulting in safety risks to third parties and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Alteration of natural drainage patterns Contamination of surface water resources Contamination of groundwater resources Air pollution Increase in disturbing noise levels Negative visual views Loss of heritage/cultural and palaeontological resources Inward migration Economic impact Change in land use
Non-mineralised waste	Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Alteration of natural drainage patterns Contamination of surface water resources Contamination of groundwater resources Air pollution Increase in disturbing noise levels Negative visual views Loss of heritage/cultural and palaeontological resources Inward migration Economic impact Change in land use
Water use and management	Hazardous excavations and infrastructure resulting in safety risks to third parties and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Alteration of natural drainage patterns Contamination of surface water resources Contamination of groundwater resources Air pollution Increase in disturbing noise levels Negative visual views Loss of heritage/cultural and palaeontological resources Inward migration Economic impact Change in land use
Support services	Hazardous excavations and infrastructure resulting in safety risks to third parties and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Alteration of natural drainage patterns Contamination of surface water resources Contamination of groundwater resources Air pollution Increase in disturbing noise levels

Main activity/process	Impacts (unmitigated)
	Negative visual views Loss of heritage/cultural and palaeontological resources Inward migration Economic impact Change in land use
Transport system	Hazardous excavations and infrastructure resulting in safety risks to third parties and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Alteration of natural drainage patterns Contamination of surface water resources Contamination of groundwater resources Air pollution Increase in disturbing noise levels Negative visual views Loss of heritage/cultural and palaeontological resources Inward migration Economic impact Change in land use
Open pit mining	Loss and sterilisation of mineral resources Hazardous excavations and infrastructure resulting in safety risks to third parties and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Alteration of natural drainage patterns Contamination of surface water resources Contamination of groundwater resources Lowering of groundwater levels and reducing availability Air pollution Increase in disturbing noise levels Negative visual views Road disturbance and traffic safety Ground vibration, air blasts and fly rock Loss of heritage/cultural and palaeontological resources Inward migration Economic impact Change in land use
Continued use of approved facilities and services	Loss and sterilisation of mineral resources Hazardous excavations and infrastructure resulting in safety risks to third parties and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Alteration of natural drainage patterns Contamination of surface water resources Contamination of groundwater resources Air pollution Increase in disturbing noise levels Negative visual views Road disturbance and traffic safety Ground vibration, air blasts and fly rock Loss of heritage/cultural and palaeontological resources Inward migration Economic impact Change in land use

Main activity/process	Impacts (unmitigated)
Final land forms	Loss and sterilisation of mineral resources Hazardous excavations and infrastructure resulting in safety risks to third parties and animals Loss of soil resources and land capability through contamination Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Alteration of natural drainage patterns Contamination of surface water resources Contamination of groundwater resources Air pollution Increase in disturbing noise levels Negative visual views Inward migration Economic impact Change in land use
Closure activities in line with closure plan	Inward migration Economic impact

7.4 ASSESSMENT OF THE SIGNIFICANCE OF EACH IMPACT AND RISK AND AN INDICATION OF THE EXTENT OF TO WHICH THE ISSUE AND RISK CAN BE AVOIDED OR ADDRESSED BY THE ADOPTION OF MANAGEMENT ACTIONS

The assessment of the significance of the impacts identified for the mining area included in Section 8. The extent to which the identified impacts can be avoided or addressed by the adoption of management actions is included in Section 8.

8 ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

A summary of the assessment of the environmental and socio-economic impacts associated with the project is provided in Table 45 below. A full description of the assessment is included in Appendix F. The impacts below are considered cumulatively in the context of the existing Tshipi mining infrastructure and activities.

TABLE 45: ASSESSMENT OF SIGNIFICANT IMPACTS AND RISKS

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Management actions type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
Mineralised waste Continued use of approved facilities and services Open pit mining Final land forms	Loss and sterilisation of mineral resources	Geology	Operational Decommissioning Closure	High	• Management through best practises	Low	Can be managed/mitigated to acceptable levels
Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Hazardous excavations and infrastructure resulting in safety risks to third parties and animals	Topography	Construction Operational Decommissioning Closure	High	• Control through access control; • control through management and monitoring; • control through rehabilitation; and • remedy through emergency response procedures (Section 30.2.2)	Low	Can be managed/mitigated to acceptable levels
Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities	Loss of soil resources and land capability through contamination	Soil and land capability	Construction Operational Decommissioning Closure	High	• Control through waste management practices; • control through rehabilitation; • control through appropriate design; and • remedy through emergency response procedures (Section 30.2.2)	Low	Can be managed/mitigated to acceptable levels

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Management actions type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
and services Open pit mining Final land forms							
Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Loss of soil resource and land capability through physical disturbance		Construction Operational Decommissioning Closure	High	• Manage through limiting the project footprint; • manage through soil conservation procedures; and • manage through closure planning and rehabilitation	Low (Medium for approved tailings dam)	Can be managed/mitigated to acceptable levels
Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Physical destruction of biodiversity	Biodiversity	Construction Operational Decommissioning Closure	High	• Management though biodiversity action plan and offset (when relevant); • managing through limiting the project footprint; • management through rehabilitation; and • control through permits for removal	Medium	Can be managed/mitigated to acceptable levels
Earthworks	General		Construction	High	• Management through	Medium	Can be

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Management actions type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	disturbance of biodiversity		Operational Decommissioning Closure		alien invasive species programme; • management through training; • management through monitoring; • management through appropriate design; and • remedy through emergency response procedures (Section 30.2.2)		managed/mitigated to acceptable levels
Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Alteration of natural drainage patterns	Surface water	Construction Operational Decommissioning Closure	Medium	• Management through stormwater control; and • manage through monitoring water requirements	Low	Can be managed/mitigated to acceptable levels
Earthworks Mineralised waste Water use and management Support services	Contamination of surface water resources		Construction Operational Decommissioning Closure	Medium	• Management through waste management practises; • management through monitoring; • management through	Low	Can be managed/mitigated to acceptable levels

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Management actions type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
Transportation system Continued use of approved facilities and services Open pit mining Final land forms					compensation; and • remedy through emergency response procedures (Section 30.2.2)		
Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Contamination of groundwater resources	Groundwater	Construction Operational Decommissioning Closure	Low	• management through monitoring; • management through compensation; • management through appropriate design; and • remedy through emergency response procedures (Section 30.2.2)	Low	Can be managed/mitigated to acceptable levels
Open pit mining	Lowering of groundwater levels and reducing availability		Operational	Medium	• Management through monitoring; and • management through compensation	Low	Can be managed/mitigated to acceptable levels
Earthworks Mineralised waste Non-mineralised waste Water use and management	Air pollution	Air quality	Construction Operational Decommissioning Closure	High	• Manage through air controls and monitoring	Medium (High for Mn)	Can be managed/mitigated to acceptable levels

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Management actions type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms							
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Increase in disturbing noise levels	Noise	Construction Operational Decommissioning	Medium	• Manage through noise controls and once off sampling	Low (day-time) Medium (night-time)	Can be managed/mitigated to acceptable levels
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities	Negative visual views	Visual	Construction Operational Decommissioning Closure	Medium	• Manage through limiting project footprint, rehabilitation and visual controls	Low	Can be managed/mitigated to acceptable levels

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Management actions type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
and services Open pit mining Final land forms							
Continued use of approved facilities and services	Road disturbance and traffic safety	Traffic	Construction Operational Decommissioning	Medium	• Manage through road maintenance; and • remedy through emergency response procedures (Section 30.2.2)	Low	Can be managed/mitigated to acceptable levels
Continued use of approved facilities and services Open pit mining	Ground vibration, air blasts and fly rock	Blasting	Operational	High	• Management through blast design; and • remedy through emergency response procedures (Section 30.2.2)	Medium	Can be managed/mitigated to acceptable levels
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Loss of heritage/cultural and palaeontological resources	Heritage/cultural and palaeontological resources	Construction Operational Decommissioning	N/A	• Control through avoidancel; and • remedy through emergency response procedures (Section 30.2.2)	N/A	Can be avoided
Earthworks Mineralised waste Non-mineralised	Inward migration	Socio-economic	Construction Operational Decommissioning	High	• Control through the monitoring of living conditions of employees,	Low	Can be managed/mitigated to acceptable levels

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Management actions type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Closure activities in line with closure plan			Closure		recruitment processes, disease management; and • remedy through emergency response procedures (Section 30.2.2)		
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Closure activities in line with closure plan	Economic impact		Construction Operational Decommissioning Closure	Medium-high	• Control through good communication, recruitment and procurement processes	Medium-high	Can be managed/mitigated to acceptable levels
Earthworks Mineralised waste Non-mineralised waste Water use and	Change in land use	Land use	Construction Operational Decommissioning Closure	Medium	• Management through communication	Low	Can be managed/mitigated to acceptable levels

Activity	Potential impact	Aspects affected	Phase	Significance (unmitigated)	Management actions type	Significance (mitigated)	Extent to which the impact can be avoided or addressed through the implementation of management actions
management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms							

9 SUMMARY OF SPECIALIST REPORT FINDINGS

The recommendations made by the specialist in support of the project are summarised in Table 44 below. Where applicable relevant specialist reports have been attached in the appendices to this EMPr report.

TABLE 46: SUMMARY OF SPECIALIST REPORTS

Studies undertaken	Recommendation of specialist	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
Biodiversity	• Preconstruction surveys, of areas to be cleared, for species suitable to search and rescue operations; • all cleared areas should be re-seeded once the topsoil has been replaced with a seed mixture reflecting the natural vegetation as is currently found (harvesting of seed from similar areas within the Tshipi Borwa Mine should be undertaken). This may be used in conjunction with a commercially available mix as this will ensure a good vegetation coverage and soil stability. Species such as Stipagrostis are good sand binders and aid in stabilising the substrate and are present within the Tshipi Borwa Mine; • pods of *Vachellia erioloba*, and *Vachellia haematoxylon* should be collected from the area in order to aid in the re-establishment of these species. These seeds do however require artificial scarring/acid washing in order to aid in germination. The establishment of these trees will form a pivotal part in the rehabilitation of this area post mining as V. erioloba increases habitat heterogeneity. V. erioloba increases species richness by providing habitats and services for a variety of plants, reptiles, birds and mammals. Evidence also suggests that V. erioloba obtains nitrogen from deep ground water and then cycles nutrients from great depths, making them available above ground. High nutrient levels and shade of the sub canopy microhabitat increase survivorship of shade tolerant fleshy fruited plants. This microhabitat enables a suite of species, not adapted to conditions, to exist in this environment, thus enriching overall biodiversity. These plants provide a valuable food resource for a number of bird and mammal species; • prior to the clearing of the protected floral species the relevant permits must be obtained from the relevant authorities; • a comprehensive monitoring programme of the protected trees within the area must be undertaken. This monitoring will need to be conducted on an individual tree basis as well as monitoring at a community level. A suitability qualified professional should assist in developing such a monitoring programme. Depending on the results of the monitoring programme, additional management actions can be recommended by the qualified specialist; and • disturbing the smallest area possible should be enforced. A long-term comprehensive alien eradication programme should be compiled by a relevant specialist and implemented, this process will need to be continuously monitored and updated.	X	Appendix F and section 27
Groundwater	• The source term used for groundwater modelling is conservative. Further source term modelling should be carried out on waste samples collected from site and incorporated in the future groundwater model updates. • Prevent pollution through basic infrastructure design. • Tshipi will monitor groundwater according to it's monitoring programme. The Tshipi groundwater	X	Appendix F and section 27

Studies undertaken	Recommendation of specialist	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	monitoring programme includes boreholes for monitoring pollution sources, pollution plume or impact monitoring points and background or upstream points. Water quality analyses results should be classified in terms of the SANS 241 (2015) Water Quality Standards and the DWAF Target Quality Range for Livestock Watering (1996) or whichever is applicable at the time. The monitoring results should be assessed by a suitably-qualified professional registered with the South African Council for Natural Scientific Professional (SACNASP). Groundwater quality monitoring is conducted on a quarterly basis and groundwater levels on a monthly basis. • If borehole users experience any mine related water contamination or loss of water supply, Tshipi will, in conjunction with other mines in the area that are contributors to the cumulative impact, provide compensation, which could include an alternative water supply of equivalent water quality and quantity. • In the event that water quality monitoring around any WRD indicates that the waste rock dumps are causing pollution, catchment paddocks and soak-always will be provided to minimise the risk of exposure to wildlife, livestock and humans. • Should any off-site contamination be detected, the mine will immediately notify DWS. The mine, in consultation with DWS and an appropriately qualified person, will then notify potentially affected users, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures. • If monitoring shows that the base flow of the Vlermuisleegte is affected, a specialist team comprising DWS and biodiversity and groundwater experts will be commissioned to investigate the significance of the impacts and the specific management actions that must be implemented by all contributing mines. • The footprint of temporary waste rock dumps will be rehabilitated by ripping the underlying subsoil, then replacing the topsoil, vegetating, applying fertilizer, and irrigating the new growth for a short period. • Prior to closure, the groundwater model will be re-run to consider potential pollution impacts without the retardation effect of pit dewatering. If necessary, provision will be made by the mine for post closure compensation that may be required for any future negative impacts. This will form part of detailed closure planning • In case of a major discharge incident that may result in the pollution of groundwater resources the Tshipi emergency response procedure will be followed.		
Traffic	• improvements are recommended for the intersection of the R380 and the D3457. These improvements include a 60m dedicated right-turn land on northern approach, reflective road studs and update road markings; • detailed investigations should be conducted in conjunction with the relevant road authority in terms of the	X	Appendix F and section 27

Studies undertaken	Recommendation of specialist	Specialist recommendations that have been included in the EIA report (mark with an x)	Reference to applicable section in this report
	existing quality and potential life span of the existing road surface layers of the roads where consumables and workers will be transported; and • a road maintenance plan needs to be prepared in conjunction with the relevant road authority on public roads where trucks will operate as soon as the project has been approved in order to ensure that the consumables and workers can be transported at all times.		
Heritage	• Should any heritage features and/or objects be located or observed at the Tshipi Borwa Mine, a heritage specialist must immediately be contacted. Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist had been able to make an assessment as to the significance of the site (or material) in question.	X	Appendix F and section 27
Palaeontological	• Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably in situ) and the ECO should alert SAHRA so that appropriate management actions (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.	X	Appendix F and section 27

10 ENVIRONMENTAL IMPACT STATEMENT

10.1.1 SUMMARY OF KEY FINDINGS OF THE EIA

This section provides a summary of the findings of identified and assessed potential impacts on the receiving environment in both the unmitigated and mitigated scenarios, including cumulative impacts. A summary of the potential impacts (as per Section 8), associated with the chosen alternatives (as per Section 6), in the unmitigated and mitigated scenarios for all project phases is included in Table 47 below.

TABLE 47: SUMMARY OF POTENTIAL CUMULATIVE IMPACTS

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)	
		Unmitigated	Mitigated
Geology	Loss and sterilisation of mineral resources	High	Low
Topography	Hazardous excavations and infrastructure resulting in safety risks to third parties and animals	High	Low
Soil and land capability	Loss of soil resources and land capability through contamination	High	Low
	Loss of soil resource and land capability through physical disturbance	High	Low (medium for approved tailings dam)
Biodiversity	Physical destruction of biodiversity	High	Medium
	General disturbance of biodiversity	High	Medium
Surface water	Alteration of natural drainage patterns	Medium	Low
	Contamination of surface water resources	Medium	Low
Groundwater	Contamination of groundwater resources	Low	Low
	Lowering of groundwater levels and reducing availability	Medium	Low
Air quality	Air pollution	High	Medium (High for Mn)
Noise	Increase in disturbing noise levels	Medium	Low (day-time) and medium (nigh-time)
Visual	Negative visual views	Medium	Low
Traffic	Road disturbance and traffic safety	Medium	Low
Blasting	Ground vibration, air blasts and fly rock	High	Medium
Heritage/cultural and palaeontological resources	Loss of heritage/cultural resources	N/A	N/A
Socio-economic	Inward migration	High	Low
	Economic impact	Medium-high	Medium-high
Land use	Change in land use	Medium	Low

The assessment of the project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the bio-physical, cultural and socio-economic environments both on the project site and in the surrounding area. With management actions these potential impacts can be prevented or reduced to acceptable levels.

It follows that provided the EMP is effectively implemented there is no environmental, social or economic reason why the project should not proceed.

10.1.2 FINAL SITE MAP

The final preferred site layout plan is included in Appendix G.

10.1.3 SUMMARY OF THE POSITIVE AND NEGATIVE IMPLICATIONS AND RISKS OF THE PROPOSED ACTIVITY AND IDENTIFIED ALTERNATIVES

With reference to Section 6.1, no site layout alternatives were considered as part of the project and as such this section is not applicable.

11 IMPACT MANAGEMENT OBJECTIVES AND OUTCOMES FOR INCLUSION IN THE EMPR

Based on the outcome of the impact assessment and where applicable the recommendations from specialists the proposed management objectives and outcomes specific to the proposed changes and for inclusion into the environmental management programme are detailed in this section.

11.1 PROPOSED MANAGEMENT OBJECTIVES AND OUTCOMES FOR ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS

Specific environmental objectives to control, remedy or stop potential impacts emanating from the project are provided in Table 48 below. These objectives are as per the approved EMPr (Metago, May 2009).

TABLE 48: ENVIRONMENTAL OBJECTIVES AND OUTCOMES

Aspect	Environmental objective	Outcome
Geology	To prevent unacceptable mineral sterilisation	Avoid mineral sterilisation
Topography	To prevent physical harm to third parties and animals from potentially hazardous excavations and infrastructure	To ensure the safety of people and animals
Soil and land capability	To prevent soil pollution and to minimise the loss of soil resources and related land capability through physical disturbance, erosion and compaction	To handle, manage and conserve soil resources to be used as part of rehabilitation and re-establishment of the pre-mining land capability
Biodiversity	To prevent the unacceptable disturbance and loss of biodiversity and related ecosystem functionality through physical and general disturbance	To limit the area of disturbance as far as practically possible
Surface water	To prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow and to prevent pollution of surface water resources	To ensure surface water quality remains within acceptable limits for both domestic and agricultural purposes (where relevant). To ensure that the reduction of the volume of run-off into the downstream catchment is limited to what is necessary and that natural drainage patterns are re-established as part of rehabilitation.
Groundwater	To prevent pollution of groundwater resources and related harm to water users and to prevent losses to third party water users.	To ensure groundwater quality remains within acceptable limits for both domestic and agricultural purposes. To ensure that groundwater continues to be available to current users.
Air	To prevent air pollution health impacts	To ensure that any pollutants emitted as a result of the project remains with acceptable limits.
Noise	To prevent public exposure to disturbing noise	To ensure that any noise generated as a result of the project remains within acceptable limits.
Visual	To limit negative visual impacts	To ensure visual views that complement the surrounding environment
Traffic	To prevent transport related accidents and/or injury to people and livestock.	To ensure the mine’s use of public roads is done in a responsible manner.
Blasting	To prevent harm to people, animals and	To protect third party property from mine-

Aspect	Environmental objective	Outcome
	structures	related activities Where damage is unavoidable, to work together with the third parties to achieve a favourable outcome To ensure public safety
Heritage and cultural	To minimize the disturbance of heritage resources	To protect heritage resources where possible If disturbance is unavoidable, then mitigate impact in consultation with a specialist and the SAHRA and in line with regulatory requirements
Socio-economic	To limit inward migration and related social impacts and enhance positive economic impacts	To work together with existing structures and organisations and to establish and maintain a good working relationship with surrounding communities, local authorities and land owners
Land uses	To prevent unacceptable negative impacts on surrounding land uses	To co-exist with existing land uses To negatively impact existing land uses as little as possible

11.1.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES

Outcomes of the environmental objectives are the implementation of monitoring programmes. Impacts that require monitoring include:

- hazardous excavations and structures;
- physical destruction and general disturbance of biodiversity;
- pollution of surface water resources;
- contamination of groundwater;
- depletion of groundwater resources;
- increase in air pollution;
- increase in noise levels; and
- traffic increase and road use

11.1.2 ACTIVITIES AND INFRASTRUCTURE

The source activities of potential impacts which require management are detailed in Section 3.1 and include:

- earthworks;
- transport system;
- mineralised ore and waste;
- supporting services;
- water use and management;
- non-mineralised waste;
- open pit mining; and
- continued use of approved facilities and activities.

11.1.3 MANAGEMENT ACTIONS

Management actions which will be conducted to control the project activities or processes which have the potential to pollute or result in environmental degradation are detailed in Section 27.

11.1.4 ROLES AND RESPONSIBILITIES

The key personnel to ensure compliance to this EMPr will be the operations executive and the environmental department manager. As a minimum, these roles as they relate to the implementation of monitoring programmes and management activities will include:

- The environmental offices and SHE manager and officers will:
  - ensure that the monitoring programmes and audits are scoped and included in the annual mine budget;
  - identify and appoint appropriately qualified specialists/engineers to undertake the programmes;
  - appoint specialists in a timeously manner to ensure work can be carried out to acceptable standards;
  - liaise with the relevant structures in terms of the commitments in the SLP;
  - ensure that commitments in the SLP are developed and implemented timeously;
  - establish and maintain good working relations with surrounding communities and landowners; and
  - facilitate stakeholder communication, information sharing and grievance mechanism.

12 FINAL PROPOSED ALTERNATIVES

With reference to Section 6.1, no site layout alternatives were considered as part of the project and as such this section is not applicable.

13 ASPECTS FOR INCLUSION AS CONDITIONS OF THE AUTHORISATION

Management actions including monitoring requirements as outlined in Sections 27 and 29 need to form part of the conditions of the environmental authorisation. With reference to Section 26 of GN.982 of NEMA, additional conditions that need to form part of the environmental authorisation that are not specifically included in the EMPr report include:compliance with all applicable environmental legislation whether specifically mentioned in this document or not and which may be amended from time to time.

14 ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

Assumptions, uncertainties and limitations associated with the project are included below. No assumption, uncertainties and limitations were applicable to the following environmental and social aspects:

- topography;
- climate;
- soils and land capability;
- blasting;
- visual; and
- socio-economic

14.1 ENVIRONMENTAL ASSESSMENT LIMIT

The EMPr focused on third parties only and did not assess health and safety impacts on workers because the assumption was made that these aspects are separately regulated by health and safety legislation, policies and standards, and that Tshipi will adhere to these.

14.2 PREDICTIVE MODELS IN GENERAL

All predictive models are only as accurate as the input data provided to the modellers. If any of the input data is found to be inaccurate or is not applicable because of project design changes that occur over time, then the model predictions will be less accurate.

14.3 GEOCHEMISTRY STUDY

As part of the geochemical assessment (SLR, October 2013), SPLP tests were undertaken using distilled water to represent neutral drainage conditions. Although the SPLP can determine the leachability of determinants, the liquid-to-solid ratio does not represent actual field conditions; therefore resultant concentrations should not be considered representative of run-off that could emanate from site. The tests are commonly used as a preliminary screening process to identify potential chemicals of concern (CoCs) based on a comparison against relevant water quality and effluent standards.

In addition to the above, assumptions that were made as part of geochemical modelling to predict water quality includes the following:

- the water chemistries used in the modelling are representative of input sources. It is not possible to model water quality without this essential assumption. Input water qualities are derived from the results of the geochemical characterisation programme. Therefore, the water compositions used in the modelling do not represent actual water samples but "theoretical" compositions;

- predicting field-scale leaching from lab-scale leach tests is an approximation. Metal leaching at the field scale is variable through time and controlled by factors not fully applied at the lab scale. These factors include temperature, nature of the leaching solution, the solution to solid ratio, solution-solid contact time, particle size of the solid; and
- modelled waters are in full thermodynamic equilibrium. Equilibrium is the computational basis of PHREEQC. Equilibrium is unlikely to be the case for all chemical components throughout all mine waters. However, geochemical research has shown that assuming equilibrium conditions may usefully describe the composition of natural and mine waters. The PHREEQC model simulates chemical reactions and contains the appropriate thermodynamic constants.

Due to the assumptions and inherent limitations of predictive modelling, the model results are order of magnitude estimates. Therefore, results do not indicate modelled concentrations less than 0.01 mg/L.

14.4 BIODIVERSITY STUDY

The following assumptions apply to the biodiversity study undertaken for the project (EMS, February 2017):

- a potential limitation associated with the sampling approach is the narrow temporal window of sampling undertaken as part of the original survey (EMS, November 2008). Ideally, a site should be visited several times during different seasons to ensure that the full complement of plant and animal species present are captured. However, this is rarely possible due to time and cost constraints. The information presented in this report represents the wet/summer season survey (Summer or wet season data is always preferable in the northern cape as it facilitates identification). A full plant species list was compiled for the site from the site visits; this was complemented by a list of any listed species which are known from other studies to occur in the broad vicinity of the site. The lists of amphibians, reptiles and mammals for the site are based on those observed at the site as well as those likely to occur in the area based on their distribution and habitat preferences. This represents a sufficiently conservative and cautious approach that takes account of the study limitations;
- the Tshipi Borwa Mine is not located in any known CBA's. No information is currently available on the fine scale distribution of Aquatic Dependent Ecosystems (ADEs), type of plant association, (singly, in stands or gallery forests), aquifer association, condition of vegetation etc. and therefore a precautionary approach should be taken when developing in and around these systems until such time that the research data indicates whether or not they are in fact CBAs;
- there is no quantitative analysis of the resource base for the protected trees (*Vachellia erioloba* and *Vachellia haematoxylon*) thus it is not known how many of the trees can be removed from an area without detrimentally affecting the overall population numbers; and

- no additional survey was undertaken as part of this updated report. The vegetation map presented in this report has therefore been compiled from the original survey, thus the areas that have subsequently been mined and developed have not been included, and are still represented by the original vegetation communities. There is a constraint with respect to reporting the effect of disturbance and additional impacts when the raw data is out of date. As the vegetation data has not been updated the report can only assess the area as if it had not been disturbed at all and express an opinion as to how the project may or may not have affected the biodiversity based on the original data. It is important to note that impacts are unlikely to change, however additional management actions may be required based on the findings of the monitoring programme.

14.5 SURFACE WATER

The following assumptions apply to the stormwater management plan undertaken for the project (SLR, June 2017):

- rainfall related inflows and evaporation related losses for the wet and dry season scenarios were estimated based on: i) average values during the three driest months of the year; and ii) average values during the three wettest months of the year;
- runoff and evaporation coefficients for each surface were fixed and not influenced by antecedent climatic conditions, likewise all catchment areas are constant;
- evaporation from the dams will only occur if there was water in the dam;
- under normal / average conditions there will be no overflow of stormwater from the dirty water dam or workshop dirty water collection dam to the stormwater dam;
- there will be no inflow of stormwater from the Mamatwan pit, during mining of the barrier pillar; and
- the water balance model was run for only steady state average wet season and average dry season conditions and no consideration is given to storage of water at any aspect of the infrastructure modelled i.e. flow in = flow out.

14.6 GROUNDWATER

The following assumptions apply to the groundwater management plan undertaken for the project (SLR, July 2017):

- a numerical groundwater flow and transport model is a representation of some or all characteristics of a real system on an appropriate scale. It is a management tool that is typically used to understand why a system is behaving in a particular observed manner or to predict how it will behave in the future. Its precision depends on chosen simplifications (in a conceptual model) as well as on the completeness and accuracy of input parameters. In particular, data on input parameters like water levels and aquifer properties is often scare and limits the precision and confidence of numerical groundwater models. Impact predictions are based on numerical model results, the precision of which depends obviously on the chosen simplifications as well as the accuracy of input parameters like hydraulic conductivities, porosities or source concentrations;

- the groundwater model simulated the UMK and Mamatwan Mines, using their existing pits and does not take into account future mining or backfilling at these mines. An improved groundwater simulation of hydraulic heads (cone of drawdown) and a more realistic contaminant plume could be modelled through information sharing between Tshipi, Mamatwan and UMK;
- the source term used for groundwater modelling is considered to be conservative and may overestimate the potential pollution impacts; and
- it should be noted that no significant faults, fractures or other lineaments were observed at the Tshipi Borwa Mine (Metago, May 2009) and therefore no geological structures have been included in the model. Should such structures be encountered, further hydrogeological work will be needed and the groundwater model will need to be updated.

14.7 AIR QUALITY

The following assumptions apply to the air quality opinion undertaken for the project (Airshed, February 2017):

- the mining rate would remain the same; and
- the modelled impacts from the 2009 study were used to qualitatively assess the potential for any increases in ground level concentrations.

14.8 NOISE

The change in the operations crushing and screening and train loading activities from day-time only to day-time and night-time including weekends is not expected to significantly add to ambient noise levels due to other noise generating activities in the area.

14.9 TRAFFIC STUDY

The following assumptions apply to the traffic study undertaken for the project (Siyazi, June 2017):

- the average rate of growth of vehicle traffic in the area under investigation that is not relevant to the existing mining development (background traffic) between the 2017 manual traffic counts and the 2027 scenarios was anticipated at 3% per annum;
- the vehicle traffic absorption rate (rate at which existing developments attract vehicular traffic) by all other types of completed developments will maintain the same status for the next ten years;
- vehicle traffic currently generated by the existing mining development will remain unchanged; and
- the traffic study does not comment on pavement layer attributes in terms of the relevant road sections.

14.10 HERITAGE/ CULTURAL AND PALAEONTOLOGICAL RESOURCES

The assumptions outlined in the heritage/cultural study undertaken as part of the approved EMPr (Metago, May 2009) are deemed relevant for the project. The following assumption apply:

- not subtracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the Tshipi Borwa Mine. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted. Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist had been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well; and
- in the foregoing discussion the long history of occupation of the region by black farmer communities has also been pointed out. In the event that any graves or burial places are located during the project the procedures and requirements pertaining to graves and burials will apply as set out above.

The accuracy and reliability of desktop Palaeontological Impact Assessments as components of heritage impact assessments are normally limited by the following restrictions:

- fossil databases that have not been kept up-to-date or are not computerised. These databases do not always include relevant locality or geological information;
- the accuracy of geological maps where information may be based solely on aerial photographs and small areas of significant geology have been ignored. The sheet explanations for geological maps are inadequate and little to no attention is paid to palaeontological material; and
- impact studies and other reports (*e.g*. of commercial mining companies) - is not readily available for desktop studies.

Large areas of South Africa have not been studied paleontologically. Fossil data collected from different areas but in similar Assemblage Zones might however provide insight on the possible occurrence of fossils in an unexplored area. Desktop studies therefore usually assume the presence of unexposed fossil heritage within study areas of similar geological formations.

14.11 CLOSURE COST ESTIMATE

The following assumptions are made for the development of the Preliminary Closure Plan at this stage of the mining operations:

- the mine will follow and adhere to the commitments made in the EMPr;

- the mine will follow the mine plan and design / layout to minimise the potential for additional disturbed areas;
- the volume of stockpiled topsoil that has been stripped from infrastructure and operational areas will be sufficient for closure activities;
- the overburden material excavated from the open pit will be available for backfilling of the open pit void at closure;
- groundwater in the deeper BIF aquifer will not be negatively impacted by the mine workings;
- runoff water quality from rehabilitated areas will be acceptable and will not require any further treatment;
- no allowance for salvage and / or recycling scrap material has been considered in the estimation procedure;
- inert building and demolition rubble can be safely disposed and buried on site (or disposed in the final open pit voids);
- hazardous material can be safely disposed of offsite at a nearby appropriate facility;
- reagent, fuel, lubricant and explosive manufacturers/suppliers will accept returned product at the end of the mine life;
- no consideration of the social closure costs has been included in this report;
- no assessment of any socio-economic/shared value/ community based programmes being implemented and whether these would continue post-closure of the operation; and
- all costs associated with pre-closure monitoring, auditing and reporting are presumed to be covered under the operations expenditure of the mine, and have not been included in this preliminary closure plan.

Assumptions will be reviewed during the ongoing operations of the mine and any required technical work conducted in order to reduce information gaps and uncertainty prior to mine closure.

The Financial Provisioning Regulations, 2015 (GNR 1147) require the closure cost estimate to have an accuracy of approximately 70% since the LOM is more than 10 years but less than 30 years.

14.12 SPECIALIST STUDIES AND NEMA REPORTING STRUCTURE

As part of the approved EMPr (Metago, May 2009), numerous specialist studies were undertaken. As part of the project some of these specialist studies were updated. These included the groundwater study, the biodiversity study and the traffic study. In terms of the air study, soil study, and heritage study it was not deemed necessary to update these studies as the specialist were of the opinion that the overall results of their studies undertaken for the approved EMPr (Metago, May 2009), would remain unchanged when considering project activities. It follows that in terms of the soil study, the air study and the heritage study, professional opinions were provided.

Taking the above into consideration, where specialist studies were updated for the project, and any new studies (palaeontological study) were undertaken these reports have been structured in accordance with Appendix 6 of NEMA, Regulations 982 of 4 December 2014 (EIA Regulations), as amended that specifies the content of specialist studies. It is important to note that where specialist studies undertaken as part of the approved EMPr (Metago, May 2009) did not require updating as advised by specialist input, these studies will not fully comply with the requirements for specialist reports in terms of NEMA Appendix 6 as this was not a requirement at the time of completing the studies.

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

15.1.1 REASONS WHY THE ACTIVITY SHOULD BE AUTHORIZED OR NOT

The assessment of the project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the bio-physical, cultural and socio-economic environments both on the project sites and in the surrounding area. With management actions these potential impacts can be prevented or reduced to acceptable levels. It follows that provided the EMP is effectively implemented there is no environmental, social or economic reason why the project should not proceed.

15.1.2 CONDITIONS THAT MUST BE INCLUDED IN THE AUTHORISATION

15.1.2.1 Specific conditions for inclusion in the EMPR

Refer to Section 13.

15.1.2.2 Rehabilitation Requirements

Refer to Section 28.

16 PERIOD FOR WHICH AUTHORISATION IS REQUIRED

The estimated life of mine is 20 years. The mine has been operational for 7 years.

17 UNDERTAKING

I, Natasha Smyth, the Environmental Assessment Practitioner responsible for compiling this report, undertake that:

- the information provided herein is correct;
- the comments and inputs from stakeholders and I&APs has been included;
- inputs and recommendations from the specialist reports have been included where relevant; and
- any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.

24/08/2017

Signature of EAP

Date

Signature of commissioner of oath

24/08/2017
Date

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18 FINANCIAL PROVISION

18.1 METHOD TO DERIVE THE FINANCIAL PROVISION

The financial provision for the project is based on a preliminary mine closure plan compiled for Tshipi Borwa mine in accordance with the NEMA Regulations (Regulation 1147 of 2015) pertaining to the financial provision for mining operations (SLR, March 2017) (see Appendix R).

The closure cost liability was calculated as per the methodology of the DMR guideline document of January 2005. As per the DMR guideline, Tshipi Borwa mine is classified as a Class C (low risk) mine, with a medium environmental sensitivity based on the pre-mining environment of the mining area, the proximity of the mine to local communities and the surrounding area's existing economic activity.

The amount determined for financial provision for the project is provided in Section 28.

18.2 CONFIRM THAT THE AMOUNT CAN BE PROVIDED FOR FROM OPERATING EXPENDITURE

The amount required in order to manage and rehabilitate the environmental is provided for in the operating costs.

19 DEVIATIONS FROM SCOPING REPORT AND APPROVED PLAN OF STUDY

19.1.1 DEVIATION FROM THE METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

This section is not applicable given that a substantive amendment process only requires the submission of an EMP amendment report and does not include a scoping phase.

19.1.2 MOTIVATIONS FOR DEVIATION

With reference to Section 19.1.2 above, this section is not applicable.

20 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

20.1.1 IMPACT ON THE SOCIO-ECONOMIC CONDITIONS OF ANY DIRECTLY AFFECTED PERSON

The impacts associated with socio-economic conditions are discussed in Appendix F. Management and management actions identified to address any socio-economic impacts are included in Section 27. It is however important to note that no person will be directly affected by the project given that no IAPs currently reside within the project footprint area.

20.1.2 IMPACT ON ANY NATIONAL ESTATE REFERRED TO IN SECTION 3(2) OF THE NATIONAL HERITAGE RESOURCES ACT

Not applicable as no national estate will be affected as part of the project.

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

No other matters are required in terms of Section 24(4)(A) and (B) of the act.

PART B – ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

22 DETAILS OF THE EAP

It is hereby confirmed that the details of the EAP who undertook the EIA and prepared this EMP are provided in Part A, Section 1 of the EIA report.

23 DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

It is hereby confirmed that the activities covered by this EMP are fully described in Part A, Section 3 of the EIA report.

24 COMPOSITE MAP

A map indicated all surface infrastructure superimposed on the environmental sensitive areas of the preferred site is included in Appendix G.

25 DESCRIPTION OF THE IMPACT MANAGEMENT OBJECTIVES INCLUDING MANAGEMENT STATEMENT

25.1 DETERMINATION OF CLOSURE OBJECTIVES

The closure objectives for the project were determined taking into account the existing type of environment as described in Section 6.4.1, in order to ensure that the closure objectives strive to achieve a condition approximating its natural state as far as possible. Further information pertaining to the closure objectives identified for the project, refer to Section 28.1.1.

25.2 THE PROCESS FOR MANAGING ENVIRONMENTAL DAMAGE AS A RESULT OF UNDERTAKING THE ACTIVITY

The management actions outlined in Section 27 have been identified in order to manage and reduce impacts associated with the project in order to prevent unnecessary damage to the environment as a result of the project. In the event that incidents occur that may result in environmental damages the emergency response procedure as outlined in Section 30.2 will be implemented to avoid pollution or degradation.

25.3 POTENTIAL RISK OF ACID MINE DRAINAGE

With reference to Section 6.4.1.1, geochemical tests and analysis indicate that waste rock at the Tshipi Borwa Mine have a negligible potential to generate acid drainage due to non-detectable sulphur content.

25.4 STEPS TAKEN TO INVESTIGATE, ASSESS AND EVALUATE THE IMPACT OF ACID MINE DRAINAGE

With reference to Section 25.3, waste rock is not acid generating and as such this section is not applicable.

25.5 ENGINEERING OR MINE DESIGN SOLUTIONS TO AVOID OR REMEDY ACID MINE DRAINAGE

With reference to Section 25.3, waste rock is not acid generating and as such this section is not applicable.

25.6 MEASURES IN PLACE TO REMEDY RESIDUAL OR CUMULATIVE IMPACT FROM ACID MINE DRAINAGE

With reference to Section 25.3, waste rock is not acid generating and as such this section is not applicable.

25.7 VOLUMES AND RATE OF WATER USE FOR MINING

The volumes of water required as part of the project include:

- potable water (27 387m^3/month); and
- process plan water requirement (9 432m^3/month) which will increase to 15 004m^3/month when the tailings dam and sinter plant are operational.

25.8 HAS A WATER USE LICENCE BEEN APPLIED FOR?

As part of the project a water use licence will be applied for.

25.9 IMPACTS TO BE MITIGATED IN THEIR RESPECTIVE PHASES

The section focuses on management actions that are specific to listed activities based on actions outlined in Section 27. It is important to note, that a substantive amendment process does not trigger any listed activities and as such this section is not applicable.

26 IMPACT MANAGEMENT OUTCOMES

The section below provides a description of the outcomes and objective of management actions in order to manage, remedy, control or modify potential impacts. The management actions identified to achieve these outcomes and objectives are described in Section 27.

TABLE 49: DESCRIPTION OF IMPACT MANAGEMENT OUTCOMES

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Mineralised waste Continued use of approved facilities and services Open pit mining Final land forms	Loss and sterilisation of mineral resources	Geology	Operational Decommissioning Closure	• Management through best practices	Avoid sterilisation of mineral resources to prevent unacceptable mineral sterilisation.
Earthworks Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Hazardous excavations and infrastructure resulting in safety risks to third parties and animals	Topography	Construction Operational Decommissioning Closure	• Control through access control • control through management and monitoring • control through rehabilitation • remedy through emergency response procedures (Section 30.2.2)	To ensure the safety of third parties and animals in order to prevent physical harm from potentially hazardous excavations and infrastructure
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services	Loss of soil resources and land capability through contamination	Soil and land capability	Construction Operational Decommissioning Closure	• Control through waste management practices • control through rehabilitation • control through appropriate design • remedy through emergency response procedures	To ensure that soil resources are handled and managed properly in order to conserve these resources for use as part of rehabilitation which will assist with the restoration

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Transportation system Continued use of approved facilities and services Open pit mining Final land forms				(Section 30.2.2)	of pre-mining land capability as far as possible.
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Loss of soil resource and land capability through physical disturbance		Construction Operational Decommissioning Closure	• Manage through limiting the project footprint • manage through soil conservation procedures • manage through closure planning and rehabilitation	To ensure that soil resources are handled and managed properly in order to conserve these resources for use as part of rehabilitation which will assist with the restoration of pre-mining land capability as far as possible.
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Physical destruction of biodiversity	Biodiversity	Construction Operational Decommissioning Closure	• Management though biodiversity action plan and offset (when relevant) • managing through limiting the project footprint • management through rehabilitation • control through permits for removal	To prevent the unacceptable disturbance and loss of biodiversity and related ecosystem functionality through physical destruction and to limit the area of disturbance as far as possible.
Earthworks Mineralised waste Non-mineralised waste	General disturbance of biodiversity		Construction Operational Decommissioning	• Management through alien invasive species programme • management through	To prevent the unacceptable disturbance and loss of biodiversity

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms			Closure	training • management through monitoring • management through appropriate design • remedy through emergency response procedures (Section 30.2.2)	and related ecosystem functionality through general disturbance.
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Alteration of natural drainage patterns	Surface water	Construction Operational Decommissioning Closure	• Management through stormwater control • manage through monitoring water requirements	To ensure that the reduction of the volume of run-off into the downstream catchment is limited to what is necessary and that natural drainage patterns are re-established as part of rehabilitation in order to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Contamination of surface water resources		Construction Operational Decommissioning Closure	• Management through waste management practises • management through monitoring • management through compensation • remedy through emergency response procedures (Section 30.2.2)	To ensure surface water quality remains within acceptable limits for both domestic and agricultural purposes to prevent pollution of surface water resources and related harm to surface water users.

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Contamination of groundwater resources	Groundwater	Construction Operational Decommissioning Closure	• Management through monitoring • management through compensation • management through appropriate design • remedy through emergency response procedures (Section 30.2.2)	To ensure groundwater quality remains within acceptable limits for both domestic and agricultural purposes to prevent harm to water users.
Continued use of approved facilities and services Open pit mining	Lowering of groundwater levels and reducing availability	Groundwater	Operational	• Management through monitoring • management through compensation	To avoid loss of groundwater for third party use.
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Air pollution	Air quality	Construction Operational Decommissioning Closure	• Manage through air controls and monitoring	To ensure that any pollutants emitted as a result of the project remain with acceptable limits so as to prevent health related impacts.
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system	Increase in disturbing noise levels	Noise	Construction Operational Decommissioning Closure	• Manage through noise controls and once off sampling	To ensure that any noise generated as a result of the project remains within acceptable limits to avoid the disturbance of third parties.

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Continued use of approved facilities and services Open pit mining					
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Negative visual views	Visual	Construction Operational Decommissioning Closure	• Manage through limiting project footprint, rehabilitation and visual controls	To ensure visual views that complements the surrounding environment to limit negative visual views.
Continued use of approved facilities and services	Road disturbance and traffic safety	Traffic	Operational Decommissioning	• Manage through road maintenance • remedy through emergency response procedures (Section 30.2.2)	To ensure the mine's use of public roads is done in a responsible manner to reduce the potential for safety and vehicle related impacts on road users.
Continued use of approved facilities and services Open pit mining	Ground vibration, air blasts and fly rock	Blasting	Operational	• Management through blast design • remedy through emergency response procedures (Section 30.2.2)	To protect third party property from project-related activities, where possible.
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system	Loss of heritage/cultural and palaeontological resources	Heritage/cultural and palaeontological resources	Construction Operational Decommissioning Closure	• Control through avoidance • remedy through emergency response procedures (Section 30.2.2)	To avoid the disturbance of significant heritage resources

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Continued use of approved facilities and services Open pit mining					
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Closure activities in line with closure plan	Inward migration	Socio-economic	Construction Operational Decommissioning Closure	• Control through the monitoring of living conditions of employees, recruitment processes, disease management • remedy through emergency response procedures (Section 30.2.2)	To establish and maintain a good working relationship with surrounding communities, local authorities and land owners in order to limit the impacts associated with inward migration.
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Closure activities in line with closure plan	Economic impact		Construction Operational Decommissioning Closure	• Control through good communication, recruitment and procurement processes	To enhance the positive economic impacts by working together with existing structures and organisations.
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services	Change in land use	Land use	Construction Operational Decommissioning Closure	• Management through communication	To negatively impact on land uses as little as possible in order to prevent unacceptable impacts on surrounding

Activity	Potential Impact	Affected Aspect	Phase	Management actions Type	Standard to be Achieved (Impact management outcome/objectives)
Transportation system Continued use of approved facilities and services Open pit mining Final land forms					land uses and their economic activity.

27 IMPACT MANAGEMENT ACTIONS

Management actions identified to prevent, reduce, control or remedy the assessed impacts are tabulated below. It is important to note that management actions will include any measures outlined in the approved EMPr and any additional management actions identified as part of the project, where relevant. Any additional management actions will be indicated in *italics*. The action plans include the timeframes for implementing the management actions together with a description of how management actions comply with relevant standards. Management actions and recommendations identified by specialists have been summarised and are included into Table 50 below.

TABLE 50: DESCRIPTION OF IMPACT MANAGEMENT ACTIONS

Activity	Potential Impact	Management actions Type	Time Period for Implementation	Compliance with Standards
Mineralised waste Continued use of approved facilities and services Open pit mining Final land forms	Loss and sterilisation of mineral resources	• *In operation, decommissioning and closure, best mining practices will be undertaken to ensure that mineral sterilisation is minimised as far as possible.*	On-going	Not applicable
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Hazardous excavations and infrastructure resulting in safety risks to third parties and animals	• Management actions that have been identified for all mine phases include the following: o until hazardous excavations are rehabilitated and closed, they will each have a barrier to prevent access by people and animals. The barrier may be in the form of fences, walls or berms. In addition, the barriers must have warning signs at appropriate intervals. These warning signs must be in picture format and/or written in English; o sams with a safety risk will be monitored by a professional civil engineer in accordance with Section 29; o *all mineralised waste facilities and water dams will be operated and closed in a manner to ensure stability and related safety risks to third parties and animals are mitigated; and* o *Tshipi will survey its mining and surface use area and update its mine plan map on a routine basis to ensure that the position and extent of all potential hazardous excavations and hazardous infrastructure is known as part of operation and decommissioning. Tshipi will*	On-going	Not applicable

Activity	**Potential Impact**	**Management actions Type**	**Time Period for Implementation**	**Compliance with Standards**
		furthermore ensure that appropriate management actions are taken to mitigate the related safety risks to third parties and animals; • *During decommissioning planning of any part of the mine, provision will be made to mitigate long term safety risks in the decommissioning and rehabilitation phases;* • *At closure the hazardous infrastructure will be removed and the disturbed area rehabilitated in a manner that it does not present a long term safety and/or stability risk; and* • In case of incident or death due to hazardous excavations, the emergency response procedure in Section 30.2.2 will be followed.	As required As required As required	
Earthworks Mineralised waste Water use and management Non-mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Loss of soil resources and land capability through contamination	• Management actions that have been identified for all mine phases include the following: o Tshipi will conduct all potentially polluting activities (i.e. transportation, handling and storage) in a manner that pollutants *(such as hazardous chemicals (new and used), dirty water, mineralized waste*s and non-mineralised wastes) are contained at source and do *not pollute soils*. In this regard, the mine will ensure that: - all vehicles and *mobile* equipment are *serviced and that this is done* in workshops and washbays with contained impermeable, floors, dirty water collection facilities and oil traps; - all new and used chemical, fuel, and oil storage and handling facilities will be designed and operated in a manner that all spillages are contained in impermeable areas and cannot be released into the environment; - ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) will be reported to the environmental manager immediately and cleaned up/remediated immediately; - a dirty water management system, as set out in the respective section below is implemented *and maintained;* - the waste management practices, as set out in Table 51 below is implemented; - *all employees (temporary and permanent) are educated and trained in pollution prevention; and* - *steps are in place to enable fast reaction to contain and remediate pollution incidents.* o *specifications for post rehabilitation audit should be determined and*	On-going	Not applicable

Activity	Potential Impact	Management actions Type	Time Period for Implementation	Compliance with Standards
		implemented to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and if not, to recommend and implement further measures; and o *the designs of any permanent and potentially polluting structures (such as the waste rock dumps and tailings dam) must take into account the requirements for long term soil pollution prevention, land function and confirmatory monitoring.* • In case of major spillage incidents the emergency response procedure in Section 30.2.2 will be followed.	As required	
Earthworks Water use and management Mineralised waste Non-mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Loss of soil resources and land capability through physical disturbance	• Management actions that have been identified for all mine phases include: o land disturbance by mine activities will be limited to those activities and areas that are described in the EMPr report; o Tshipi will implement the soil conservation procedure as set out in Table 52; and o rehabilitation will be undertaken *in line with an approved mine closure plan that ensures a suitable post-closure land use is achieved.* • *As part of closure planning, the designs of any permanent landforms (approved tailings dam) will take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring.*	On-going As required	Not applicable
Earthworks Water use and management Mineralised waste Non-mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Physical destruction of biodiversity	• Management actions to be implemented during all phases include the following: o Tshipi will continue to implement a biodiversity action plan that will be refined and implemented in consultation with *DAFF and a qualified specialist;* o Tshipi will continue to limit mine infrastructure, activities and disturbance to those specifically identified and described in this EMPr, with controlled access and zero tolerance of unnecessary disturbances to the identified sensitive habitats and associated species of the *Vachellia haematoxylon* Savannah and Mixed *Vachellia* Savannah vegetation types; o pods of the Camel Thorn (*Vachellia erioloba)* and the Grey Camel Thorn (*Vachellia haematoxylon)* will continue be collected in order to aid in the re-establishment of these species. Necessary steps (such as artificial scarring/acid washing) will be taken in order to aid in germination of these species;	On-going	Permit applications will have to be made to the DAFF and DENC to obtain the required permission to remove and/or translocate protected species in terms of the NFA and the NCNCA respectively. Only for new areas to be disturbed.

Activity	Potential Impact	Management actions Type	Time Period for Implementation	Compliance with Standards
		o there will be planned removal of fauna and flora (plants and seeds) species prior to disturbance by mine infrastructure and activities. This will include planning on the preservation, cultivation and re-use of these species in ongoing rehabilitation. Links will also be made to the soil conservation procedure and actions. Harvesting of seeds in a controlled manner from similar areas within the Tshipi Borwa Mine area will be undertaken to aid in rehabilitation of the mining areas; o as a first priority, every attempt will be made to preserve existing larger trees; o where protected plant and/or tree species need to be removed/destroyed, the relevant permits must be obtained *prior to removal; and* o management of the rehabilitated areas will consider an "after care" programme, which will aid in ensuring that the correct species are able to re-establish.		
		• A biodiversity offset will be implemented should this be requested by DAFF in accordance with the relevant biodiversity offset guidelines. Issues that will be considered in the biodiversity offset with guidance from DAFF are as follows: o the size of the potentially affected area; o the conservation status of the potentially affected area; o the offset ratio (in terms of the required size of the offset site) to be applied; o evaluation of alternative offset sites on the basis of: compensation for the mine's negative impact on biodiversity, long term functionality, long term viability, contribution to biodiversity conservation in the Northern Cape including linkages to areas of conservation importance, acceptability to IAPs, management of negative impacts on local communities, distances from other mines in relation to dust fallout and other impacts, and biodiversity condition scores as compared to that at the UMK site; o land ownership now and in the future; o status/security of the offset site, i.e. will it receive conservation status; o measures to guarantee the security, management, monitoring and auditing of the offset; o capacity of Tshipi to implement and manage the offset (collaboration with surrounding mine's offsets may be an option); o identification of unacceptable risks associated with the offset; and	As required	

Activity	Potential Impact	Management actions Type	Time Period for Implementation	Compliance with Standards
		o the start up and ongoing costs associated with the offset for the life of the project.		
Earthworks Water use and management Mineralised waste Non-mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	General disturbance of biodiversity	• Management actions to be implemented during all phases includes the following: o Tshipi will implement an alien/invasive/weed management programme (Section 29) in collaboration with the *DENC and DAFF* to control the spread of these plants onto and from disturbed areas. Care will be taken to prevent the encroachment of these species into rehabilitated areas; o *vertebrates should be kept away from the illuminated areas with appropriate fencing where feasible;* o *there is training for workers on the value of biodiversity and the need to conserve the species and systems that occur at the Tshipi Borwa Mine;* o *there is zero tolerance of the killing or collecting of any biodiversity by anybody working for or on behalf of Tshipi;* o *strict speed control measures are used for any vehicles driving within the Tshipi Borwa Mine area;* o *noisy and/or vibrating equipment will be well maintained to control noise and vibration emission levels;* o *dust control measures will be implemented as discussed under the air quality section in this appendix; and* o *pollution and litter prevention measures will be implemented as outlined in Table 51 and Table 52.*	On-going	The management action to implement an alien invasive species programme is in accordance with the NEMBA Alien and Invasive Species Regulations (2014) that requires the control of invasive species.
Earthworks Water use and management Mineralised waste Non-mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Alteration of natural drainage patterns	• Management actions to be implemented in all mine phases include the following: o *Mine infrastructure will be constructed, operated and maintained so as to comply with the provisions of the Regulation 704 of 1999 in terms of the NWA. These include:* - *clean water systems are separated from dirty water systems;* - *the size of dirty water areas are minimized; and* - clean water *(run-off and rainfall)* must be diverted around the mine/*dirty areas and back into its normal flow in the environment;* o the site wide water balance is refined on an on-going basis with the input of actual flow volumes and used as a decision making tool for water management and impact management actions (Section 29).	On-going	Constructed and operate stormwater management facilities so as to comply with Regulation 704 of 1999 in terms of the NWA. The submission of a water use licence for authorisation in terms of the NWA for dirty water containment facilities.

Activity	**Potential Impact**	**Management actions Type**	**Time Period for Implementation**	**Compliance with Standards**
Earthworks Water use and management Mineralised waste Non-mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Contamination of surface water resources	• Management actions to be implemented in all mine phases include the following: o all hazardous chemicals *(new and used), mineralized waste and non-mineralised waste must be handled in a manner that they do not pollute surface water. This will be implemented by means of the following:* - *pollution prevention through basic infrastructure design;* - *pollution prevention through maintenance of equipment;* - *pollution prevention through education and training of workers (permanent and temporary);* - pollution prevention through appropriate management of hazardous materials as *outlined in Table 51*; - *the required steps to enable containment and remediation of pollution incidents; and* - *specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.* o Tshipi will implement a monitoring programme for surface water within and outside the vicinity of its operations. The surface water monitoring programme must also focus on surface water sampling of different mine dirty water streams, any unplanned discharges, and monitoring both up and downstream of the Vlermuisleegte of the mining operations when possible (the possibility of monitoring water in the Vlermuisleegte River may only arise during heavy periods of rain). Details of the surface water monitoring programme are outlined in Section 29; o should any surface water resource contamination be detected, the mine will immediately notify DWS. Tshipi, in consultation with DWS and an appropriately qualified person, will then notify potentially affected users, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures. Any related loss caused by the mine (in the short and long term) will be addressed through compensation, which may include an alternative water supply of equivalent quality and quantity; and o *in the event that water quality monitoring around any WRD indicates that the waste rock dumps are causing pollution, catchment paddocks*	On-going	Constructed and operate stormwater management facilities so as to comply with Regulation 704 of 1999 in terms of the NWA. The submission of a water use licence for authorisation in terms of the NWA for dirty waste containment facilities.

Activity	Potential Impact	Management actions Type	Time Period for Implementation	Compliance with Standards
		and soak-always will be provided to minimise the risk of exposure to wildlife, livestock and humans. • In case of a potentially polluting discharge incident that may result in the pollution of surface water resources, the emergency response procedure in Section 30.2.2 will be followed.	As required	
Earthworks Water use and management Mineralised waste Non-mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining (including backfilling) Final land forms	Contamination of groundwater resources	• Management measures to be implemented in all phases include the following: o Tshipi will continue to monitor groundwater quality (refer to Section 29 for the monitoring programme). The existing monitoring network is considered sufficient to detect any pollution related to the revised site layout. Should any off-site contamination be detected, the mine will immediately notify DWS. The mine, in consultation with DWS and an appropriately qualified person, will then notify potentially affected users, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures; o if water users experience any Tshipi related contamination and related loss of water supply, Tshipi will provide compensation, which could include an alternative water supply of equivalent water quality and quantity; o *in the event that water quality monitoring around any WRD indicates that the waste rock dumps are causing pollution, catchment paddocks and soak-always will be provided to minimise the risk of exposure to wildlife, livestock and humans;* o *prevent pollution through basic infrastructure design; and* o *the footprint of temporary waste rock dumps will be rehabilitated by ripping the underlying subsoil, then replacing the topsoil, vegetating, applying fertilizer, and irrigating the new growth for a short period.* o *prior to closure, the groundwater model will be re-run to consider* potential pollution impacts without the retardation effect of pit dewatering. If necessary, provision will be made by the mine for post closure compensation that may be required for any future negative impacts. This will form part of detailed closure planning. o in case of a major discharge incident that may result in the pollution of groundwater resources the Tshipi emergency response procedure will be followed. o *the source term used for groundwater modelling is conservative. Further source term modelling should be carried out on waste samples collected*	On-going	The submission of a water use licence for authorisation in terms of the NWA for changes to the volumes of the waste rock dumps.

Activity	Potential Impact	Management actions Type	Time Period for Implementation	Compliance with Standards
		from site and incorporated in the future groundwater model updates.		
Open pit mining (Pit dewatering) Recovery of groundwater levels	Lowering of groundwater levels and reducing availability	• Management actions to be implemented include the following: o Tshipi will continue to monitor groundwater levels (refer to Section 9 for the monitoring programme). The existing monitoring network is considered sufficient to detect changes in water levels due to the revised site layout; o if borehole users experience any mine related water loss, Tshipi will, in conjunction with other mines in the area that are contributors to the cumulative impact, provide compensation, which could include an alternative water supply of equivalent water quality and quantity; and o if monitoring shows that the base flow of the Vlermuisleegte is affected, a specialist team comprising DWS and biodiversity and groundwater experts will be commissioned to investigate the significance of the impacts and the specific management actions that must be implemented by all contributing mines.	On-going	The submission of a water use licence for authorisation in terms of the NWA for changes to the existing WUL abstraction volumes.
Earthworks Water use and management Mineralised waste Non-mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Air pollution	• Management actions identified in all mine phases include the following: o treatment as many roads as possible; o a target dust control efficiency of 90% can be achieved by maintaining strict control of driving speeds and a combination of chemical dust binding agent and/or water suppression along roads. *Where dust binding agents are used, this must be limited to the roads only;* o a 90% reduction in PM_{10}, TSP, and Mn emissions from vehicle movement of paved roads can be achieved through sweeper on paved road surfaces; o a 70% and 50% reduction in PM_{10}, TSP, and Mn emissions from truck offloading and conveyor transfer from paved roads can be achieved by water sprays; and o a 25% reduction in PM_{10}, TSP, and Mn emissions from in-pit drilling can be achieved by drill fitted with cyclone. • Tshipi will develop and implement other key elements of an air quality control system. This system will include inter alia: o monitoring in accordance with Section 29; and o if monitoring determines that third parties (Figure 25) will be exposed to unacceptable cumulative concentrations of manganese or PM10, a health risk assessment will be commissioned. Commissioning this health risk assessment, including the implementation of any related management actions, is the responsibility of both Tshipi and other	On-going On-going	National Atmospheric Emission Reporting Regulations in terms of the National Environmental Management: Air Quality Act (No. 39 of 2004) requires that holders of mining rights register on the National Atmospheric Emissions Inventory System (NAEIS) and to ensure that annual monitoring reports are uploaded onto the NAEIS.

Activity	Potential Impact	Management actions Type	Time Period for Implementation	Compliance with Standards
		contributing mines. • *A complaints register should be available at the mine. The date and time noted on the complaints register should be the date and time that the reported problem is observed, not the date and time that the complaint is logged. If used correctly, the complaints register can be compared to monitoring data as well as recorded meteorological data to identify problem areas and to iteratively adjust the dust management plan to ensure efficient and effective mitigation of fugitive dust sources.* • *Tshipi will apply for an air emissions licence for the sinter plant prior to operation.*	On-going As required	
Earthworks Water use and management Mineralised waste Non-mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining	Increase in disturbing noise levels	• Management actions that have been identified in all phases prior to closure include the following: o no blasting will take place at night and on Sundays; o all diesel-powered earth moving equipment will be of high quality and will be well maintained. Regular maintenance schedules must include the checking and replacement of exhaust and intake silencers; o *all haul roads will be kept clean and maintained in a good state of repair at all times to avoid unwanted rattle and "body-slap" from vehicles;* o *plant and equipment will be operated in a proper manner with respect to minimising noise emissions, for example, minimisation of drop heights when loading and no un-necessary revving of engines;* o *pumps, generators and compressors will be located behind screening mounds where possible and should be electrically powered where possible and/or be fitted with acoustic covers as necessary Diesel powered pumps, generators and compressors will be installed within acoustic enclosures if necessary; and* o the mine will record and respond immediately to complaints about disturbing noise. All such complaints will be documented and recorded as incidents. The measures taken to address these complaints will be included in the documentation. These records will be kept for the life of mine. *Noise monitoring will be undertaken following the receipt of a complaint (Section 29). Where necessary additional management actions will be implemented to avoid repeat occurrences.* • A once off sampling exercise with input from a specialist must be undertaken over the times of crushing and screening and train loading. Depending on the outcome of the sampling exercise additional management actions may be	On-going As required	Not applicable

Activity	Potential Impact	Management actions Type	Time Period for Implementation	Compliance with Standards
		implemented if required.		
Earthworks Water use and management Mineralised waste Non-mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms	Negative visual views	• The following management actions should be implemented in all phase: o ensure that the absolute minimum amount of vegetation and land is disturbed during construction and operation. This is important on the boundaries of the mine where vegetation can assist with screening; o *only the footprint area as defined by the approved layout in this EMPr will be exposed. In all other areas, the natural vegetation will be retained to the extent that control of these areas sits with Tshipi;* o implement the recommended air pollution control system to avoid plumes of dust; o where possible, paint structures and buildings in colours that reflect and compliment the natural landscape; o rehabilitation of all mined out areas in accordance with the principles of ongoing rehabilitation that includes: backfilling, placement of topsoil and re-establishment of vegetation; o effective rehabilitation of the tailings is significant because this will be a permanent post closure feature. In this regard, the appropriate mix of waste rock and vegetation could soften the impact of these facilities; o all vegetation that is planted as part of rehabilitation should reflect the natural vegetation of the area; o night lighting will be fitted with fixtures to minimise light spillage and focus the light on precise mine activities and infrastructure; and o *any residual waste rock dumps left on surface due to the bulking factor needs to be shape;* • During closure final rehabilitated areas and facilities remaining in perpetuity will be managed through a care and maintenance programme to limit and/or enhance the long term post closure visual impacts.	On-going As required	Not applicable
Continued use of approved facilities and services Open pit mining	Road disturbance and traffic safety	• During the construction, operation and decommissioning phase the following management actions apply: o in regard to road maintenance, Tshipi in conjunction with the relevant road authorities and other role players in the area will continue to monitor the quality and lifespan of the roads used by the mines and determine if a road maintenance plan should be implemented; o the mine will record and respond, appropriately and immediately, to any complaints about usage of roads by mine vehicles; and o Tshipi will provide data to Transnet regarding the number of vehicles making use of the railway crossing on the D3457. Transnet will be	On-going	Not applicable

Activity	Potential Impact	Management actions Type	Time Period for Implementation	Compliance with Standards
		requested to comment on the related safety issues and whether there is a need to upgrade this crossing. If there is a need to upgrade the crossing all relevant role players will have to work together to implement the upgrade. • In case of a person or animal being injured by transport activities the emergency response procedure in Section 30.2.2 will be followed.	As required	
Continued use of approved facilities and services Open pit mining	Ground vibration, air blasts and fly rock	• The following specific actions *during the operational phase* are required in addition to compliance with the relevant blasting and explosives legislation including the Explosives Act (No. 15 of 2003) and the Mine Health and Safety Act (No. 29 of 1996): o the blast design will, as a minimum standard, ensure that the peak particle velocity from all blasts is less than 12mm/s at all vulnerable third party structures, that flyrock is contained within 500m of each blast and that the airblast is less than 130 dB for all blasts. This will be tracked through the monitoring of blasts. Further detail is provided in Section 29; o all structures within 1500m of the blast will be marked on a site plan and surveyed photographically in the presence of the owner before blasting commences. All parties that exist and/or that have property and/or that provide services within 1500m of the blast sites will be informed, prior to mining, about the blast programme and associated safety precautions; o in deciding whether or not to set off blasts, a procedure must be developed to take temperature inversions, low cloud cover, and wind direction into account; o for each blast, the mine will observe the following procedural safety steps: - the fly rock danger zone associated with each blast is delineated and people and animals are cleared from this zone before every blast - if the D3457 is within this zone it will temporarily closed 5 minutes before the blast until the blast has been set off and the area declared safe; and - an audible warning is given at least three minutes before the blast is fired. o the mine will respond immediately to any blast related complaints. These complaints and the follow up actions will be dated, documented,	On-going	Compliance with Explosives Act (No. 15 of 2003) and the Mine Health and Safety Act (No. 29 of 1996)

Activity	Potential Impact	Management actions Type	Time Period for Implementation	Compliance with Standards
		and kept as records for the life of mine. Where the mine has caused blast related damage it will provide appropriate compensation. • In case of a person or animal being injured by blasting activities the emergency response procedure in Section 30.2.2 will be followed.	As required	
Earthworks Water use and management Mineralised waste Non-mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining	Loss of heritage/cultural and palaeontological resources	• Prior to the removal or destruction of any heritage/cultural *and palaeontological* resources that may be discovered by chance at the mine, Tshipi will engage a professionally registered heritage *and/or palaeontological* specialist to make associated recommendations that Tshipi will comply with. • *In all mine phases, if there are any chance finds of heritage/ cultural or paleontological sites, Tshipi will follow the emergency response procedure (Section 30.2.2).*	As required As required	Compliance with the National Heritage Resource Act (No. 25 of 1999) in the event of any chance finds.
Earthworks Water use and management Mineralised waste Non-mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining Closure activities in line with closure plan	Inward migration	• The following management actions should be implemented in all phases: o Tshipi will continue to monitor the location and living conditions of its employees during the operation of the mine; o it is imperative that there is good recruitment discipline among the company and its contractors, and a strong commitment from authorities to act swiftly at the first sign of an informal settlement. It should also be stressed that these measures must not impede the free movement of labour or infringe on the rights of individuals to look for work. Rather, they must be used to prevent job seekers from illegally occupying land and establishing impromptu informal settlements where no services currently exist; o all contractors and sub-contractors working on behalf of Tshipi must comply with the recruitment process. If possible, other developers and employers in the immediate area should adhere to the same process. The following additional points must be adhered to in the Tshipi recruitment process: - there will be no recruitment at the mine site. All recruitment will take place on set dates and at an arranged venue-preferably a formal gathering place in a nearby community/town; - there will be no ad hoc hiring of temporary casual labour, no matter how small and temporary the job (washing of vehicles or litter clearance). A sign clearly indicating that there will be no	On-going	Not applicable

Activity	Potential Impact	Management actions Type	Time Period for Implementation	Compliance with Standards
		recruitment at the mine site will be erected at the entrance to the site. In addition, a list of available temporary workers in the area will be drawn up and kept by the Tshipi in the event that temporary labour is required. If it is not possible to draw up such a list, notices will be put up in local communities/towns stating the precise demand for temporary labour and a date and venue at which recruitment will take place; - recruitment will take place in accordance with company policy; - once the recruitment process is complete, unsuccessful job seekers must be clearly informed as such and understand that there is absolutely no reason to remain in the vicinity of the development; - local authorities will be requested to remove any informal settlements near the mine that are occupied by people who are there in the hope of obtaining employment. This must be carried out immediately; and - there will be no worker accommodation at the mine site; o with regard to crime, Tshipi will communicate with the local police force particularly in the context of developing strategies for combating crime near the mine, surrounding communities and surrounding land users/owners; o disease and particularly HIV/AIDS is not a problem only for Tshipi, its employees and contractors, but it is also a local community problem. As a result, successful management actions of this impact will also depend on the intensity in which it is addressed by other structures such as the health department, the local municipality, education departments, etc. Tshipi will ensure that its employees and contractors are made aware of the issues surrounding the spread of HIV and AIDS in the area. This awareness will be promoted by initiatives such as training and development, peer education, community interventions and visual awareness campaigns. Prevention and management strategies also need to be introduced. Voluntary Counselling and Testing (VCT) is a vital aspect to any HIV/Aids management programme. All employees at Tshipi will be encouraged to participate in a VCT programme. Once a high level of VCT is taking place, it is possible to define the magnitude of the problem and begin to develop appropriate strategies for dealing with it; and		

Activity	Potential Impact	Management actions Type	Time Period for Implementation	Compliance with Standards
		o Tshipi should be part of a local economic development forum that, together with the relevant local authorities, finds solutions to these social problems. • The establishment of informal settlements in the area and a veld fire in the mining area is considered an emergency situation. In such instances the emergency procedure included in Section 30.2.2 will be followed.	As required	
Earthworks Water use and management Mineralised waste Non-mineralised waste Support services Transportation system Continued use of approved facilities and services Open pit mining Closure activities in line with closure plan	Economic impact	• The following management actions should be implemented in all phases: o clear communication that employment of exclusively local people for the mine cannot be guaranteed but that where possible the employment opportunities will go to local people, *where applicable;* o effective and timeous communication with community leaders who can attest to a fair and transparent process amongst the community rather than challenging the mine on the community's behalf over jobs and recruitment, *where applicable;* o the existence and screening of specific skills will be determined through the establishment of a skills register prior to employee selection processes; o good communication with all job seekers will be maintained throughout the recruitment process. The process must be fair; o urging people to get all their documents and certificates, including valid driving licences, in order prior to recruitment; o notifying unsuccessful job seekers once the recruitment process is complete; o Tshipi will comply with the requirements of the Mining Charter. In this regard procurement will, where possible: - promote the development of small and medium enterprises; - focus on local business; and - promote businesses owned by historically disadvantaged South Africans.	On-going	Not applicable
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)* Non-mineralised waste	Change in land use	• Tshipi will communicate with its neighbouring communities including land users and owners and other key stakeholders as required to to facilitate information sharing and environmental impact management relevant to Tshipi and its associated infrastructure and activities.	On-going	Not applicable

Activity	Potential Impact	Management actions Type	Time Period for Implementation	Compliance with Standards
Support services Transportation system Continued use of approved facilities and services Open pit mining Final land forms				

The waste management and soil conservation procedures applicable to the Tshipi are included in Table 51 and Table 52 below.

TABLE 51: WASTE MANAGEMENT PROCEDURES FOR GENERAL AND HAZARDOUS WASTE

Items to be considered		**Intentions**
General	**Specific**	
Classification and record keeping	General	The waste management procedure for the mine will cover the storage, handling and transportation of waste to and from the mine. The mine will ensure that the contractor's responsible are made aware of these procedures.
	Waste opportunity analysis	In line with DWEA's strategy to eliminate waste streams in the longer term, Tshipi will assess each waste type to see whether there are alternative uses for the material. This will be done as a priority before the disposal option.
	Classification	*Wastes (except those listed in Annexure 1 of the new Waste Regulations) will be classified in accordance with SANS 10234 within one hundred and eighty (180) days of generation.* *Waste will be re-classified every five (5) years, or within 30 days of modification to the process or activity that generated the waste, changes in raw materials or other inputs, or any other variation of relevant factors.*
	Safety data sheets	*The mine will maintain, where required in terms of the Regulations, the safety data sheets for hazardous waste (prepared in accordance with SANS 10234).*
	Inventory of wastes produced	The mine will keep an accurate and up to date record 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 cubic metres 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.*
	Labelling and inventory of waste produced	*Any container or storage impoundment holding waste must be labelled, or where labelling is not possible, records must be kept, reflecting:* • *the specific category or categories of waste in the container or storage impoundment as identified in terms of the National Waste Information Regulations, 2012; and* • *the classification of the waste in terms of Regulation 4 once it has been completed (if required).*
	Disposal record	Written evidence of safe disposal of waste will be kept.
	Record keeping	*Records will be retained for a period of at least 5 years and will be made available to the Department on request.*
Waste management	Collection points	Designated waste collection points will be established on site. Care will be taken to ensure that there will be sufficient collection points with adequate capacity and that these are serviced frequently.
	Laydown/ *salvage* areas	During decommissioning and closure, lay down areas for re-usable non-hazardous materials will be established.
	General waste	Will be stored in designated skips and removed by an approved contractor for disposal at a licenced facility.
	Scrap metal and *building rubble*	Care will be taken to ensure that scrap metal and building rubble does not become polluted or mixed with any other waste. The scrap metal will be collected in a designated area for scrap metal. It will be sold to scrap dealers. *Building rubble will either be disposed off-site or buried in the pit at closure.*
	Hazardous wastes	Medical waste, laboratory chemicals and related packaging, used chemicals and chemical containers will be temporarily stored in sealed containers in a bunded store before removal by an approved waste contractor and disposal in a licenced facility.
	Old explosives waste	It is stored in an old explosives storage box prior to being destroyed at the on-site destruction bay

Items to be considered		Intentions
General	**Specific**	
	Used and/or spilled oil and grease	In designated areas used and/or spilt oil and grease will be collected in suitable containers at identified collection points. The identified collection points will be bunded and underlain by impervious materials to ensure that any spills are contained. In general areas used and/or spilt oil and grease will be collected in suitable containers and deposited in a designated storage area. Notices will be erected at each waste oil point giving instructions on the procedure for waste oil discharge and collection. An approved subcontractor will remove oil from site.
	Any soil polluted by a spill	If soil (whether stockpiled or in its undisturbed natural state) is polluted, the first management priority is to treat the pollution by means of in situ bio-remediation at the designated site. *In situ remediation is generally considered to be the preferred option because with successful in situ remediation the soil resource will be retained in the correct place. The in situ options include bioremediation at the point of pollution, or removal of soils for washing and/or bio remediation at a designated area after which the soils are returned.*
		If remediation of the soil *in situ* is not possible, the soils will be classified as a waste in terms of the Waste Regulations and will be disposed of at an appropriate permitted waste facility.
	Mixing of wastes	Waste will not be mixed or treated where this would reduce the potential for re-use, recycling or recovery; or result in treatment that is not controlled and not permanent.
	Particles and salts from the sinter scrubbers and reverse osmosis plant	This material will either be recycled into the process through the thickeners or there is the option of storage in sealed drums and removal to an appropriately licenced waste site.
Disposal	Offsite waste disposal facilities	Waste will be disposed of at appropriate permitted waste disposal facilities. For general waste the closest permitted site is in Kuruman. For hazardous waste, the closest permitted site is at Holfontein.
		Unless collected by the municipality, the mine must ensure that the waste is assessed in accordance with the Norms and Standards for Assessment of Waste for Landfill Disposal set in terms of section 7(1) of the NEM:WA prior to the disposal of the waste to landfill.
		Unless collected by the municipality, the mine must ensure that the disposal of their waste to landfill is done in accordance with the Norms and Standards for Disposal of Waste to Landfill set in terms of section 7(1) of the NEM:WA.
Waste transport	Contractor	A qualified waste management subcontractor will undertake the waste transport. *The contractor will provide an inventory of each load collected and of proof of disposal at a licenced facility.*
Banned practices	Long-term stockpiling of waste	Stockpiling of waste is a temporary measure. Waste stockpiling sites must have an impervious floor, be bunded and have a drainage system for collection and containment of water on the site.
	Burying of waste	No wastes will be placed on site.

TABLE 52: SOIL MANAGEMENT PRINCIPLES

Steps	Factors to consider	Detail
Delineation of areas to be stripped		Stripping will only occur where soils are to be disturbed by activities that are described in the EMPr report, and where a clearly defined end rehabilitation use for the stripped soil has been identified. *Soil stripping should be conducted a suitable period ahead of mining.*
Reference to biodiversity action plan		All requirements for moving and preserving fauna and flora according to the biodiversity action plan will be adhered to.
Stripping	Topsoil	As a general rule 50cm of topsoil must be stripped *unless a soils expert advises otherwise.*

Steps	Factors to consider	Detail
	Subsoil	Given the nature of the soils, no distinction needs to be made between subsoil and the topsoil.
Delineation of stockpiling areas	Location	Stockpiling areas will be identified in close proximity to the source of the soil to limit handling and to promote reuse of soils in the correct areas.
	Designation of the areas	Soil stockpiles will be clearly marked to identify both the soil type and the intended area of rehabilitation. *All topsoil will be stockpiled in areas clearly demarcated on the infrastructure layout and should be defined as no-go areas.* *Topsoil stockpiles must be located outside of areas susceptible to erosion.*
Stockpile management	Vegetation establishment and erosion control	Rapid growth of vegetation on the topsoil stockpiles will be promoted (e.g. by means of watering or fertilisation). The purpose of this exercise will be to encourage vegetation growth on soil stockpiles and to combat erosion by water and wind.
	Storm water controls	Stockpiles will be established with storm water diversion berms to prevent run off erosion.
	Height and slope	Soil stockpiles height will be restricted to avoid compaction and damage to the underlying soils. *In this regard, topsoil stockpiles should be limited to a maximum height of 5m. The stockpile side slopes should be flat enough to promote vegetation growth and reduce run-off related erosion. In addition to this, the topsoil stockpiles need to be established on a gradual slope if possible.*
	Waste	No waste material will be placed on the soil stockpiles.
	Vehicles	Equipment movement on top of the soil stockpiles will be limited to avoid topsoil compaction and subsequent damage to the soils and seedbank.
Management of disturbed land	*Erosion control*	*To prevent the erosion of topsoil, management actions may include one or more of the following; berms, soil traps, hessians and stormwater diversions away from areas susceptible to erosion.*
Rehabilitation of disturbed land: restoration of land capability	Placement of soil	*Once the site has been cleared on infrastructure, the area to be rehabilitated should be ripped in order to reduce soil compaction.* As a general rule, a minimum layer of 50cm of topsoil will be replaced *unless a soils expert advises otherwise.*
	Fertilisation	A few samples of stripped soils will be analysed to determine the nutrient status of the soil *before rehabilitation commences*. As a minimum, the following elements will be tested for cation exchange capacity, pH, and phosphate. These elements provide the basis for determining the fertility of soil. Based on the analysis, fertilisers will be applied if necessary.
	Erosion control	Erosion control measures will be implemented to ensure that the topsoil is not washed away and that erosion gulley's do not develop prior to vegetation establishment.
	Restore land function and capability	*Apply landscape function analysis and restoration interventions to areas where soil has been replaced as part of rehabilitation, but the land function and capability has not been effectively restored.*

28 FINANCIAL PROVISION

28.1 DETERMINATION OF THE AMOUNT OF THE FINANCIAL PROVISION

28.1.1 DESCRIPTION OF THE CLOSURE OBJECTIVES AND THE ALIGNMENT WITH THE BASELINE ENVIRONMENT

The preliminary closure plan objectives and principles have been developed against the background of the mine location in the Kuruman region of the Northern Cape Province, and include the following:

- that environmental damage is minimised to the extent that it is acceptable to all parties involved;
- that at closure, the land will be rehabilitated to achieve an end use of wilderness and grazing;
- that all surface infrastructure will be removed from site after closure. The open pit will be completely backfilled and the remaining waste rock dumps shaped to 1V:3H slopes or flatter;
- that contamination beyond the mine site by wind, surface run-off or groundwater movement will be prevented;
- that mine closure is achieved efficiently, cost effectively and in compliance with the law; and
- that the social and economic impacts resulting from mine closure are managed in such a way that negative socio-economic impacts are minimised.

The closure target outcomes for the site are therefore assumed to be as follows:

- to achieve chemical, physical and biological stability for an indefinite, extended time period over all disturbed landscapes and residual mining infrastructure;
- to protect surrounding surface water, groundwater, soils and other natural resources from loss of current utility value or environmental functioning;
- to limit the rate of emissions to the atmosphere of particulate matter and salts to the extent that degradation of the surrounding areas' land capability or environmental functioning does not occur;
- to maximise visual 'harmony' with the surrounding landscape; and
- to create a final land use that has economic, environmental and social benefits for future generations that outweigh the long term aftercare costs associated with the mine.

28.1.2 CONFIRMATION THAT THE CLOSURE OBJECTIVES HAVE BEEN CONSULTED WITH LANDOWNERS AND IAPS

The closure objectives are outlined in this report and the related specialist study which will be made available to IAPs, including landowners for review and comment (Section 6.2).

To date no comments regarding the closure objectives associated with the project have been received from IAPs including landowners.

28.1.3 REHABILITATION PLAN

The scale and aerial extent of the main mining activities at closure is indicated on the site infrastructure plan (see Figure 3).

The rehabilitation plan caters for the following:

- for surface infrastructure will be demolished and removed;
- for the pit void will be completely backfilled and the area rehabilitated;
- for areas where infrastructure has been removed will be levelled and restored in terms of soil horizons (as far as practical), vegetation and drainage; and
- for remaining material stockpiles and waste rock dumps will be shaped to 1V:3H slopes or flatter and rehabilitated.

Generally accepted closure methods have been used as the basis for determining the closure cost liability.

28.1.4 COMPATIBILITY OF THE REHABILITATION PLAN WITH THE CLOSURE OBJECTIVES

It can be confirmed that the rehabilitation plan is compatible with the closure objectives given that the closure objectives were taken into account during the determination of the financial provision.

28.1.5 CALCULATE AND STATE THE QUANTUM OF THE FINANCIAL PROVISION

The closure cost calculations have been determined for the following periods, namely:

- a current closure cost liability (as at December 2016);
- a future closure cost liability, 5 years from now (as at December 2021);
- a future closure cost liability, 10 years from now (as at December 2026); and
- a Life of Mine (LOM) closure cost liability, 25 years from now (as at December 2041).

The Financial Provisioning Regulations, 2015 (GNR 1147) require the closure cost estimate to have an accuracy of approximately 70% since the LOM is more than 10 years but less than 30 years. The calculated quantum of financial provision is included in Table 53 below. The Financial Provisioning Regulations, 2015 (GNR 1147) requires that the current liability is provided.

TABLE 53: CALCULATED QUANTUM OF FINANCIAL PROVISION (SLR, MARCH 2017)

Time-frame	Date	Closure Cost Liability incurred during the period (incl. VAT)	Progressive Closure Cost Liability (incl. VAT)	Progressive Closure Cost Liability as a % of LOM liability
Current	July 2017	n/a	R 118,842,762	63.3 %
+5 years	July 2022	R 29,547,462	R 148,390,224	79.0 %
+ 10 years	July 2027	R 24,016,339	R 172,406,563	91.8 %
+ 25 years (LOM)	**July 2042**	**R 15.384,891**	**R 187,791,454**	**100%**

28.1.6 CONFIRMATION THAT THE FINANCIAL PROVISION WILL BE PROVIDED

The financial provision is provided in the form of a Gaurdrisk Insurance.

29 MECHANISMS FOR MONITORING COMPLIANCE AND PERFORMANCE AGAINST THE EMP

Environmental impacts requiring monitoring are listed in Table 54 below. It is important to note that the monitoring programme below includes requirements as outlined in the approved EMPr (Metago, May 2009) and any additional requirements identified as part of the project, where relevant. Any additional monitoring requirements will be indicated in italics. As a general approach, Tshipi will ensure that the monitoring programmes comprise the following:

- a formal procedure;
- appropriately calibrated equipment;
- where sample require analysis they will be preserved according to laboratory specifications;
- parameters to be monitored will be identified in consultation with a specialist in the field and/or the relevant authority;
- if necessary, following the initial monitoring results, certain parameters may be removed from the monitoring programme in consultation with a specialist and/or the relevant authority; and
- that data will be interpreted and reports on trends in the data will be compiled by an appropriately qualified person.

TABLE 54: MONITORING OF COMPLIANCE AND PERFORMANCE IN TERMS OF EMPR

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities	Hazardous infrastructure	In terms of the tailings dam and the return water dam, as a minimum and where applicable (in certain instances low hazard facilities do not require the same level of monitoring as medium and high hazard facilities), the following will be monitored: • phreatic surface, slope stability, adequacy of freeboard, integrity of walls, the position of the pools, silt trap sediment, presence of seepage, and functioning of drains; • the success of vegetation establishment on the outer side walls; and • erosion damage. *The waste rock dumps and stormwater/process dams will be monitored to*	Qualified engineer	In terms of the tailings dam and the return water dam, monitoring will be done on a quarterly basis. Tailings management and risk reports must be submitted annually to the DMR. *The frequency of waste rock dump and*

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
and services		*ensure stability, safety and prevention of environmental impacts.* *Monitoring results will be documented for record-keeping and auditing purposes and addressed where relevant to achieve the stated objective.*		*stormwater/process dam monitoring will be determined on an infrastructure specific basis. Monitoring reports will be made available on request.* Monitoring will be undertaken when the facilities are in operation for the duration of the mine.
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Alteration of natural drainage patterns	*An operational water balance for the mine needs to be developed from recorded flow measurements and production figures. The water balance is used to check on an on-going basis that the capacity of the stormwater dam facilities is adequate.* *In addition to the above the IWUL requires that Tshipi updates the water balance on an annual basis to determine the loads of waste emanating from the activities. Tshipi shall determine the contribution of their activities to the mass balance for water resources and must furthermore co-operate with other water users in the catchment to determine the mass balance for the water resources reserve compliance point.*	*Environmental Department*	*Operational water balance must be updated on a monthly basis for the duration of the mine. This information must be made available on request.* *Mass water balance to be updated on an annual basis for the duration of the mine. This information must be submitted to the DWS on an annual basis.*
Earthworks Mineralised waste Non-mineralised waste	Contamination of surface water resources	*Monitoring of surface water quality must be undertaken in the event that surface water flow is present in the Vlermuisleegte River.* In this regard, samples should be taken from both upstream and downstream of the Vlermuisleegte River. Refer to Figure 22 for the location of the surface water	Environmental Department	Monitoring will be undertaken when the Vlermuisleegte River is in flow.

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
Water use and management Support services Transportation system Continued use of approved facilities and services		monitoring points. Monitoring of surface water within stormwater dam facilities also needs to be undertaken on a quarterly basis. This includes the 78Ml stormwater dam, the return water dam, dirty water dams (combined), workshop dirty collection dam and the temporary construction dam. *Water quality analyses results should be classified in terms of the SANS 241 (2015) Water Quality Standards and the DWAF Target Quality Range for Livestock Watering (1996), or whichever is applicable at the time. The monitoring results should be assessed by a suitably-qualified professional registered with the South African Council for Natural Scientific Professional (SACNASP).* The parameters that need to be analysed are summarised in the table below. pH Conductivity in mS/m at 25 ° c Total dissolved solids (TDS) at 180 ° c Alkalinity as $CaCO_3$ Carbonate as CO_3 Bicarbonate as HCO_3 Boron as B Nitrate as N Chloride as Cl Sulphate as SO_4 Fluoride as F Sodium as Na ***** Potassium as K ***** Calcium as Ca ***** Magnesium as Mg ***** Manganese as Mn * Full metal scan - Inter Coupled Plasma Scan (ICP) (via Mass Spectrometry (MS)		*Monitoring of the stormwater dam facilities must be undertaken on a quarterly basis.* *Monitoring reports need to be submitted to the DWS as per the conditions of the IWUL, on an annual basis. Monitoring reports need to cater for any reporting requirements stipulated in the IWUL.*

<table>
<tr><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td></td><td></td><td>In the event that the IWUL is amended and changes to the surface water monitoring programme as outlined in this report are made, the requirements as per the IWUL should be adhered to.</td><td></td><td></td></tr>
<tr><td>Earthworks
Mineralised waste
Non-mineralised waste
Water use and management
Support services
Transportation system
Continued use of approved facilities and services</td><td>Contamination of groundwater resources</td><td>Monitoring of groundwater quality and quantify must be undertaken on a quarterly and monthly basis respectively. Refer to Figure 26 for the location of the groundwater monitoring points.

Water quality analyses results should be classified in terms of the SANS 241 (2015) Water Quality Standards and the DWAF Target Quality Range for Livestock Watering (1996) or whichever is applicable at the time. The monitoring results should be assessed by a suitably-qualified professional registered with the South African Council for Natural Scientific Professional (SACNASP). The parameters that need to be analysed are summarised in the table below.

<table>
<tr><td>pH</td></tr>
<tr><td>Conductivity in mS/m at 25 ° c</td></tr>
<tr><td>Total dissolved solids (TDS) at 180 ° c</td></tr>
<tr><td>Alkalinity as $CaCO_3$</td></tr>
<tr><td>Carbonate as CO_3</td></tr>
<tr><td>Bicarbonate as HCO_3</td></tr>
<tr><td>Boron as B</td></tr>
<tr><td>Nitrate as N</td></tr>
<tr><td>Chloride as Cl</td></tr>
<tr><td>Sulphate as SO_4</td></tr>
<tr><td>Fluoride as F</td></tr>
<tr><td>Sodium as Na *</td></tr>
<tr><td>Potassium as K *</td></tr>
<tr><td>Calcium as Ca *</td></tr>
<tr><td>Magnesium as Mg *</td></tr>
<tr><td>Manganese as Mn *</td></tr>
<tr><td>Full metal scan - Inter Coupled Plasma Scan (ICP) (via Mass</td></tr>
</table></td><td>Environmental Department</td><td>Groundwater quality and quantity must be monitored on a monthly basis as stipulated in the IWUL.

Monitoring reports need to be submitted to the DWS as per the conditions of the IWUL, on an annual basis. Monitoring reports need to cater for any reporting requirements stipulated in the IWUL.</td></tr>
</table>

Activity	**Impacts requiring monitoring**	**Functional requirements for monitoring**	**Roles and responsibilities**	**Monitoring and reporting frequency and time period for management actions**
		Spectrometry (MS) *In the event that the IWUL is amended and changes to the groundwater monitoring programme as outlined in this report are made, the requirements as per the IWUL should be adhered to.*		
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Physical destruction and general disturbance of biodiversity	*Tshipi will implement an alien/invasive/weed management programme to control the spread of these plants onto and from disturbed areas. This will be achieved by active eradication and the establishment of natural species and through on-going monitoring and assessment. The use of herbicides will be limited and focussed and will only be used under strict controls. Herbicides will be selected to ensure least residual harm. Herbicides will be administered by suitably qualified people.* *Continued monitoring will be undertaken to ensure that the alien invasive species have been eradicated and are controlled for both controlled sites as well as rehabilitated areas.* *For each area requiring rehabilitation specific landscape functionality objectives will be set with specialist input and the associated targets and monitoring program will follow accordingly.* *A comprehensive monitoring programme of the protected trees within the area must be undertaken. This monitoring should be conducted on an individual tree basis as well as monitoring on a community level.*	*Environmental Department*	*The alien/invasive/weed management programme should be undertaken on an annual basis for the duration of the mine. This information should be made available to DAFF on request, unless otherwise specified.* *After closure, repeat surveys should be carried out annually for at least the first three years post-rehabilitation.* *Monitoring of protected trees should take place on an annual basis. The result must be submitted to DAFF on an annual basis.*
Earthworks Mineralised waste Non-mineralised	Air pollution	A monitoring network will be implemented and it will comprise the following: • five directional dust fallout buckets; • one PM10 ambient concentration monitoring station;	*Environmental Department*	*Monitoring reports need to be uploaded onto the National Emissions*

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
waste Water use and management Support services Transportation system Continued use of approved facilities and services		• provision to analyse the PM10 for manganese concentrations over a period of two operational years; • three passive samplers for NO_2 and SO_2 *(this is only applicable when the sinter plant is operational); and* • one meteorological station. It is further recommended that Tshipi, UMK and Mamatwan mine work together to establish and maintain an optimal monitoring network. *The location of the dust fallout buckets is illustrated in Figure 26. Tshipi will consult with a qualified specialist regarding the placement of the PM10 ambient monitoring station, passive samplers and the meteorological station.*		*Inventory System on annual basis.* *Dust fallout monitoring must be undertaken on a monthly basis for the duration of the mine.* *A qualified specialist needs to advise on the frequency on monitoring for the PM10 ambient monitoring station, passive samplers and the meteorological station*
Earthworks Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Increase in disturbing noise levels	*In the event that Tshipi receives noise related complaints during either construction or operation, Tshipi should conduct short term (24-hour) ambient noise measurements as part of investigating the complaints. The results of the measurements should be used to inform any follow up interventions.*	*Environmental Department with input from qualified specialist*	*If and when a complaint is raised*
Continued use of approved facilities and services (barrier pillar)	Blasting	Monitoring will be done for each blast to verify that fly rock is being contained within 500m from the blast. On a monthly basis monitoring will be undertaken to verify that the air blast is less than or equal to 130 dB at the mine boundary and that the ground vibration is less than or equal to a peak particle velocity of	*Qualified engineer*	Monitoring of each blast will be undertaken for the duration of operational phase of

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
		12,5mm/s at the mine boundary.		the mine. Monthly monitoring of air blasts and ground vibrations will be undertaken for the duration of the operational phase of the mine.

29.1 FREQUENCY OF PERFORMANCE ASSESSMENT REPORT

Tshipi must for the period during which the environmental authorisation and the EMPr is valid, submit environmental audit reports to the DMR. These audits will focus on the mines compliance with the conditions of the environmental authorisation and the commitments in the EMPr. These audits must be undertaken by a qualified independent person and must be compiled in accordance with the relevant NEMA No. R982 Regulations, 2014.

The environmental manager will conduct internal management audits against the commitments in the EMPr in accordance with a annual audit plan. In the operational phase, these audits will be conducted on a quarterly basis. The audit findings will be documented for both record keeping purposes and for informing continual improvement.

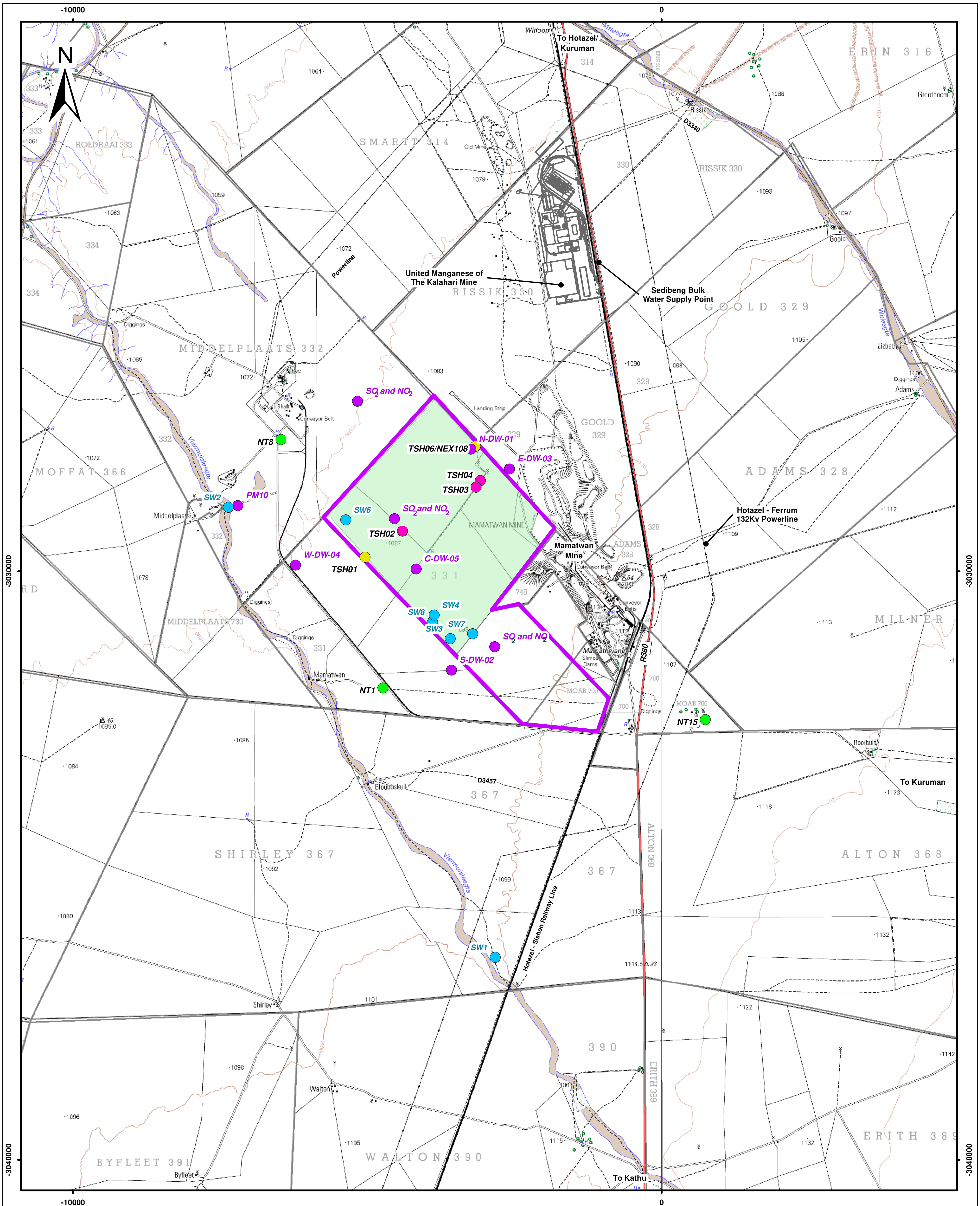
29.2 CLOSURE COST REPORTING

The financial provision for the mine must be updated on an annual basis and submitted to the DMR for the duration of the operation. The annual updates must be undertaken in accordance with the NEMA Regulations (Regulation 1147 of 2015) pertaining to the financial provision for mining operations.

29.3 AFTERCARE AND MAINTENANCE OF THE TAILINGS DAM

On completion of the final closure measures an aftercare program has to be implemented to ensure that the closure measures are robust, have performed adequately and that no further liabilities arise. The aftercare period is normally not less than 5 years but can be extended into decades depending on the physical and chemical characteristics of the facility. In the case of the relatively inert manganese tailings at Tshipi a period of 5 years is considered reasonable. The typical aftercare requirements would be:

- the monitoring of closure activities to ascertain that side slope vegetation has been successfully established (where required), earthworks have not been impaired in any way, failing which some remediation work would be required; and
- fixing up areas which have degraded since closure and which require minor remediation work.



Legend

- Surface Use Area
- Approved Mining Right Area
- Farm Boundaries
- Surface Water Monitoring Points
- Air Quality Sampling Points

Groundwater Monitoring Points

- Background Monitoring
- Plume Monitoring
- Source Monitoring

0 1 000 2 000 Meters

Scale: 1:60 000 @ A3
Projection: Transverse Mercator
Datum: WGS1984, Lo23

TSHIPI E' NTLE MANGANESE MINING

Figure 26

Monitoring Programme

SLR

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2017/08/08

30 ENVIRONMENTAL AWARENESS PLAN

30.1 MANNER IN WHICH APPLICANT INTENDS TO INFORM EMPLOYEES OF THE ENVIRONMENTAL RISKS

This section includes an environmental awareness plan for the Tshipi Borwa Mine. In this regard, the environmental awareness plan provided in the approved EMPr (Metago, May 2009) has been updated to cater for any legislation changes/requirements. The plan describes how employees are informed of environmental risks which may result from their work, the manner in which the risk must be dealt with in order to avoid pollution or degradation of the environment and the training required for general environmental awareness and the dealing of emergency situations and remediation measures for such emergencies.

All contractors that conduct work on behalf of Tshipi are bound by the content of the EMPr and a contractual condition to this effect will be included in all such contracts entered into by the mine. The responsibility for ensuring contractor compliance with the EMPr will remain with Tshipi.

The purpose of the environmental awareness plan is to ensure that all personnel and management understand the general environmental requirements of the site. In addition, greater environmental awareness must be communicated to personnel involved in specific activities which can have a significant impact on the environment and ensure that they are competent to carry out their tasks on the basis of appropriate education, training and/or experience. The environmental awareness plan should enable Tshipi to achieve the objectives of the environmental policy.

30.1.1 ENVIRONMENTAL POLICY

Tshipi will display the environmental policy. To achieve world class environmental performance in a sustainable manner Tshipi is currently committed to:

- integrating environmental management into all aspects of the business, including the entire product life cycle;
- complying with all applicable legislation and other requirement to which Tshipi subscribes;
- practising responsible stewardship by adopting world class standards;
- proactively identifying and managing significant environmental aspects in order to:
  - minimise emissions to atmosphere;
  - minimise the release of effluent;
  - optimise resource consumption;
  - mitigate our impacts on climate change;
  - minimise waste;
  - rehabilitate disturbed land; and

  - protect cultural heritage resources (where relevant);
- ensuring environmental awareness and appropriate competency among employees and promoting environmental awareness in the community;
- setting objectives and, where possible, quantitative targets, to determine continual improvement in environmental performance and the prevention of pollution;
- to participate in environmental forums with neighbouring mines and the Kalagadi catchment forum with neighbouring mines, farmers and commenting authorities (primarily DWS); and
- to provide relevant and constructive consultation/public participation on the management of the potential environmental impacts posed by the mine in the future. In addition to this, Tshipi will also participate with the any relevant farmers' association.

30.1.2 STEPS TO ACHIEVE THE ENVIRONMENTAL POLICY OBJECTIVES

Tshipi's environmental policy is realised by setting specific and measurable objectives. It is proposed that new objectives are set throughout the life of mine, but initial objectives are as follows:

- management of environmental responsibilities:
  - tshipi will establish and appoint Managers at senior mine management level at each site, who will be provided with all necessary resources to carry out the management of all environmental aspects of the site irrespective of other responsibilities, for example:
    - compliance with environmental legislation and EMP commitments;
    - implementing and maintaining an environmental management system with the assistance of the appointed environmental officer and SHE manager and officers;
    - developing environmental emergency response procedures and coordinating personnel during incidents;
    - manage routine environmental monitoring and data interpretation;
    - environmental trouble shooting and implementation of remediation strategies; and
    - closure planning.
- communication of environmental issues and information:
  - meetings, consultations and progress reviews will be carried out, and specifically Tshipi will:
    - discussions of environmental issues and feedback on environmental projects will form part of the annual work plan of the social and ethics committee who will report periodically to the board of the company;
    - provide progress reports on the achievement of policy objectives and level of compliance with the approved EMP to the Department of Minerals Resources;
    - ensure environmental issues are raised at monthly mine management executive committee meetings and all relevant mine wide meetings at all levels; and
    - ensure environmental issues are discussed at all general liaison meetings with local communities and other interested and affected parties, where possible.
- environmental awareness training:

- tshipi will provide environmental awareness training to individuals at a level of detail specific to the requirements of their job, but will generally comprise:
  - basic awareness training for all prior to granting access to site (e.g. short video presentation requiring registration once completed). Employees and contractors who have not attended the training will not be allowed on site;
  - general environmental awareness training will be given to all employees and contractors as part of the Safety, Health and Environment induction programme. All non-Tshipi personnel who will be on site for more than three days must undergo the SHE induction training; and
  - specific environmental awareness training will be provided to personnel whose work activities can have a significant impact on the environment (e.g. workshops, waste handling and disposal, sanitation, etc.).
- review and update the environmental topics already identified in the EMPr which currently includes the following purpose:
  - topography (hazardous excavations);
  - soil and land capability management (loss of soil resource);
  - management of biodiversity;
  - surface water management (alteration of surface drainage and pollution of surface water);
  - groundwater management (reduction in groundwater levels/availability and groundwater contamination);
  - management of air quality (dust generation);
  - noise (specifically management of disturbing noise);
  - visual aspects (reduction of negative visual impacts);
  - surrounding land use (traffic management and land use loss);
  - heritage resources (management of sites where needed); and
  - socio-economic impacts (management of positive and negative impacts).
- the mine will be designed to minimise impact on the environment and to accomplish closure/rehabilitation objectives; and
- tshipi will maintain records of all environmental training, monitoring, incidents, corrective actions and reports.

30.1.3 TRAINING OBJECTIVES OF THE ENVIRONMENTAL AWARENESS PLAN

The environmental awareness plan ensures that training needs are identified and that appropriate training is provided. The environmental awareness plan should communicate:

- the importance of conformance with the environmental policy, procedures and other requirements of good environmental management;
- the significant environmental impacts and risks of individuals work activities and explain the environmental benefits of improved performance;

- the individuals roles and responsibilities in achieving the aims and objectives of the environmental policy; and
- the potential consequences of not complying with environmental procedures.

30.1.3.1 General contents of the environmental awareness plan

To achieve the objectives of the environmental awareness plan the general contents of the training plans are as follows:

- Module 1 – Basic training plan applicable to all personnel entering the site:
  - short (15 min) presentation to indicate the site layout and activities at specific business units together with their environmental aspects and potential impacts; and
  - individuals to sign off with site security on completion in order to gain access to the site.
- Module 2 – General training plan applicable to all personnel at the site for longer than 3 days:
  - general understanding of the environmental setting of the mine (e.g. local communities, nearby towns, isolated farmsteads and proximity to natural resources such as rivers);
  - understanding the environmental impact of individuals activities on site (e.g. excessive production of waste, poor housekeeping, energy consumption, water use, noise, etc.);
  - indicate potential site specific environmental aspects and their impacts;
  - Tshipi's environmental management strategy;
  - identifying poor environmental management and stopping work which presents significant risks;
  - reporting incidents;
  - examples of poor environmental management and environmental incidents; and
  - procedures for emergency response and cleaning up minor leaks and spills.
- Module 3 – Specific training plan:
  - environmental setting of the workplace (e.g. proximity of watercourses, vulnerability of groundwater, proximity of local communities, towns and isolated farmsteads etc.);
  - specific environmental aspects such as:
    - spillage of hydrocarbons at workshops;
    - poor waste management such as mixing hazardous and general wastes, inappropriate storage and stockpiling large amounts of waste;
    - poor housekeeping practices;
    - poor working practices (e.g. not carrying out oil changes in designated bunded areas);
    - excessive noise generation and unnecessary use of hooters; and
    - protection of heritage resources (including palaeontological resources).
  - impact of environmental aspects, for example:
    - hydrocarbon contamination resulting in loss of resource (soil, water) to downstream users;
    - groundwater contamination also resulting in loss of resource due to potential adverse aesthetic, taste and health effects; and
    - dust impacts on local communities (nuisance and health implications).

- Tshipi's duty of care (specifically with respect to waste management); and
- purpose and function of Tshipi's environmental management system.

Individuals required to complete Module 3 (Specific training module) will need to complete Modules 1 and 2 first. On completion of the Module 3, individuals will be subject to a short test (written or verbal) to ensure the level of competence has been achieved. Individuals who fail the test will be allowed to re-sit the test after further training by the training department.

The actual contents of the training modules will be developed based on a training needs analysis.

Key personnel will be required to undergo formal, external environmental management training (e.g. how to operate the environmental management system, waste management and legal compliance).
In addition to the above Tshipi will:

- conduct refresher training/presentations on environmental issues for mine employees (permanent and contractors) at regular intervals;
- promote environmental awareness using relevant environmental topic posters displayed at strategic locations on the mine. These topics will be changed monthly, and will be reviewed annually by the Environmental Department Manager to ensure relevance; and
- participate and organise events which promote environmental awareness, some of which will be tied to national initiatives e.g. National Arbour Week, World Environment Day and National Water Week.

30.2 MANNER IN WHICH RISKS WILL BE DEALT WITH TO AVOID POLLUTION OR DEGRADATION

30.2.1 ON-GOING MONITORING AND MANAGEMENT ACTIONS

The monitoring programme as described in Section 29 will be undertaken to provide early warning systems necessary to avoid environmental emergencies.

30.2.2 PROCEDURES IN CASE OF ENVIRONMENTAL EMERGENCIES

Emergency procedures apply to incidents that are unexpected and that may be sudden, and which lead to serious danger to the public and/or potentially serious pollution of, or detriment to the environment (immediate and delayed). Procedures to be followed in case of environmental emergencies are described in the table below (Table 55).

30.2.2.1 General emergency procedure

The general procedure that should be followed in the event of all emergency situations is as follows.

- an applicable incident controller defined in emergency plans must be notified of an incident upon discovery;
- an area to be cordoned off to prevent unauthorised access and tampering of evidence;

- to undertake actions defined in emergency plant to limit/contain the impact of the emergency;
- if residue facilities/dams, stormwater diversions, etc., are partially or totally failing and this cannot be prevented, the emergency siren is to be sounded (nearest one available). After hours the Operations Engineer on shift must be notified;
- to take photographs and samples as necessary to assist in investigation;
- to report the incident immediately to the environmental department for emergencies involving environmental impacts or to the safely department in the case of injury;
- the Environment department must comply with Section 30 of the NEMA such that:
  - the Environment department must immediately notify the Director-General (DWS and DMR and Inspectorate of Mines as appropriate), the South African Police Services, the relevant fire prevention service, the provincial head of DMR, the head of the local municipality, the head of the regional DWS office and any persons whose health may be affected of:
    - the nature of the incident;
    - any risks posed to public health, safety and property;
    - the toxicity of the substances or by-products released by the incident; and
    - any steps taken to avoid or minimise the effects of the incident on public health and the environment.
- the Environment department must as soon as is practical after 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;
    - undertake clean up procedures;
    - remedy the effects of the incident; and
    - assess the immediate and long term effects of the incident (environment and public health).
  - within 14 days the Environment department must report to the Director-General DWS and DEA, the provincial head of DMR, the regional manager of the DMR, the head of the local and district municipality, the head of the regional DWS office such information as is available to enable an initial evaluation of the incident, including:
    - the nature of the incident;
    - the substances involved and an estimation of the quantity released;
    - the possible acute effects of the substances on the persons and the environment (including the data needed to assess these effects);
    - initial measures taken to minimise the impacts;
    - causes of the incident, whether direct or indirect, including equipment, technology, system or management failure; and
    - measures taken to avoid a recurrence of the incident.

30.2.2.2 Identification of Emergency Situations

The site wide emergency situations that have been identified together with specific emergency response procedures are outlined in Table 55.

30.2.3 TECHNICAL, MANAGEMENT AND FINANCIAL OPTIONS

Technical, management and financial options that will be put into place to deal with the remediation of impacts in cases of environmental emergencies are described below.

- the applicant will appoint a competent management team with the appropriate skills to develop and manage a mine of this scale and nature;
- to prevent the occurrence of emergency situations, the mine will implement as a minimum the mine plan and management actions as included in this EMPr report;
- the mine has an environmental management system in place where all operation identify, report, investigate, address and close out environmental incidents;
- as part of its annual budget, the mine will allow a contingency for handling of any risks identified and/or emergency situations; and
- where required, the mine will seek input from appropriately qualified people.

TABLE 55: EMERGENCY RESPONSE PROCEDURES

ITEM	EMERGENCY SITUATION	RESPONSE IN ADDITION TO GENERAL PROCEDURES
1	Spillage of chemicals, engineering substances and waste	Where there is a risk that contamination will contaminate the land (leading to a loss of resource), surface water and/or groundwater, Tshipi will: • notify residents/users downstream of the pollution incident; • identify and provide alternative resources should contamination impact adversely on the existing environment; • cut off the source if the spill is originating from a pump, pipeline or valve (e.g. refuelling bays) and the infrastructure 'made safe'; • ontain the spill (e.g. construct temporary earth bund around source such as road tanker); • pump excess hazardous liquids on the surface to temporary containers (e.g. 210 litre drums, mobile tanker, etc.) for appropriate disposal; and • remove hazardous substances from damaged infrastructure to an appropriate storage area before it is removed/repaired.
2	Discharge of dirty water to the environment	Apply the principals listed for Item 1 above. To stop spillage from the dirty water system the mine will: • redirect excess water to other dirty water facilities where possible; • pump dirty water to available containment in the clean water system, where there is no capacity in the dirty water system; • carry out an emergency discharge of clean water and redirect the spillage to the emptied facility; and • apply for emergency discharge as a last resort.
3	Pollution of surface water (where relevant)	Personnel discovering the incident must inform the Environment department of the location and contaminant source. Apply the principals listed for Item 1 above. Absorbent booms will be used to absorb surface plumes of hydrocarbon contaminants. Contamination entering the surface water drainage system should be redirected into the dirty water system. The Environment department will collect in-stream water samples downstream of the incident to assess the immediate risk posed by contamination.
4	Groundwater contamination	Use the groundwater monitoring boreholes as scavenger wells to pump out the polluted groundwater for re-use in the process water circuit (hence containing the contamination and preventing further migration). Investigate the source of contamination and implement control/management actions.
5	Burst water pipes (loss of resource and erosion)	Notify authority responsible for the pipeline (if not mine responsibility). Shut off the water flowing through the damaged area and repair the damage. Apply the principals listed for Item 1 above if spill is from the dirty/process water circuit.
6	Flooding from failure of surface water control infrastructure	Evacuate the area downstream of the failure. Using the emergency response team, rescue/recover and medically treat any injured personnel. Temporarily reinstate/repair stormwater diversions during the storm event (e.g. emergency supply of sandbags).

ITEM	EMERGENCY SITUATION	RESPONSE IN ADDITION TO GENERAL PROCEDURES
		Close the roads affected by localised flooding or where a stormwater surge has destroyed crossings/bridges.
7	Risk of drowning from falling into water dams	Attempt rescue of individuals from land by throwing lifeline/lifesaving ring. Get assistance from emergency response team whilst attempting rescue or to carry out rescue of animals and or people as relevant. Ensure medical assistance is available to recovered individual.
8	Veld fire	Evacuate mine employees from areas at risk. Notify downwind residents and industries of the danger. Assist those in imminent danger/less-able individuals to evacuate until danger has passed. Provide emergency firefighting assistance with available trained mine personnel and equipment.
9	Falling into hazardous excavations	Personnel discovering the fallen individual or animal must mobilise the emergency response team to the location of the incident and provide a general appraisal of the situation (e.g. human or animal, conscious or unconscious, etc.). Trained professionals such as the mine emergency response team should recover the injured party. A doctor (or appropriate medical practitioner)/ambulance should be present at the scene to provide first aid and transport individual to hospital.
10	Road traffic accidents (on site)	The individual discovering the accident (be it bystander or able casualty) must raise the alarm giving the location of the incident. Able personnel at the scene should shut down vehicles where it is safe to do so. Access to the area should be restricted and access roads cleared for the emergency response team. Vehicles must be made safe first by trained professionals (e.g. crushed or overturned vehicles). Casualties will be moved to safety by trained professionals and provided with medical assistance. Medical centres in the vicinity with appropriate medical capabilities will be notified if multiple seriously injured casualties are expected. A nearby vet should be consulted in the case of animal injury
11	Development of informal settlements	The mine will inform the local authorities (municipality and police) that people are illegally occupying the land and ensure that action is taken within 24hrs.
12	Uncovering of graves and sites and fossils	Personnel discovering the grave or site must inform the Environment department immediately and all work must be stopped immediately The environmental department must inform the South African Heritage Recourse Agency (SAHRA) and contact an archaeologist and/or palaeontologist, depending on the nature of the find, to assess the importance and rescue them if necessary (with the relevant SAHRA permit). No work may be resumed in this area without the permission from the ECO and SAHRA. If the newly discovered heritage resource is considered significant a Phase 2 assessment may be required. Historical buildings older than 60 years fall under the jurisdiction of the Free State Provincial Heritage Authority. If any sites are affected this provincial authority should be contacted Should further burial grounds, graves or graveyards be found, the SAHRA Burial Grounds and Graves Unit must be contacted.

ITEM	EMERGENCY SITUATION	RESPONSE IN ADDITION TO GENERAL PROCEDURES
		Prior to damaging or destroying any of the identified graves, permission for the exhumation and relocation of graves must be obtained from the relevant descendants (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local Police. The exhumation process must comply with the requirements of the relevant Ordinance on Exhumations, and the Human Tissues Act, 65 of 1983.

31 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

The following documents will be submitted to the DMR from the start of construction until mine closure:

- in accordance to section 34 of GNR. 982 of NEMA, the holder of a mining right needs to submit an environmental audit report, prepared by an independent person, to the DMR at intervals indicated in the environmental authorisation. The purpose of the environmental audit report is to ensure compliance with the conditions of the environmental authorisation and the EMP; and
- the financial provision will be updated on an annual basis and submitted to the DMR.

32 UNDERTAKING

I, Natasha Smyth, the Environmental Assessment Practitioner responsible for compiling this EMPR hereby confirm:

- the correctness of the information provided in the report;
- the inclusion of comments and inputs form stakeholders and IAPs;
- the inclusion of inputs and recommendations from the specialist reports where relevant; and
- the acceptability of the project in relation to the finding of the assessment and the level of management actions proposed.

Date: 24/08/2017

Signature of the EAP

33 REFERENCES

Airshed Planning Professionals (Pty) Ltd, Air Quality Impact Assessment for the Proposed Ntsimbintle Manganese Mining Operations, April 2009.

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Banzai Environmental (Pty) Ltd, Palaeontological Desktop Assessment for the changes to the surface infrastructure at the Tshipi Borwa Mine, February 2017.

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PGS, Heritage Impact Assessment, Ntsimbintle Mining (Pty) Ltd on Portions 1, 2, 3 and 8 of the farm Mamatwan 331 and the farm Moab 700 in the Kalagadi District Municipality of the Northern Cape Province, March 2009.

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Tshipi é Ntle, Social and Labour Plan, December 2014.

APPENDIX A: EXISTING ENVIRONMENTAL AUTHORISATIONS

APPENDIX B: PROOF OF EAP QUALIFICATIONS AND CURRICULUM VITAE OF EAP

APPENDIX C: LOCAL AND REGIONAL SETTING

APPENDIX D: SITE LAYOUT

APPENDIX E: STAKEHOLDER ENGAGEMENT DOCUMENTS

- NEMA amendment application
- Minutes of pre-application meeting with the DMR held on 15 June 2016
- Land claims commissioner correspondence
- Public participation database
- Newsletter and proof of distribution
- Site notices and photos
- Meeting minutes of the general public meeting held on 21 February 2017 including copies of the attendance registers
- Meeting minutes of the commenting authorities meeting held on 21 February 2017 including copies of the attendance registers

APPENDIX F: IMPACT RATING FOR EACH POTENTIAL IMPACT

Potential environmental and socio-economic impacts were identified by SLR and other stakeholders. The impacts are discussed under issue headings in this section. All identified impacts are considered both incrementally and cumulatively in the context of the existing Tshipi mining infrastructure and activities. The criteria used to rate each impact is outlined in Section 6.6. The potential impacts are rated with the assumption that no management actions are applied and then again with management actions. An indication of the phases in which the impact will occur including the project specific activity associated with each impact is provided below. A summary of the impact assessment is summarised in Section 8 of the main report. Management actions identified to prevent, reduce, control or remedy the assessed impacts are provided under the relevant impact discussions sections below. A summary of the management actions are provided in Section 27. It is important to note that management actions will include any measures outlined in the approved EMPr and any additional management actions identified as part of the project, where relevant. Any additional management actions will be indicated in italics.

For the purpose of this assessment discussion project changes have been grouped. In this regard reference will only be made to the relocation of approved surface infrastructure, design changes and the establishment of additional facilities and activities as opposed to making specific reference to each project change, unless otherwise stated. When referencing the relocation of approved surface infrastructure this specifically caters for:

- the western waste rock dump;
- the product stockpiles;
- the sewage treatment plant;
- the dirty water dams;
- the 78 Ml stormwater dam;
- the office, plant, workshop and related infrastructure; and
- change in the position of the secondary crushing and screening plant.

When referencing the design changes this specifically caters for:

- the dirty water dams;
- the railway siding;
- the sewage treatment plant;
- the potable water storage facilities; and
- the expansion of approved topsoil stockpile area No. 1.

When referencing the establishment of additional facilities and activities this specifically caters for:

- the establishment of the eastern waste rock dump;
- topsoil stockpile area (No. 2).

- the temporary ROM stockpile area;
- the workshop dirty water collection dam;
- the clean and dirty water separation;
- the tyre bays;
- the additional weighbridges; and
- mining of the barrier pillar.

Environmental impacts associated with the project that will be assessed in this section include the following:

- the loss and sterilisation of a mineral resource;
- hazardous excavations and infrastructure resulting in safety risks to third parties and animals;
- the loss of soil resources and land capability through contamination;
- the loss of soil resources and land capability through physical disturbance;
- the physical destruction of biodiversity;
- general disturbance of biodiversity;
- the contamination of surface water resources;
- the alteration of natural drainage patterns;
- the contamination of groundwater resources;
- the lowering of groundwater levels and reducing availability;
- air pollution;
- increase in disturbing noise levels;
- negative visual views;
- road disturbance and traffic safety;
- ground vibrations, air blasts and fly rock;
- the loss of heritage, cultural and palaeontological resources;
- inward migration impact;
- economic impact; and
- a change in land use.

GEOLOGY

ISSUE: LOSS AND STERILISATION OF MINERAL RESOURCES

Information in this section was sourced from the project team.

Introduction

Mineral resources can be sterilised and/or lost in the event that Tshipi disposes feasible mineral resources onto the waste rock dumps, which will be backfilled into the open pit in a manner that makes it difficult or impossible to access the resources. It may also occur through the disposal of feasible minerals onto the approved tailings dam in a manner that makes it difficult or impossible to access the resources. Sterilisation can also occur through the placement of infrastructure above mineable resources.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
N/A			
N/A	Mineralised waste Continued use of approved facilities and services Open pit mining	Mineralised waste Continued use of approved facilities and services	Final land forms

Rating of impact

<u>Severity/ nature</u>

The impact of the loss and sterilisation of mineral resources was assessed as part of the approved EMPr (Metago, May 2009). The approved EMPr assessed that the placement of surface infrastructure would not sterilise any mineral resources. The relocation of surface infrastructure and design changes will not influence the loss and sterilisation of mineral resources. Additional activities associated with the project such as the mining of the barrier pillar, will generate additional waste rock material which will be deposited onto the waste rock dumps. Incrementally this is a medium severity and reduces to low with mitigation.

Following detailed work undertaken by Tshipi, it has been identified that some mineral resources have been sterilised by the placement of the northern waste rock dump. It is understood that this material is economically viable.

The cumulative severity rating assesses the impact of the changes to the operation within the context of the current approved mining operation. In this regard the severity of sterilising mineral resources is considered to be high because of the associated potential economic value that is lost when sterilisation occurs. In the mitigated scenario, planning and co-ordination between the project team can help to prevent the unacceptable sterilisation of resources, without compromising safety requirements. The mitigated severity can be reduced, however given that some resources have been sterilised this reduces the mitigated severity to medium.

Duration

The sterilisation of resources will extend beyond the life of mine. This is a long term duration. With mitigation this reduces to the life of mine.

Spatial scale / extent

The spatial extent of the physical impact is linked to the spatial extent of the mining area. This is a localised spatial extent as the impact remains within the mining area. If one however considers the economic nature of the impact, it will extend beyond the mining area into the broader economy.

Consequence

The unmitigated consequence is high. The mitigated consequence is medium.

Probability

Without management actions the probability is high. With the implementation of management actions, planning structures will be in place to avoid infrastructure and development related sterilisation which reduces the probability to low.

Significance

The unmitigated significance is high. In the mitigated scenario the significance is low.

Unmitigated – summary of the rated loss and sterilisation of mineral resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation, decommissioning and closure						
Unmitigated	H	H	M	H	H	H

Mitigated – summary of the rated loss and sterilisation of mineral resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation, decommissioning and closure						
Mitigated	M	M	M	M	L	L

Management objectives

To prevent unacceptable mineral sterilisation.

Management actions

During all mine phases Tshipi will ensure the following:

- *Best mining practises will be undertaken to ensure that mineral sterilisation is minimised as far as possible.*

TOPOGRAPHY

ISSUE: HAZARDOUS EXCAVATIONS AND INFRASTRUCTURE RESULTING IN SAFETY RISKS TO THIRD PARTIES AND ANIMALS

Information in this section was sourced from site visits undertaken by the project team and topographical data.

Introduction

Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. Hazardous excavations and infrastructure occur through the construction, operation to decommissioning and closure phases. In the construction and decommissioning phase these hazardous excavations and infrastructure are usually temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term hazardous excavations and infrastructure and the closure phase will present final rehabilitated areas that are considered hazardous (approved tailings dam).

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impact

<u>Severity/ nature</u>

The impacts associated with hazardous excavations and infrastructure was assessed as part of the approved EMPr (Metago, May 2009). Taking this into account, the relocation of approved surface

infrastructure and design changes within the Tshipi Borwa Mine area will not present hazards and safety risks that are new to the mine, albeit that the position of these hazards and risks will be different.
In the absence of security and access control measures, the establishment of additional facilities and activities presents additional hazardous excavations and infrastructure that has the potential to harm third parties and animals. Security and access control measures are in place at the Tshipi Borwa Mine. It follows that the incremental mitigated scenario is low.

The cumulative severity rating assesses the impact of the changes to the operation within the context of the current approved mining operation where there are already potential hazardous excavations and infrastructure. It follows that this has a high severity in the unmitigated scenario when considered cumulatively within the context of the current approved operations, reducing to low with management actions.

Duration

Death or permanent injury is considered a long term, permanent impact in both the mitigated and unmitigated scenarios.

Spatial scale/ extent

Direct impacts associated with hazardous infrastructure and excavations will extend beyond the site boundary in all project phases, with or without management actions. The potential indirect impacts will however extend beyond the site boundary to the communities to which the injured people and/or animals belong.

Consequence

The consequence is high in the unmitigated scenario and reduces to medium with management actions.

Probability

In the unmitigated scenario, without design and management interventions such as security and access control the impact probability is expected to be medium. With management actions that focus on infrastructure safety design and implementation as well as on limiting access to third parties and animals the probability of the impact occurring reduces to low.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance of this potential impact is low because there will be a reduction in probability that the impact occurs.

<u>Unmitigated – summary of the rated cumulative hazardous excavations and infrastructure resulting in safety risks to third parties and animals per phase of the mine</u>

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	M	H

<u>Mitigated – summary of the rated cumulative hazardous excavations and infrastructure resulting in safety risks to third parties and animals per phase of the mine</u>

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	H	M	M	L	L

Management objectives

The objective is to prevent physical harm to third parties and animals from potentially hazardous excavations and infrastructure.

Management actions

Management actions that have been identified for all mine phases include the following:

- until hazardous excavations are rehabilitated and closed, they will each have a barrier to prevent access by people and animals. The barrier may be in the form of fences, walls or berms. In addition, the barriers must have warning signs at appropriate intervals. These warning signs must be in picture format and/or written in English;
- dams with a safety risk will be monitored by a professional civil engineer in accordance with Section 29;
- *all mineralised waste facilities and water dams will be operated and closed in a manner to ensure stability and related safety risks to third parties and animals are mitigated; and*
- *Tshipi will survey its mining and surface use area and update its mine plan map on a routine basis to ensure that the position and extent of all potential hazardous excavations and hazardous infrastructure is known as part of operation and decommissioning. Tshipi will furthermore ensure that appropriate management actions are taken to mitigate the related safety risks to third parties and animals.*

During decommissioning planning of any part of the mine, provision will be made to mitigate long term safety risks in the decommissioning and rehabilitation phases.

At closure the hazardous infrastructure will be removed and the disturbed area rehabilitated in a manner that it does not present a long term safety and/or stability risk.

In case of incident or death due to hazardous excavations, the emergency response procedure in Section 30.2.2 will be followed.

SOIL AND LAND CAPABILITY

ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH CONTAMINATION

Information in this section is based on the soil study undertaken by ARC (ARC, October 2008) as part of the approved EMPr (Metago, May 2009). As part of the project, the specialist confirmed that the results of the soil study undertaken in October 2008 are still relevant.

Introduction

Soil is a valuable resource that supports a variety of ecological functions. Mining projects in general have the potential to damage soil resources through contamination. Contamination of soils also has the potential to impact biodiversity, surface and groundwater resources. Biodiversity, surface water and groundwater contamination impacts are discussed under their respective headings in this appendix. The loss of soil resources has a direct impact on the potential loss of the natural capability of the land. This section focuses on the potential contamination of the soil resources and the effect this has on land capability.

There are a number of sources in all phases that have the potential to pollute soil resources. Limited sources occur during the closure phase. In the construction and decommissioning phases these activities are temporary in nature, usually existing from a few weeks to a few months. The operational phase will present more long term activities and the closure phase will present final land forms (approved tailings dam) that may be susceptible to erosion.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impact

Severity/ nature

The approved infrastructure and activities presents numerous sources of soil pollutants that can result in a loss of soils (and associated land capability) as a resource. This in turn can result in a loss of soils as an ecological driver because it can create a toxic environment for vegetation and ecosystems that rely on the soil. The impact associated with soil contamination was assessed as part of the approved EMPr (Metago, May 2009). Taking this into account the relocation of approved surface infrastructure and design changes within the Tshipi Borwa Mine area will not present different contaminants or different source types to those previously assessed. The establishment of additional facilities and activities will contribute additional sources of soil pollutants. When considered incrementally, this has a medium severity in the unmitigated scenario, reducing to low with appropriate management actions.

The cumulative severity rating assessing the impact of the changes to the operation within the context of the approved mining operations is high in the unmitigated scenario. In the mitigated scenario the number of sources and number of pollution events should be significantly less which reduces the potential severity to medium to low.

Duration

In the unmitigated scenario, most pollution impacts and associated loss in land capability will remain long after closure. In the mitigated scenario most of these potential impacts should either be avoided or be remedied immediately which reduces the duration to less than the mines life. This will be achieved by the effective reaction time of the clean-up team and the chosen remediation methods.

Spatial scale/extent

In the unmitigated scenario for all phases the potential loss of soil resources and associated land capability will extend beyond the site boundary. With management actions, the potential loss of soil resources and associated land capabilities will be restricted to within the site boundary.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is reduced to low.

Probability

Without any management actions the probability of impacting on soils and land capability through pollution events is definite. With management actions, the probability will be significantly reduced to low because emphasis is be placed on preventing pollution events and on quick and effective remediation if pollution events do occur.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance reduces to low because with management actions the severity, duration and probability associated with the potential impact all reduces.

Unmitigated – summary of the rated cumulative loss of soil resources and land capability through contamination impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H

Mitigated – summary of the rated cumulative loss of soil resources and land capability through soil contamination impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequenc e	Probability of Occurrence	Significance
All phases						
Mitigated	L	L	L	L	L	L

Management objective

The objective is to prevent soil pollution.

Management actions

Management actions that have been identified for all mine phases include the following:

- Tshipi will conduct all potentially polluting activities *(i.e. transportation, handling and storage)* in a manner that pollutants *(such as hazardous chemicals (new and used), dirty water, mineralized wastes and non-mineralised wastes)* are contained at source *and do not pollute soils*. In this regard, the mine will ensure that:
  - all vehicles and *mobile* equipment *are serviced and that this is done* in workshops and washbays with contained impermeable, floors, dirty water collection facilities and oil traps;
  - all new and used chemical, fuel, and oil storage and handling facilities will be designed and operated in a manner that all spillages are contained in impermeable areas and cannot be released into the environment;
  - ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) will be reported to the environmental manager immediately and cleaned up/remediated immediately;
  - a dirty water management system, as set out in the respective section below is implemented *and maintained;*
  - the waste management practices as set out in Table 56 below is implemented;
  - *all employees (temporary and permanent) are educated and trained in pollution prevention; and*
  - *steps are in place to enable fast reaction to contain and remediate pollution incidents;*

- *specifications for post rehabilitation audit should be determined and implemented to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and if not, to recommend and implement further measures;*
- *the designs of any permanent and potentially polluting structures (such as the waste rock dumps and tailings dam) must take into account the requirements for long term soil pollution prevention, land function and confirmatory monitoring; and*
- in case of major spillage incidents the emergency response procedure in Section 30.2.2 will be followed.

TABLE 56: WASTE MANAGEMENT PROCEDURES FOR GENERAL AND HAZARDOUS WASTE

Items to be considered		**Intentions**
General	**Specific**	
Classification and record keeping	General	The waste management procedure for the mine will cover the storage, handling and transportation of waste to and from the mine. The mine will ensure that the contractor's responsible are made aware of these procedures.
	Waste opportunity analysis	In line with DWEA's strategy to eliminate waste streams in the longer term, Tshipi will assess each waste type to see whether there are alternative uses for the material. This will be done as a priority before the disposal option.
	Classification	*Wastes (except those listed in Annexure 1 of the new Waste Regulations) will be classified in accordance with SANS 10234 within one hundred and eighty (180) days of generation.* *Waste will be re-classified every five (5) years, or within 30 days of modification to the process or activity that generated the waste, changes in raw materials or other inputs, or any other variation of relevant factors.*
	Safety data sheets	*The mine will maintain, where required in terms of the Regulations, the safety data sheets for hazardous waste (prepared in accordance with SANS 10234).*
	Inventory of wastes produced	The mine will keep an accurate and up to date record 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 cubic metres 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.*
	Labelling and inventory of waste produced	*Any container or storage impoundment holding waste must be labelled, or where labelling is not possible, records must be kept, reflecting:* • *the specific category or categories of waste in the container or storage impoundment as identified in terms of the National Waste Information Regulations, 2012; and* • *the classification of the waste in terms of Regulation 4 once it has been completed (if required).*
	Disposal record	Written evidence of safe disposal of waste will be kept.
	Record keeping	*Records will be retained for a period of at least 5 years and will be made available to the Department on request.*
Waste management	Collection points	Designated waste collection points will be established on site. Care will be taken to ensure that there will be sufficient collection points with adequate capacity and that these are serviced frequently.
	Laydown/ *salvage* areas	During decommissioning and closure, lay down areas for re-usable non-hazardous materials will be established.
	General waste	Will be stored in designated skips and removed by an approved contractor for disposal at a licenced facility.

Items to be considered		Intentions
General	**Specific**	
	Scrap metal and *building rubble*	Care will be taken to ensure that scrap metal and building rubble does not become polluted or mixed with any other waste. The scrap metal will be collected in a designated area for scrap metal. It will be sold to scrap dealers. *Building rubble will either be disposed off-site or buried in the pit at closure.*
	Hazardous wastes	Medical waste, laboratory chemicals and related packaging, used chemicals and chemical containers will be temporarily stored in sealed containers in a bunded store before removal by an approved waste contractor and disposal in a licenced facility.
	Old explosives waste	It is stored in an old explosives storage box prior to being destroyed at the on-site destruction bay
	Used and/or spilled oil and grease	In designated areas used and/or spilt oil and grease will be collected in suitable containers at identified collection points. The identified collection points will be bunded and underlain by impervious materials to ensure that any spills are contained. In general areas used and/or spilt oil and grease will be collected in suitable containers and deposited in a designated storage area. Notices will be erected at each waste oil point giving instructions on the procedure for waste oil discharge and collection. An approved subcontractor will remove oil from site.
	Any soil polluted by a spill	If soil (whether stockpiled or in its undisturbed natural state) is polluted, the first management priority is to treat the pollution by means of in situ bio-remediation at the designated site. *In situ remediation is generally considered to be the preferred option because with successful in situ remediation the soil resource will be retained in the correct place. The in situ options include bioremediation at the point of pollution, or removal of soils for washing and/or bio remediation at a designated area after which the soils are returned.*
		If remediation of the soil *in situ* is not possible, the soils will be classified as a waste in terms of the Waste Regulations and will be disposed of at an appropriate permitted waste facility.
	Mixing of wastes	Waste will not be mixed or treated where this would reduce the potential for re-use, recycling or recovery; or result in treatment that is not controlled and not permanent.
	Particles and salts from the sinter scrubbers and reverse osmosis plant	This material will either be recycled into the process through the thickeners or there is the option of storage in sealed drums and removal to an appropriately licenced waste site.
Disposal	Offsite waste disposal facilities	Waste will be disposed of at appropriate permitted waste disposal facilities. For general waste the closest permitted site is in Kuruman. For hazardous waste, the closest permitted site is at Holfontein.
		Unless collected by the municipality, the mine must ensure that the waste is assessed in accordance with the Norms and Standards for Assessment of Waste for Landfill Disposal set in terms of section 7(1) of the NEM:WA prior to the disposal of the waste to landfill.
		Unless collected by the municipality, the mine must ensure that the disposal of their waste to landfill is done in accordance with the Norms and Standards for Disposal of Waste to Landfill set in terms of section 7(1) of the NEM:WA.
Waste transport	Contractor	A qualified waste management subcontractor will undertake the waste transport. *The contractor will provide an inventory of each load collected and of proof of disposal at a licenced facility.*
Banned practices	Long-term stockpiling of waste	Stockpiling of waste is a temporary measure. Waste stockpiling sites must have an impervious floor, be bunded and have a drainage system for collection and containment of water on the site.
	Burying of waste	No wastes will be placed on site.

ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

Information in this section is based on the soil study undertaken by ARC (ARC, October 2008) as part of the approved EMPr (Metago, May 2009). As part of the project, the specialist confirmed that the results of the soil study undertaken in October 2008 are still relevant.

Introduction

Soil is a valuable resource that supports a variety of ecological functions. Soil is the key to re-establishing post closure land capability. There are a number of activities/infrastructure in all phases that have the potential to disturb soils and related land capability through removal, compaction and/or erosion. The loss of soil resources has a direct impact on the potential loss of the natural capability of the land. This section focuses on the potential for physical disturbance of the soil resources and the effect this has on land capability.

In the construction and decommissioning phases these activities could be temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term activities and the closure phase will present final land forms (approved tailings dam) that may be susceptible to erosion.

Mine phase and link to project specific activities/infrastructure

Construction	**Operational**	**Decommissioning**	**Closure**
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impact

<u>Severity/nature</u>

In the unmitigated scenario, physical soil disturbance can result in a loss of soil functionality as an ecological driver. In the case of erosion, the soils will be lost to the area of disturbance, and in the case of compaction the soils functionality will firstly be compromised through a lack of rooting ability and aeration, and secondly the compacted soils are likely to erode because with less inherent functionality there will be little chance for the establishment of vegetation and other matters that naturally protects the soils from erosion.

The impacts associated with physical disturbance of soil resources were assessed as part of the approved EMPr (Metago, May 2009). The approved infrastructure disturbed an area of 950ha (Metago, May 2009). Where applicable, soil resources from infrastructure footprint sites have been stripped and stockpiled on site. Taking this into account, the relocation of approved surface infrastructure and design changes within the Tshipi Borwa Mine area will not disturb different soil types as the soils are uniform across the mine site. The approved EMPr (Metago, May 2009), caters for a disturbance area of 950ha. The establishment of additional facilities and activities forms part of this approved disturbance area. When considered incrementally, this has a low severity in the unmitigated and mitigated scenarios.

The cumulative severity rating assessing the impact of the changes to the operations within the context of the approved mining operations is high in the unmitigated scenario. In the mitigated scenario the soils can mostly be conserved and reused which reduces the severity to medium.

Duration

In the unmitigated scenario the loss of soil and related land capability is long term and will continue after the life of the mine. In the mitigated scenario, most of the soil is conserved and used for rehabilitation which reduces the duration of the impact to the life of the operations. However for the approved tailings dam, the land capability will be altered forever resulting in a long term duration.

Spatial scale/extent

In both the unmitigated and mitigated scenarios for all phases of the mine, the potential loss of soil and land capability through physical disturbance will be restricted to within the site boundary.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is medium.

Probability

Without any management actions the probability of losing soil and related land capability is definite. With management actions, the probability will mostly be reduced because emphasis will be placed on soil conservation and re-use during rehabilitation. In the case of the approved tailings dam, while some topsoil can be conserved and used for rehabilitation, the probability of a land capability change will remain high as the approved tailings dam will remain in perpetuity.

Significance

In the unmitigated scenario the significance is high. In the mitigated scenario the significance is reduced to low for all components except the approved tailings dam. For these facilities, in the mitigated scenario, the significance is reduced to medium as although rehabilitation will take place, these facilities covering 30 ha of land will remain in perpetuity.

Unmitigated – summary of the rated cumulative loss of soil resources and land capability through physical disturbance impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	L	H	H	H

Mitigated – summary of the rated cumulative loss of soil resources and land capability through physical disturbance impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	M (H for approved tailings dam)	L	M	L (H for tailings dam)	L (M for approved tailings dam)

Management objective

The objective is to minimise the loss of soil resources and related land capability through physical disturbance, erosion and compaction.

Management actions

Management actions that have been identified for all mine phases include the following:

- land disturbance by mine activities will be limited to those activities and areas that are described in the EMPr report;
- Tshipi will implement the soil conservation procedure as set out in Table 57;
- rehabilitation will be undertaken *in line with an approved mine closure plan that ensures a suitable post-closure land use is achieved*; and
- *as part of closure planning, the designs of any permanent landforms (approved tailings dam) will take into consideration the requirements for land function, long term erosion prevention and confirmatory monitoring.*

TABLE 57:SOIL CONSERVATION PROCEDURE

Steps	Factors to consider	Detail
Delineation of areas to be stripped		Stripping will only occur where soils are to be disturbed by activities that are described in the EMPr report, and where a clearly defined end rehabilitation use for the stripped soil has been identified. *Soil stripping should be conducted a suitable period ahead of mining.*
Reference to biodiversity action plan		All requirements for moving and preserving fauna and flora according to the biodiversity action plan will be adhered to.
Stripping	Topsoil	As a general rule 50cm of topsoil must be stripped *unless a soils expert advises otherwise.*
	Subsoil	Given the nature of the soils, no distinction needs to be made between subsoil and the topsoil.
Delineation of stockpiling areas	Location	Stockpiling areas will be identified in close proximity to the source of the soil to limit handling and to promote reuse of soils in the correct areas.
	Designation of the areas	Soil stockpiles will be clearly marked to identify both the soil type and the intended area of rehabilitation. *All topsoil will be stockpiled in areas clearly demarcated on the infrastructure layout and should be defined as no-go areas.* *Topsoil stockpiles must be located outside of areas susceptible to erosion.*
Stockpile management	Vegetation establishment and erosion control	Rapid growth of vegetation on the topsoil stockpiles will be promoted (e.g. by means of watering or fertilisation). The purpose of this exercise will be to encourage vegetation growth on soil stockpiles and to combat erosion by water and wind.
	Storm water controls	Stockpiles will be established with storm water diversion berms to prevent run off erosion.
	Height and slope	Soil stockpiles height will be restricted to avoid compaction and damage to the underlying soils. *In this regard, topsoil stockpiles should be limited to a maximum height of 5m. The stockpile side slopes should be flat enough to promote vegetation growth and reduce run-off related erosion. In addition to this, the topsoil stockpiles need to be established on a gradual slope if possible.*
	Waste	No waste material will be placed on the soil stockpiles.
	Vehicles	Equipment movement on top of the soil stockpiles will be limited to avoid topsoil compaction and subsequent damage to the soils and seedbank.
Management of disturbed land	*Erosion control*	*To prevent the erosion of topsoil, management actions may include one or more of the following; berms, soil traps, hessians and stormwater diversions away from areas susceptible to erosion.*
Rehabilitation of disturbed land: restoration of land capability	Placement of soil	*Once the site has been cleared on infrastructure, the area to be rehabilitated should be ripped in order to reduce soil compaction.* As a general rule, a minimum layer of 50cm of topsoil will be replaced *unless a soils expert advises otherwise.*
	Fertilisation	A few samples of stripped soils will be analysed to determine the nutrient status of the soil *before rehabilitation commences*. As a minimum, the following elements will be tested for cation exchange capacity, pH, and phosphate. These elements provide the basis for determining the fertility of soil. Based on the analysis, fertilisers will be applied if necessary.
	Erosion control	Erosion control measures will be implemented to ensure that the topsoil is not washed away and that erosion gulley's do not develop prior to vegetation establishment.
	Restore land function and capability	*Apply landscape function analysis and restoration interventions to areas where soil has been replaced as part of rehabilitation, but the land function and capability has not been effectively restored.*

BIODIVERSITY

ISSUE: PHYSICAL DESTRUCTION OF BIODIVERSITY

Information in this section was sourced from the biodiversity study undertaken for the project (EMS, February 2017) included in Appendix K.

Introduction

There are a number of activities/infrastructure in all phases that have the potential to destroy biodiversity in the broadest sense. In this regard, the discussion relates to the physical destruction of habitat and related species which are considered to be significant because of their status, and/or the role that they play in the ecosystem.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impact

<u>Severity/nature</u>

Areas of high ecological sensitivity are functioning biodiversity areas with species diversity and associated intrinsic value. In addition, some of these areas host protected species. The linking areas have value because of the role they play in allowing the migration or movement of flora and fauna between the areas which is a key function for the broader ecosystem. The transformation of land for any purpose, including mining and associated activities, increases the destruction of the site specific biodiversity, the fragmentation of habitats, reduces its intrinsic functionality and reduces the linkage role that undeveloped land fulfils between different areas of biodiversity importance.

The impact associated with the physical destruction of biodiversity was assessed as part of the approved EMPr (Metago, May 2009). The approved infrastructure disturbed an area of 950ha (Metago, May 2009). Taking this into account, the relocation of approved surface infrastructure and design changes within the Tshipi Borwa Mine area have not resulted in a material change in the mine's footprint, nor changed the types of habitat or species impacted.

Although the establishment of additional facilities and activities forms part of the approved 950ha area of disturbance, these will require clearing of vegetation and could result in the loss of additional protected trees such as the Camel Thorn (*Vachellia erioloba)*, Grey Camel Thorn (*Vachellia haematoxylon)* and Goldblatt (*Moraea longistyla)*. With reference to Figure 21, the establishment of additional facilities and activities is predominantly located within the medium sensitivity *Grewia Flava* Scrub vegetation type and a small portion located within the high sensitivity *Vachellia haemotoxlyon* Savannah vegetation type. The density of protected trees varies within these vegetation types, but it is more significant in the *Vachellia haematoxylon* Savannah vegetation type. The establishment of additional facilities and activities will however increase the mine's disturbance footprint by approximately 61 ha. When considered incrementally, this has a medium severity in the unmitigated and mitigated scenarios.

The cumulative severity rating assessing the impact of changes to the operation within the context of the approved mining operation is high in the unmitigated scenario. Linked to the high severity rating is the fact that the Tshipi Borwa mine falls within the Griqualand Centre of Endemism which is under research, and therefore the cumulative loss of habitat increases the risk of losing information as well as ecosystem functioning. The severity can be reduced to medium with management actions.

<u>Duration</u>

In the unmitigated scenario the loss of biodiversity and related functionality is long term and will continue after the life of the mine. With management actions, biodiversity and related functionality may be partially restored during the operational, decommissioning and closure phases. The duration is therefore high in the unmitigated scenario, reducing to medium in the mitigated scenario.

<u>Spatial scale / extent</u>

Given that biodiversity processes are not confined to the mine site, the spatial scale of impacts will extend beyond this boundary in both the mitigated and unmitigated scenarios. The spatial scale is therefore medium in both the unmitigated and mitigated scenarios.

<u>Consequence</u>

In the unmitigated scenario the consequence is high and reduces to medium with management actions.

<u>Probability</u>

Without management actions the probability is definite. With management actions, the probability may be reduced with correct management actions and concurrent rehabilitation.

<u>Significance</u>

The significance of this impact is high without management actions, reducing to medium with the correct management actions.

<u>Unmitigated – summary of the cumulatively rated loss of biodiversity through physical destruction impact per phase of the mine</u>

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H

<u>Mitigated – summary of the cumulatively rated loss of biodiversity through physical destruction impact per phase of the mine</u>

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	M	M	M	M	M

Management objective

The objective is to prevent the unacceptable loss of biodiversity and related ecosystem functionality through physical disturbance.

Management actions

Management actions to be implemented during all phases include the following:

- Tshipi will continue to implement a biodiversity action plan that will be refined and implemented in consultation with *DAFF and a qualified specialist*;
- Tshipi will continue to limit mine infrastructure, activities and disturbance to those specifically identified and described in this EMPr, with controlled access and zero tolerance of unnecessary disturbances to the identified sensitive habitats and associated species of the *Vachellia haematoxylon* Savannah and Mixed *Vachellia* Savannah vegetation types;
- pods of the Camel Thorn (*Vachellia erioloba)* and the Grey Camel Thorn (*Vachellia haematoxylon)* will continue be collected in order to aid in the re-establishment of these species. Necessary steps (such as artificial scarring/acid washing) will be taken in order to aid in germination of these species;
- there will be planned removal of fauna and flora (plants and seeds) species prior to disturbance by mine infrastructure and activities. This will include planning on the preservation, cultivation and re-use of these species in ongoing rehabilitation. Links will also be made to the soil conservation procedure and actions. Harvesting of seeds in a controlled manner from similar areas within the Tshipi Borwa Mine area will be undertaken to aid in rehabilitation of the mining areas;
- as a first priority, every attempt will be made to preserve existing larger trees;
- where protected plant and/or tree species need to be removed/destroyed, the relevant permits must be obtained *prior to removal*; and
- management of the rehabilitated areas will consider an “after care” programme, which will aid in ensuring that the correct species are able to re-establish.

In addition, *a biodiversity offset will be implemented should this be requested by DAFF in* accordance with the relevant biodiversity offset guidelines. Issues that will be considered in the *biodiversity offset with guidance from DAFF* are as follows:

- the size of the potentially affected area;
- the conservation status of the potentially affected area;
- the offset ratio (in terms of the required size of the offset site) to be applied;
- evaluation of alternative offset sites on the basis of: compensation for the mine's negative impact on biodiversity, long term functionality, long term viability, contribution to biodiversity conservation in the Northern Cape including linkages to areas of conservation importance, acceptability to IAPs, management of negative impacts on local communities, distances from other mines in relation to dust fallout and other impacts, and biodiversity condition scores as compared to that at the UMK site;
- land ownership now and in the future;
- status/security of the offset site, i.e. will it receive conservation status;
- measures to guarantee the security, management, monitoring and auditing of the offset;
- capacity of Tshipi to implement and manage the offset (collaboration with surrounding mine's offsets may be an option);
- identification of unacceptable risks associated with the offset; and
- the start up and ongoing costs associated with the offset for the life of the project.

ISSUE: GENERAL DISTURBANCE OF BIODIVERSITY

Information in this section was sourced from the biodiversity study undertaken for the project (EMS, February 2017) included in Appendix K.

Introduction

There are a number of activities/infrastructure that have the potential to directly disturb vegetation, vertebrates and invertebrates in all project phases, particularly in the unmitigated scenario. In the construction and decommissioning phases these activities are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term occurrences and the closure phase will present final land forms (approved tailings dam and residual waste rock dumps (where applicable) that may have pollution potential through long term seepage and/or run-off.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impact

Severity / nature

In the unmitigated scenario, biodiversity may be disturbed in the following ways:

- lighting can attract large numbers of invertebrates which become easy prey for predators. This can upset the invertebrate population balances;
- people may kill various types of species for food, for sport, for fire wood etc.;
- people may illegally collect and remove vegetation, vertebrate and invertebrate species;
- excessive dust fallout from various dust sources (exposed areas, soil stockpiles etc.) and the processing plant may have adverse effects on the growth of some vegetation, and it may cause varying stress on the teeth of vertebrates that have to graze soiled vegetation;
- noise and vibration pollution (from the processing plant, vehicle movement, materials handling etc.) may scare off vertebrates and invertebrates. In some instances the animals may be deterred from passing close to noisy activities which can effectively block some of their migration paths. In other instances, vertebrates and invertebrates that rely on vibration and noise senses to locate for, and hunt, prey may be forced to leave the vicinity of noisy, vibrating activities;
- an increased presence of vehicles in the area can cause road kills especially if drivers speed;
- the presence of mine water impoundments (stromwater dams) may lead to drowning of fauna; and
- an increase in pollution emissions and general litter may directly impact on the survival of individual plants, vertebrates and invertebrates.

In addition to the above, and with reference to section 6.4.1.6, ADEs provide habitats for an array of species, especially in arid areas, and are considered important in ecological processes and making available resources for the biodiversity in an area that would otherwise not be available. It is possible that species associated with deep root systems such as the Grey Camel Thorn (*Vachellia haematoxylon)*, and Camel Thorn (*Vachellia karroo)*, source water from groundwater aquifers. A mine related drop in groundwater levels can effectively place these trees in a situation where they are unable to reach water, particularly with larger trees as they are less adaptable to a change in groundwater levels than smaller trees. Although very limited information is known regarding how ADE plants access water and at what depths, lowering of groundwater levels may indirectly result in a loss of trees. The approved EMPr (Metago, May 2009) did not assess the impact on ADE plants and as such it is included in this assessment. It is however important to note that changes to the surface infrastructure as part of the project will not change dewatering impacts and therefore will not change the effects that lowering of groundwater levels may have on ADE plants.

The impact of the general disturbance of biodiversity was assessed as part of the approved EMPr (Metago, May 2009). The relocation of approved surface infrastructure and design changes within the Tshipi Borwa Mine area have not resulted in a material change in the mine's footprint, nor change the expected disturbances to biodiversity as described in the list above. The establishment of additional facilities and activities, will however increase the number of disturbance activities at the Tshipi Borwa Mine. When considered incrementally this is a medium severity reducing to low with management actions.

The cumulative severity rating assessing the impact of changes to the operation within the context of the approved mining operation is high in the unmitigated scenario. The severity can be reduced to medium with management actions.

Duration

In the unmitigated scenario, the impacts are long term because where biodiversity is compromised, killed or removed from the area this impact is likely to exist beyond the life of mine. With management actions, most of these disturbances can be prevented/minimised and will cease upon closure; however, any imbalances caused by disturbances will take some time to restore.

Spatial scale / extent

Given that biodiversity processes are not confined to the Tshipi Borwa Mine, the spatial scale of general disturbances will extend beyond the site boundary in the unmitigated and mitigated scenarios. Key related issues are the migration of species and linkages between biodiversity areas. This is a medium spatial scale.

Consequence

In the unmitigated scenario, the consequence of this potential impact is high. With management actions, this reduces to moderate.

<u>Probability</u>

Without any management actions, the probability of negatively impacting on biodiversity through multiple disturbance events is high. With management actions, the probability can be reduced because most of the disturbances can be controlled through implementation and enforcement of practices, policies and procedures.

<u>Significance</u>

In the unmitigated scenario, the significance of this potential impact is high reducing to medium with management actions.

<u>Unmitigated – summary of the cumulatively rated general disturbance of biodiversity impact per phase of the mine</u>

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H

<u>Mitigated – summary of the cumulatively rated general disturbance of biodiversity impact per phase of the mine</u>

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	M	M	M	M	M

Management objective

The objective is to prevent unacceptable disturbance of biodiversity and related ecosystem functionality.

Management actions

Management actions to be implemented during all phases include the following:

- Tshipi will implement an alien/invasive/weed management programme (Section 29) in collaboration with the *DENC and DAFF* to control the spread of these plants onto and from disturbed areas. Care will be taken to prevent the encroachment of these species into rehabilitated areas;
- *vertebrates should be kept away from the illuminated areas with appropriate fencing where feasible*
- *there is training for workers on the value of biodiversity and the need to conserve the species and systems that occur at the Tshipi Borwa Mine;*
- *there is zero tolerance of the killing or collecting of any biodiversity by anybody working for or on behalf of Tshipi;*
- *strict speed control measures are used for any vehicles driving within the Tshipi Borwa Mine area;*
- *noisy and/or vibrating equipment will be well maintained to control noise and vibration emission levels;*

- *dust control measures will be implemented as discussed under the air quality section in this appendix; and*
- *pollution and litter prevention measures will be implemented as outlined in*
- Table 56 *and Table 57.*

A comprehensive monitoring programme of the protected trees will be implemented, on an individual tree basis as well as monitoring at a community level. The area will be defined within input from a specialist. A suitability qualified specialist should assist in developing such a monitoring programme. Depending on the results of the monitoring programme, additional management actions can be recommended by the qualified specialist.

As part of closure planning, the designs of any permanent and potentially polluting structures (approved tailings dam) will take consideration of the requirements for long term pollution prevention and confirmatory monitoring.

In case of major spillage incidents the emergency response procedure in Section 30.2.2 will be followed.

SURFACE WATER

ISSUES: ALTERATION OF NATURAL DRAINAGE PATTERNS

The information in this section was sourced from the approved EMPr (Metago, May 2009) and the updated stormwater management plan undertaken for the project (SLR, June 2017) included in Appendix L.

Introduction

With reference to the table below, there are a number of activities/infrastructure which will alter drainage patterns by reducing the volume of run-off into the downstream catchments. During the construction, operational and decommissioning phase, these activities will continue until such time as infrastructure can be removed and/or the mining areas are rehabilitated. During the closure phase rehabilitation will allow for the restoration of drainage patterns. For the mine, rainfall and surface water run-off will be collected in all areas that have been designed with water containment infrastructure as required by legislation. The collected run-off will therefore be lost to the catchment and can result in the alteration of drainage patterns. As part of the project, all activities and infrastructure will be located within the Tshipi Borwa Mine area and as such will not result in the physical alteration of any nearby water resources such as the ephemeral Vlermuisleegte and Witleegte Rivers.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impacts

Severity/nature

During the construction, operation, decommissioning, and to a lesser extent, the closure phases, rainfall and surface water run-off will be collected in all areas that have been designed with water containment infrastructure. The collected run-off will therefore be lost to the catchment and can result in the alteration of drainage patterns. The total MAR for the quaternary catchment D41K is 6.53 million m^3/year (Section 6.4.1.7). The impacts associated with the alteration of natural drainage patterns was assessed as part of the approved EMPr (Metago, May 2009). Infrastructure approved as part of the approved EMPr (Metago, May 2009) will reduce the run-off to quaternary catchment D41K by 0.138%. The relocation of approved surface infrastructure and design changes will not result in a change to this reduction.

The establishment of additional facilities and activities will further reduce the run-off to the quaternary catchment D41K by 0.014%. When considered incrementally this is a low severity in both the mitigated and unmitigated scenarios.

The cumulative severity rating assessing the impact of the changes to the operation within the context of the approved mining operations is medium because although the reduction is measurable it will not result in a substantial deterioration in the catchment in both the mitigated and unmitigated scenarios.

Duration

In the unmitigated scenario, the alteration of drainage patterns will extend beyond closure. In the mitigated scenario, the duration of the alterations will mostly be restricted to the phases before closure.

Spatial scale / extent

In the mitigated and unmitigated scenario the physical alteration of drainage patterns will extend beyond the site boundary as flow reduction impacts could extend further downstream.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is medium.

Probability

The probability of the alteration of drainage patterns is definite, but the magnitude of the reduced flows is unlikely to result in substantial deterioration and related flow impacts downstream due to the relatively flat topography and high infiltration rates therefore the probability is low in both the mitigated and unmitigated scenarios.

Significance

The significance is medium without management actions. With management actions the significance reduces to low.

Unmitigated – summary of the cumulative rated alteration of natural drainage patterns impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M	H	M	H	L	M

Mitigated – summary of the cumulative rated alteration of natural drainage patterns impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	M	M	M	L	L

Management objective

The objective is to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.

Management actions

Management actions to be implemented in all mine phases include the following:

- *mine infrastructure will be constructed, operated and maintained so as to comply with the provisions of the Regulation 704 of 1999 in terms of the NWA. These include:*
    - *clean water systems are separated from dirty water systems;*
    - *the size of dirty water areas are minimized; and*
    - clean water (*run-off and rainfall)* must be diverted around the mine/*dirty areas and back into its normal flow in the environment;*
- the site wide water balance is refined on an on-going basis with the input of actual flow volumes and used as a decision making tool for water management and impact management actions (Section 29).

ISSUE: CONTAMINATION OF SURFACE WATER RESOURCES

The information in this section was sourced from the approved EMPr (Metago, May 2009) and the updated stormwater management plan undertaken for the project (SLR, June 2017) included in Appendix L.

Introduction

There are a number of pollution sources in all phases that have the potential to pollute surface water, particularly in the unmitigated scenario. In the construction and decommissioning phases these potential pollution sources are temporary in nature. Although these sources may be temporary, the potential pollution may be long term. The operational phase will present more long term potential sources and the closure phase will present final land forms such as the approved tailings dam and residual waste rock dumps (where applicable) that may have the potential to contaminate surface water through long term seepage and/or run-off.

Mine phase and link to project specific activities/infrastructure

Construction	**Operational**	**Decommissioning**	**Closure**
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impacts

<u>Severity/nature</u>

The approved infrastructure and activities present numerous sources of pollution during all mine phases that can contaminate surface water resources. The impact associated with surface water contamination was assessed as part of the approved EMPr (Metago, May 2009). The relocation of surface infrastructure and design changes will not present additional pollution sources or sources that are new to the mine.

The establishment of additional infrastructure will present additional pollution sources albeit similar in nature to what has already been assessed for the mine. In the unmitigated scenario, potential construction and decommissioning phase pollution sources associated with the establishment of additional infrastructure include:

- sedimentation from erosion.

Potential operational phase pollution sources associated with the establishment of additional infrastructure include:

- spillage of operational fuel, lubricants and leaks from vehicles and equipment;
- run-off from waste rock dumps; and
- sedimentation from erosion.

At elevated concentrations contaminants can exceed the relevant surface water quality limits imposed by DWS and can be harmful to humans and livestock if ingested directly and possibly even indirectly through contaminated vegetation, vertebrates and invertebrates (Refer to the biodiversity section in this appendix for the potential biodiversity impacts. This impact will not be re-assessed in this section).

When considered incrementally the severity is low in both the unmitigated and mitigated scenarios. The cumulative severity rating assessing the impact of the changes to the operation within the context of the approved mining operations is medium in the unmitigated scenario. In the mitigated scenario, clean water will be diverted away from dirty areas and contaminated run-off and process water will be contained and re-used in the process. The severity can therefore be reduced to low.

<u>Duration</u>

The contamination of surface water resources will occur for the life of the mine in the unmitigated scenario. With management actions, pollution can be prevented and/or managed and as such the impacts can be reduced to less than the mine life.

<u>Spatial scale / extent</u>

In the mitigated and unmitigated scenarios the spatial scale is limited to the mining area given that the nearest river is located 2 km west of the mine and is ephemeral in nature.

<u>Consequence</u>

In the unmitigated scenario the consequence is medium and in the mitigated scenario it is low.

<u>Probability</u>

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- does contamination reach surface water resources;
- will people and livestock utilise this contaminated water; and
- is the contamination level harmful?

The first element is that contamination reaches the surface water resources. Due to the distance of the Tshipi Borwa Mine to the closest surface water resource (Vlermuisleegte River), which is located 2 km west of the mine, it is unlikely that pollution sources will reach surface water resources. It should also be noted that the Vlermuisleegte is ephemeral in nature and therefore is associated with long periods of no flow.

The second element is that third parties and/or livestock use this contaminated water for drinking purposes. There is a limited possibility that this will occur given that there is no reliance on surface water resources in the area, for domestic use or livestock watering.

The third element is that it is likely that only some contaminants will be at a level which is harmful to humans and livestock. This is influenced both by the quality of any discharged water and by the diluting effect of any rainwater particularly in the rainy season.

As a combination, when considering the nature and location of the mine in proximity to the Vlermuisleegte River, the unmitigated probability is medium, reducing to low with management actions.

Significance

In the unmitigated scenario, the significance of this potential impact is medium. In the mitigated scenario, the significance is reduced to low because of the reduction in severity, duration and probability.

Unmitigated – summary of the rated cumulative contamination of surface water resources impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M	M	L	M	M	M

Mitigated – summary of the rated cumulative contamination of surface water resources impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	L	L	L	L	L

Management objective

The objective is to prevent pollution of surface water resources.

Management actions

Management actions to be implemented in all mine phases include the following:

- all hazardous chemicals *(new and used), mineralized waste and non-mineralised waste must be handled in a manner that they do not pollute surface water. This will be implemented by means of the following:*
    - *pollution prevention through basic infrastructure design;*
    - *pollution prevention through maintenance of equipment;*
    - *pollution prevention through education and training of workers (permanent and temporary);*

  - pollution prevention through appropriate management of hazardous materials as *outlined in Table 51;*
  - *the required steps to enable containment and remediation of pollution incidents; and*
  - *specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.*
- Tshipi will implement a monitoring programme for surface water within and outside the vicinity of its operations. The surface water monitoring programme must also focus on surface water sampling of different mine dirty water streams, any unplanned discharges, and monitoring both up and downstream of the Vlermuisleegte of the mining operations when possible (the possibility of monitoring water in the Vlermuisleegte River may only arise during heavy periods of rain). Details of the surface water monitoring programme is outlined in Section 29; and
- should any surface water resource contamination be detected, the mine will immediately notify DWS. Tshipi, in consultation with DWS and an appropriately qualified person, will then notify potentially affected users, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures. Any related loss caused by the mine (in the short and long term) will be addressed through compensation, which may include an alternative water supply of equivalent quality and quantity.
- *in the event that water quality monitoring around any WRD indicates that the waste rock dumps are causing pollution, catchment paddocks and soak-always will be provided to minimise the risk of exposure to wildlife, livestock and humans.*

In case of a potentially polluting discharge incident that may result in the pollution of surface water resources, the emergency response procedure in Section 30.2.2 will be followed.

GROUNDWATER

ISSUE: CONTAMINATION OF GROUNDWATER RESOURCES

Introduction

There are a number of sources in all mine phases that have the potential to pollute groundwater. Some sources are permanent (approved tailings dam) and some sources are transient (starting later and at different time-steps) and becoming permanent (pit backfilling). Even though some sources are temporary in nature, related potential pollution can be long term. The operational phase will present more long term potential sources (waste rock dumps) and the closure phase will present final land forms, such as the backfilled open pit and the tailings dam that may have the potential to pollute water resources through long term seepage and/or run-off.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining (including backfilling)	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Backfilling of open pit	Final land forms

Rating of impacts

<u>Severity / nature</u>

The impact associated with groundwater contamination was assessed as part of the approved EMPr (Metago, May 2009). The groundwater study supporting the approved EMPr found that there would be no significant off-site migration of contaminants and therefore the related impact was rated as having a low significance in the unmitigated and mitigated scenarios. The key contributing factors included:

- low seepage rates from the TSF and waste rock dumps;
- limited hydraulic conductivity of the material underlying the TSF and waste rock dumps; and
- the retardation effect of the pit dewatering on parts of the modelled pollution plume.

The relocation of surface infrastructure and design changes will not present significantly different contaminants or source types to those previously assessed for all project phases. However the establishment of additional facilities will contribute additional pollution sources during the operational, closure and post-closure phases. This relates to the additional waste rock dumping areas and the mining of the barrier between Tshipi and Mamatwan mine, with associated backfilling.

A chloride source concentration of 2200 mg/ℓ was simulated for mining the barrier and WRDs. The maximum chloride plume is predicted to extend up to 1.1 km in a western direction at the end of the simulation (year 100). This results in a low concentrations for a small area outside of the mining right area. However, there are no known third party boreholes within the predicted pollution plume. When considered incrementally this has a low severity in the unmitigated and mitigated scenarios.

The cumulative severity rating assessing the impact of the changes to the operation within the context of the approved mining operations is also low in the unmitigated scenario because the migration of the pollution plume is not expected to impact on third party water users.

<u>Duration</u>

Groundwater contamination is long term in nature, occurring for periods longer than the life of mine in both the unmitigated and mitigated scenarios.

<u>Spatial scale / extent</u>

The pollution plume will extend beyond the mining area in both the unmitigated and mitigated scenarios.

<u>Consequence</u>

The consequence is moderate in the unmitigated and mitigated scenarios.

<u>Probability</u>

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- does contamination reach groundwater resources;
- will people and animals utilise this contaminated water; and
- is the contamination level harmful?

The first element is that contamination reaches the groundwater resources underneath or adjacent to the mining area. Pollution plume modelling shows that contaminants could reach groundwater resources.

The second element is that third parties and/or livestock use this contaminated water for drinking purposes. There are no known third party boreholes located within the contaminant plume.

The third element is whether contamination is at concentrations which are harmful to users. Based on predicted groundwater modelling, mine related contamination will be at low concentrations for a small area outside of the mining.

As a combination, the unmitigated and mitigated probability is low.

<u>Significance</u>

The unmitigated and mitigated scenario significance is low.

<u>Unmitigated – summary of the rated cumulative contamination of groundwater impact per phase of the mine</u>

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	L	H	M	M	L	L

Mitigated – summary of the rated cumulative contamination of groundwater impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	H	M	M	L	L

Management objective

The objective is to prevent pollution of groundwater resources and related harm to other water users.

Management actions

Management actions to be implemented in all phases include the following:

- Tshipi will continue to monitor groundwater quality (refer to Section 29 for the monitoring programme). The existing monitoring network is considered sufficient to detect any pollution related to the revised site layout. Should any off-site contamination be detected, the mine will immediately notify DWS. The mine, in consultation with DWS and an appropriately qualified person, will then notify potentially affected users, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures;
- if water users experience any Tshipi related contamination and related loss of water supply, Tshipi will provide compensation, which could include an alternative water supply of equivalent water quality and quantity;
- *in the event that water quality monitoring around any WRD indicates that the waste rock dumps are causing pollution, catchment paddocks and soak-always will be provided to minimise the risk of exposure to wildlife, livestock and humans;*
- *prevent pollution through basic infrastructure design; and*
- *the footprint of temporary waste rock dumps will be rehabilitated by ripping the underlying subsoil, then replacing the topsoil, vegetating, applying fertilizer, and irrigating the new growth for a short period.*

Prior to closure, the groundwater model will be re-run to consider potential pollution impacts without the retardation effect of pit dewatering. If necessary, provision will be made by the mine for post closure compensation that may be required for any future negative impacts. This will form part of detailed closure planning.

In case of a major discharge incident that may result in the pollution of groundwater resources the Tshipi emergency response procedure will be followed.

ISSUE: LOWERING OF GROUNDWATER LEVELS AND REDUCING AVAILABILITY

Introduction

Dewatering of the open pit has the potential to lower groundwater levels in the operational phase. Lowering of groundwater levels through dewatering may cause a loss in water supply to surrounding borehole users if they are in the impact zone.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
N/A		N/A	N/A
N/A	Open pit mining (Pit dewatering)	Recovery of groundwater levels	Recovery of groundwater levels

Rating of impact

Severity / nature

The impact of lowering of groundwater levels was assessed as part of the approved EMPr (Metago, May 2009). In this regard, the modelled cone of depression indicated a drop in the order of 22 m and that this drop in water levels would reduce with distance from the mine up to a limit of approximately 8.3 km towards the east and between 2 and 5 km in the other directions. This model also presented the possibility that pit dewatering and the surrounding mining operations could both lower the water level in some third party boreholes around the site and reduce the contribution of groundwater to the sub surface flow of the Vlermuisleegte. Prior to mining the depth of the water in surrounding boreholes ranged from 25 to 55 m below ground level. Groundwater level monitoring data in 2016 shows water depths ranging from 41 to 75 m below ground level. This shows a drop in water levels similar to that predicted by the simulations undertaken as part of the approved EMPr (Metago, May 2009). The impact was rated as high in the unmitigated scenario and low in the mitigated scenario as per the approved EMPr (Metago, May 2009).

The relocation of surface infrastructure and design changes will not influence the lowering of groundwater levels and related reduction in availability. However the mining of the barrier pillar could result in further dewatering impacts. In addition, the presence of several mines in close proximity will have a combined effect on the cone of drawdown. The model considered cumulative effects taking into account the neighbouring Mamatwan and UMK Mines.

Mining at Tshipi has been simulated to create a cone of drawdown with a maximum extent of 5.5 km to the east and 8.3 km to the west of the Tshipi Borwa Mine at the end of mining (Year 25). Third parties within the simulated cone of depression may therefore experience a drop in water levels. The simulation shows that as mining operations stop and backfilling takes place, the water levels start recovering and allow the water levels to recover by the end of life of mine. The cone of drawdown at year 50 (25 years after mining and dewatering has ceased at Tshipi) until the end of the simulation (year 100) is located mainly around Mamatwan and UMK Mines, and Tshipi Mine has no significant contribution to the cone of drawdown. It remains a possibility that dewatering at Tshipi and the surrounding mining operations could reduce the contribution of groundwater to the sub surface flow of the Vlermuisleegte during the operational phase, until groundwater levels recover after mining ceases.

When considered incrementally this has a medium severity in the unmitigated scenario reducing to low with mitigation. The cumulative severity rating assessing the impact of the changes to the operation within the context of the approved mining operations is medium in the unmitigated scenario. In the mitigated scenario the severity reduces to low.

Duration

The duration of the impacts is linked to the duration of the dewatering and the recharge time thereafter. Based on groundwater model predictions, the groundwater level will recover by the end of life of mine. It follows that in both the unmitigated and mitigated scenarios the duration is the life of the mine.

Spatial scale / extent

The spatial scale of the predicted dewatering cone extends beyond the mining area in both the mitigated and unmitigated scenarios.

Consequence

The consequence is moderate in the unmitigated and mitigated scenarios.

Probability

The probability of impacting on third party water users is high given that there are third party boreholes identified within the simulated impact zone.

Significance

The impact significance is medium in the unmitigated scenario and low in the mitigated scenario.

Unmitigated – summary of the rated cumulative lowering of groundwater levels and reduced availability impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation						
Unmitigated	M	M	M	M	H	M

Mitigated – summary of the rated cumulative lowering of groundwater levels and reduced availability impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation						
Mitigated	L	M	M	M	L	L

Management objective

The objective is to prevent water losses to third party water users.

Management actions

Management actions to be implemented include the following:

- Tshipi will continue to monitor groundwater levels (refer to Section 9 for the monitoring programme). The existing monitoring network is considered sufficient to detect changes in water levels due to the revised site layout;
- if borehole users experience any mine related water loss, Tshipi will, in conjunction with other mines in the area that are contributors to the cumulative impact, provide compensation, which could include an alternative water supply of equivalent water quality and quantity; and
- if monitoring shows that the base flow of the Vlermuisleegte is affected, a specialist team comprising DWS and biodiversity and groundwater experts will be commissioned to investigate the significance of the impacts and the specific management actions that must be implemented by all contributing mines.

AIR QUALITY

ISSUES: AIR POLLUTION

Information in this section was sourced from the air quality study undertaken by Airshed Planning Professionals (Airshed, April 2009) as part of the approved EMPr (Metago, May 2009). As part of the project the specialist provided a qualitative opinion regarding the changes to the infrastructure layout in February 2017. The air quality study undertaken as part of the approved EMPr (Airshed, April 2009) and the specialist opinion (Airshed, February 2017) are included in Appendix N.

Introduction

There are a number of activities in all phases that have the potential to contribute to the pollution of air. In the construction and decommissioning phases these activities are usually temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term activities and the closure phase will present final rehabilitated areas.

Air pollution related impacts on biodiversity are discussed in the biodiversity section of this appendix and therefore this section focuses on the potential for human health impacts.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impact

<u>Severity / nature</u>

The main contaminants associated with the mine includes: inhalable particulate matter less than 10 microns in size (PM_{10}), larger total suspended particulates (TSP) that relate to dust fallout, Mn concentrations, SO_2, NO_2 and gaseous emissions mainly from vehicles and generators.

Mine components that have the potential to contribute to existing ambient emission sources within the area include:

- diesel generators;
- vehicle tail pipe emissions;
- material handling such as crushing, tipping of waste rock and ore;
- dust generation from open pit operations (blasting and material handling);
- vehicle activity on paved and unpaved roads;
- wind erosion from exposed working surfaces;
- earthworks; and
- removal of soil.

The impact of air pollution was assessed as part of the approved EMPr (Metago, May 2009). In this regard potential contaminants included, PM10, Mn concentrations, SO_2, NO_2, diesel particle matter (DPM), CO and dust fallout. The relocation of approved infrastructure will not present pollutant sources that are new to the mine, albeit that the position of the sources will be different. The design changes (specifically the expansion of the approved topsoil stockpile area) and the establishment of additional facilities and activities will contribute additional sources of PM10 and dust fallout. No increases in SO_2, NO_2, Mn and CO are foreseen as a result of the project. DPM concentrations might increase due to the increased truck activity but it is unlikely to exceed the guidelines. When considered incrementally this is a medium severity and reduces to low with management actions.

The cumulative severity rating assessing the impact of the changes to the operation within the context of the approved mining operations is high and reduces to medium with management actions. It is however noted in the approved EMPr (Metago, May 2009), that even in the mitigated scenario Mn concentrations are predicted to exceed World Health Organisation (WHO) guidelines at a number of residence and farm houses (A.Pyer, Middelplaats and Nic Fourie (Figure 25). While manganese is an essential trace element that is required for good health, exposure to high levels of manganese can cause neuro-toxic health effects in susceptible individuals – generally referred to as Manganism. It follows that the severity remains high in the mitigated scenario for Mn concentrations.

Duration

Health related impacts could extend beyond closure. With mitigation, the duration of impacts will be limited to the life of the mine. This remains high in the mitigated scenario for Mn concentrations as health related impacts will extend beyond closure.

Spatial scale / extent

The spatial scale of the potential impact could be beyond the immediate mining area in both the unmitigated and mitigated scenarios.

Consequence

Without mitigation the consequence is high. With mitigation the consequence reduces to medium. The consequence for Mn remains high in the mitigated scenario.

Probability

The health impact probability is linked to the probability of ambient concentrations exceeding the evaluation criteria in relation to potential receptors. In the unmitigated scenario this is high. With mitigation the probability reduces to medium given that the probability of exceedance at potential receptors reduces.

Significance

The significance of this impact is high in the unmitigated scenario. With mitigation, the significance of reduces to medium. The mitigated scenario remains high for Mn concentrations.

Unmitigated – summary of the cumulatively rated air pollution impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H

Mitigated – summary of the cumulatively rated air pollution impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M (H for Mn)	M (H for Mn)	M	M (H for Mn)	M	M (H for Mn)

Management objective

The objective is to prevent air pollution health impacts.

Management action

Management actions identified in all mine phases include the following:

- the following specific measures will be implemented:
    - treatment as many roads as possible;
    - a target dust control efficiency of 90% can be achieved by maintaining strict control of driving speeds and a combination of chemical dust binding agent and/or water suppression along roads. *Where dust binding agents are used, this must be limited to the roads only;*
    - a 90% reduction in PM_{10}, TSP, and Mn emissions from vehicle movement of paved roads can be achieved through sweeper on paved road surfaces;
    - a 70% and 50% reduction in PM_{10}, TSP, and Mn emissions from truck offloading and conveyor transfer from paved roads can be achieved by water sprays; and
    - a 25% reduction in PM_{10}, TSP, and Mn emissions from in-pit drilling can be achieved by drill fitted with cyclone.
- Tshipi will develop and implement other key elements of an air quality control system. This system will include inter alia:
    - monitoring in accordance with Section 29; and
    - if monitoring determines that third parties (Figure 25) will be exposed to unacceptable cumulative concentrations of manganese or PM10, a health risk assessment will be commissioned. Commissioning this health risk assessment, including the implementation of any related management actions, is the responsibility of both Tshipi and other contributing mines.
- *a complaints register should be available at the mine. The date and time noted on the complaints register should be the date and time that the reported problem is observed, not the date and time that the complaint is logged. If used correctly, the complaints register can be compared to monitoring data as well as recorded meteorological data to identify problem areas and to iteratively adjust the dust management plan to ensure efficient and effective mitigation of fugitive dust sources; and*

- *Tshipi will apply for an air emissions licence for the sinter plant prior to operation.*

NOISE

ISSUES: INCREASE IN DISTURBING NOISE LEVELS

Information in this section is based on the approved EMPr (Metago, May 2009).

Introduction

Two types of noise are distinguished: noise disturbance and noise nuisance. The former is noise that can be registered as a discernible reading on a sound level meter and the latter, although it may not register as a discernible reading on a sound level meter, may cause nuisance because of its tonal character (egg. distant humming noises).

Mine activities/infrastructure present the possibility of generating both noise disturbances and noise nuisance in all phases prior to closure. Refer to the biodiversity section in this appendix for the potential noise impacts on biodiversity. This section will only focus on the potential human related noise impacts.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
			N/A
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	N/A

Rating of impact

<u>Severity / nature</u>

Noise pollution can create nuisance that will have different impacts on different receptors because some are very sensitive to noise and others are not. Potential human noise receptors include the isolated residences and farmhouses within 2 km and 2.5 km radius of the Tshipi Borwa Mine.

The impact associated with an increase in disturbing noise levels was assessed as part of the approved EMPr (Metago, May 2009). In this regard, the assessment predicted that unmitigated construction noise would be insignificant both during the day and at night due to the small population density in the area and that significant night time construction work activities were not expected to occur. During operations, in the unmitigated scenario, the assessment predicted that noise impacts would be insignificant during the day but greater at night although still low due to reduced activities taking place at night. Taking this into account, a change in the operating times of the crushing and screening and train loading activities from day-time only to day-time and night-time including weekends has the potential to increase night-time noise levels. When considered incrementally, this has a medium severity in the unmitigated and mitigated scenarios given the small population density in the area and related distance to potential noise receptors. The cumulative severity rating assessing the impact of the changes to the operations within the context of the approved mining operations is medium for day-time noise impacts and medium to high for night-time noise impacts in the unmitigated and mitigated scenarios. The night-time rating is dependent on the sensitivity of noise receptors; which is expected to differ between receptors.

Duration

In both the unmitigated and mitigated scenarios the noise pollution impacts will generally occur until the closure phase of the mine when the noise generating activities are stopped. This is a medium duration.

Spatial scale / extent

The noise footprint of any construction noise is expected to be restricted to the immediate vicinities of construction activities. This is a low spatial scale. In the operational phase, in both the unmitigated and mitigated scenarios the noise impacts will extend beyond the mining area. This is a medium spatial scale.

Consequence

The unmitigated consequence is medium and the mitigated consequence is medium to low for day-time noise impacts and medium for night-time noise impacts.

Probability

The unmitigated probability of the predicted noise increases causing a noise related disturbance at the nearest sensitive receptors is considered to be medium without management actions. With management actions the probability reduces to low for day-time noise impacts and remains medium for night-time noise impacts.

Significance

The unmitigated significance is medium and can be reduced to low for day-time noise impacts. For night-time noise impacts the mitigated significance remains medium given the presence of potentially sensitive noise receptors in areas surrounding the mine.

Unmitigated – summary of the rated cumulative increase in disturbing noise levels impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Unmitigated	H to M	M	M	M	M	M

Mitigated – summary of the rated cumulative increase in disturbing noise levels impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M to L (day-time) H to M (night-time)	M	M	M to L (day-time) M (night-time)	L (day-time) M (night-time)	L (day-time) M (night-time)

Management objective

To prevent public exposure to disturbing noise.

Management actions

Management actions that have been identified in all phases prior to closure include the following:

- no blasting will take place at night and on Sundays;
- all diesel-powered earth moving equipment will be of high quality and will be well maintained. Regular maintenance schedules must include the checking and replacement of exhaust and intake silencers;
- *all haul roads will be kept clean and maintained in a good state of repair at all times to avoid unwanted rattle and "body-slap" from vehicles;*
- *plant and equipment will be operated in a proper manner with respect to minimising noise emissions, for example, minimisation of drop heights when loading and no un-necessary revving of engines;*
- *pumps, generators and compressors will be located behind screening mounds where possible and should be electrically powered where possible and/or be fitted with acoustic covers as necessary Diesel powered pumps, generators and compressors will be installed within acoustic enclosures if necessary; and*
- the mine will record and respond immediately to complaints about disturbing noise. All such complaints will be documented and recorded as incidents. The measures taken to address these complaints will be included in the documentation. These records will be kept for the life of mine. *Noise monitoring will be undertaken following the receipt of a complaint (Section 29). Where necessary additional management actions will be implemented to avoid repeat occurrences.*

A once off sampling exercise with input from a specialist must be undertaken over the times of crushing and screening and train loading. Depending on the outcome of the sampling exercise additional management actions may be implemented if required.

VISUAL

ISSUE: NEGATIVE VISUAL VIEWS

Information in this section was sourced from on-site observations by the SLR project team and the review of relevant maps.

Introduction

Visual impacts on this receiving environment may be caused by activities and infrastructure in all mine phases. The more significant visual impacts relate to the larger infrastructure components (such as the waste rock dumps) and the long term infrastructure (approved tailings dam and residual waste rock dumps (where applicable) that will remain post closure.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Final land forms

Rating of impact

<u>Severity / nature</u>

The severity of visual impacts is determined by assessing the change to the visual landscape as a result of mine related infrastructure and activities.

As discussed in Section 6.4.1.11, the visual landscape is determined by considering: landscape character, sense of place, scenic quality, sensitivity of the visual resource and sensitive views. In this regard, the visual landscape within the Tshipi Borwa Mine area has been transformed due to the presence of approved mining infrastructure and activities. In general the visual landscape of the area surrounding the Tshipi Borwa Mine is characterised by flat open areas associated with semi-arid vegetation and an ephemeral river (Vlermuisleegte River), that has been influenced by the presence of existing mining operations, roads, powerline infrastructure and isolated farmsteads.

When considering the potential change to the visual landscape the key issues are: visual exposure, visual intrusion, and sensitivity of receptors. The visual impact was assessed as part of the approved EMPr (Metago, May 2009). Taking this into account, the relocation of approved surface infrastructure and design changes within the Tshipi Borwa Mine area are not expected to influence existing negative visual impacts. The establishment of additional facilities and activities will present additional visual intrusions, however these facilities will be established within and adjacent to existing mine infrastructure and will therefore be absorbed by this infrastructure. When considered incrementally, this has a low severity in the unmitigated and mitigated scenarios.

The cumulative severity rating assesses the impact of the changes to the visual landscape within the context of the current approved mining operation where there is already similar infrastructure. It follows that this has a medium severity in the unmitigated scenario when considered cumulatively within the context of the current approved operations. The severity is unlikely to reduce with management actions until the closure phase when the site has been rehabilitated (in the mitigated scenario).

<u>Duration</u>

In the unmitigated scenario the duration is high because the impacts will continue post closure. In the mitigated scenario the impact is unlikely to extend post closure because all infrastructure will have been removed and any remaining facilities will have been rehabilitated.

<u>Spatial scale / extent</u>

In all phases visual impacts are likely to extend beyond the mine in both the unmitigated and mitigated scenarios. This is a medium spatial scale.

<u>Consequence</u>

The unmitigated consequence is high. With management actions, prior to closure, this reduces to medium. After closure the consequence reduces to low.

<u>Probability</u>

In the unmitigated and mitigated scenarios the probability of visual impacts occurring is definite because of the nature of the existing landscape. At closure when the mine site has been rehabilitated, the probability will be reduced to low.

<u>Significance</u>

The unmitigated significance is high. The mitigated significance is medium. The mitigated significance reduces to low at closure.

Unmitigated – summary of the rated cumulative negative visual views impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M	H	M	H	H	H

Mitigated – summary of the cumulative rated negative visual views impact per phase of the mine

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M	M	M	M	M	M
Closure						
Mitigated	L	L	M	L	L	L

Management objective

The objective is to limit negative visual impacts.

Management action

The following management actions should be implemented in all phases:

- ensure that the absolute minimum amount of vegetation and land is disturbed during construction and operation. This is important on the boundaries of the mine where vegetation can assist with screening;
- *only the footprint area as defined by the approved layout in this EMPr will be exposed. In all other areas, the natural vegetation will be retained to the extent that control of these areas sits with Tshipi;*
- implement the recommended air pollution control system to avoid plumes of dust;
- where possible, paint structures and buildings in colours that reflect and compliment the natural landscape;
- rehabilitation of all mined out areas in accordance with the principles of ongoing rehabilitation that includes: backfilling, placement of topsoil and re-establishment of vegetation;
- effective rehabilitation of the tailings is significant because this will be a permanent post closure feature. In this regard, the appropriate mix of waste rock and vegetation could soften the impact of these facilities;
- all vegetation that is planted as part of rehabilitation should reflect the natural vegetation of the area;
- night lighting will be fitted with fixtures to minimise light spillage and focus the light on precise mine activities and infrastructure; and
- *any residual waste rock dumps left on surface due to the bulking factor needs to be shaped.*

During closure final rehabilitated areas and facilities remaining in perpetuity will be managed through a care and maintenance programme to limit and/or enhance the long term post closure visual impacts.

TRAFFIC

ISSUE: ROAD DISTURBANCE AND TRAFFIC SAFETY

Information was sourced from the traffic specialist study (Siyazi, June 2017) included in Appendix O.

Introduction

Traffic impacts can occur during the construction, operational and decommissioning phases when trucks, buses, and private vehicles make use of the private and public transport network in and adjacent to the Tshipi Borwa Mine. The key potential traffic related impacts are on road capacity and public safety.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
			N/A
Continued use of approved facilities and services	Continued use of approved facilities and services Open pit mining	Continued use of approved facilities and services	

Discussion

Existing traffic volumes comprising public traffic and traffic from nearby mines that utilise the R380 and D3457 are associated with an acceptable level of service in the context of the existing public and private road infrastructure. Safety risks associated with mining traffic making use of public road infrastructure include pedestrian accidents and vehicle accidents.

The impact of road disturbance and safety was assessed as part of the approved EMPr (Metago, May 2009). The relocation of approved infrastructure, design changes and the establishment of additional facilities and activities will not result in an increase in traffic volumes. The predicted traffic impact assessed as part of the approved EMPr (Metago, May 2009) remains unchanged. In this regard, the unmitigated significance is medium and reduces to low with management actions. For completeness the management actions are included below.

Management objective

The objective of is to prevent transport related accidents and/or injury to people and livestock.

Management actions

During the construction, operation and decommissioning phases the following management actions apply:

- in regard to road maintenance, Tshipi in conjunction with the relevant road authorities and other role players in the area will continue to monitor the quality and lifespan of the roads used by the mines and determine if a road maintenance plan should be implemented;
- the mine will record and respond, appropriately and immediately, to any complaints about usage of roads by mine vehicles;
- Tshipi will provide data to Transnet regarding the number of vehicles making use of the railway crossing on the D3457. Transnet will be requested to comment on the related safety issues and whether there is a need to upgrade this crossing. If there is a need to upgrade the crossing all relevant role players will have to work together to implement the upgrade; and
- in case of a person or animal being injured by transport activities the emergency response procedure in Section 30.2.2 will be followed.

BLASTING

ISSUE: GROUND VIBRATION, AIR BLASTS AND FLY ROCK

Information provided in this section was sourced from the approved EMPr (Metago, May 2009).

Introduction

Blasting activities have the potential to impact on people, animals and structures located in the vicinity of the mining area. Air quality impacts and biodiversity impacts are discussed under their respective headings in this appendix and as such will not be re-assessed in this section.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
N/A			**N/A**
	Continued use of approved facilities and services Open pit mining	-	-

Discussion

Blasting hazards include ground vibration, air blast and fly rock. These have the potential to cause damage to buildings and/or harm people and animals.

The impact of ground vibrations, air blasts and fly rock were assessed as part of the approved EMPr (Metago, May 2009). The relocation of approved infrastructure, design changes and the establishment of additional facilities and activities will not influence current blasting activities at the Tshipi Borwa Mine. The mining of the barrier pillar will form part of on-going blasting related activities and will not increase blasting activities at the mine. It follows that the blasting impact assessed as part of the approved EMPr

(Metago, May 2009) remains unchanged. In this regard, the unmitigated significance is high and medium in the mitigated scenario.

Management objective

The objective is to prevent harm to people, animals and structures.

Management actions

The following specific actions *during the operational phase* are required in addition to compliance with the relevant blasting and explosives legislation including the Explosives Act (No. 15 of 2003) and the Mine Health and Safety Act (No. 29 of 1996):

- the blast design will, as a minimum standard, ensure that the peak particle velocity from all blasts is less than 12mm/s at all vulnerable third party structures, that flyrock is contained within 500m of each blast and that the airblast is less than 130 dB for all blasts. This will be tracked through the monitoring of blasts. Further detail is provided in Section 29;
- all structures within 1500m of the blast will be marked on a site plan and surveyed photographically in the presence of the owner before blasting commences. All parties that exist and/or that have property and/or that provide services within 1500m of the blast sites will be informed, prior to mining, about the blast programme and associated safety precautions;
- in deciding whether or not to set off blasts, a procedure must be developed to take temperature inversions, low cloud cover, and wind direction into account;
- for each blast, the mine will observe the following procedural safety steps:
    - the fly rock danger zone associated with each blast is delineated and people and animals are cleared from this zone before every blast; and
    - if the D3457 is within this zone it will temporarily closed 5 minutes before the blast until the blast has been set off and the area declared safe;
    - an audible warning is given at least three minutes before the blast is fired.
- the mine will respond immediately to any blast related complaints. These complaints and the follow up actions will be dated, documented, and kept as records for the life of mine. Where the mine has caused blast related damage it will provide appropriate compensation; and
- in case of a person or animal being injured by blasting activities the emergency response procedure in Section 30.2.2 will be followed.

HERITAGE/CULTURAL AND PALAEONTOLOGICAL RESOURCES

ISSUE: LOSS OF HERITAGE/CULTURAL AND PALAEONTOLOGICAL RESOURCES

Information in this section was sourced from the heritage study undertaken by Professional Graves Solutions (PGS, March 2009) as part of the approved EMPr (Metago, May 2009) and the specialist opinion (PGS, February 2017) included in Appendix P. In addition to this, information was also sourced from the palaeontological study undertaken by Banzai Environmental (Pty) Ltd (February 2017).

Introduction

In the event of a chance find where undisturbed areas will be cleared as part of the establishment of additional facilities and activities (barrier pillar) there is a potential to damage heritage/cultural and palaeontological resources (if present), either directly or indirectly, and result in the loss of the resource for future generations.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
			N/A
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	N/A

Discussion

With reference to Section 6.4.1.13, there is a low possibility of palaeontological resources occurring at the Tshipi Borwa Mine. In addition to this, no heritage resources are currently associated with the Tshipi Borwa Mine. The potential impact on heritage/cultural and palaeontological resources is not assessed further, however the management actions outlined below cover the steps to be taken should there be a chance find.

Management objective

To minimize the disturbance of heritage resources.

Management action

- prior to the removal or destruction of any heritage/cultural *and palaeontological* resources that may be discovered by chance at the mine, Tshipi will engage a professionally registered heritage *and/or palaeontological* specialist to make associated recommendations that Tshipi will comply with; and
- *in all mine phases, if there are any chance finds of heritage/ cultural or paleontological sites, Tshipi will follow the emergency response procedure (Section 30.2.2).*

SOCIO-ECONOMIC

ISSUE: INWARD MIGRATION

Introduction

Mining operations tend to bring with them an expectation of employment in all phases prior to closure. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. This section focuses on the potential for the inward migration and associated social issues.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Closure activities in line with closure plan

Discussion

Given that the project forms part of an existing approved mine the relocation of surface infrastructure, design changes or the establishment of additional facilities and activities will not generate any additional employment opportunities as Tshipi will make use of existing contractors and workers on site. Mitigating factors such as the monitoring of workers' living conditions, recruitment disciplines and HIV/Aids awareness and management already exist. As a result the potential for increased social risks due to project activities is negligible. The predicted negative socio-economic assessment therefore remains in accordance with the approved EMPr (Metago, May 2009). In this regard, the unmitigated significance is high in the unmitigated scenario and low with management actions. For completeness, the management actions from the approved EMPr have been included below.

Management objective

The objective is to limit inward migration and related social impacts.

Management action

The following management actions should be implemented in all phases:

- Tshipi will continue to monitor the location and living conditions of its employees during the operation of the mine;
- it is imperative that there is good recruitment discipline among the company and its contractors, and a strong commitment from authorities to act swiftly at the first sign of an informal settlement. It should also be stressed that these measures must not impede the free movement of labour or infringe on the rights of individuals to look for work. Rather, they must be used to prevent job seekers from illegally occupying land and establishing impromptu informal settlements where no services currently exist;
- all contractors and sub-contractors working on behalf of Tshipi must comply with the recruitment process. If possible, other developers and employers in the immediate area should adhere to the same process. The following additional points must be adhered to in the Tshipi recruitment process:
  - there will be no recruitment at the mine site. All recruitment will take place on set dates and at an arranged venue-preferably a formal gathering place in a nearby community/town;
  - there will be no ad hoc hiring of temporary casual labour, no matter how small and temporary the job (washing of vehicles or litter clearance). A sign clearly indicating that there will be no recruitment at the mine site will be erected at the entrance to the site. In addition, a list of available temporary workers in the area will be drawn up and kept by the Tshipi in the event that temporary labour is required. If it is not possible to draw up such a list, notices will be put up in local communities/towns stating the precise demand for temporary labour and a date and venue at which recruitment will take place;
  - recruitment will take place in accordance with company policy;
  - once the recruitment process is complete, unsuccessful job seekers must be clearly informed as such and understand that there is absolutely no reason to remain in the vicinity of the development;
  - local authorities will be requested to remove any informal settlements near the mine that are occupied by people who are there in the hope of obtaining employment. This must be carried out immediately; and
  - there will be no worker accommodation at the mine site.
- with regard to crime, Tshipi will communicate with the local police force particularly in the context of developing strategies for combating crime near the mine, surrounding communities and surrounding land users/owners;
- disease and particularly HIV/AIDS is not a problem only for Tshipi, its employees and contractors, but it is also a local community problem. As a result, successful management actions of this impact will also depend on the intensity in which it is addressed by other structures such as the health department, the local municipality, education departments, etc. Tshipi will ensure that its employees and contractors are made aware of the issues surrounding the spread of HIV and AIDS in the area. This awareness will be promoted by initiatives such as training and development, peer education, community interventions and visual awareness campaigns. Prevention and management strategies also need to be introduced. Voluntary Counselling and Testing (VCT) is a vital aspect to any HIV/Aids

management programme. All employees at Tshipi will be encouraged to participate in a VCT programme. Once a high level of VCT is taking place, it is possible to define the magnitude of the problem and begin to develop appropriate strategies for dealing with it; and

- Tshipi should be part of a local economic development forum that, together with the relevant local authorities, finds solutions to these social problems.

The establishment of informal settlements in the area and a veld fire in the mining area is considered an emergency situation. In such instances the emergency procedure included in Section 30.2.2 will be followed.

ISSUE: ECONOMIC IMPACT

Introduction

In the broadest sense, all activities associated with the mine contribute towards a positive economic impact in all phases. Mining has a positive net economic impact on the national, local and regional economy. Direct benefits are derived from wages, taxes and profits. Indirect benefits are derived through the procurement of goods and services, and the increased spending power of employees.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Closure activities in line with closure plan

Discussion

The economic impact was assessed as part of the approved EMPr (Metago, May 2009). The relocation of surface infrastructure and design changes allows Tshipi to continue their mining operations effectively and efficiently. The establishment of additional infrastructure will form an integral part of the overall mining operation. This allows for the continued stimulation of the local, regional and national economy through job, capital investment, service-sector jobs and the sale of manganese. Upon closure, there may still be some positive impacts through maintenance and aftercare activities and the fact that the mine would have contributed to a greater economic critical mass, skills, and wealth that can be used in other economic opportunities. The predicted positive economic assessment therefore remains in accordance with the approved EMPr (Metago, May 2009). In this regard, the unmitigated and mitigated significance is a medium high in both scenarios. For completeness, the management actions from the approved EMPr have been included below.

Management objective

To enhance positive economic impacts.

Management actions

The following management actions should be implemented in all phases:

- clear communication that employment of exclusively local people for the mine cannot be guaranteed but that where possible the employment opportunities will go to local people, *where applicable;*
- effective and timeous communication with community leaders who can attest to a fair and transparent process amongst the community rather than challenging the mine on the community's behalf over jobs and recruitment, *where applicable;*
- the existence and screening of specific skills will be determined through the establishment of a skills register prior to employee selection processes;
- good communication with all job seekers will be maintained throughout the recruitment process. The process must be fair;
- urging people to get all their documents and certificates, including valid driving licences, in order prior to recruitment;
- notifying unsuccessful job seekers once the recruitment process is complete;
- Tshipi will comply with the requirements of the Mining Charter. In this regard procurement will, where possible:
  - promote the development of small and medium enterprises;
  - focus on local business; and
  - promote businesses owned by historically disadvantaged South Africans.

LAND USE

ISSUE: CHANGE IN LAND USE

Information in this section was sourced from on-site observations and the project team.

Introduction

There are mine related activities and infrastructure that may have an impact on other land uses in the mining areas in all mine phases.

Mine phase and link to project specific activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks *(topsoil expansion)* Water use and management *(clean and dirty water separation and 78Ml stormwater dam)*	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services Open pit mining	Mineralised waste Non-mineralised waste Water use and management Support services Transportation system Continued use of approved facilities and services	Final land forms

Discussion

Land uses within the Tshipi Borwa Mine area include mining activities and infrastructure associated with the mine.

Land use surrounding the Tshipi Borwa Mine area includes existing mining operations, agriculture, infrastructure (road, rail network, powerlines, water pipeline, sewage works), solar plant and isolated farmsteads.

The impacts of land use were assessed as part of the approved EMPr (Metago, May 2009). The relocation of approved infrastructure, design changes or the establishment of additional facilities will not result in changes to the existing land use, given that as part of the project, all infrastructure changes remain within the boundaries of the Tshipi surface use and mining rights areas. It follows that the impact significance rating as provided in the approved EMPr (Metago, May 2009), remains unchanged. In this regard, the unmitigated significance is medium and the mitigated significance is low.

Management objective

The objective of is to prevent unacceptable negative impacts on surrounding land uses.

Management actions

Tshipi will communicate with its neighbouring communities including land users and owners and other key stakeholders as required to facilitate information sharing and environmental impact management relevant to Tshipi and its associated infrastructure and activities.

APPENDIX G: COMPOSITE MAP

APPENDIX H: NEMA LISTED ACTIVITIES APPROVED IN TERMS OF THE EA

ACTIVITY NUMBER	LISTED ACTIVITY
Listed activities in terms of Regulation 386 of 2006	
1	The construction of facilities or infrastructure, including associated structures or infrastructure, for the-
(a)	generation of electricity where the electricity output is more than 10 megawatts but less than 20 megawatts;
(b)	above ground storage of 1 000 tons or more but less than 100 000 tons of ore;
(c)	storage of 250 tons or more but less than 100 000 tons of coal;
(l)	transmission and distribution of electricity above ground with a capacity of more than 33 kilovolts and less than 120 kilovolts;
(n)	off-stream storage of water, including dams and reservoirs, with a capacity of 50 000 cubic metres or more, unless such storage falls within the ambit of the activity listed in item 6 of GN R387 of 2006
(q)(i)	landing, parking and maintenance of aircraft including helicopter landing pads, excluding helicopter landing facilities and stops used exclusively by emergency services.
7	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic metres but less than 1 000 cubic metres at any one location or site.
12	The transformation or removal of indigenous vegetation of 3 hectares or more of any size where the transformation or removal would occur within a critically endangered or an endangered ecosystem listed in terms of section 52 of NEMBA.
13	The abstraction of ground water at a volume where, any general authorisation issued in terms of the NWA, will be exceeded.
15	The construction of a road that is wider than 4 metres or that has a reserve wider than 6 metres, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 metres long.
16	The transformation of undeveloped, vacant or derelict land to (a) establish infill development covering an area of 5 ha or more, but less than 20 ha; or (b) residential, mixed, retail, commercial, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than 1 ha.
Listed activities in terms of Regulation 387 of 2006	
1	The construction of facilities or infrastructure, including associated structures or infrastructure, for –
(c)	the above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas, in containers with a combined capacity of 1 000 cubic metres or more at any location or site including the storage of one or more dangerous goods, in a tank farm;
(e)	any process or activity which requires a permit or licence in terms of legislation governing the generation or release of emissions, pollution, effluent or waste and which is not identified in GN R.386 of 2006 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act 59 of 2008;
(j)	the bulk transportation of dangerous goods using pipelines, furniculars or conveyors with a throughput capacity of 50 tons or 50 cubic meters or more per day; and
(s)	for rail transportation, excluding railway lines and sidings in industrial areas and underground railway lines in mines, but including- (i) railway lines; (ii) stations; or (iii) shunting yards.
2	Any development activity, including associated structures and infrastructure, where the total area of the developed area is, or is intended to be, 20 hectares or more.
5	The route determination of roads and design of associated physical infrastructure, including roads that have not yet been built for which routes have been determined before the publication of this notice and which has not been authorised by a competent authority in terms of the EIA Regulations, 2006, where- (a) it is a national road as defined in section 40 of the South African National Roads Agency Limited and National Roads Act, 1998; (b) it is a road administered by a provincial authority;

ACTIVITY NUMBER	LISTED ACTIVITY
	(c) the road reserve is wider than 30 meters; or (d) the road will cater for more than one lane of traffic in both directions.
6	The construction of a dam where the highest part of the dam wall, as measured from the toe of the wall to the highest part of the wall, is 5 metres or higher or where the high-water mark of the dam covers an area of 10 hectares or more.
10	Any process or activity identified in terms of section 53(1) of the NEMBA.

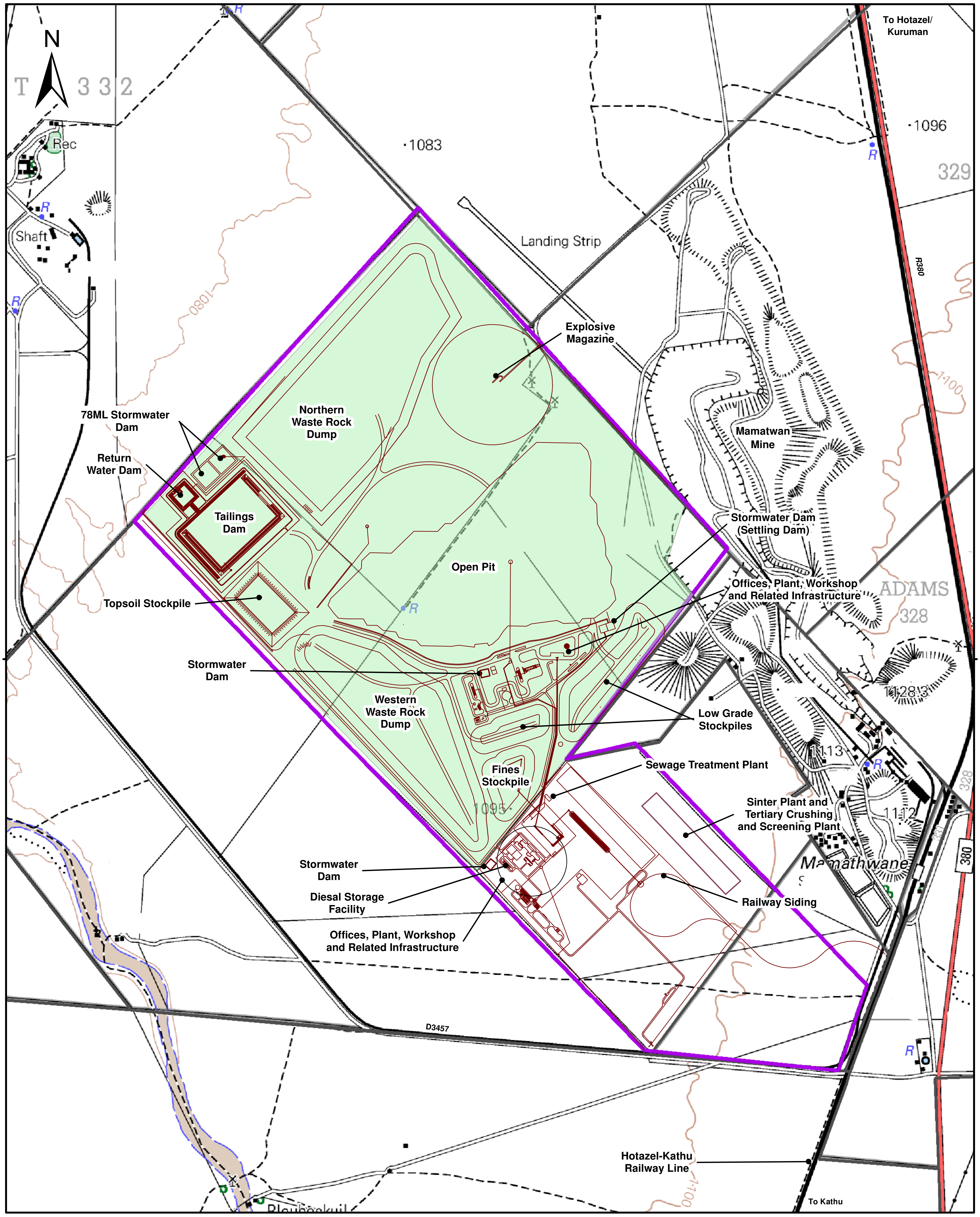
APPENDIX I: APPROVED LAYOUT

APPROVED SURFACE INFRASTRUCTURE

The surface infrastructure layout that was approved as part of the EMPr process undertaken in 2009 (Metago, May 2009) is illustrated in Figure 27 and Figure 28 (Close up). The key approved surface infrastructure includes:

- main security gate (includes fencing and lighting (with masts) for security and safety reasons);
- main entrance security offices;
- open pit;
- primary crusher and screening plant and primary crusher product stockpile and control room;
- secondary crusher stockpile and plant (crushing and screening) and control room;
- area designated for DMS, tertiary crushing plant, sinter plant, second low grade stockpile area and the sinter plant feed stockpile (still to be established);
- tailings dam and return water dam (established but not in use);
- topsoil stockpile;
- two low grade/lumpy (top cut) stockpiles and one fines stockpile;
- product stockpile area;
- waste rock dumps (western and northern);
- plant workshop, primary crusher workshop, secondary support equipment workshop and primary earth moving equipment workshop and two open bays;
- water storage facilities: Service water storage tanks, mining water filling tank and potable water tank;
- stormwater management facilities: Settler dam, 78 Ml stormwater dam (still to be established), plant stormwater dam and primary and secondary workshop stormwater dam;
- weighbridge and weighbridge control room;
- railway loop/line;
- silo and loading area for trucks and trains;
- helipad (Still to be established);
- parking area (ambulance, busses and cars) and drop off point for busses, plant and mining offices parking bay and parking/waiting area for trucks;
- change house and mining shift change building;
- main administrative offices;
- plant MCC, control room and offices;
- mining offices and control room;
- eskom substation and generators;
- conveyors;
- haul roads;
- mine stores;
- core store;

- salvage yard and store and scrap yard;
- fuel storage bay/Main fuel depot, secondary fuel storage bay and primary fuel storage bay;
- temporary waste storage area for general and hazardous wastes;
- primary and secondary mine vehicle brake test ramp;
- explosive magazine and emulsion silos;
- sewage treatment plant;
- sedibeng water supply pipeline and Sedibeng bulk meter and isolating valve;
- soil bioremediation facility;
- transfer sumps (Coffer dam in the open pit);
- crusher control room;
- process plant (associated with the thickener) (Still to be established);
- laboratory and clinic (located within the plant area – not specifically illustrated); and
- washbay (located within the plant area – not specifically illustrated).



Legend

Approved Infrastructure

Approved Mining Right Area

Surface Use Area

0 500 1 000 Meters

Scale: 1:25 000 @ A3

Projection: Transverse Mercator

Datum: WGS1984, Lo23

Tshipi é Ntle Manganese Mining (Pty) Ltd

Figure 27

Approved Infrastructure Layout (Metago, May 2009)

SLR Consulting (Africa) (Pty) Ltd
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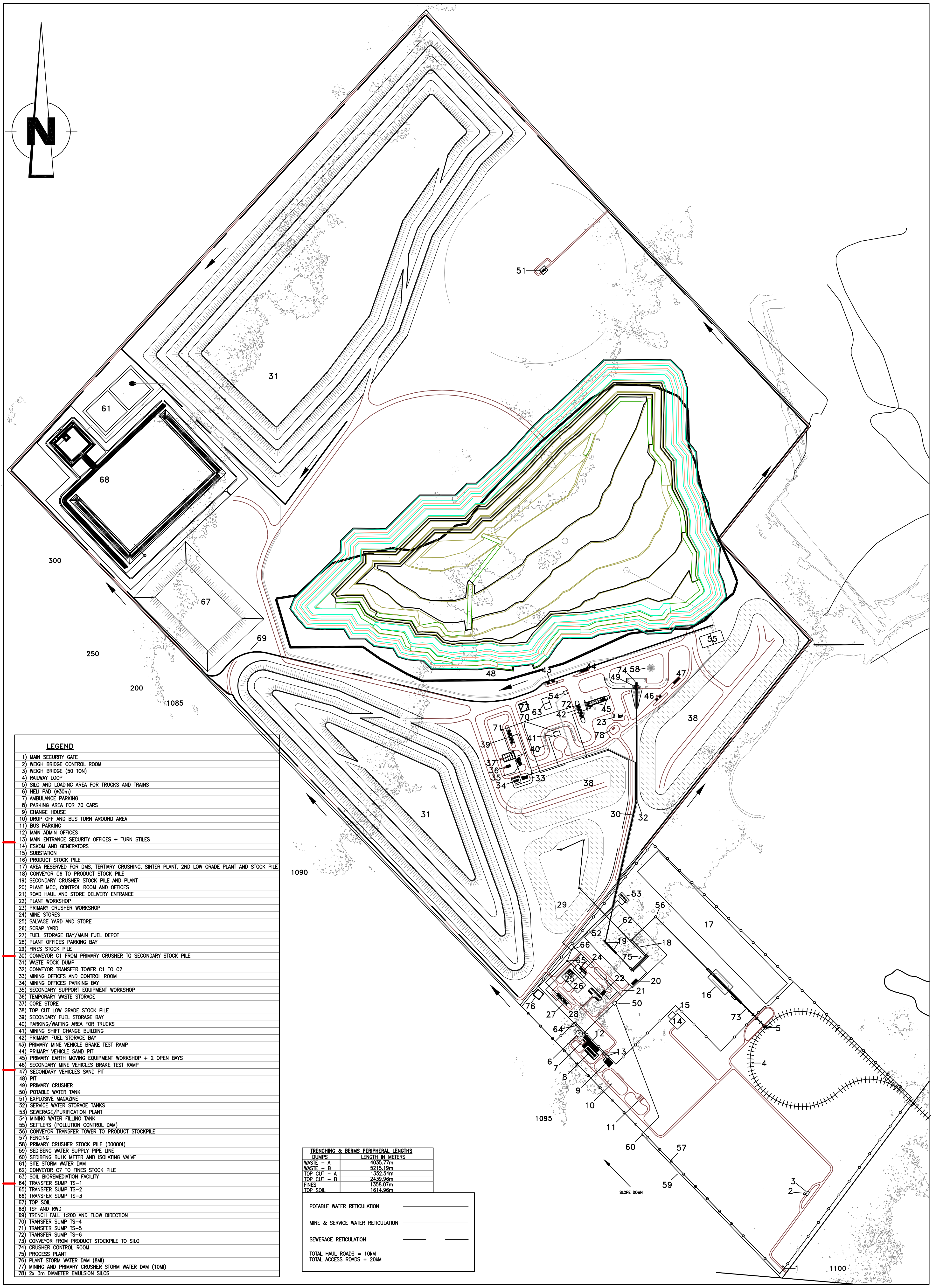
710.220029.00008

June 2017



LEGEND

1) MAIN SECURITY GATE
2) WEIGH BRIDGE CONTROL ROOM
3) WEIGH BRIDGE (50 TON)
4) RAILWAY LOOP
5) SILO AND LOADING AREA FOR TRUCKS AND TRAINS
6) HELI PAD (ø30m)
7) AMBULANCE PARKING
8) PARKING AREA FOR 70 CARS
9) CHANGE HOUSE
10) DROP OFF AND BUS TURN AROUND AREA
11) BUS PARKING
12) MAIN ADMIN OFFICES
13) MAIN ENTRANCE SECURITY OFFICES + TURN STILES
14) ESKOM AND GENERATORS
15) SUBSTATION
16) PRODUCT STOCK PILE
17) AREA RESERVED FOR DMS, TERTIARY CRUSHING, SINTER PLANT, 2ND LOW GRADE PLANT AND STOCK PILE
18) CONVEYOR C6 TO PRODUCT STOCK PILE
19) SECONDARY CRUSHER STOCK PILE AND PLANT
20) PLANT MCC, CONTROL ROOM AND OFFICES
21) ROAD HAUL AND STORE DELIVERY ENTRANCE
22) PLANT WORKSHOP
23) PRIMARY CRUSHER WORKSHOP
24) MINE STORES
25) SALVAGE YARD AND STORE
26) SCRAP YARD
27) FUEL STORAGE BAY/MAIN FUEL DEPOT
28) PLANT OFFICES PARKING BAY
29) FINES STOCK PILE
30) CONVEYOR C1 FROM PRIMARY CRUSHER TO SECONDARY STOCK PILE
31) WASTE ROCK DUMP
32) CONVEYOR TRANSFER TOWER C1 TO C2
33) MINING OFFICES AND CONTROL ROOM
34) MINING OFFICES PARKING BAY
35) SECONDARY SUPPORT EQUIPMENT WORKSHOP
36) TEMPORARY WASTE STORAGE
37) CORE STORE
38) TOP CUT LOW GRADE STOCK PILE
39) SECONDARY FUEL STORAGE BAY
40) PARKING/WAITING AREA FOR TRUCKS
41) MINING SHIFT CHANGE BUILDING
42) PRIMARY FUEL STORAGE BAY
43) PRIMARY MINE VEHICLE BRAKE TEST RAMP
44) PRIMARY VEHICLE SAND PIT
45) PRIMARY EARTH MOVING EQUIPMENT WORKSHOP + 2 OPEN BAYS
46) SECONDARY MINE VEHICLES BRAKE TEST RAMP
47) SECONDARY VEHICLES SAND PIT
48) PIT
49) PRIMARY CRUSHER
50) POTABLE WATER TANK
51) EXPLOSIVE MAGAZINE
52) SERVICE WATER STORAGE TANKS
53) SEWERAGE/PURIFICATION PLANT
54) MINING WATER FILLING TANK
55) SETTLERS (POLLUTION CONTROL DAM)
56) CONVEYOR TRANSFER TOWER TO PRODUCT STOCKPILE
57) FENCING
58) PRIMARY CRUSHER STOCK PILE (30000t)
59) SEDIBENG WATER SUPPLY PIPE LINE
60) SEDIBENG BULK METER AND ISOLATING VALVE
61) SITE STORM WATER DAM
62) CONVEYOR C7 TO FINES STOCK PILE
63) SOIL BIOREMEDIATION FACILITY
64) TRANSFER SUMP TS-1
65) TRANSFER SUMP TS-2
66) TRANSFER SUMP TS-3
67) TOP SOIL
68) TSF AND RWD
69) TRENCH FALL 1:200 AND FLOW DIRECTION
70) TRANSFER SUMP TS-4
71) TRANSFER SUMP TS-5
72) TRANSFER SUMP TS-6
73) CONVEYOR FROM PRODUCT STOCKPILE TO SILO
74) CRUSHER CONTROL ROOM
75) PROCESS PLANT
76) PLANT STORM WATER DAM (8Ml)
77) MINING AND PRIMARY CRUSHER STORM WATER DAM (10Ml)
78) 2x 3m DIAMETER EMULSION SILOS

TRENCHING & BERMS PERIPHERAL LENGTHS

DUMPS	LENGTH IN METERS
WASTE – A	4035.77m
WASTE – B	5215.19m
TOP CUT – A	1352.54m
TOP CUT – B	2439.96m
FINES	1358.07m
TOP SOIL	1614.96m

POTABLE WATER RETICULATION

MINE & SERVICE WATER RETICULATION

SEWERAGE RETICULATION

TOTAL HAUL ROADS = 10kM
TOTAL ACCESS ROADS = 20kM

CLOSE UP OF APPROVED INFRASTRUCTURE LAYOUT (METAGO, MAY 20009)

06/2017

710.20029.00008

FIGURE 28

APPENDIX J: SOILS AND LAND CAPABILITY OPINION

- Soil study undertaken for the approved EIA and EMP
- Soil opinion for the proposed project (PGS, July 2017).

APPENDIX K: BIODIVERSITY STUDY

APPENDIX L: STORMWATER MANAGEMENT PLAN

APPENDIX M: GROUNDWATER STUDY

- Groundwater study undertaken for the proposed project (SLR, July 2017).

APPENDIX N: AIR QUALITY STUDY

- Air quality study undertaken as part of the approved EIA and EMPr (Airshed, April 2009)
- Air quality opinion for the proposed project (Airshed, February 2017).

APPENDIX O: TRAFFIC STUDY

- Traffic study for the proposed project (Siyazi, June 2017).

APPENDIX P: HERITAGE STUDY

- Heritage study undertaken for the approved EIA and EMPr (PGS, March 2009)
- Heritatage opinion for the proposed project (PGS, February 2017).

APPENDIX Q: PALAEONTOLOGICAL STUDY

- Palaeontological study undertaken for the proposed project (Banzani, February 2017).

APPENDIX R: PRELIMINARY FINANCIAL PROVISION

APPENDIX S: WASTE ASSESSMENT AND MOTIVATION LETTER

RECORD OF REPORT DISTRIBUTION

Project Number:	710.20029.00008
Title:	ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME AMENDMENT REPORT FOR THE TSHIPI BORWA MINE
Report Number:	1
Proponent:	Tshipi é Ntle Manganese Mining (Pty) Ltd

Name	Entity	Copy No.	Date issued	Issuer
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Thulani Mthombeni	Department of Environment and Nature Conservation	9 - 10	August 2017	N Smyth
Esther Makungo	Department of Water and Sanitation	Electronic	August 2017	N Smyth
Natasha Higgit	South African Heritage Resource Agency	Electronic	August 2017	N Smyth
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